THE OUTPUT IMPLICATIONS OF HIGHER LABOUR FORCE PARTICIPATION

David Gruen and Matthew Garbutt

Treasury Working Paper

2003 — 02

October 2003

The authors are grateful to Steven Kennedy, Greg Smith and Julie Tinnion for discussions and suggestions, and to these people from the ABS: Nicholas Biddle, for data on average wages by age and gender; Garth Bode, for discussions on the classification of women on maternity leave in labour force statistics; and Hui Wei, for data on participation rates by level of education. The views expressed in the paper are those of the authors and not necessarily those of the Treasury or the Government.

ABSTRACT

This paper examines the output implications of a significant rise in Australian labour force participation over the next forty years. Using the projections in the Commonwealth Government's 2002-03 Intergenerational Report as a benchmark, it generates alternative projections assuming that, for each age-and-gender cohort, Australian participation rates rise gradually over (roughly) the next twenty years to reach the 80th percentile of the distribution of current participation rates across the OECD. Over the following twenty years, it assumes that Australian participation rates remain at these higher values.

These alternative projections, if they were realised, would imply gradually rising aggregate labour force participation in Australia for most of the next twenty years, rather than gradually falling participation, as projected in the Intergenerational Report. Output in twenty years time would be about 9 per cent higher than that projected in the Intergenerational Report, and would remain about 9 per cent higher for the following twenty years. About one-third of the rise in output in these alternative projections would be accounted for by higher participation by 45-64 year old males, and between one-sixth and one-quarter by higher participation by people aged 65 and over.

Some of the rise in participation rates in the alternative projections could occur as a consequence of recent rises in educational attainment flowing through to older age groups over time. Much of the rise, were it to occur, would need to come about as a consequence of changes in policy and in community attitudes, particularly to older workers.

JEL Classification Numbers: J11, J21, J24

Keywords: Intergenerational Report, labour force participation, ageing

TABLE OF CONTENTS

THE OUTPUT IMPLICATIONS OF HIGHER LABOUR FORCE PARTICIPATION

David Gruen and Matthew Garbutt

1. INTRODUCTION

This paper examines the output implications of a significant rise in Australian labour force participation over the next forty years. It takes the projections in the Commonwealth Government's 2002-03 Intergenerational Report as a benchmark, and examines the implications of significantly higher labour force participation rates than those projected in the Report.

The labour force participation projections in the Intergenerational Report envisage a continuation of trends that have been apparent for the past couple of decades. Participation rates have been increasing for females of all age groups and the Intergenerational Report projects a continuation of these trends — although with the rate of increase slowing over time. Gradual declines in the age-specific participation rates of men in most age groups (those less than 60 years of age) have provided a partial offset to these higher age-specific female participation rates, and again, the Intergenerational Report projects a continuation of these trends.

Here, we present alternative projections, and examine their implications. To generate these alternative projections, we examine the current experience of a sample of OECD countries, judged to be relatively similar to Australia. We assume that within roughly twenty years, Australian participation rates reach values defined by the 80th percentile of the distribution of current participation rates across our sample of OECD countries by age and gender, and then remain at these higher values for the following twenty years.

We do not view these OECD-80th-percentile values as targets that it would be desirable to reach for their own sake at some time in the future. The reason for choosing a fixed percentile of the distribution of participation rates across a sample of OECD countries is to provide a consistent basis on which to project participation rates for each cohort into the future. We choose the fairly high 80^{th} percentile of each distribution because it enables us to examine the implications of a substantial, albeit gradual, rise in participation rates in Australia over the coming decades. An implication of this choice, however, is that the alternative labour force projections we present are clearly ambitious ones.

We do not discuss in any detail what societal changes might lead to significantly higher participation rates in coming years. But, reducing impediments making it more difficult for people to remain in the workforce later in life (see, for example, Henry, 2002 and Encel, 2003) as well as gradually changing social attitudes to older workers will likely lead to higher labour force participation rates over coming years. Furthermore, as we show in the discussion section of the paper, recent rises in average levels of education in the community, as they filter through to older age groups over coming years, should also be expected to generate significant rises in labour force participation, especially for females. There are, therefore, some grounds for expecting higher Australian participation rates over time, although it is hard to quantify how large might be the combined effect of these influences.

The next section of the paper explains our approach in more detail, derives the distribution of participation rates by age and gender across our sample of OECD countries, and compares the 80^{th} percentile values with current Australian participation rates. It also discusses several measurement issues relevant to using these OECD data to generate projections of future Australian participation rates. The following section of the paper presents results for these alternative projections, disaggregated by age and gender, under two alternative

assumptions about the relative productivity of workers of different age and gender. The penultimate section presents a discussion of the assumptions underlying the projections, and the paper ends with a brief conclusion.

In subsequent work, we will examine the fiscal implications of the alternative labour force and output projections presented here, and compare them with those presented in the Intergenerational Report.

2. APPROACH

To generate alternative labour force projections, we examine the experience of countries that are relatively similar to Australia. The obvious place to look is the OECD. Rather than examining the whole OECD, however, we eliminate some countries on the grounds that they are least comparable to Australia in important respects. Our main criterion for exclusion is a very low level of public social expenditure relative to GDP. Workers in countries with low levels of public social expenditure — particularly expenditure on pensions and health — face much stronger incentives to remain in work later in life than those in countries like Australia with significantly higher levels of public social expenditure. The labour force participation experience of such countries is therefore likely to be of less relevance for Australia. On this basis, we eliminate the four countries with the lowest levels of public social expenditure in the OECD: Korea, Mexico, Turkey and Slovak Republic.[1] We also eliminate Hungary from the analysis, as it is the only OECD country not in a position to provide data on social expenditure to the OECD. Luxembourg is also eliminated as it has a male labour force participation rate greater than 100 per cent,

[1] These countries had public social expenditure to GDP ratios of 5.9, 8.2, 11.6 and 13.6 percent in 1998 (1980-1998: 20 Years of Social Expenditure; The OECD Database, SOCX). The United States had the next lowest ratio of public social expenditure to GDP, at 14.6 percent. Australia's ratio was 17.8 percent.

presumably because there are many males working in Luxembourg who do not live there. This leaves a remaining sample of 24 OECD countries on which to base our analysis.

Figure 1 shows distributions of participation rates by age and gender in 2001 across this sample of countries from Labour Force Statistics (OECD, 2002), including where Australia sits in the distributions.[2]

---

[2] The distributions are derived using a non-parametric technique. Given participation rates for a given age group and gender, x_i, from $i = 1,\ldots, N$ countries, the density function $f(x)$ at any point x is estimated by

$$f(x) = \frac{1}{Nh\sqrt{2\pi}} \sum_{i=1}^{N} \exp\left(-\frac{1}{2}\left[\frac{x_i - x}{h} \right]^2 \right)$$

where $h = \sigma_x N^{-1/5}$, σ_x is the standard deviation of the observations x_i, $i = 1,\ldots, N$. While this non-parametric technique is a standard one, it does not impose the constraint that $f(x) = 0$ for x outside the range $0 \le x \le 100$. Given this, 80th percentiles are calculated by integrating $f(x)$ from $x = -\infty$ rather than from 0.

