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AGEING POPULATIONS: ECONOMIC ISSUES AND POLICY CHALLENGES

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I. Introduction

The demographic characteristics of OECD and many non-OECD countries have changed considerably in the past few decades.[2] Fertility rates in almost all OECD countries have declined from the end of the 1960s to levels that are now at or below the 2.1 children required to maintain a stable population. In addition, improvements in living standards, health care and nutrition have led to an increase in life expectancy. In 1960, average life expectancy in the OECD area was 66 years. Today it is 77. Over the next five decades, fertility is projected to rise somewhat but still remain below the rate required to stabilise the population, and life expectancy should increase further. As a result, the old-age dependency ratio – the number of people 65 years and over relative to those between 20 and 64 – could more than double in the OECD area to reach nearly 50 per cent in 2050. Considerably sharper increases will take place in continental Europe and in Japan. The process is already well advanced in Japan and is currently evolving rapidly in Italy. In most other OECD countries, it will start towards the end of this decade.

Given current social security arrangements and policies, the transition towards an older and smaller working-age population will have pervasive effects on factor and product markets and on public finances. The distribution of goods and services between retirees and workers as well as between current and future generations will be affected. A considerable amount of empirical research has been produced in recent years attempting to estimate the economic consequences of ageing populations and needed policy changes.[3] Much of the empirical work has focused on individual countries or on the implications of ageing for material living standards, savings and capital flows, or public finances. In some cases, following the seminal work by Auerbach and Kotlikoff (1987), dynamic general-equilibrium, overlapping-generations models have been used. In others, multi-region, general-equilibrium models have been developed.[4]

This paper does not offer a review of this vast literature.[5] Rather, it aims to provide an assessment of some of the conclusions reached and the implications for policy. The focus is on likely economic and distributional effects, especially through pressures on living standards and government fiscal positions. With respect to the latter, the paper draws on a recent OECD exercise that examines the fiscal impact and sensitivity of age-related expenditures in OECD countries over the period to 2050.[6] It should also be stressed that there are many other important areas, such as the possible impacts of ageing on current accounts and net foreign asset positions

2. In China, for example, demographic shifts are expected to take on dimensions similar to those in most OECD countries. For a recent discussion of demographic change and related pension reforms in China, see Leckie (1999).
3. Cutler *et al.* (1990) were among the first to draw attention to the issues in the United States. Similar concerns were raised for other countries in studies by Hagemann and Nicoletti (1989) and Auerbach *et al.* (1989).
4. See, for example, Masson and Tryon (1990), Turner *et al. (*1998) and McMorrow and Roeger (1999).
5. OECD (1998) offers a synthesis of the ageing issues and the related literature. See also the G-10 report, Group of Ten (1998).
6. The main results of this exercise are presented in OECD (2001*a*). For a more extensive presentation and discussion of the exercise, which has been in part carried out in collaboration with the Working Group on Ageing of the Economic Policy Committee of the European Union, (Economic Policy Committee, 2000), see Dang *et al.* (2001).

or the implications of retirement income provision on financial markets, which are not dealt with in this paper.[7]

The paper is structured as follows. Section II offers an evaluation of likely demographic changes expected over the next 50 years. Section III considers the recent OECD exercise conducted to (re) assess the fiscal implications of ageing populations. This is followed in section IV by a discussion of the broader economic effects of ageing, with particular attention on the various channels through which ageing affects living standards and income distribution. The fifth section highlights some of the main policy challenges and options. The final section presents the main conclusions.

II. The changing demographic profile in OECD countries

The expected evolution of the age structure of a society depends on demographic assumptions about future birth rates and life expectancy, as well as the level and age structure of migration flows. Recent projections for OECD countries[8] over the next five decades assume that life expectancy will rise on average 4½ years to 82 years (Table 1). Over the same period, fertility rates in most OECD countries are assumed to recover somewhat, but to reach only 1.7 children per woman on average, well below the 2.1 children required to maintain a stable population.[9] The combination of increased longevity and lower fertility would normally be associated with quickly ageing populations. In Australia and Canada, however, relatively high immigration flows (though lower than the current ones) are also assumed, which helps to moderate ageing pressures, and in the United States, the fertility rate, despite an expected fall, remains the highest among the OECD countries shown in Table 1. On the basis of these assumptions, the population in the 22 OECD countries considered here is expected to increase by about 53 million (and in 11 countries to decline) to reach nearly one billion, an annual rise of only 0.1 per cent compared with 1 per cent on average over the last 40 years.

For the OECD area as a whole, these shifts are likely to lead to an increase in the median age by almost 10 years to 44 and to a decline in the overall working-age population (those aged 20 to 64) by 38 million. The number of people aged 65 years and over relative to the number aged between 20 and 64 – the old-age dependency ratio – will rise, particularly in the years after 2010, to almost 50 per cent by 2050 (from 22 per cent currently, Figure 1).[10] Considerably sharper

7. On these issues, see the discussion in OECD (1998) and, on population ageing and capital flows, the recent paper by Brooks (2000).
8. These demographic projections are used in the exercise discussed in section III, and are the so-called "middle variant" scenarios from national projections or, in the case of EU countries, Eurostat projections.
9. This average excludes some OECD countries with relatively high fertility rates, most importantly Mexico and Turkey, as well as a few other countries (Greece, Iceland, Ireland, Luxembourg, Slovak Republic and Switzerland) which have also not been part of the exercise.
10. Together, increased life expectancy and low fertility will lead to substantial changes in the demographic profile of OECD countries. As the number of elderly people (65 years and above) is expected to increase substantially to reach over a quarter of the OECD population, the proportion of the very elderly (80 years and above) could almost triple by 2050 to reach 9 per cent. Over the same period the proportion of children and those in their prime age (20 to 54) will shrink in each of the main OECD regions. Also of note is the rise in the share of elderly workers (55 to 64 years), which is a group where attachment to the labour force is currently very low (Figure 2).

increases in the dependency ratio are expected among some of the major European countries and Japan (Figure 3). In many countries, ageing appears to be increasing at the end of the period, suggesting further pressures beyond 2050. In virtually all OECD countries, the expected rise in the dependency ratio is accounted for from both increases in the population over 65 years old and declines, given low fertility rates, in the working-age population (Figure 4).

Long-term projections of age structures and dependency ratios are sensitive to variations in the demographic assumptions. A 15 per cent increase in the fertility rate over the next 30 years relative to the baseline would reduce the old-age dependency ratio 3 percentage points by 2050. On the other hand, an increase in life expectancy of about 3 years would raise the dependency ratio some 6 percentage points in 2050 (Table 2). These alternative assumptions for fertility and longevity correspond to a plausible range of actual outcomes, providing some reasonable bounds surrounding the evolution of the dependency ratio.[11] Much more difficult to assess, however, are future migration levels. The assumptions for migration are typically made on the basis of recent flows, which could change significantly with future modifications of immigration policy and thus alter dependency ratios, although increased immigration on its own cannot realistically resolve the ageing problem (United Nations, 2000).

Even over short periods, expected demographic projections can shift considerably (see, for example, Table 3). In many countries, old-age dependency ratios are higher the more recent the projection, and in some cases by a considerable amount. For Japan in 2040, for example, the old-age dependency ratio in the latest central projection of the United Nations is 15 per cent higher than in the UN projection published only two years ago. Most of this rise is attributed to a large increase in Japanese life expectancy. Among projections of similar vintage there is also variation. The UN demographic outlook is less optimistic, in terms of the evolution of the dependency ratio, than that of Eurostat/national projections. For most countries, however, the variation across projections for dependency ratios in 2040 is less than 10 per cent and all the projections clearly indicate that every country will experience ageing and low or negative population growth (especially important for working-age cohorts) over the next 4 decades. The calculations reported in Table 2 indicate that, even if non-negligible, the sensitivity of old-age dependency ratios to fertility, longevity and net migration would not alter significantly the broad picture presented in the baseline projections.

In principle, age-based measures of economic dependency may not capture accurately the shares of the population that are working and retired. Indeed, a proportion, albeit small, of population aged over 65 years is still active in the labour force. More significantly, a rising number of older workers – those aged between 55 and 64 – have withdrawn permanently from the labour force over the past two decades, especially in countries with high unemployment. In 1960 the average retirement age in the OECD area was around 65 years for both males and females. By 1995, males were on average retiring at 62 years and females at 60. Among most of the major continental European economies the decline has been larger and often starting from a lower level. In line with the fall in retirement ages and the difficulties older workers experience keeping old jobs or finding new ones, the employment rate of this group has dropped in some OECD countries to very low levels. Today less than half the population aged between 55 and 64 in the OECD area is employed and in a number of countries the figure is less than a third. Nonetheless, dependency ratios that attempt to correct for these trends by using the employed, rather than the working-age population, have a similar profile. Likewise, trends in overall dependency rates,

11. For a considerably more pessimistic demographic outlook (faster and more ageing populations), see Schieber and Hewitt (2000).

which add youth (0-19 years) as other dependants, are not noticeably different over the next five decades.

III. The fiscal implications of OECD ageing populations: a recent simulation exercise

Under current institutional arrangements, where the public pensions of today's retirees are paid out of the contributions of today's workers, fewer workers supporting a larger number of generally longer-living retirees will put budgetary positions in OECD countries under increasing pressure. Moreover, many other public expenditure programmes are affected by demographic shifts. These include programmes for early retirement, health care for the elderly, long-term care, family/child benefits and education. Overall, between 40 and 60 per cent of total public spending is sensitive to the age structure of the population.

In the last decade the OECD has made several efforts to evaluate the contribution to fiscal pressures of demographic shifts, on the basis of a number of partial and general equilibrium models and accounting frameworks.[12] Each of the studies finds that unless reforms are implemented, projected pension benefit levels will greatly exceed projected pension contributions. Though more difficult to quantify, similar effects would come from the rise in other age-related expenditures, such as on health care. The specific results of these simulation exercises vary, however, indicating the sensitivity of the findings to the projection methodology and system parameters used. Moreover, the modelling frameworks inevitably abstract from country-specific institutional details. Furthermore, these simulations probably exaggerate the likely fiscal outcomes, since they are typically based on a no-change scenario, while reforms are more likely in countries where the projected fiscal burden of ageing is most serious. Indeed, since these studies were completed a number of countries have announced or implemented reforms to the structure of public pension systems and other age-related programmes.[13]

A new OECD exercise (see OECD, 2001*a*, and Dang *et al.*, 2001) presents up-to-date estimates of the fiscal impacts of ageing. To reflect key institutional detail, these simulations are based on models used by national administrations or research institutes and take account of the policy initiatives implemented over the past 5 years. To strengthen the cross-country comparability of the results, the simulations are based on common assumptions for GDP growth – concerning the number of employed and average labour productivity trends – and other key macroeconomic variables.[14] Also, extensive sensitivity analysis has been carried out to show the impact of changes to key assumptions.[15]

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12. See Hagemann and Nicoletti (1989), Auerbach *et al.* (1989), Van den Noord and Herd (1993), Leibfritz *et al.* (1996), Roseveare *et al.* (1996), Turner *et al.* (1998).
13. A summary of recent policy initiatives is included in OECD (2000).
14. As mentioned, part of this exercise has been carried out in collaboration with the EPC of the European Union. It should be observed that while the OECD has helped co-ordinate the preparation of the simulations produced by the national experts, it has not attempted to vet the models used. Furthermore, the OECD has not controlled the use of underlying assumptions within the models beyond those agreed with the experts (population and the macroeconomic environment).
15. The main macroeconomic assumptions concern: i) the labour force participation rates, based for the period to 2010 on ILO projections (ILO, 1997) and for the subsequent period assumed to remain constant for men and persons outside the 20 to 64 years range, while progressively rising for women towards ceilings at the end of the period 5 percentage points below those of men in countries with widely subsidised child-care and 10 percentage points below