Figure 1: Distribution of participation rates across the OECD

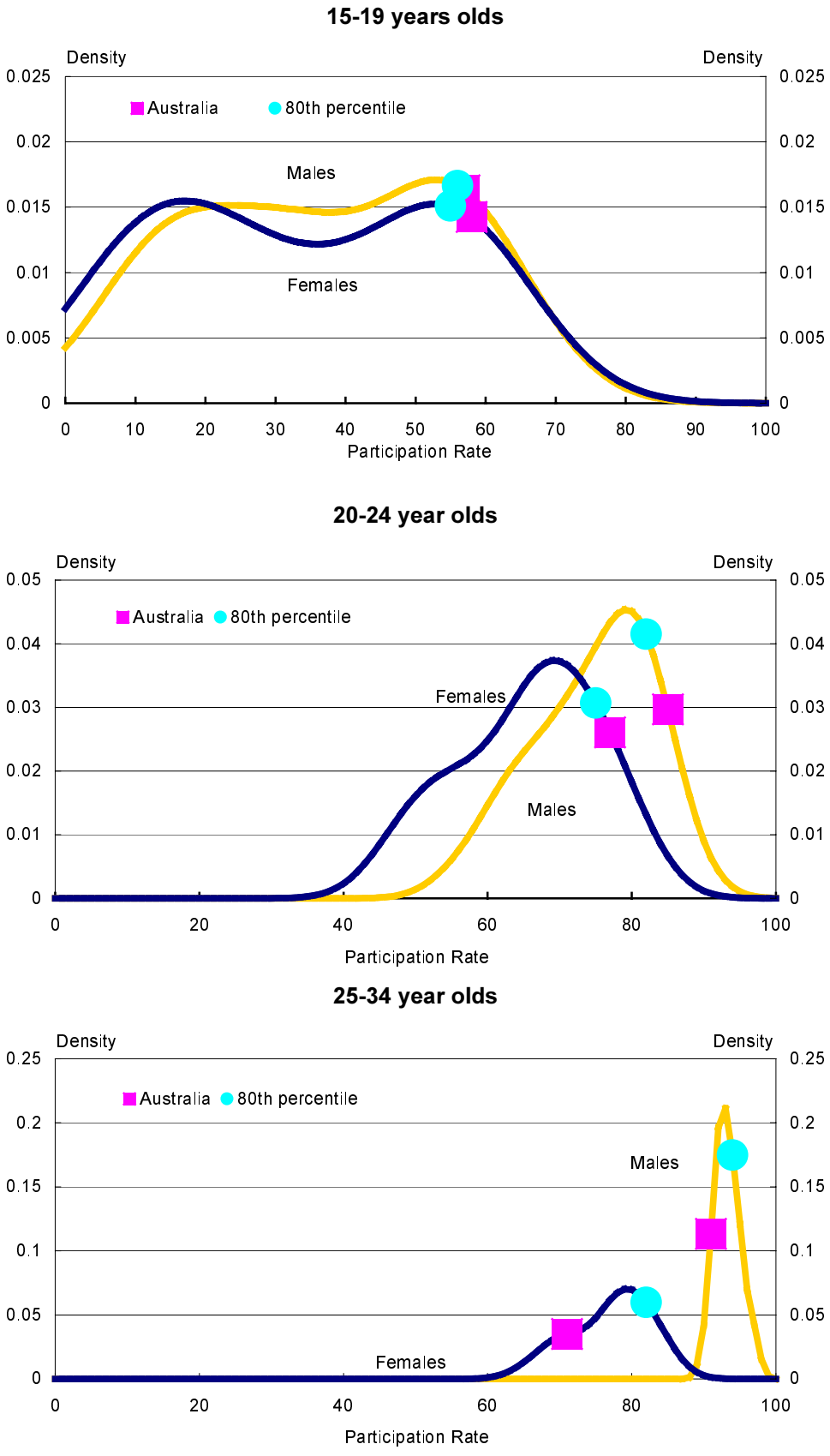


Figure 1: Distribution of participation rates across the OECD (continued)

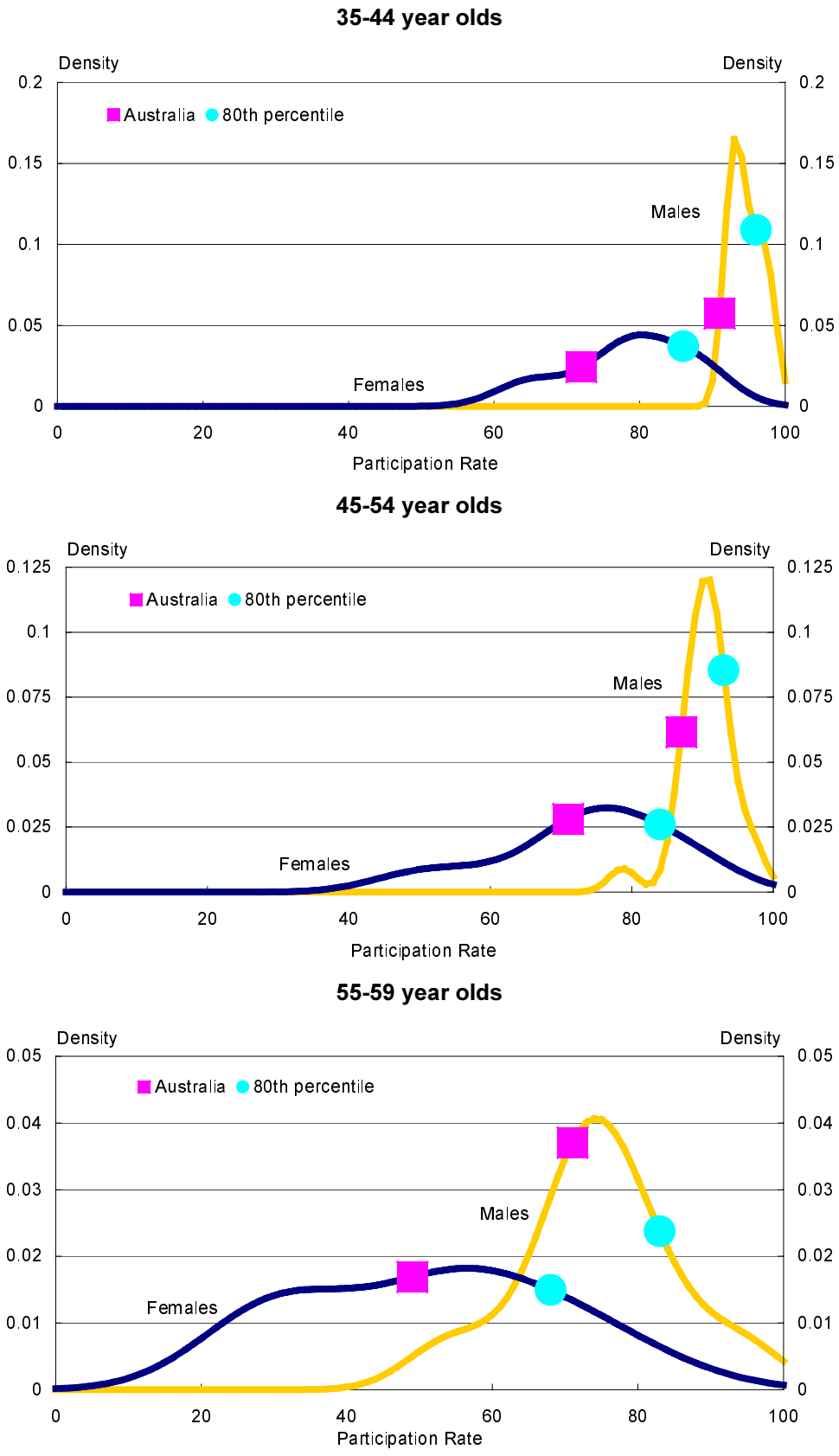
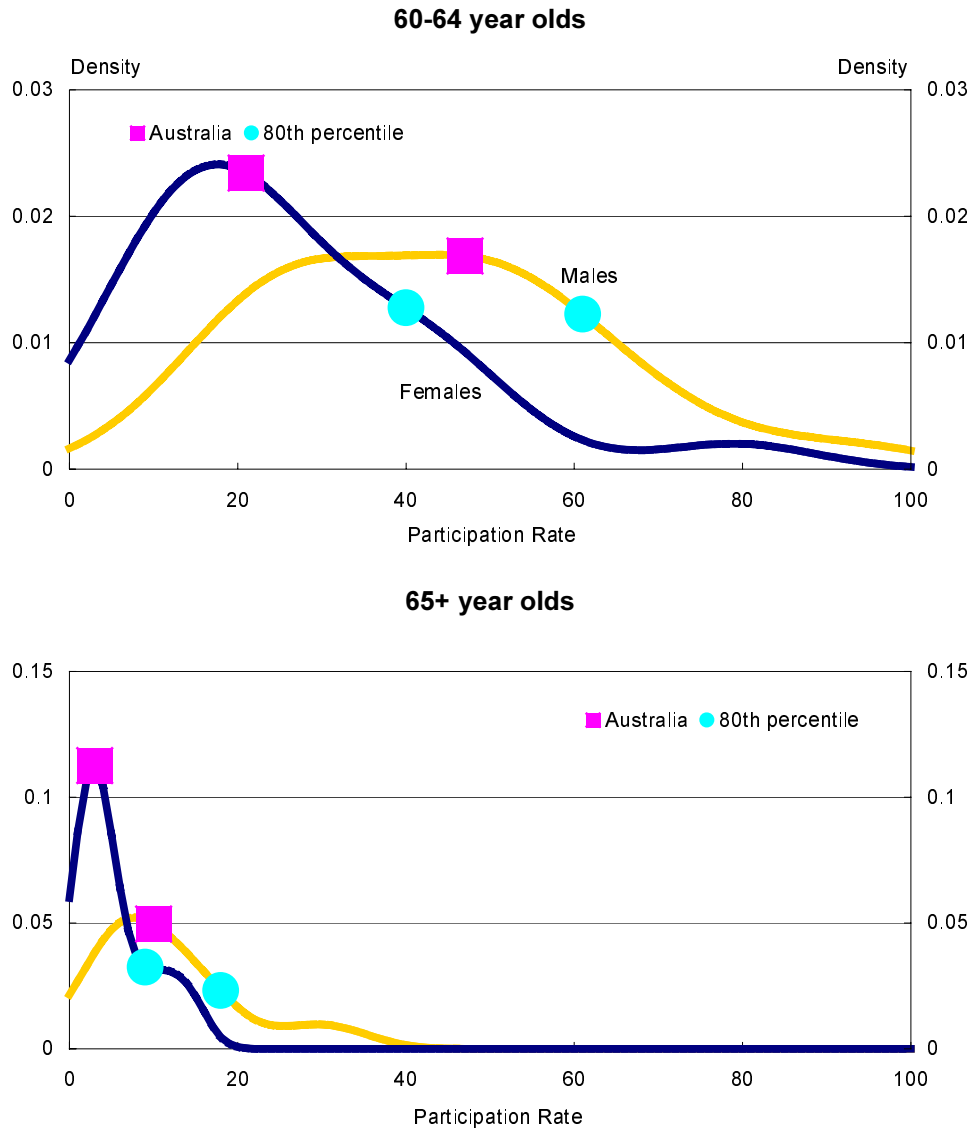