On the basis of these assumptions and unchanged policies, national administrations provided their baseline projections for old-age pension spending.[16] These show a rise on average by around 3 to 4 percentage points of GDP over the period to 2050, with considerable cross-country variation (Table 4). Smaller increases, or even reductions, are found in countries with limited ageing and low initial spending levels (*e.g.* Australia, Hungary, Sweden, the United Kingdom and the United States) or where recent reforms have been introduced (Italy and Poland).[17]

The main factor contributing to changes in spending, which typically peaks over the period 2035 to 2045, is the increase in old-age dependency ratios. Taken on their own, the projected changes in these ratios would raise pension outlays as a share of GDP on average some 5 percentage points (Table 5). Partly offsetting this rise is an assumed higher ratio of employment relative to the working-age population and an estimated decline in the average pension benefit relative to GDP per worker, in part reflecting the impact of recent reforms.[18] At the same time, in most countries the share of beneficiaries in the population aged 55 and over is projected to increase.[19]

In some countries (*e.g.* France, Germany, Italy, Japan, Poland, Sweden and the United Kingdom) the fall in average benefits relative to wages is particularly marked (between 20 and 50 per cent). This mostly reflects the shift, in countries where benefits are largely paid through earnings-related schemes, from indexation of pensions on wages towards indexation only on prices. In other countries, where flat-rate pension arrangements aim to provide a minimum basic income for the elderly irrespective of their work history, the fall in benefits reflects the assumed

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elsewhere; ii) unemployment rates are set to fall to their structural levels (as defined by the OECD) by 2005 and remain constant thereafter, although somewhat larger falls were allowed in countries where existing labour-market reforms could lead to lower structural unemployment; and iii) labour productivity growth (measured as GDP per worker), generally assumed to converge to reach a rate of 1.75 per cent per year during the period 2020 to 2030. As observed in the previous section, the ageing population profiles used for the study are based on the middle variant of Eurostat demographic projections for the countries in the European Union and national projections for the remaining countries.

16. Old-age pension spending includes, in principle, all spending that is an integral part of public pension systems (*e.g.* survivors' pensions). But comparisons of initial national spending levels with the OECD social expenditure database suggest that programme coverage may be less than complete for Austria, Denmark, Korea, the Netherlands, Norway, the United Kingdom and the United States, and hence the projections reported here may be slightly underestimated.
17. In the case of Japan, the result mostly reflects legislation that requires benefits to be adjusted every five years to bring the pension system into balance.
18. Reforms have included a reduction in benefit rates, as a result of a change in the indexation of pensions from wages towards prices (Finland, France, Hungary, Italy, Japan and Korea) or from pre-tax to after-tax wages (Germany), lengthening the contribution period for a full pension (France) and lengthening the reference period for calculating pensions (Belgium, the Czech Republic, Finland, France, Italy and Spain). For further details see Dang *et al.* (2001).
19. The increase in the share of beneficiaries due both to the higher employment rates of women and the maturing of pension systems is in principle offset by the effect of reforms aimed, in a number of countries, at directly increasing the effective age of retirement. Only for Austria, Italy and Poland do these reforms appear sufficient to reduce significantly the overall share of pensioners.

constancy of the flat-rate basic pension in real terms over the whole simulation period.[20] In these cases, either a (possibly substantial) build-up in private pension saving is required to maintain income adequacy in retirement or political pressure from the elderly for a reversal of recent policy reforms and changes to particular transfer schemes become more likely.

The second most important public expenditure item on elderly persons relates to health and long-term care. Reported public health and long-term care spending averaged around 6 per cent of GDP in 2000, again with considerable cross-country variation (Table 6). Formulating projections for these public outlays is considerably more uncertain than for pension expenditure. Unlike pensions, there is no existing framework of rules that provides a basis for projecting the demand for and supply of health care. Partly as a result, the method of projecting health care spending can vary considerably. Furthermore, there is a great deal of uncertainty as to which demographic features are most important for driving health care spending. For example, since a large part of spending is made during the last months of life, a key question is whether spending patterns by age group are related to mortality. If so, longer life expectancy may delay increases in health spending. For the OECD study, most countries providing estimates for future health and long-term care outlays projected per capita health care expenditures by age group, which rise with age, multiplied by the number of people in each age group. Between now and 2050, in the 14 countries where information on spending by age category is available health care spending relative to GDP is estimated to increase more than 3 percentage points.[21]

In addition to old-age pensions and health care, most countries have programmes that provide income support for those of working age, which are often seen as an integral part of overall pension arrangements. Examples include disability pensions, long-term unemployment benefits and early-retirement arrangements.[22] While the coverage varies across countries, these programmes represent around 1½ per cent of GDP in the countries providing data. Despite the increasing average age of the working population and hence higher probability of becoming disabled, countries providing projections for these expenditures anticipate broad stability or marginal declines relative to GDP over the next 50 years. This is presumably attributed to reforms already undertaken to tighten access to these programmes and to limit the generosity of benefits, as well as the assumed drop in unemployment. These projected trends in spending on the elderly are expected to be only partly offset, by around 1 percentage point of GDP on average over the projection period, by lower spending on education and family/child benefits in line with falls in youth dependency ratios.[23]

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20. In the case of the United Kingdom the pension projections do not take into account the effects of the minimum income guarantee, so that benefits, linked to prices alone, decline continuously over time relative to GDP, overestimating the likely reduction.
21. On long-term care see also Jacobzone *et al.* (2000). In principle, other factors might partly offset the increase in medical costs associated with the combination of an increase in life expectancy and the tendency of medical costs to rise with age. In particular, Cutler and Sheiner (1998) point to the progressive reduction in disability rates and the fact that with higher life expectancy, in any single year a smaller share of the very old will be in their last year of life (when medical costs are particularly high). They conclude, however, with reference to the United States that the reduction in average medical spending on the elderly due to these changes is unlikely to significantly reduce the projected increases in overall medical costs.
22. Such programmes have contributed in many countries to the marked fall in the participation rates of older male workers over the past several decades (Blöndal and Scarpetta, 1999).
23. In practice, it has been difficult to make cuts in these areas and there may well be further pressures arising from longer periods of education for the young, increased training for older

Overall, for countries projecting spending categories that include more than just old-age pensions, total age-related expenditures relative to GDP could rise on average by about 7 percentage points over the period 2000-2050 to reach over one quarter of GDP (Table 4). Under the assumptions that non-age-related spending is unchanged as a share of GDP over the period.[24] and that some age-related tax revenues increase, the average decline in the primary balance as a share of GDP is projected to be in the range of 6 to 7 percentage points.

The overall impact on public debt levels will depend on the cumulated change in the primary balance over the projection period coupled with the associated change in debt interest payments. The outcome in terms of the net public debt as a share of GDP is highly sensitive to the initial levels of debt and the primary balance, the change in the latter through the period, and the assumed level of the interest rate relative to GDP growth. In Table 7, the change in debt associated with the rise in age-related spending is calculated for a "typical" OECD country, constructed using parameters close to the middle of the range for OECD countries. GDP growth of about 2 per cent is assumed, in line with the productivity assumption and average demographic developments, and the real interest rate is assumed to be 4 per cent.[25] In such a country, ageing would lead to an increase in public debt as a share of GDP over the period to 2050 of about 200 percentage points. The actual increase in debt would, however, be slightly less than 100 percentage points: about half of the impact of age-related spending would be offset by sustaining the initial primary surplus over the entire period.

Small changes in assumptions can lead to substantial differences in outcomes, however. For example, if the real interest rate is assumed to be 1 percentage point lower, the impact of ageing on debt would decline about one third. Likewise, a 10-percentage-point reduction in the initial debt ratio would leave the debt ratio 20 percentage points lower in 2050. Countries will be in a worse position to confront ageing pressures if their primary balances are not sufficiently high to reduce their net debt positions rapidly in the period before dependency ratios begin to rise sharply. For example, with a sustained primary deficit of 1 per cent of GDP (rather than the 2.5 percent primary surplus assured in this baseline), the ratio of net debt to GDP would increase, for the typical country, more than 400 percentage points by 2050; with a primary surplus that declined to zero by 2010 and remained there until 2050, the increase in the debt ratio would be about 300 percentage points.

IV. The economic impacts of ageing populations

As we have seen in the previous section, fiscal problems are likely to emerge as public pensions and expenditures on health care absorb a growing share of total social outlays. These increases will put obvious pressure on government budgets and public debts. To keep them from rising, it will be necessary to increase taxation or to lower social security benefits and other non-age-related expenditures.

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workers and more demand for publicly subsidised child-care as the share of women working increases.

24. Exceptions are the result of policies already enacted and of the macroeconomic assumptions, e.g. lower spending on unemployment benefits.
25. The calculation assumes that non-age-related primary government spending and revenues are constant relative to GDP, implying that changes in the primary balance are fully driven by age-related spending.

Apart from fiscal impacts, ageing populations will have a number of other potentially sizeable economic and distributional consequences. For example, fewer workers and shorter working lives will reduce the consumption possibilities of the population, compared with the levels that might have been reached with unchanged dependency ratios. A relevant question, then, is by how much will output and living standards change and relative to what path? The answer to this question depends not only on uncertain long-term demographic and technological developments, but also on the structural and institutional conditions of different countries, their underlying fiscal positions, the specific welfare arrangements, the relative degree of openness to trade, capital and labour flows.

A number of general equilibrium exercises have been conducted in recent years to examine the economic implications of ageing populations. In particular, two modelling approaches have been used, based on i) dynamic multi-region macroeconomic models, which allow for trade and capital flows among different economic regions, and ii) closed-economy, overlapping-generations (OLG) models, which allow for decisions by different age groups.

Among those in the first group, noteworthy are the recent ones conducted at the OECD and at the European Commission, respectively by Turner *et al.* (1998) with the Minilink model and by McMorrow and Roeger (1999) with the QUEST model. To the second class of models belong those recently utilised (for the United Kingdom and Europe) by Miles (1999) and (for the United States) by Kotlikoff, Smetters and Walliser (2001).

These two groups of models differ in a number of respects. The first relies mostly on econometric estimates of household and business decision rules derived from time series of aggregate macroeconomic variables. Regions of the world are linked through international trade in goods, services and financial assets. While expectations are forward-looking and time-consistent and the specifications of behavioural equations are consistent with dynamic optimisation, the estimates inevitably suffer from aggregation problems.

The second class of models explicitly allows for different age cohorts of optimising, rational agents. As these models are founded on detailed microeconomic information, in particular on households, most of the parameters are not estimated but obtained from external sources and adapted through calibration. The models are then solved for single economies or regions under a hypothesis that allows relative prices to vary to equilibrate goods and factor markets. The results are often sensitive, however, to variation in parameters that might be rather uncertain, and at times the models require strong assumptions to be solved. Given the large number of parameters, sensitivity tests are typically difficult to conduct. Margins of uncertainty are likely to be wide, leading many to question the overall reliability of this otherwise appealing approach.