Figure 1: Distribution of participation rates across the OECD (continued)



Notes: The distributions are calculated across between 20 and 24 OECD countries, depending on the age group. Participation rates for Hungary, Korea, Luxembourg, Mexico, Slovak Republic and Turkey are excluded for all age groups for reasons described in the text. Further exclusions are necessary for some age groups, due to a lack of comparable data. For both males and females, Switzerland is excluded from all age groups other than 65+; Italy is excluded for age groups in the range 25-59; Ireland and Sweden are excluded for age groups in the range 55-64.

Figure 2 summarises these data by showing a direct comparison between the Australian participation rates by age and gender and the corresponding 80th percentiles for the OECD sample. The Australian participation rates are slightly higher than the 80th percentiles for both males and females in the 15-19 and 20-24 age groups. For older age groups, however, the Australian participation rates are lower than the 80th percentiles, and for some age groups the difference is large — significantly more than 10 percentage points. As previously explained, we assume for our alternative profiles that Australian participation rates rise gradually from their actual values in 2001-02 to reach these 80th percentile values in 2021-22. From that year out to 2041-42, we assume that they remain constant at these higher values.[3]

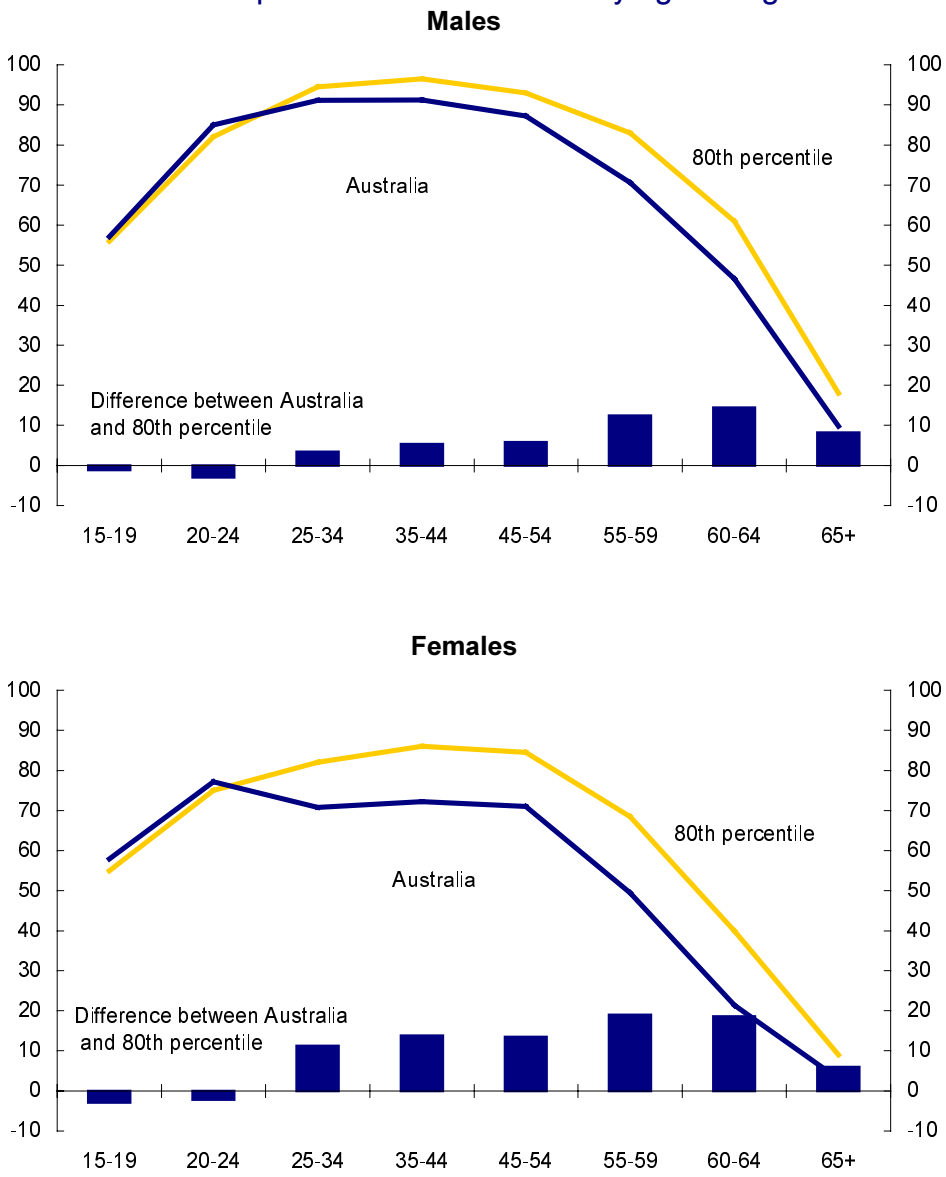
It is also of interest to examine the distribution of aggregate participation rates for the 15+ working age population across our sample of OECD countries. For each country, the 15+ participation rate depends not only on participation rates by age and gender, but also on the distribution of the country's population across these age-and-gender cohorts. To abstract from the effects of different population distributions across countries, we generate a synthetic distribution assuming that all countries share Australia's 2001-02 population proportions for each age group and gender. Figure 3 shows the resulting distribution.[4]

---

[3] Since Australian participation rates in 2001 were higher than the 80th percentiles of our OECD sample for 15-19 and 20-24 year olds of both genders, our alternative profiles assume the participation rate projections from the IGR for these groups. In contrast to the other age groups, these projections therefore incorporate some changes in participation rates over the period 2021-22 to 2041-42, since the IGR projects some (usually small) changes in age-specific participation rates over this time.

[4] Assuming Australian 2001-02 population proportions applied to each country's 2001 participation rates by age and gender from Labour Force Statistics (2002) implies these participation rates for the 15+ population: Iceland, 76.4; Switzerland, 69.9; Norway, 68.9; Sweden, 67.4; United States, 66.5; New Zealand, 65.8; Spain, 65.2; Canada, 65.2; United Kingdom, 65.2; Portugal, 64.4; Japan, 64.4; Finland, 63.7; Netherlands, 63.7; Australia, 63.2; Germany, 62.4; Czech Republic, 61.0; Austria, 60.3; Ireland, 58.9; France, 57.6; Poland, 57.1; Denmark, 56.9; Greece, 54.8; Belgium, 53.8; and Italy, 53.3 (with

Figure 2: Comparison of Australian participation rates with the 80th percentile of the OECD by age and gender

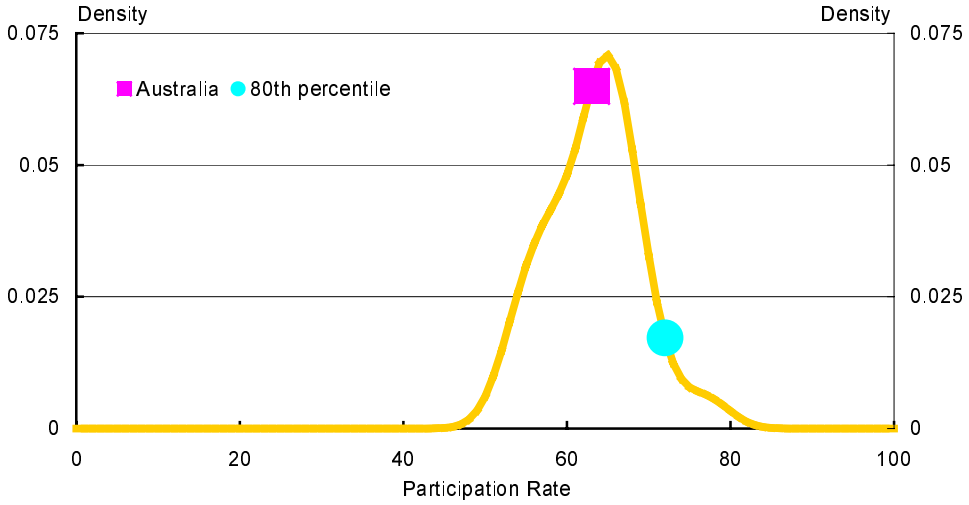


Note: The results are derived from the same samples of OECD countries as those used for Figure 1 (see the notes attached to that Figure for further details).