It should be stressed that in many respects the two OLG models considered here represent substantial improvements with respect to previous attempts. Particularly noteworthy are the specification of demographic conditions (fertility and life expectancy) and the direct introduction of heterogeneous households in terms of productivity and age cohorts (with an explicit modelling of the impact of technical change). Furthermore, these models are specified in a way that allows them to be solved from initial conditions that do not impose on an economy the need to be in a steady state equilibrium. Also, despite the different modelling strategies, the macro and OLG approaches share a number of fundamental features. They are both general equilibrium in nature and are usually solved over long time periods. In both cases goods are produced on the basis of a

standard neoclassical production function with exogenous technical progress,[26] while ageing affects household decisions through the explicit adoption of the life-cycle hypothesis (providing a direct link between aggregate saving and demographic structure). In its stripped-down version, this hypothesis of saving behaviour posits that individuals save during their working life to consume their accumulated assets in retirement.

Population ageing can affect an economy through higher longevity or reduced fertility. These features are explicitly taken into account in the OLG models; in contrast, in the macroeconomic models, these shocks are introduced in an *ad hoc* way in the estimated consumption functions, relying on separate evidence on the impact of the dependency-ratios on saving.[27] All models are solved under an explicit government budget constraint but, while Turner *et al.* allow for some increase in both public debt and taxes, in the other three models ageing does not produce a rising imbalance in government accounts but results in increases in (mostly payroll) tax rates (and revenues). This has important consequences on household and business decisions. In both classes of models the final results reflect the establishment of a general equilibrium once the ageing shock is imposed. Two "scarcities" are then balanced, that of a decline in the working-age relative to the total population and that due to a decline in aggregate saving as the number of retired individuals (who dissave) increases relative to the number in working age. While in the exercises conducted by Miles and McMorrow and Roeger, as well as in Turner's *et al.*, the real rate of interest falls over time (though moderately) and the wage rate increases, the opposite result is obtained by Kotlikoff *et al.*

In all cases, however, the standard of living[28] grows less than if demographic pressures were absent. This is more so in Kotlikoff *et al.*, where the higher return to capital and lower real wages result in a fall in the capital-labour ratio, reflecting the effects of a substantial rise in tax rates. In that model, the reduction in per capita income growth is about ¾ of a percentage point per annum (over the 2000-2030 period); in the other three cases it is between ¼ and ½ a percentage point for the various countries or regions considered (*i.e.* United States, Japan and Europe). All models also show a large implicit deterioration in fiscal balances, similar in extent to that identified by the projection exercise discussed in the previous section.

On the basis of these results, a number of issues deserve further study. First, a thorough assessment of the direct impact of demographic developments on individual saving decisions should continue to be high on the research agenda, as this is the most important and still controversial channel through which ageing might affect an economy. More and better household data (possibly panel data) should be used to verify the validity of variants of the life-cycle model. Aggregate time-series results are generally supportive, but cross-section evidence is rather less favourable, although cross-section studies appear to face a number of difficult measurement

26. This feature is adopted by most macro and OLG models, but is one that can in principle be modified. For an explicit modelling of endogenous growth features in an OLG framework, see Fougère and Mérette (1999).
27. In all models but Miles', besides pensions also health care expenditures (mostly determined – in a given population – by longer life spans) are considered. Possible reductions in education expenditures (linked to low fertility rates) are allowed for in the two macro models, even though they might end up being difficult to materialise.
28. The standard of living is approximated by GDP per capita, except in Turner *et al*. who consider GNP per capita corrected for changes in the terms of trade.

problems. On balance, recent evidence tends to be more supportive of the life-cycle hypothesis,[29] even if, perhaps, not in its simplest stripped-down version.

Second, the general equilibrium results show that the relative price effects on labour and capital vary across the modelling exercises. Indeed, the very large increase in tax rates and the consequent effects on capital intensity obtained by Kotlikoff *et al.* are striking, given that they are obtained for the United States, where the projected fiscal imbalance is likely to be much smaller than that for Japan and Europe. The role played in the model specification by particular parameters should be therefore carefully assessed and differences in the way technical change affects household productivity in the various models, within and across generations, should be highlighted.

Third, the interaction between resource scarcity and technological change might be investigated in more detail. It should be observed, in fact, that in these models growth is determined by the interaction of the general equilibrium resolution of ex ante imbalances (in the demand and supply of labour and capital) with the process of technical change. The latter is, however, assumed to evolve over time independently from changes in other variables. More attention should perhaps be given to the possible effect that demographic changes may have on labour and total factor productivity. While negative effects cannot be excluded, the scarcity of labour induced by a drop in fertility might induce a reallocation from physical to human capital investment. In an endogenous growth framework this might lead to positive effects on the rate of economic growth. These effects might at least partly offset, during the transition towards a new steady state equilibrium, the mechanical impact of ageing on productivity implicit in the simulation results discussed above. Indeed, according to some specifications the overall final effect of ageing on growth might even be positive.[30]

That this is an issue worthy of further investigation is supported by the results produced in a recent paper by Fougère and Mérette (1999). In this paper, the authors build on a previous OLG modelling effort by Hviding and Mérette (for seven OECD countries), where results very much in line with the ones examined above were obtained (though on the basis of a much simpler OLG model than the ones used by Miles and Kotlikoff *et al.*). Once a human capital sector is introduced to incorporate the main features of an endogenous growth specification, a substantial attenuation of the reduction in growth due to ageing populations (and in some instances of the fiscal imbalances as well) is obtained. Obviously this result is dependent on the specification and the parameters used, chosen by the authors on the basis of a calibration exercise. Given the strikingly different implications of this result for policies, further empirical work is needed to evaluate its importance.

As shown by all the models discussed above, increases in tax rates or reductions in benefits to counter the negative fiscal effects of ageing will change the distribution of income between the working and the retired today and between current and future generations. A cut in benefits goes in the direction of shifting from a pay-as-you-go pension system to a more funded one. Indeed an extreme form of funding would be to cut pension benefits to zero so that all retirement income would be provided through personal saving, raising rather starkly the issue of

29. See, especially, Miles (1999) and references therein, as well as the extensive discussion in Turner *et al.* (1998) and McMorrow and Roeger (1999). According to Miles, allowing for a bequest motive or for precautionary saving (which are implicitly or explicitly considered in the other three models) is unlikely to modify significantly the final results.
30. For a recent analysis supporting this view with specific attention to the effect of an increase in longevity (as opposed to a drop in fertility), see Futagami and Nakajima (2001).

intergenerational equity. Alternatively, in the absence of a fiscal policy response, current generations would certainly benefit at the expense of future ones. On the other hand, during the transition to a funded system (which, once completed, should assure higher welfare for all future generations), current generations may suffer substantially, as shown in Miles' simulations. This cost to current generations is also identified in the simulations conducted by Kotlikoff *et al*., who however suggest that a shift to a funded system (which they would also link to the privatisation of the existing Social Security system) would entail major gains for future generations, particularly those with very low incomes.

Regardless of the way pensions are funded, it must be kept in mind that the population at large can only consume out of the production of current capital and labour. It is possible that a shift to a fully funded system would be accompanied by an increase in saving with the result of a rise in capital intensity and output per capita. But it seems inevitable, as Paul Johnson puts it, that "future workers will inevitably have to forego a larger share of investment and consumption than do current workers in order to sustain pensioners income."[31] Even if a higher rate of growth might make the redistribution problem less acute, this issue is one that would probably need to be examined further with a more thorough quantitative assessment.

V. Challenges for policy

A move towards more funding is indeed a component of the strategy suggested by the OECD in response to the structural changes and fiscal pressures associated with ageing populations. But the need for action on many fronts is stressed.[32] The specific combination of measures will depend on the circumstances in countries and needs to be formulated within well-balanced national frameworks. As shown, however, demographic trends provide only a narrow window of opportunity before reform will become much more painful. To illustrate, based on the projections of age-related spending discussed in section III, a stylised reform where average pension benefits are cut so as to attain the share of net debt to GDP in 2050 equal to that in 2000 implies a reduction of 17 per cent if implemented in 2005. But if such a measure were delayed by 10 years, the required adjustment in average benefits would increase around ¼, and delaying them 20 years would require an increase of around ¾ (Table 8). In addition, because many reforms require advance notice and gradual implementation, responses need to be put in place early. Indeed, a major difficulty and challenge for policy makers is anticipating problems and building support for reforms even though the impacts of ageing are only likely to arise some decades down the road.

Several broad areas are targeted for reform in the OECD strategy. Among these, two are briefly discussed in what follows: first, shifting towards more diversified retirement income sources, with a larger role for full funding of pension liabilities and, second, modifying public

31. Johnson (1996), p. 268.
32. As a result of the analysis synthesised in OECD (1998), a number of principles to guide reforms, within well-balanced national frameworks, were identified. In particular, financial incentives to early retirement should be removed and ways to enhance job opportunities for older workers and improve their skills and competencies should be looked for. Public pension benefits should be reduced, for given contributions, to ensure fiscal consolidation and lower the public debt burdens associated with the ageing of populations. At the same time risk diversification should be pursued and retirement income provided by a mix of tax-and-transfer systems, funded systems and private savings, with the development of advance-funding pension systems linked with the strengthening of financial market infrastructures. Finally, cost-effectiveness in health and long-term care should be pursued.

pension generosity and eligibility criteria (for instance by increasing the average number of years individuals spend active in the labour force). In addition, two complementary approaches to support improvements in living standards and to ease future fiscal pressures will also be briefly considered. These are fostering policies that promise to boost productivity performance and allowing for higher levels of immigration.

Diversifying the sources of retirement income

An important and universal element of the OECD strategy is to reform the structure of retirement income to take account of all the resources available to older people, including public and private pensions, earnings and assets. A more diversified structure of retirement income is needed so that sources other than public pension payments play a growing role in provision for retirement and help spread the burden across generations. A wider range of income sources would also help lower the risk of future income loss.

The so-called "3 pillar" approach would put in place a system where retirees would potentially have three sources of pension income: from a pay-as-you-go pension, from a compulsory fully funded pension plan and from a voluntary fully funded pension plan. Specific measures to diversify retirement income provision and facilitate the "3 pillar" system could include increasing the size of advance-funded elements in countries where pay-as-you go systems now dominate; reducing the size of public pension benefits where these are now particularly high; establishing a direct link between life-time benefits and contributions and putting the anti-poverty and income-replacement elements of public pensions into different programmes.

Some countries have taken initial steps along these lines, which prepare the ground for future reforms, and a few countries have taken measures that will ultimately make their pension systems broadly neutral by strengthening the link between life-time contributions and pension benefits. Mexico, for example, has transformed its previous pay-as-you-go system into a fully funded capitalisation system. In Italy, while its pay-as-you-go system will be retained, pension benefits will be determined by the stock of contributions and made available from the age of 57 onwards, with adjustments reflecting life expectancy and expected GDP growth rates. Other countries – such as Hungary, Poland and Sweden – have introduced or will introduce two-tier pension systems: a pay-as-you-go tier and a fully funded compulsory tier.