---

a standard deviation across countries of 5.5). Assuming that participation rates take their 80th percentile values by age and gender generates a 15+ participation rate of 71.6. Calculated on this basis, the 15+ participation rates of five countries, Iceland, Switzerland, Norway, Sweden and United States are within one standard deviation of the 15+ participation rate of a hypothetical country with 80th-percentile-by-age-and-gender participation rates.

Figure 3: Distribution of 15+ participation rates across the OECD



Notes: The distribution is derived across the sample of 24 OECD countries using the non-parametric technique used for Figure 1. We assume, counter-factually, that all countries share Australia's 2001-02 population distribution across age groups and genders.

Before examining the further implications of our alternative participation rate projections, there are three measurement issues to be dealt with.

The first issue relates to paid maternity leave. In OECD countries in which women receive paid maternity leave provided by the government for several months after the birth of their children, the relevant international definitions imply that women on paid maternity leave are included in the labour force. This raises the measured participation rate of women of child-bearing age above the rate that would otherwise apply. To allow for this measurement effect, we lower the participation rate to be achieved in 2021-22 for women in the 25-34 year age group by 4 percentage points and in the 35-44 year age group by 1 percentage point below their 80th percentile values.[5] This is consistent with assuming that women in countries near the 80th percentile of the OECD receive paid maternity

[5] The participation rates at the 80th percentile of the OECD distributions are 82 percent for 25-34 year old women, and 86 percent for 35-44 year olds. The adjusted participation rates for women in these age groups are, therefore, 78 percent and 85 percent.

leave for about 22 weeks for each child. Further explanation about these adjustments is provided in Appendix 1.

The second measurement issue relates to the different treatment of armed force personnel in the definitions of age-specific participation rates used in the Intergenerational Report and in Labour Force Statistics (OECD, 2002). Appendix 2 provides a discussion of this issue, and concludes that the differences are sufficiently small for our purposes that they can be safely ignored.

The third measurement issue also relates to differences between the statistics reported in Labour Force Statistics (OECD, 2002) and those used in the Intergenerational Report; in this case, for people aged 65 and over. Appendix 3 explains this issue, and how we deal with it.

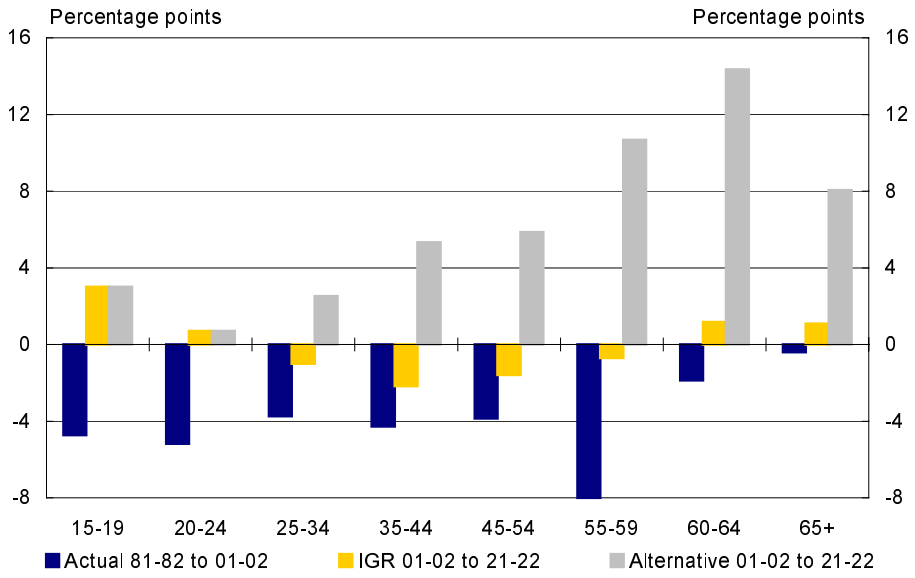
3. RESULTS

Figure 4 shows a comparison of the projected changes in participation rates by age and gender over the twenty years, 2001-02 to 2021-22, in the Intergenerational Report and in the alternative projections with the actual changes over the past twenty years, 1981-82 to 2001-02. The differences between males and females are instructive.

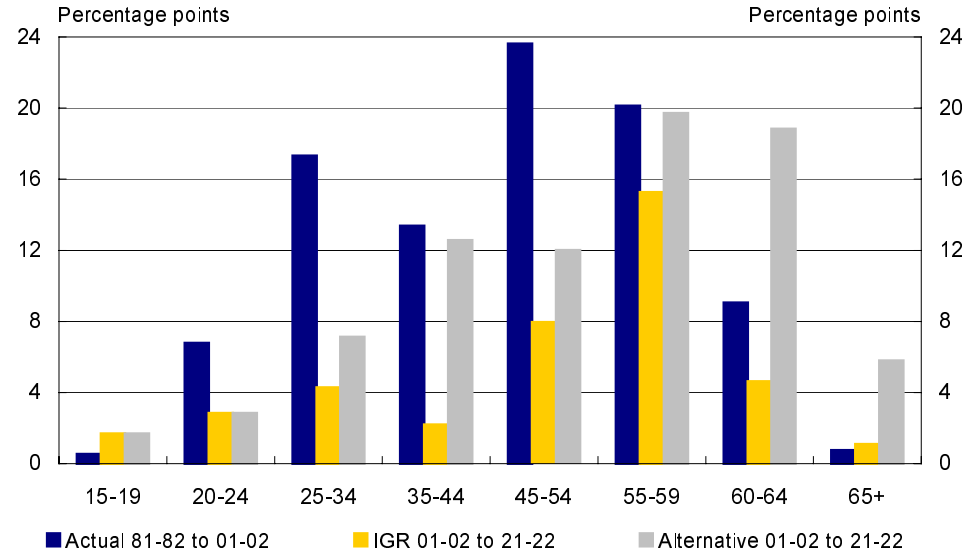
Figure 4: Changes in participation rates

Intergenerational Report and alternative participation rate profiles

Males



Females

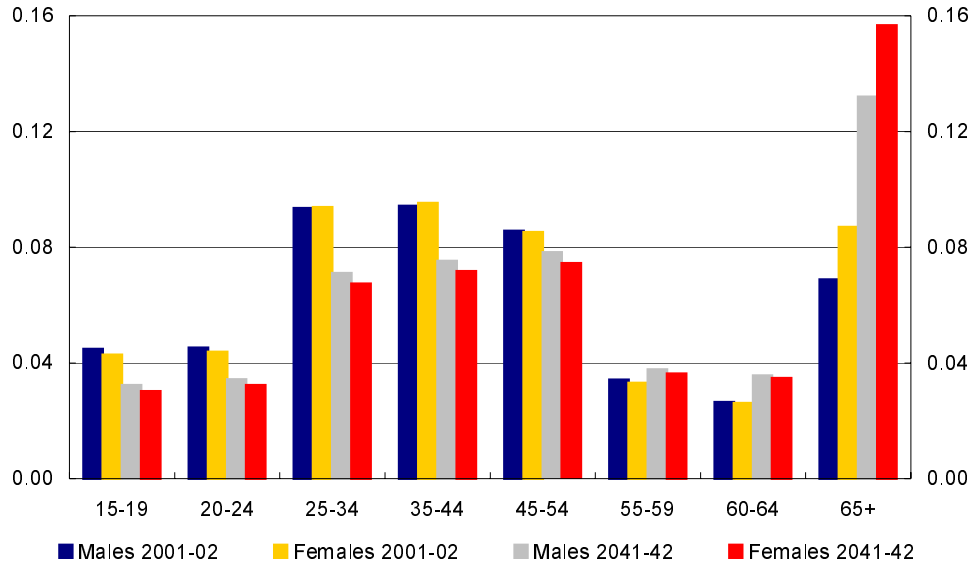


The Intergenerational Report projects further small declines in participation rates for males aged between 25 and 59, and small rises for other age groups. By contrast, the alternative projections show rises across all male age groups. For prime-age males, the projected rises roughly offset the falls that occurred over the past twenty years, while for older age groups, the rises are significantly

larger than those earlier falls. For females, the Intergenerational Report projects rises in participation across all age groups, as do the alternative projections. For some of the younger age groups, the two projections envisage quite similar rises, while for over-60 year olds, they are significantly different.

Figure 5 compares the proportions of different age groups in the 15+ population in 2001-02 with those projected for 2041-42 in the IGR. Over this forty-year period, there are noticeable falls in the proportions of younger age groups. What is particularly striking, however, is the strong rise in the proportion of 65+ year olds. Males and females in this older age group, taken together, accounted for 16 per cent of the 15+ population in 2001-02, but this proportion is projected to rise to 22 per cent in 2021-22 and to 29 per cent in 2041-42. It follows that even a modest rise in the participation rate of this older age group should be expected to have a significant impact on the aggregate economy.

Figure 5: Proportions of 15+ population

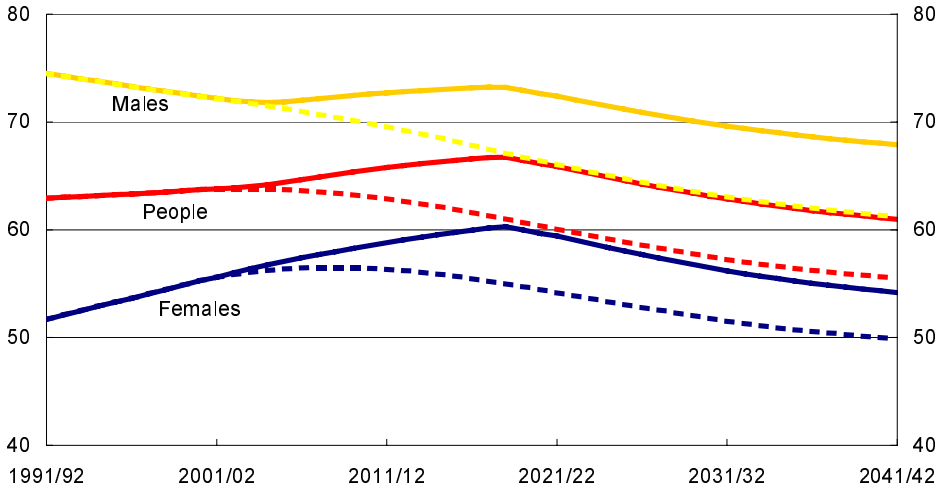


Note: From the Intergenerational Report.

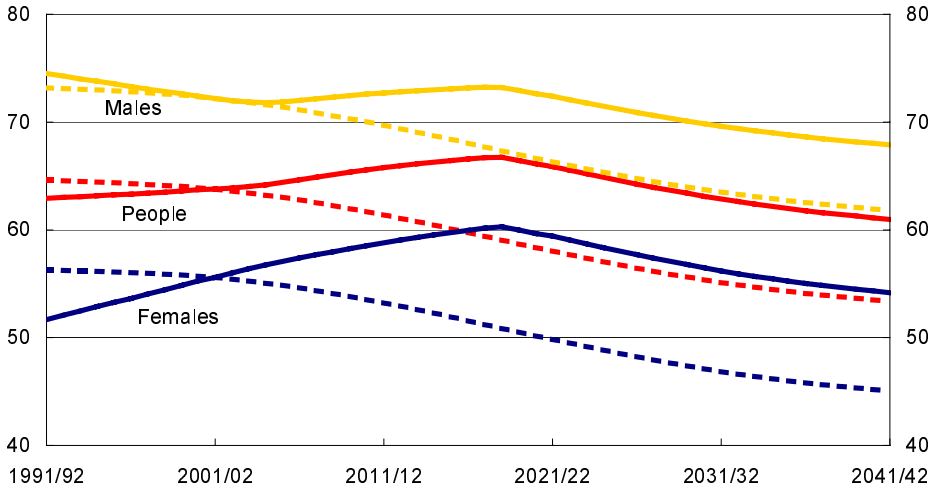
Figure 6 shows participation rates for the 15+ population. The IGR projects that aggregate 15+ participation rates will remain around current levels (near 64 per cent) until about 2007-08, before declining gradually to 55½ per cent in 2041-42. The alternative profiles imply an aggregate 15+ participation rate that continues to rise gradually until the second half of the next decade, when it reaches about 66½ per cent before declining gradually to about 61 per cent in 2041-42.[6] The lower panel of the figure shows how aggregate participation rates for the 15+ population would evolve if participation rates by age and gender were fixed at their 2001-02 levels. In that case, the gradual declines in participation rates, for males, females and for people, would be driven solely by ageing, leading to a gradual transition of the population into older age groups with lower rates of labour force participation.

[6] To generate the alternative profiles, we begin with actual participation rates in 2001-02 and their projected values in 2021-22 and 2041-42 for each age and gender cohort. We then generate smooth participation-rate profiles through time for each cohort by interpolating between these values, using a combination of straight lines and logistic curves. Applying the gradually time-varying population proportions from the IGR to these smooth participation-rate profiles for each cohort then generates the alternative aggregate participation rate profiles.

Figure 6: Participation rates for 15+ population



Note: The dashed lines show participation rates, in per cent, from the Intergenerational Report, while the solid lines show the alternative profiles.



Note: The dashed lines show participation rates, in per cent, assuming that participation rates by age and gender are fixed at their 2001-02 levels, while the solid lines again show the alternative profiles.

To translate changes in participation rates into changes in output, it is necessary to take into account a range of labour market characteristics. In general, cohorts in the labour force differ in terms of their proportions of full-timers; unemployment rates for full-timers and part-timers; average hours worked for full-timers and part-timers; and levels of productivity.

The results in the Intergenerational Report are based on detailed quantitative projections for these characteristics, which we also use here for the alternative profiles. It is worth providing a brief summary of these projections.

As with participation rates, the IGR projects past trends into the future for the proportion of full-timers, unemployment rates for full-timers and part-timers, and average hours for full-time and part-time workers. These projections are (mostly) conducted separately for each age and gender cohort. By and large, however, there are only small changes projected into the future for these labour market characteristics.

The proportion of full-timers in the labour force is highest for prime-age males, much lower for females, and declines significantly for older age groups.[7] The IGR assumes an aggregate unemployment rate of 5 per cent from 2006-07 onwards, although it allows for differences in relative unemployment rates for different cohorts, and for part-timers and full-timers. Applying cohort and date-specific unemployment rates from the IGR to the alternative participation rate projections, however, need not generate the 5 per cent aggregate unemployment rate that is a feature of the IGR. Since older age groups have lower average unemployment rates than younger age groups, and the alternative projections include a disproportionate number of older people in the labour force compared to the IGR (see Figure 4), we should expect the alternative projections to generate lower aggregate unemployment rates in the future. This is indeed the outcome, although the effect is small, with aggregate unemployment rates in the alternative projections of 4.8 per cent in both 2021-22 and 2041-42.

---

[7] For example, the proportion of full-timers in the labour force for 35-44 years olds in 2001-02 is 93.7 percent for males and 54.5 percent for females. These numbers are projected to change gradually to 91.1 percent and 55.1 percent in 2041-42. For 65-69 year olds, the corresponding numbers are 61.5 percent for males and 29.1 percent for females in 2001-02, declining gradually to 57.0 percent and 27.2 percent in 2041-42.

Average hours for employed full-time and part-time workers are gender specific (with males working longer average hours than females for full-timers, but slightly shorter for part-timers) and gradually rise over the projection period for both genders and for both full-timers and part-timers. Full-time (and part-time) workers of a given gender in a given year are, however, assumed to work the same average number of hours, regardless of their age.

The Intergenerational Report assumes that aggregate labour productivity (GDP per hour worked) rises at an annual rate of 1¾ per cent from the middle of this decade out to 2041-42. No distinction is drawn between the productivity levels of workers of different age or gender — an hour worked in a given year is assumed to make the same contribution to GDP regardless of who worked it.

For the alternative projections, we assume that labour productivity for each age and gender cohort rises at the same annual rate as assumed in the IGR, 1¾ per cent. But we show results for two alternative assumptions about the relative productivity of the cohorts. The first assumption is the one used in the IGR — that productivity levels in a given year are the same for each cohort. The second assumption is that these productivity levels are proportional to the average hourly wages paid to workers in these cohorts in 1999.[8]

Table 1 shows the implications of different participation rate projections for GDP assuming that productivity levels are the same for each cohort. The participation rate trends built into the IGR (see Figure 4), along with the trends in other labour market characteristics, imply significant rises in GDP in 2021-22 and 2041-42 compared to a baseline in which these trends did not occur. As should be clear from Figure 4, this rise in GDP arises predominantly from the projected strong

---

[8] In standard models, workers are paid their marginal labour productivity, while we are interested in the average labour productivity of each cohort. At least for the Cobb-Douglas production function, marginal and average labour productivity are proportional

rise in labour force participation for females aged 25-64, offset to some extent by projected declines in participation for males aged 25-59.[9]

Table 1: Changes in GDP relative to baseline
Labour productivity levels are assumed to be the same for each cohort (per cent)

Age Group		IGR relative to no-change baseline		Alternative projections relative to IGR baseline	
		2021-22	2041-42	2021-22	2041-42
15-24	M	-0.5	-0.8		
	F	-0.1	-0.1		
25-44	M	-0.5	-0.8	1.8	2.0
	F	1.4	1.8	1.5	1.3
45-64	M	-0.1	-0.2	3.0	3.2
	F	2.3	2.9	1.4	1.0
65+	M	0.1	0.2	1.1	1.4
	F	0.1	0.2	0.6	0.8
Total		**2.7**	**3.1**	**9.4**	**9.7**

Notes: All projections (no-change baseline, IGR and alternative) assume the date-specific population proportions by age group and gender from the IGR (shown in Figure 5). For both 2021-22 and 2041-42, the no-change baseline assumes 2001-02 values for age-and-gender-specific participation rates, proportions of full-time workers, full-time and part-time average hours, and relative unemployment rates. Age-and-gender-specific unemployment rates are, however, adjusted in this no-change baseline to generate an aggregate unemployment rate of 5 per cent in both 2021-22 and 2041-42, consistent with the IGR. The alternative projections assume age, gender and date specific values for proportions of full-time workers, full-time and part-time average hours, and unemployment rates from the IGR.