There appear to be limits, however, on the speed at which a country can move towards the "3 pillar" system, because of intergenerational equity considerations, as current workers would be paying twice – once for the pensions of the current retired and again for their own.[33] No fully satisfactory solutions to this problem are available, as observed in the previous section, even if some authors suggest that there are conditions under which a substantial shift at low immediate costs, and significant long-term gains, might be envisaged.[34] In any case, financial structures and taxation systems would require modification, which also implies a period of transition. As Richard Disney clearly puts it: "The long-run solution seems to involve a strong funded element, but the transition costs have to be handled carefully and partial strategies need to take particular care as to their distributional consequences and potential for complexity."[35]

33. For a discussion of the fiscal costs associated to a shift from a pay-as-you-go to a fully funded pension system, see Chand and Yaeger (1996).
34. See, for example, Feldstein (1998), who also argues in favour of privatising social security systems, and Modigliani, Ceprini and Muralidhar (2001).
35. Disney (2000*a*), p. F21. See also Disney (2000*b*). In Mirrlees (1997), a forceful welfare argument, strengthened by the prospect of an ageing population, is also made in favour of

Lengthening working lives and raising employability

A strong OECD recommendation, also advanced in the 1998 G10 report, points to the need for reducing disincentives to early retirement and increasing the working possibilities of the elderly population. If the transition from productive activity to retirement could be delayed, the fiscal impact of ageing would be reduced, because the number of pension beneficiaries would fall and output and tax revenues would be higher. As an order of magnitude, a reduction of around 8 per cent in the number of pension beneficiaries would be sufficient to neutralise the impact of ageing on the public debt to GDP ratio.[36] To put this into some perspective, this is broadly equivalent to countries on average permanently increasing their non-age-related primary surplus by around 1 percentage point (Table 9).

Since the economic impact of ageing populations is directly linked to fewer workers relative to the total population, it follows that such impacts can be contained to the extent that working lives are extended, for instance via increased participation of older workers and females. Similarly, productive potential could be enhanced to the extent that structural levels of unemployment can be lowered. The scope to raise the number of years spent active in the labour force and to generally enhance employability is large. This is because life expectancy has risen and will presumably continue to rise, as well as because of the relatively low age at which workers currently withdraw from the labour market and the low employment rates of older workers (aged 55 to 64) in some countries. The potential for adjustment in these features varies widely between countries, however, reflecting differences in the structure of incentives to continue to work and consequently the average effective age of retirement.

For instance, in France, the Netherlands and Spain the employment rate has declined to less than 35 per cent for the 55 to 64 year old population and to about 25 per cent or below in Italy and Belgium, while in others, such as the United States, Japan, Korea, Norway and Sweden, it is well above 50 per cent and has remained broadly steady over the past 15 years (Figure 5). The relative scarcity of labour arising from the decline in the working-age population might also provide upward pressure on real wages and thus motivate an increase in the participation rate across all age groups. On the other hand, such real wage effects may themselves be partly offset by higher taxes and social security contributions needed to finance the increasing pension and health care burden.

It has been estimated, with respect to the situation prevailing in the early 1990s, that increasing the incentives to remain in the labour market could lead to an increase in the participation rate of older workers by about 8-9 percentage points in those countries where the financial penalties were particularly large (Finland, France, Italy, the Netherlands and Portugal).[37] Such improvements would help ease the budgetary pressure on public pension funds and social security budgets in general and would also limit the extent of the slowdown in the growth of living standards. Specific policy measures that can help bring this about are, for instance, increasing the length of the contribution period for full benefit and generally linking life-time

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increasing the extent to which pension systems are fully funded rather than pay-as-you-go, even if it is suggested that funding should not be complete.

36. This corresponds to the effective age of retirement rising by approximately one year.
37. See Blöndal and Scarpetta (1999) for details on the model used to calculate these effects on the male participation rate. In some of the countries where the potential impact on male participation rates is high measures have since been implemented, which make the pension system more actuarially neutral. This is especially so in Italy.

benefits and contributions; removing pension earnings rules and other penalties for working later; increasing the average age of entitlement to full pension and the lower age limit for early retirement; phasing out programmes that encourage access to invalidity or open-ended unemployment benefits for labour market reasons. Several countries have already taken initial steps along these general lines.[38]

Futagami and Nakajima (2001) have recently argued that an increase in retirement age might end up being counter-productive, as it would induce lower saving rates and, endogenously, lower growth. Retiring at an older age would, according to their model, raise lifetime wages and pension benefits in the retirement years. Households would therefore raise their consumption and the saving rate would decline. Counter to these effects but insufficient to avoid an overall decrease in the aggregate saving rate would be the increase in labour supply, and therefore a reduction in wages, and the delay in receiving pensions. Allowing, however, for an increase in longevity, the budget constraint would determine, for given tax rates, a reduction in pension benefits; this would push up saving and growth rates. If pension benefits were kept unchanged, an alternative would be a rise in tax rates, with negative consequences on growth. I would argue that the effects of raising the age of retirement should be evaluated in comparison with this alternative (rather than for a given life span): an alternative very likely to be worse, especially during the transition period.[39]

Also in Kotlikoff *et al.* (2001), however, delaying retirement does not seem to help to reduce the social security problems. In this case, the authors argue that aggregate labour supply is not much affected as higher expected future earnings induce an increase in leisure by younger and middle-aged cohorts.[40] This seems, however, to be an extreme result, likely to be dependent on specific elasticity assumptions, as well as the institutional set-up. But the result shows that the link between labour force participation rates and retirement conditions cannot be ignored. Indeed, recent research has concluded that in the 1985-1995 period "the lower standard retirement age in France, Japan and Italy may have contributed to reduce participation rates amongst older workers by about 4.6 percentage points".[41]

In an earlier paper (Visco, 2001*a*), some rough sensitivity calculations of age-related spending to labour market developments illustrated the potential for higher female and older worker labour force participation rates and lower structural unemployment to offset the pressures of ageing on output and, therefore on, fiscal positions. It was concluded that to the extent that improvements could be realised, output would be increased and pressure on age-related spending correspondingly reduced, especially in countries where labour force attachment rates are initially low (*e.g.* Austria, Belgium, Italy, the Netherlands and Spain).

As an example, within the simulation exercise discussed in section III of this paper, a decline in the unemployment rate to the levels prevailing in the late 1960s would on average reduce spending on old-age pensions, as a share of GDP, by about a ¼ of a percentage point, and total age-related spending by almost ½ of a percentage point, between now and 2050 (Table 9). In general, measures which facilitate further increases in employment/participation rates are also desirable and need to be pursued, even if it should also be recognised that increased labour

38. A detailed description and analysis of recent reforms can be found in OECD (2000).
39. Observe that Futagami and Nakajima only compare different steady state equilibria.
40. Delayed retirement also induces workers to reduce their retirement saving, as should be expected, but this should be considered jointly with the effect on government saving linked to the reduction in pension spending.
41. See Blöndal and Scarpetta (1999), p. 38.

utilisation would lead to a build-up in implicit government pension liabilities, which the state will have to honour in the future. Also in this case, relatively large increases in the employment rate are unlikely on their own to prove sufficient to deal with the direct impacts of ageing populations. To illustrate, a 5 percentage point increase in either the participation rate of older workers or that of women relative to the baseline in 2050 would again on average only reduce total age-related spending relative to GDP by ½ a percentage point.[42]

How important is increasing productivity growth?

It is sometimes argued that harnessing the "new economy" could offer a substitute response to ageing pressures, since increased productivity growth implies higher living standards, which would provide additional scope to modify pension benefit levels and contribution rates. Moreover, as discussed in the previous section, the possibility that population ageing might also produce positive effects on the potential rate of growth of an economy should also be taken into account.

The OECD has recently completed a major series of studies to better understand the factors shaping the growth process and the policies favouring better growth performance.[43] The evidence suggests that the accumulation of various kinds of capital – physical and, especially, human – as well as research and development are important for growth. Also important are a broad set of policies extending to sound macroeconomic management, openness to international trade and competition, a tax system that encourages work effort and entrepeneurship, and government expenditure programmes that emphasise investment and capital accumulation. Appropriate conditions in financial markets and product market regulations also play a role in fostering innovation and productivity enhancement.

It is not certain, however, that higher productivity growth would ease significantly the future fiscal pressures of ageing populations in many countries. The impact depends on the degree to which the linkages between higher productivity and wages feed through to higher per capita pension payments. This in turn depends on the specific institutional arrangements governing pension systems. In countries where pensions are regularly indexed to some measure of earnings, faster productivity growth would only have a minor impact on government pension spending relative to GDP. This is the situation in many European Union countries, including Austria, Denmark, Germany, the Netherlands, Portugal and Sweden, although the link is not automatic in all of these countries. On the other hand, where there is no direct link between pension benefits and the earnings of those in work, higher productivity growth would likely make a sizeable impact, since the generosity of benefits over the pension period would not grow so rapidly over time. In earnings related pension systems, however, the budgetary impact is only transitory, as higher productivity leads to an increase in the wages of those currently working and hence their pension benefit in retirement.

The European Union countries where pensions are only or mostly linked to price movements include Finland, France, Italy, Luxembourg, Spain and the United Kingdom. The

42. As observed in Section III, for a number of countries the baseline already includes sizeable increases in participation rates. For example, in Italy and Spain participation rates of women 20 to 54 years old are assumed to increase by about 20 percentage points to reach levels around 80 per cent by 2050. Some significant increases are also assumed for older workers, even though in a number of countries their participation rates remain rather low. See, for further details, Dang *et al*. (2001).
43. For a synthesis of the findings of this work see OECD (2001*b*).

European Commission has estimated that in some of these countries[44] a 0.5 percentage point increase in annual productivity growth could ease the level of public expenditures relative to GDP by about 1¼ percentage points on average compared with the level it would have otherwise reached. Past experience shows, however, that higher living standards as a result of increased productivity have generally led to public pressures for increases in pension benefits, even when there is no direct link.

For the average OECD country, moderately higher growth would provide only a partial offset; substantial increases in economic growth (through higher productivity) would be needed to have a large impact on the economic costs of ageing. To illustrate, under current institutional arrangements it is found that 0.5 per cent a year higher productivity growth over the next 50 years might ease the increase in the level of pension expenditures relative to GDP only about ½ of a percentage point, compared with the level it would have otherwise reached, and by slightly more if all age-related expenditures are considered (Table 9). Nonetheless, if productivity growth can be raised, this is in itself a positive achievement as it implies an improvement in living standards more generally. In addition, with higher government revenues, there would be additional scope to modify pension benefit levels and contribution rates, helping to introduce the public pension reforms necessary to address the fiscal challenges that ageing populations pose.

Could increased immigration ease the impacts of ageing?

Another complementary approach for dealing with ageing populations is to increase the working population through immigration.[45] Increased immigration would have an immediate impact on the working-age population, assuming the relatively young age structure of net migration to apply also in the future.[46] In addition, fertility rates among immigrant women are often relatively high which can help boost overall fertility and hence long-term population growth. In fact, for the EU as a whole, net migration has been a more important source of population growth over the past decade than domestic fertility, with a number of European countries virtually, or entirely reliant on immigration for population growth. In the United States and Japan the relative importance of net migration in overall population growth has increased over the same period. Nonetheless, in a number of OECD countries, the age profile of the foreign population is not too different from that of the native population. This suggests that maintenance of past migration trends would not be sufficient to offset ageing populations.