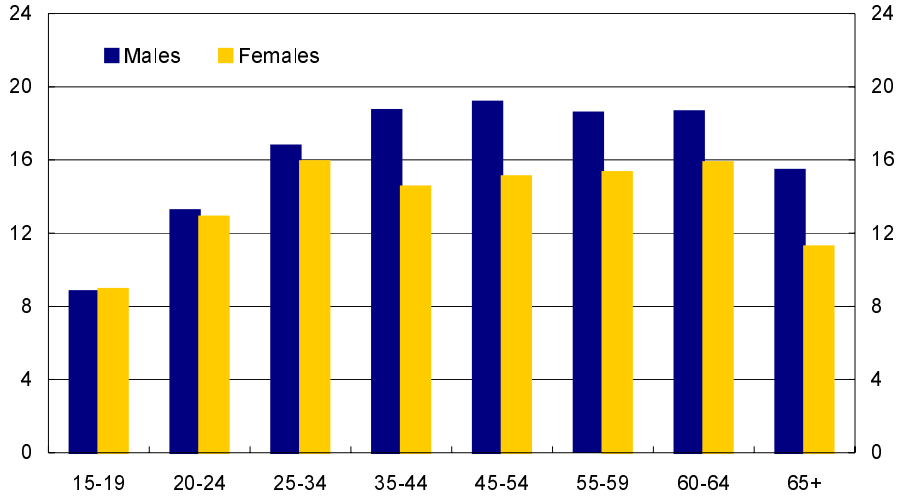
Before discussing the alternative projections in Table 1, we present results assuming the second productivity assumption — that productivity levels across cohorts are proportional to the average hourly wages paid to workers in these cohorts in 2001. These average wages are shown in Figure 7.

---

to each other. In the Discussion section of the paper, we also revisit the assumption that aggregate labour productivity grows at an annual rate of 1¾ per cent.

[9] The age group 15-24 detracts slightly from GDP in the IGR for both genders compared to the no-change baseline despite projected rises in participation rates in the IGR. This is a consequence of significant rises in the proportion of part-timers projected for this age group. These rises represent a continuation of long-standing trends, and are undoubtedly related to rising levels of educational attainment for this age group – a topic we will return to in the Discussion section.

Figure 7: Average Wages by Age and Gender
Dollars per hour in 1999/2000



Notes: Data are for wage and salary earners in market industries, from the ABS Survey of Income and Housing Costs, and are weighted to reflect relative population proportions.

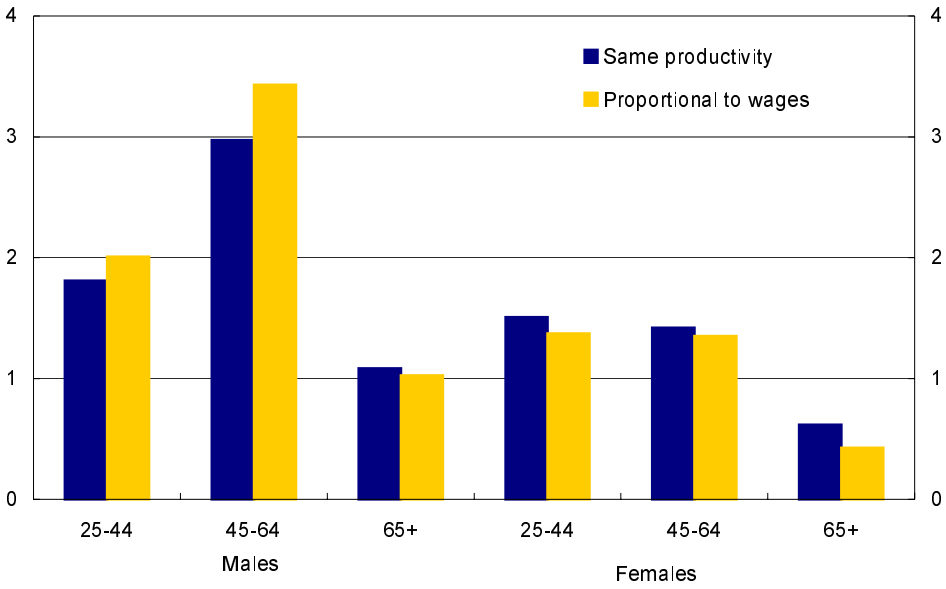
Figure 8 presents a comparison of the contributions to GDP made by each cohort in the alternative participation rate projections relative to the IGR baseline. The figure shows results assuming that the labour productivity of each cohort is either the same, or proportional to wages, as shown in Figure 7. (The 'same productivity' results are those reported in Table 1.)[10]

[10] The IGR did not report results using the productivity-proportional-to-wages assumption. These results should be interpreted as outcomes had both the alternative projections and the IGR imposed this assumption.

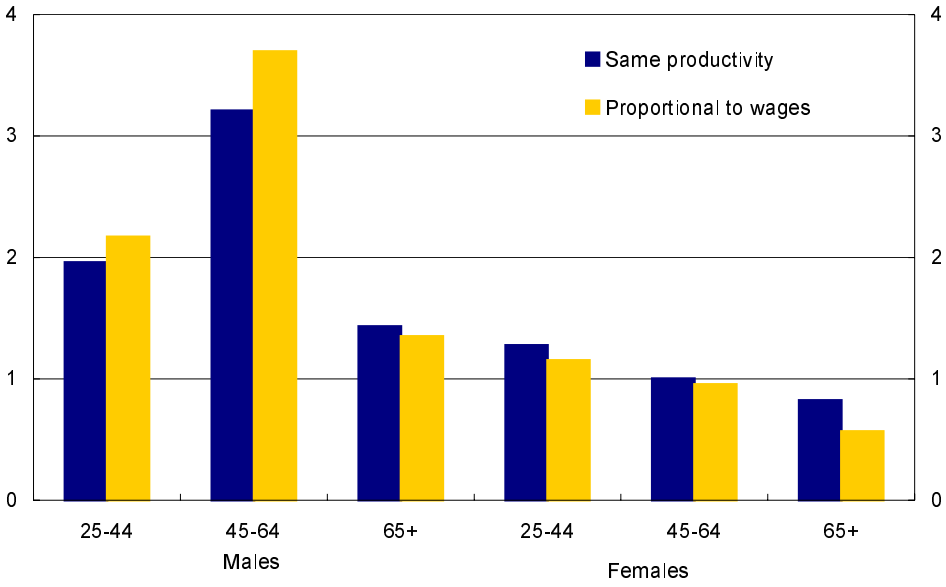
Figure 8: GDP contributions from alternative projections

per cent, relative to IGR baseline

2021-22



2041-42



Note: The average level of labour productivity is assumed to be either the same for workers in each age and gender cohort, or proportional to their average wages in 1999/2000 from Figure 7.

The overall rise in GDP relative to the IGR is between 9 and 10 per cent in both 2021-22 and 2041-42, using either assumption for cohort-specific productivity.[11] Each of the broad age groups, 25-44, 45-64, and 65+, contributes significantly to this outcome.[12]

In each age group, males contribute more to output than females — largely because the IGR already projects significant rises in female participation. Males in the 45-64 age group make the largest contribution — about one-third of the total in both 2021-22 and 2041-42 (slightly less assuming cohorts have the same productivity; slightly more assuming productivity is proportional to wages). This large contribution arises for three main reasons: participation rates in this age group are projected to rise strongly (Figure 4); these workers are predominantly full timers; and, relevant to the second productivity assumption, they are paid more than other groups in the community (Figure 7).