A recent report (United Nations, 2000) investigates the level of migration required to achieve population objectives in selected countries between 1995 and the year 2050. Maintaining the size of the population or that of the working-age population (in this study defined as those aged 15 to 64 years) at peak levels reached in the absence of migration after 1995 would imply migration flows for the EU not too different than those recorded over the past decade. On average almost a million net immigrants per year would be required to keep the EU population constant. With slightly more than 1½ million net immigrants, a constant working-age population would be maintained. In contrast, the same scenarios would imply lower net-migration for the United States, compared with recent experience. On the other hand, the level of net migration required to maintain old-age dependency ratios at their 2000 levels entails enormous increases in all countries and regions studied, implying extremely large increases in the overall population (Figure 6).

44. France and Luxembourg were not part of this simulation.
45. For a discussion of the economic consequences of immigration, see Coppel *et al.* (2001).
46. The median age of new immigrants is on average about 30 years, compared with 36 years for the overall OECD population.

Even if these large numbers of immigrants could be attracted to countries with ageing populations, immigration policy cannot easily be fine-tuned to reach precise demographic objectives. For instance, while policy may have control over the level of immigration, it has little or no control over emigration and hence net migration is difficult to influence. In addition, the existence of free circulation agreements, the persistence and difficulty of tackling illegal immigration and humanitarian commitments limit and complicate the ability to control the demographic composition of immigration.[47] Realistically, therefore, while increased immigration can limit the adverse impact on living standards and government budgetary positions due to declining and ageing populations, it can hardly be the sole solution.[48] On average, the estimates reported in Table 10 put at slightly less than ¾ of a per cent of GDP by the end of 2050 the decline induced in all age-related spending by immigration levels 50 per cent higher than in the baseline.[49]

VI. Conclusions

While living longer and in good health is a marvellous achievement, especially if one has the resources to enjoy it, a consequence of a contracting labour force (in particular associated with low fertility rates) might be, all other things equal, to undermine material living standards. Furthermore, under current institutional arrangements where public pensions are paid out of the contributions of today's workers, fewer workers supporting more and older retirees will put budgetary positions in the OECD countries under increasing pressure. In addition, health care spending is also likely to increase significantly. Overall, the most recent and thorough projections conducted across OECD countries show that budgetary pressures from ageing populations could add on average some 7 percentage points, as a share of GDP, to government outlays on the aged. This may even turn out to be a conservative estimate, as it is based on possibly optimistic assumptions concerning old-age dependency rates.

In 1930, a period of numerous technical innovations, John Maynard Keynes wrote a thoughtful essay imagining the economy 100 years hence.[50] He predicted substantial improvements in living standards stemming from capital deepening and technical change and concluded that adjustment to productivity increases will ultimately imply a need to work only a 15-hour week in order to meet economic needs. While Keynes was correct on capital accumulation and technical innovations, as well as on the substantial improvements in living standards, his bold conclusion about the working week reminds us all how wide of the mark long-term predictions can turn out to be. In the context of ageing, it is possible that demographic trends might be reversed, as a consequence of technological, economic and social developments. Still, it has to be acknowledged that population ageing trends in OECD countries are in good part dependent on demographic changes that have already taken place or are unlikely to be reversed.

47. Even those countries that have traditionally had selective immigration seem unable to make a large difference to the overall composition of arrivals (Cobb-Clark, 2000, for Australia and Duleep and Regets, 1992, for Canada).
48. For further discussion on the limitations of migration policy as a response to the adverse economic impacts of demographic decline and ageing populations see United Nations (2000) and Tapinos (2000).
49. A similar effect would be obtained for fertility rates 15 per cent higher than in the baseline, while an average increase in longevity between 2½ years might imply higher spending levels of about 1½ per cent of GDP.
50. See Keynes (1933).

Projections of their fiscal and economic implications are then helpful in better understanding whether and how policy should respond.

A number of studies, briefly discussed in this paper, anticipate a possibly significant reduction in saving rates in the next 50 years in the major OECD countries and regions accompanied by a reduction in the annual growth of per capita incomes – also as a consequence of the necessary response on the fiscal side – between ½ and ¾ of a percentage point. This is an important effect. As it depends on a number of factors, among which the general equilibrium resolution of imbalances in factor markets, three issues have been highlighted as especially in need of further research and discussion. These concern: i) the channels through which ageing affects the life-cycle saving decisions of households; ii) the response of factor prices and capital intensity to the demographic shocks and to technological improvements; and iii) the effects that demographic changes may have on technical progress itself.

It has been argued however – uncertainty on these implications notwithstanding – that it will be very difficult to escape from the fiscal impact of ageing populations. Moreover, this impact and the possible policy responses to it are likely to have significant intra and intergenerational distributional effects.[51] While these may be evaluated with various degrees of precision, for example by means of specifically designed overlapping-generations models, the most likely conclusion is that a Pareto optimal solution is not within reach. The policy responses, then, will have also to be evaluated having in mind the possible political and social costs of specific reforms.

A few years ago, the OECD indicated that a strategy based on a comprehensive approach, within well-balanced national frameworks might be best suited to address the challenges coming from the ageing of populations. Two lines of action have been discussed as fruitful, the first aimed at increased funding of pensions, within a multi-pillar approach that should take account of possibly significant transition costs, and the second aimed at lengthening working lives and raising employability. The possibility of beneficial effects linked to higher productivity growth and net immigration rates has also been considered, concluding that even if possibly non-negligible, these effects are unlikely – for reasonable changes and trends – to substantially ease the future fiscal pressures of ageing populations.

In conclusion, while ageing should not necessarily be seen as a problem in itself, its fiscal and economic consequences may be such that action on many fronts will be needed. It is certainly possible that technological progress, favoured by an endogenous response to the demographic shock, may help to reduce the burden of necessary reforms. Nonetheless, reforms will require advance notice and gradual implementation to minimise the distributional burden. The challenge for policy makers is significant, as they need to anticipate problems and build support for

51. On one side, under a pay-as-you-go system, working-age populations will have to transfer a rising share of their production to the retired population. On the other side, even with more funding of pension outlays, the transfer will take place through the substitution of capital for labour. An increase in productivity growth, necessary to maintain living standards on a trend not too distant from the one experienced in the past decades, might possibly make such transfers less costly for the working-age population, at least in absolute terms. Alternatively, the international distribution of labour and capital might also be affected. In this respect, besides increased immigration in the ageing OECD countries, one might also consider the possibility of increased net imports of goods and services paid out of domestic assets. This channel, not discussed in this paper, might be relevant in terms of both asset prices and international flow and stock imbalances.

reforms, even though the effects are only likely to be seen one or two decades down the road. Some progress has however already been made, and more certainly will come. After all, the historical record offers a rich testimony of mankind's ability to change when faced with major challenges. Even if some of Keynes' specific predictions about the long-run future were evidently wrong, he was certainly correct to stress the adaptability of the human race. This optimism should be shared.

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Table 1. **Assumptions for fertility, life expectancy and immigration**

	Fertility (children per woman)		Life expectancy at birth		Immigration (per cent of total population)	
	2000	2050	2000	2050	2000	2050
Australia	1.7	1.6	79.4	85.2	0.9	0.4
Austria	1.3	1.5	78.1	83.2	0.1	0.3
Belgium	1.5	1.8	78.4	83.0	0.1	0.1
Canada	1.6	1.5	78.4	82.0	0.6	0.4
Czech Republic	1.1	1.5	75.0	78.4	0.1	0.2
Denmark	1.8	1.8	77.0	81.0	0.2	0.2
Finland	1.7	1.7	77.5	82.4	0.1	0.1
France	1.7	1.8	78.8	83.5	0.1	0.1
Germany	1.4	1.5	77.8	82.5	0.4	0.3
Hungary	1.3	1.6	71.0	77.9	-0.1	0.0
Italy	1.2	1.5	78.7	83.5	0.1	0.2
Japan	1.4	1.6	80.8	83.0	..	..
Korea	1.7	1.6	74.4	79.6	..	..
Netherlands	1.7	1.8	78.2	82.5	0.2	0.2
New Zealand [1]	..	..	77.7	82.5	..	..
Norway	1.8	1.8	78.5	82.3	0.3	0.2
Poland	1.3	1.6	74.0	81.6	..	..
Portugal	1.5	1.7	75.6	81.0	0.1	0.2
Spain	1.2	1.5	78.5	82.0	0.1	0.2
Sweden	1.5	1.8	79.7	84.0	0.2	0.2
United Kingdom	1.7	1.8	77.6	82.5	0.2	0.1
United States	2.1	2.0	76.8	81.3	0.3	0.2
Average of countries above [2]	1.5	1.7	77.4	82.0	0.2	0.2

.. Indicates unavailable data.

1. Data are for 1996 and 2051.

2. OECD average is unweighted and excludes countries where information is not available.

Source : OECD (2001a).

Table 2. **Sensitivity of old-age dependency rates to higher fertility rates, life expectancy and net immigration** [1]

	Baseline scenario		Higher fertility rate [2]	Longer life expectancy [3]	Higher net immigration [4]
	2000	2050	2050	2050	2050
Austria	25	55	52	62	51
Belgium	28	50	46	56	48
Canada	20	46	46	..	..
Czech Republic	22	57	54	64	56
Denmark	24	40	35	44	39
Finland	24	48	45	54	47
France	27	51	47	57	50
Germany	27	53	50	60	50
Greece	28	59	55	66	55
Hungary	28	50	..	..	..
Ireland	19	44	41	49	42
Italy	29	67	63	75	63
Japan	28	65	61	72	..
Korea [5]	11	45	48	52	..
Luxembourg	23	42	39	47	38
Netherlands	22	45	42	51	45
New Zealand	28	50	..	..	..
Norway	28	50	..	..	..
Poland	20	55	52	60	..
Portugal	25	49	46	54	46
Spain	27	66	62	73	62
Sweden	29	46	43	52	44
United Kingdom	26	46	43	52	45
United States	22	38	35	44	36
Average of above countries [6]	25	51	48	57	48

1. The old age dependency ratio is the elderly population (65+) as a percentage of the working age population (20-64).

2. Fertility rates are assumed to rise by 15 percent relative to the baseline up to 2029 and remain constant at that level thereafter.

3. Mortality rates are assumed to fall by 30 percent and 20 percent respectively for males and females for all age groups by 2050. This corresponds, for instance, for males to about 3 years of gain in life expectancy at birth and less than 2 years of gain at 65 years old.

4. Net immigration, in numbers of persons, gradually increases from current (or estimated) levels in the year 2000 to +50 percent above the 2010 level, remaining constant over the rest of the period.