The 65+ age group contributes between about one-sixth and one-quarter of the rise in GDP, depending on the time period and the cohort-specific productivity assumption. Participation rates in this age group are currently very low — 9.8 per cent for males and 3 per cent for females in 2001 — and would remain low even with the rises projected in the alternative profiles — to 18 per cent and 9 per cent by 2021-22. Furthermore, nearly two-thirds of the people in this age group who work do so part-time. But the proportion of the working-age population in this age group is rising very significantly (see Figure 5), and so changes in their labour force participation have a noticeable impact on the aggregate economy.

---

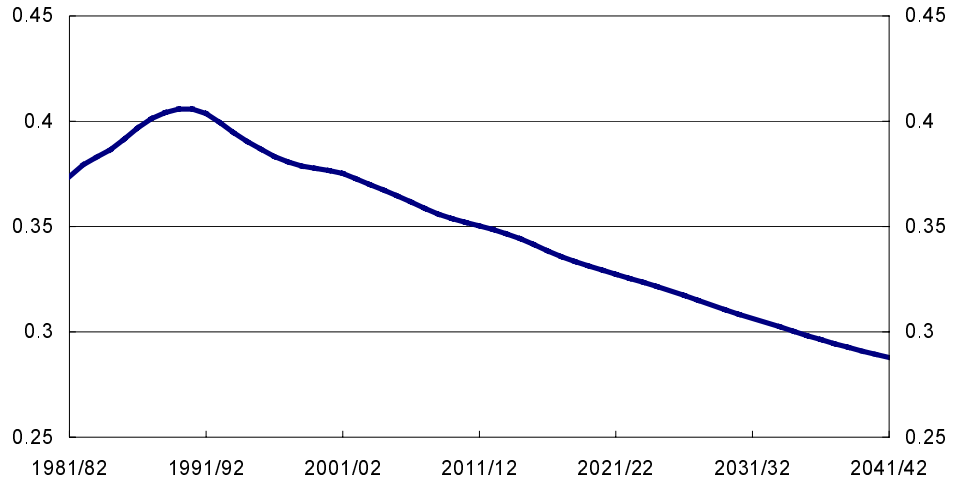
[11] For completeness, Appendix 4 provides a version of Table 1 assuming that productivity is proportional to wages.

[12] The 15-24 age group makes no contribution because the alternative projections use the participation rates from the IGR for this group, as explained earlier.

4. DISCUSSION

We do not discuss in any detail what changes might be necessary to generate the higher rates of labour force participation projected in the alternative profiles. Nevertheless, a few comments are worth making. In aggregate, employers will find it increasing difficult to find younger workers to fill vacancies as the number of younger people in the workforce, which is already falling as a proportion of the total population, continues to fall over coming decades (Figure 9).

Figure 9: Ratio of 15-44 year olds in the labour force to the total civilian population

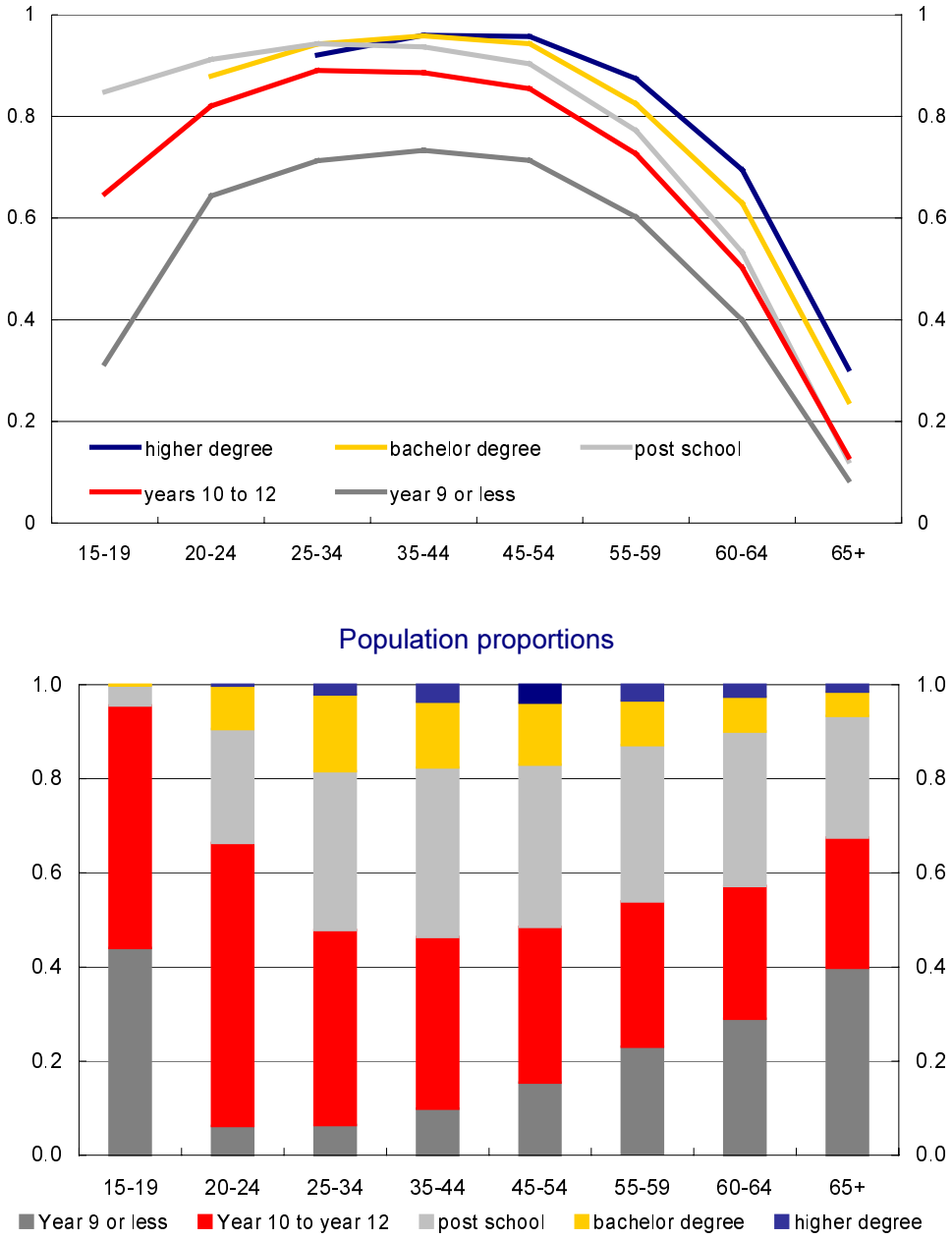


Source: Projections based on the Intergenerational Report.

As a result of this demographic transition, there will be increasing demand for older age workers. Furthermore, there is a growing appreciation of the benefits, to both individuals and society, of reducing incentives for early retirement, as well as other impediments which make it more difficult for people to remain in the workforce later in life (see, for example, Henry, 2002 and Encel, 2003). The importance of reducing these impediments to longer working lives will undoubtedly be felt with increasing force as the proportion of older people in the community continues to rise strongly over time.