5. Korea assumed a lower fertility rate for this scenario.

6. Unweighted average of countries shown.

Table 3. **Comparison of population projections for 2040**

Index 2000=100

	World Bank	UN 1998 Revision	Eurostat/ National projections	UN 2000 Revision
	early 1990s	late 1990s	late 1990s	2001
	Total population			
Australia	119.6	131.6	131.6	132.8
Belgium	94.4	92.3	101.7	96.6
Canada	117.5	131.0	131.0	127.4
Denmark	97.5	94.3	105.6	98.4
France	104.7	103.2	107.2	105.9
Germany	86.1	93.1	97.0	90.8
Italy	87.4	79.7	89.5	82.0
Japan	93.3	88.1	88.1	90.9
Netherlands	97.9	94.9	112.6	102.7
Sweden	105.0	99.3	103.9	91.5
United Kingdom	102.1	99.1	105.7	101.7
United States	120.6	123.1	123.1	133.7
	Working-age population (aged 20-64)			
Australia	105.8	119.9	119.9	121.0
Belgium	81.4	80.1	89.7	84.9
Canada	101.2	114.3	116.4	112.6
Denmark	83.1	80.7	92.3	83.5
France	93.2	92.2	96.5	94.4
Germany	68.0	79.1	82.7	76.1
Italy	69.1	62.9	73.4	65.9
Japan	76.9	72.3	72.3	72.3
Netherlands	79.4	77.5	96.0	87.2
Sweden	95.3	87.7	95.8	80.1
United Kingdom	90.9	89.7	95.8	90.1
United States	108.1	115.3	115.3	123.6
	Old-age dependency ratio			
Australia	225.6	199.2	199.2	196.2
Belgium	178.2	190.1	182.8	190.9
Canada	229.6	212.9	214.4	216.6
Denmark	191.6	194.3	184.8	209.7
France	178.6	177.5	184.1	183.7
Germany	234.4	207.2	210.7	225.1
Italy	218.1	240.4	221.5	237.6
Japan	203.5	216.4	216.4	249.8
Netherlands	238.4	256.4	219.5	234.2
Sweden	151.9	176.7	157.8	196.1
United Kingdom	172.8	172.0	178.4	195.1
United States	202.8	183.5	183.5	184.7

Sources: Bos, E. *et al.* (1994); Eurostat; United Nations (1998); United Nations (2001).

Table 4. **Age-related spending**

(Levels in per cent of GDP, changes in percentage points)

	Total age-related spending [1]			Old-age pension spending		
	Level 2000	Change 2000-peak [2]	Change 2000-50	Level 2000	Change 2000-peak [3]	Change 2000-50
Australia	16.7	5.6	5.6	3.0	1.6	1.6
Austria [4]	10.4	4.6	2.3	9.5	4.3	2.2
Belgium	22.1	5.4	5.2	8.8	3.7	3.3
Canada	17.9	8.7	8.7	5.1	5.8	5.8
Czech Republic	23.1	6.9	6.9	7.8	6.8	6.8
Denmark [5]	29.3	7.3	5.7	6.1	3.6	2.7
Finland	19.4	8.5	8.5	8.1	4.8	4.8
France [6]	..	..	..	12.1	4.0	3.9
Germany	..	..	..	11.8	5.0	5.0
Hungary [7]	7.1	1.6	1.6	6.0	1.2	1.2
Italy	..	..	..	14.2	1.7	-0.3
Japan	13.7	3.0	3.0	7.9	1.0	0.6
Korea	3.1	8.5	8.5	2.1	8.0	8.0
Netherlands	19.1	10.1	9.9	5.2	5.3	4.8
New Zealand	18.7	8.4	8.4	4.8	5.7	5.7
Norway	17.9	13.7	13.4	4.9	8.2	8.0
Poland [7]	12.2	-2.6	-2.6	10.8	-2.5	-2.5
Portugal	15.6	6.6	4.3	8.0	4.5	4.5
Spain	..	..	..	9.4	8.0	8.0
Sweden	29.0	3.4	3.2	9.2	2.2	1.6
United Kingdom	15.6	0.8	0.2	4.3	0.0	-0.7
United States	11.2	5.5	5.5	4.4	1.8	1.8
Average of above countries [8]	16.9	5.9	5.5	7.4	3.8	3.4
Average of above countries providing all or nearly all spending components [9]	18.7	7.2	6.9			

1. Includes old-age pension expenditures and other, but not necessarily all, age-related expenditures.
2. The peak values are in 2050 except for Denmark (2030), Sweden and the United Kingdom (2035), and Belgium, Norway, the Netherlands and Korea (2040).
3. The peak values are in 2050 except for Japan (2015), the United Kingdom and Italy (2030), the United States, Sweden, Austria, Denmark and France (2035) and the Netherlands, Norway and Belgium (2040).
4. Total pension spending refers to old-age pensions and "other" pension spending which does not fall within the headings shown in this table or Table 6. This represents 0.9 per cent of GDP in 2000 and rises by 0.1 percentage point in the period to 2050.
5. Total includes other age related spending not classifiable under the headings shown in this table and Table 6. This represents 6.3 per cent of GDP in 2000 and increases by 0.2 percentage points from 2000 to 2050.
6. For France, the latest available year is 2040.
7. Total includes old-age pension spending and "early retirement" programmes only.
8. Average excludes Portugal which is less comparable than other countries.
9. Includes Australia, Belgium, Canada, Czech Republic, Denmark, Finland, Japan, Korea, Netherlands, New Zealand, Norway, Sweden, United Kingdom and United States.

Source : OECD (2001a).

Table 5. **Decomposition of changes in old-age pension spending: 2000-2050** [1]

(Level in per cent of GDP, changes in percentage points)

	Old-age pension spending		Contributions of :			
	Level in 2000	Change from 2000 to 2050	Old-age dependency ratio	Employment ratio	Benefit ratio[2]	Eligibility ratio
Australia	3.0	1.6	2.5	-0.1	-0.5	-0.2
Austria	9.5	2.2	7.6	-1.9	-1.1	-2.4
Belgium	8.8	3.3	4.7	-0.7	-1.6	1.0
Canada	5.1	5.8	5.1	0.0	-0.6	1.3
Czech Republic	7.8	6.8	8.2	-0.8	-0.1	-0.1
Denmark	6.1	2.7	2.7	-0.3	-1.5	1.7
Finland	8.1	4.8	5.2	-0.1	-0.2	0.0
France [3]	12.1	3.8	7.6	-0.5	-3.4	0.4
Germany	11.8	5.0	6.4	-0.7	-2.7	2.1
Hungary	6.0	1.2	2.9	-1.0	-0.3	-0.4
Italy [4]	14.2	-0.3	10.1	-3.2	-5.5	-1.5
Japan [4]	7.9	0.6	5.1	-1.2	-3.9	0.9
Korea	2.1	8.0	4.8	-1.0	0.2	5.0
Netherlands	5.2	4.8	3.8	-0.5	0.2	1.4
New Zealand	4.8	5.7	4.7	-0.1	1.0	0.0
Norway	4.9	8.0	3.0	0.1	3.9	1.2
Poland	10.8	-2.5	7.3	-1.3	-5.9	-2.1
Portugal	8.0	4.5	6.1	-1.0	-2.7	1.1
Spain	9.4	8.0	8.6	-2.6	0.0	2.0
Sweden [4]	9.2	1.6	3.9	-0.5	-2.1	0.4
United Kingdom [4]	4.3	-0.7	1.7	0.1	-2.5	0.1
United States	4.4	1.8	2.4	-0.1	-0.2	-0.3
Average of above countries [5]	7.4	3.4	5.2	-0.8	-1.3	0.5

1. See Dang *et al.* (2001, forthcoming) for methodology and detailed information on the time profile. Columns do not add up because linear approximations are used.
2. The associated percent declines in average benefits relative to average productivity over the period 2000 to 2050 is particularly important in the following countries: Belgium (-16), Denmark (-11), France (-21), Germany (-20), Italy (-30), Japan (-38), Poland (-51), Sweden (-22) and the United Kingdom (-47) per cent. All other countries are under 10 per cent except Norway where the average benefit is projected to rise by 53.6 per cent.
3. For France, data are available for 2040.
4. For these countries information on the number of pension recipients and average pensions was not available. These variables were estimated by the OECD Secretariat except for Italy, where data refer to the number of pensions and not the number of pensioners.
5. Average excludes countries where national information is not available and Portugal which is less comparable than other countries.

Source : OECD (2001a).

Table 6. **Other age-related spending**
(Levels in per cent of GDP, changes in percentage points)

	"Early retirement" programmes			Health care and long-term care			Child/Family benefits and education		
	Level 2000	Change 2000-peak [1]	Change 2000-50	Level 2000	Change 2000-peak [2]	Change 2000-50	Level 2000	Change 2000-peak [3]	Change 2000-50
Australia	0.9	0.2	0.2	6.8	6.2	6.2	6.1	0.0	-2.3
Austria	..	..	..	..	..	..	..	..	..
Belgium	1.1	0.1	0.1	6.2	3.0	3.0	6.0	0.0	-1.3
Canada	..	..	..	6.3	4.2	4.2	6.4	0.0	-1.3
Czech Republic	1.8	-0.7	-0.7	7.5	2.0	2.0	6.0	..	-1.2
Denmark	4.0	0.8	0.2	6.6	2.7	2.7	6.3	0.3	0.0
Finland	3.1	-0.1	-0.1	8.1	3.8	3.8	..	..	..
France [4]	..	..	..	..	..	..	..	..	..
Germany	..	..	..	..	..	..	..	..	..
Hungary	1.2	0.3	0.3	..	..	..	..	..	..
Italy	..	..	..	..	..	..	..	..	..
Japan	..	..	..	5.8	2.4	2.4	..	..	..
Korea	0.3	0.0	0.0	0.7	0.8	0.5	..	..	..
Netherlands [5]	1.2	0.4	0.4	7.2	4.8	4.8	5.4	0.1	0.0
New Zealand	..	..	..	6.7	4.0	4.0	7.2	0.0	-1.3
Norway	2.4	1.6	1.6	5.2	3.5	3.2	5.5	0.5	0.5
Poland	1.4	0.2	-0.1	..	..	..	..	..	..
Portugal	2.5	0.4	-0.4	..	..	..	..	..	..
Spain	..	..	..	..	..	..	..	..	..
Sweden	1.9	-0.2	-0.4	8.1	3.2	3.2	9.8	0.0	-1.2
United Kingdom	..	..	..	5.6	1.8	1.7	5.7	0.0	-0.9
United States	0.2	0.3	0.3	2.6	4.4	4.4	3.9	0.0	-1.0
Average of above countries [6]	1.7	0.3	0.1	6.0	3.3	3.3	6.2	..	-0.9

1. The peak values are in 2050 except for Belgium and Denmark (2025), Finland (2010), the Netherlands (2020), Poland (2035) and Sweden (2005). For Czech Republic the highest level is in 2000.
2. The peak values are in 2050 except for Denmark and Korea (2035), Norway (2040) and the United Kingdom (2040).
3. The entry "0.0" indicates the highest level is in 2000. The peak values are in 2035 for Denmark and in 2040 for Norway and the Netherlands.
4. For France, the latest available year is 2040.
5. "Early retirement" programmes only include spending on persons 55+.
6. Average excludes countries where information is not available and Portugal which is less comparable than other countries.

Source : OECD (2001a).

Table 7. **The fiscal impact of ageing in a "stylised" country, 2000-2050** [1]

(variables as a share of GDP and changes in percentage points)

	Change in:		Difference relative to baseline
	Primary balance	Net debt	
Baseline			
Impact of all age-related spending on the "stylised" country	-6.1	-95.8	
-- Impact abstracting from initial debt and primary surpluses [2]	-6.1	-210.1	
-- Impact of initial and sustained primary surpluses [3]		114.8	
Impact of pension spending alone [4]	-4.2	-74.0	22.0
Policy simulations			
Sustained primary deficit of 1 per cent of GDP [5]	-6.1	-435.4	-339.6
Primary surpluses disappear after 10 years	-8.6	-274.2	-178.4
Sensitivity test			
Sustained increase in the primary surplus of 1 percentage point of GDP [6]	-6.1	-1.2	97.0
Age-related spending is 1 percentage point lower in 2050	-5.1	-61.8	34.0
Initial debt is 10 percentage points lower	-6.1	-74.9	20.9
Real interest rates are one percentage point lower	-6.1	-60.6	35.2

1. The "stylised" country has pension spending equal to 8 per cent of GDP, a primary surplus of 2.5 per cent and net debt to 55 per cent of GDP. This country experiences an ageing-related shock measured by the median value in country submissions for the number of pensioners, average pensions, health-care spending and other age-related spending over the period.
2. Initial debt and primary balances, excluding the effects of ageing, are set to zero.
3. Assumes that age-related spending increases in line with GDP.
4. Assumes that other age-related spending increases in line with GDP.
5. The primary deficit is assumed to be 1 per cent of GDP initially (compared to a surplus of 2.5 per cent in the baseline). The deficit is assumed to remain constant over the period, excluding the effect of ageing. The impact of ageing is then introduced in this new baseline.
6. Increase throughout the period from 2000 excluding the effect of ageing. The impact of ageing is then introduced in this new baseline.

Source : OECD (2001a).

Table 8. **Policy measures in a "stylised" country to keep the year 2000 debt to GDP ratio constant** [1]

	Year policy measure takes effect:		
	2005 [2]	2015 [2]	2025 [2]
Reduction in average pension benefits (per cent)	17.3	21.3	29.9
Reduction in the number of pension beneficiaries (per cent)	7.7	9.5	12.3
Increase in the primary surplus needed to keep debt constant at the level in 2000 (per cent of GDP) [3]	1.1		
Memorandum item:			
Increase in the primary surplus needed to eliminate all debt by 2050 (per cent of GDP) [3]	1.8		

1. The "stylised" country has pension spending equal to 8 per cent of GDP, a primary surplus of 2.5 per cent and net debt to 55 per cent of GDP. This country experiences an ageing-related shock measured by the median value in country submissions for the number of pensioners, average pensions, health-care spending and other age-related spending over the period.
2. The reduction is fully implemented in the corresponding year and sustained through the period.
3. The surpluses are sustained throughout the period.

Source : OECD (2001a).

Table 9. **Average impact of sensitivity tests on total age-related spending: 2000-2050** [1]

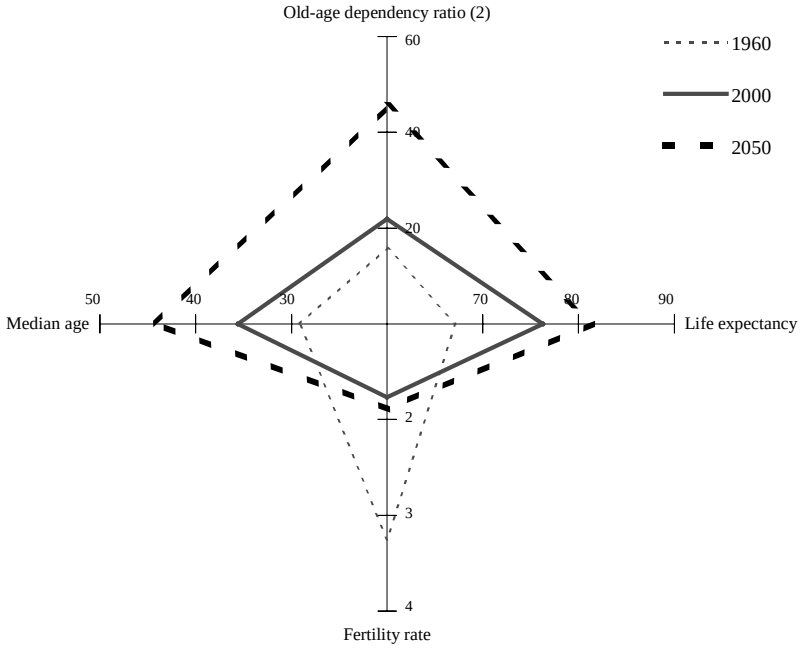
(Percentages points of GDP)

	Old-age pensions	Total age-related spending		Old-age pensions	Total age-related spending
Increased longevity (+3 years for males and +2 years for females relative to baseline)	1.0	1.4	Fall in unemployment rates (decline to levels experienced in late 1960s)	-0.2 [2]	-0.4 [2]
Higher fertility (+15% relative to baseline)	-0.7	-0.7	Higher older worker participation rates (5 percentage points higher by 2050 relative to baseline)	-0.3	-0.5
Higher immigration (+50% by end of period relative to baseline)	-0.4	-0.7	Higher female participation rates (5 percentage points higher in 2050 relative to baseline)	-0.3	-0.5
Increase in labour productivity growth (increase in growth rate by 1/2 point relative to baseline)	-0.5	-0.6 [3]			

1. Averages across the following countries: Belgium, Canada, the Czech Republic, Denmark, France, Germany, Italy, Japan, the Netherlands, Poland, Spain, Sweden and the United States. However, certain of these countries did not provide all of the sensitivity tests. For further details see Dang *et al.* (2001, forthcoming). Results are defined relative to baseline at the end of the period.
2. This indicates the impact relative to baseline. However, the baseline projections included some decline in unemployment rates particularly for Belgium, Italy, France and Spain, so that the impact of the total fall in unemployment over the period would be larger than reported here.
3. Excluding the Czech Republic and the United States because projections of spending on health and long-term care and education are insensitive to the change in productivity growth in these two countries, i.e. lower productivity growth does not lead to a fall in wage growth relative to baseline in these two countries.

Source : OECD (2001*a*).

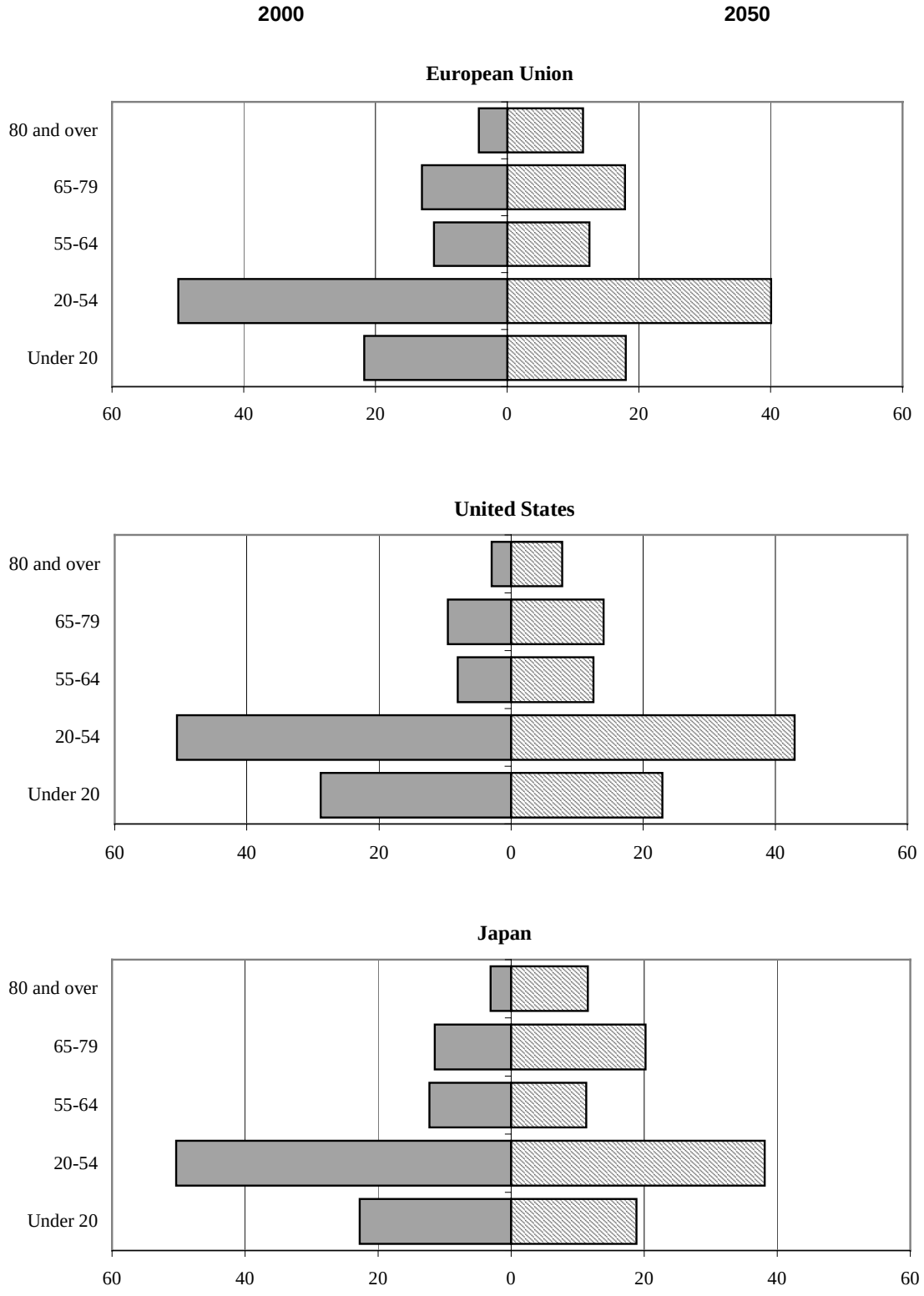
Figure 1. **Demographic pressures in the OECD area** [1]



1. Weighted average of OECD countries, based on total population shares in each period.
2. Population aged 65 and over as a percentage of the population aged 20-64.

Source: United Nations (1998).

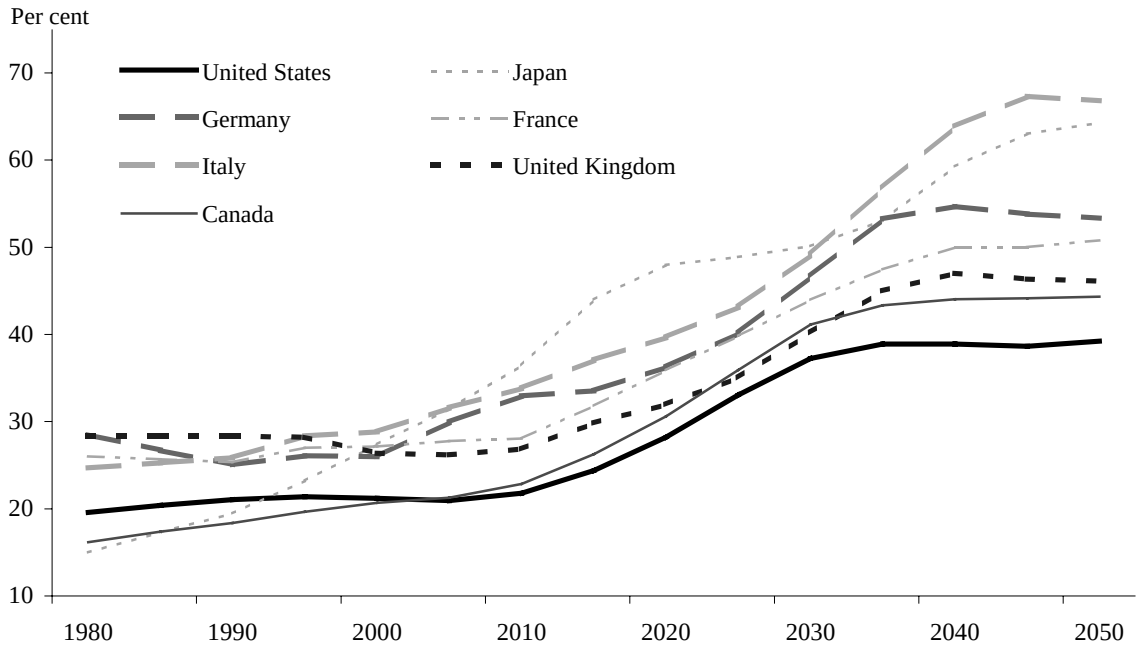
Figure 2. **Breakdown of age groups in major OECD zones: estimates and projections**
Percentage of total population



Source : Eurostat; United Nations (1998).

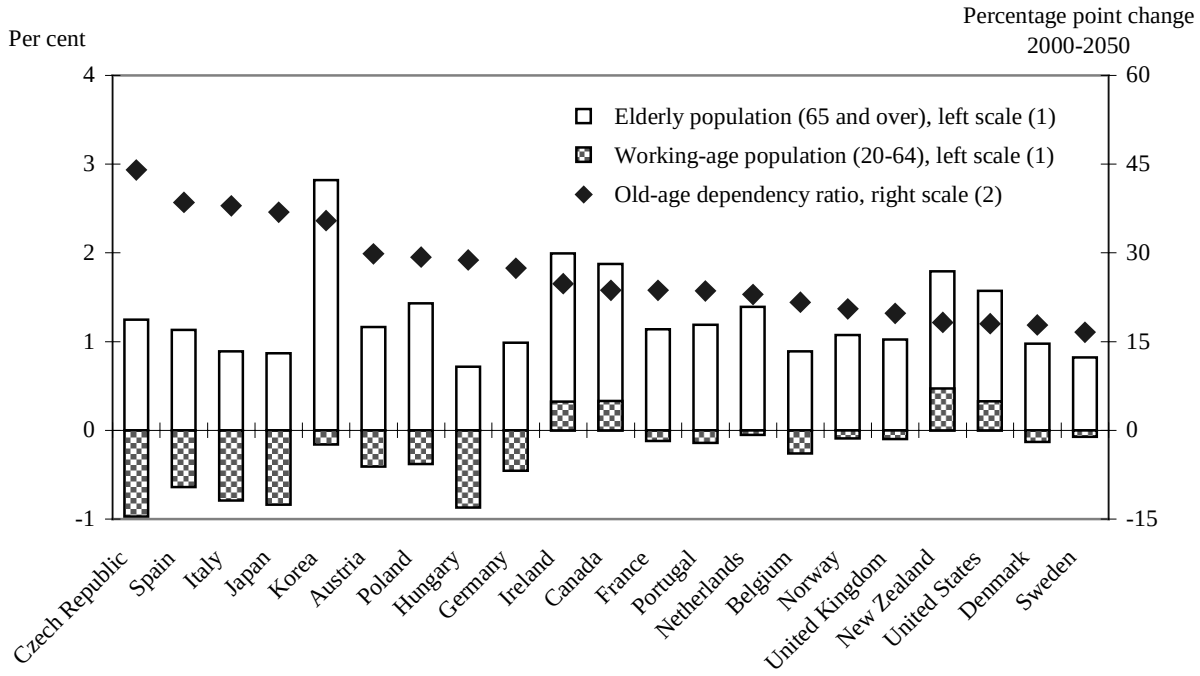
Figure 3. **Old-age dependency ratios in G7 countries**

Population aged 65 and over as a percentage of the working-age population (aged 20-64)



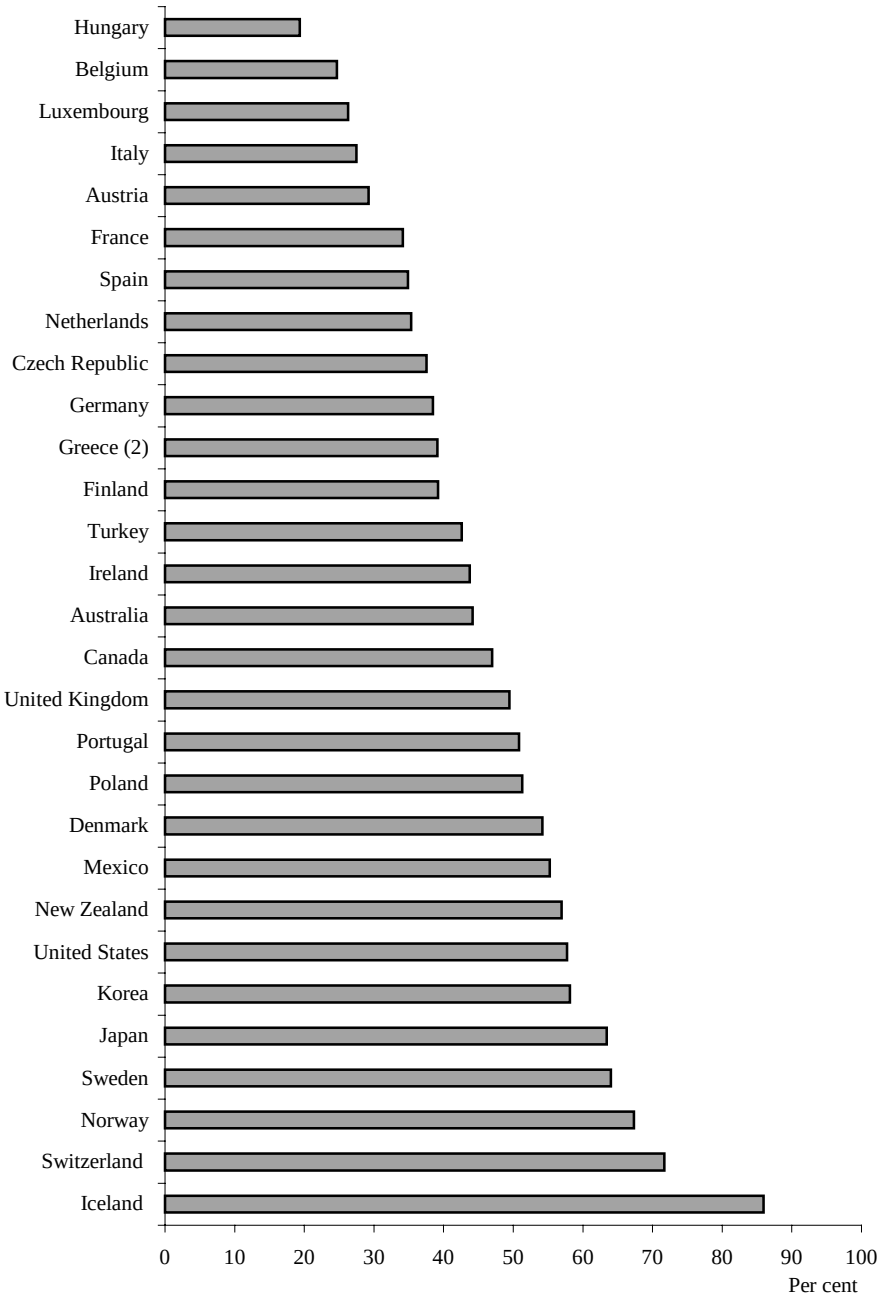
Source : Eurostat; United Nations (1998).

Figure 4. **Decomposition of the change in the old-age dependency ratio, 2000-2050**



1. Annual average per cent change over the period 2000-2050.
2. Percentage point change in the old-age dependency ratio over the period 2000-2050.

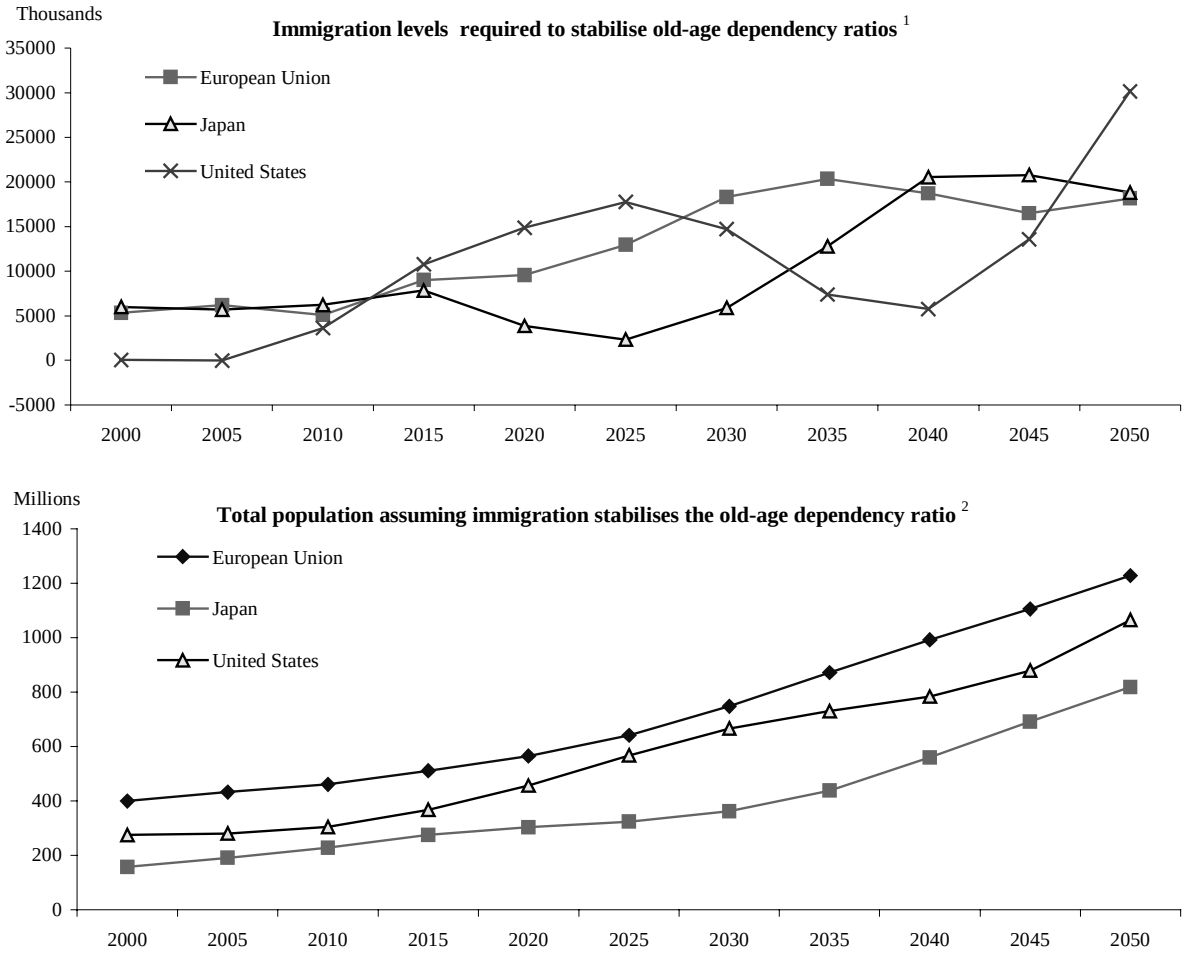
Figure 5. **Employment rate of older workers in OECD countries, 1999** [1]



1. Employment of workers aged 55-64 as a percentage of the population aged 55-64.
2. 1998 data.

Source: OECD *Labour Force Statistics* .

Figure 6. **Immigration and ageing**



1. Average annual net migration for 5 years ending in the year shown.
2. Total population in the year shown.

Source: United Nations (2000).