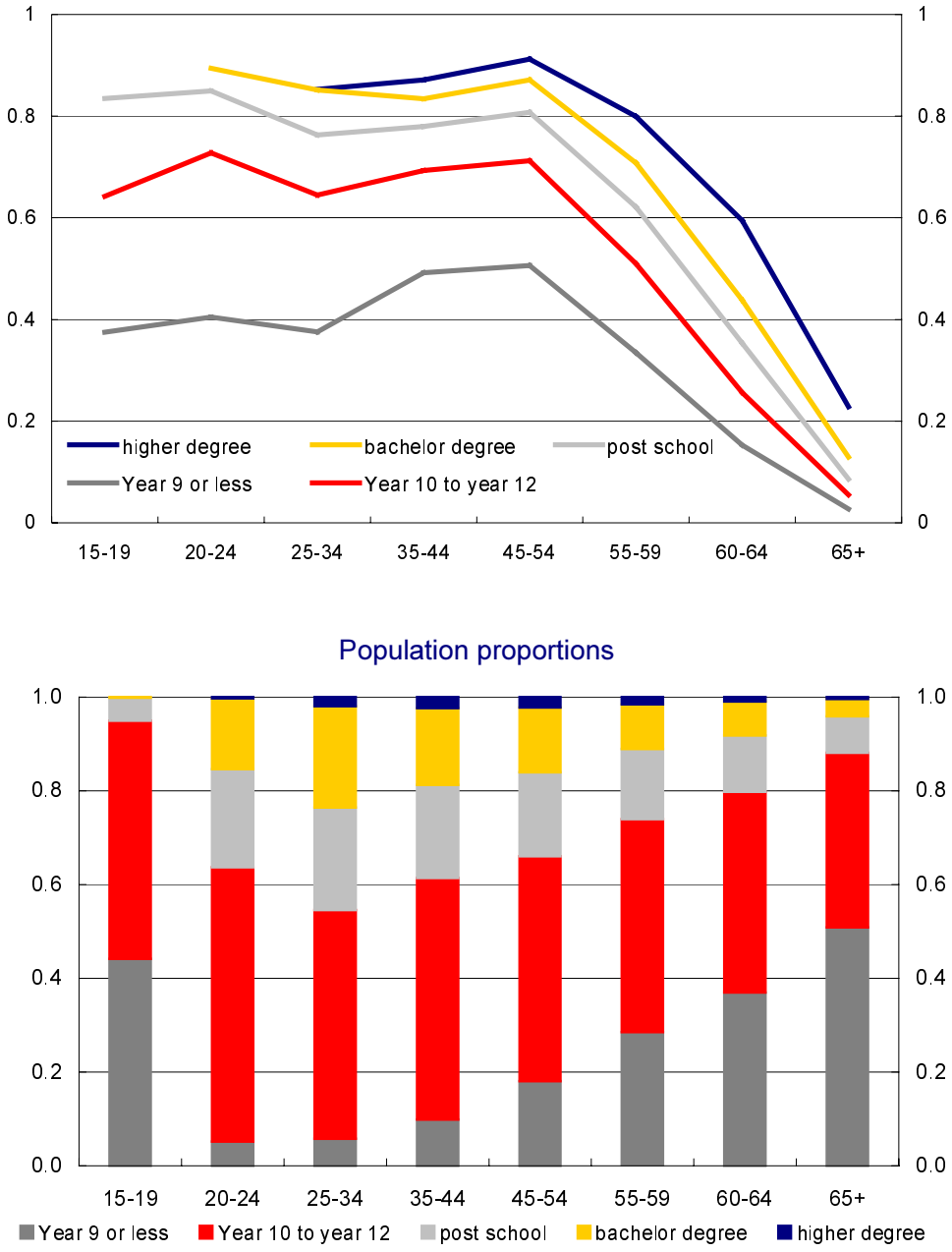
A further longer-term influence which should lead to higher labour force participation over time, highlighted by Dowrick and McDonald (2002), is the significant rise in levels of education in Australia over the past couple of decades. Year 12 retention rates in high school rose from around one-third in the 1970s to about three-quarters by the early 1990s (Collins, Kenway and McLeod, 2000), and the proportion of the population with post-school qualifications has also been rising. Participation rates are significantly higher across the life cycle for people with higher levels of education, as shown in Figures 10 and 11.

Figure 10: Male participation rates and population proportions by level of education



Notes: People with 'post school' qualifications have advanced diplomas, diploma-level or certificate-level qualifications. Bachelor degrees include graduate diplomas and graduate certificates. Data are derived from the 2001 Census.

Figure 11: Female participation rates and population proportions by level of education

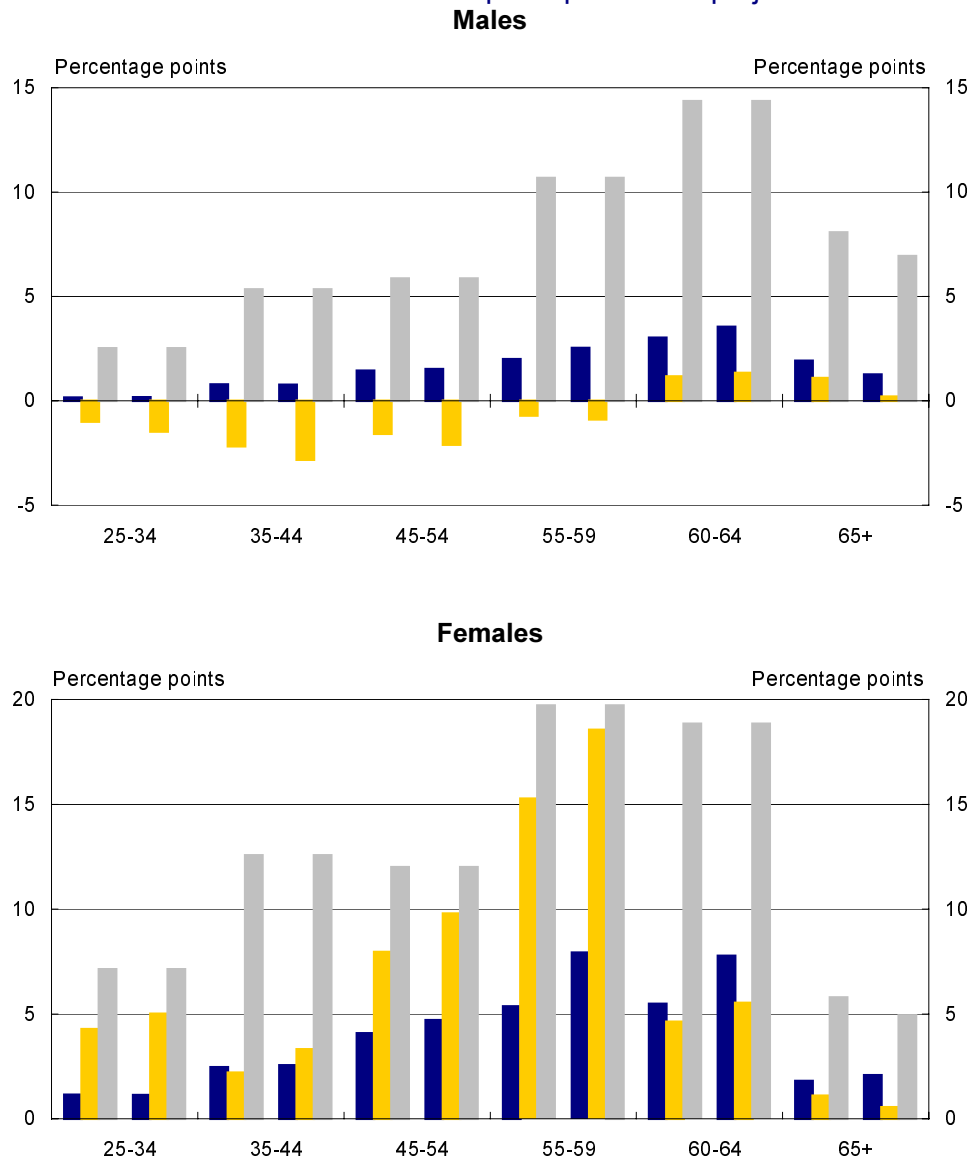


Notes: See notes to Figure 10.

We can estimate by how much these rising levels of education might be expected to add to participation rates over coming years. To derive these estimates, we assume that age-specific participation rates by level of education remain at their 2001 rates into the future, and that the proportion of the population achieving each level of education in future years remains at the level

that has recently been established. Further details on the construction of these estimates are provided in Appendix 5. Figure 12 shows the results using the demographic projections that underlie the IGR. Rising education levels in the community, by themselves, can be expected to significantly raise participation rates in coming years for middle-aged and older people, especially females.

Figure 12: Changes in participation rates
The effect of rising education levels compared to
the IGR and the alternative participation rate projections



Notes: For each age cohort, the first group of three bars shows changes in participation rates in percentage points from 2001-02 to 2021-22; the second group shows changes from 2001-02 to 2041-42. In each group, the first (blue) bar shows the effect of rising education levels; the second (yellow), the change projected in the IGR; and the third (gray), the change projected in the alternative profile.

It seems plausible, moreover, that these estimates may represent lower bounds on the actual contribution of higher levels of education to labour force participation in coming years. They show the implications of projecting current levels of education into the future, assuming no further increase in the average educational attainment of future cohorts entering adulthood relative to those doing so now.[13] Given the experience of the past forty years (revealed by the changing pattern of educational proportions by age in Figures 10 and 11), however, a more natural assumption might well be that these average education levels might continue to rise over time, presumably with further favourable implications for future labour force participation rates.[14]

4.1 Productivity assumptions

4.1.1 The level of productivity of extra workers

The IGR assumes that an hour worked in a given year generates the same quantity of output regardless of who works it. In our alternative projections, we also use this assumption, in addition to examining the implications of assuming that productivity is proportional to wages. Here we discuss these assumptions in more detail.

When additional people enter the workforce as a consequence of a fall in the unemployment rate, the new entrants are usually expected to be less productive on average than those currently working. But this presumption may be less relevant for the alternative projections we are envisaging. Cohort-specific unemployment rates are kept constant by assumption in these projections. The additional people are presumably attracted to the labour force — or, more

---

13 See Appendix 5 for further details.

14 Possibly working the other way, one could argue that the relatively small proportion of older highly educated people might differ in important respects from their much more numerous younger counterparts. If so, their participation rates might be a poor guide to the participation experience of their younger counterparts as they age.

relevant in most cases, remain in the labour force — because of some combination of higher levels of education, reduced incentives for early retirement, and changed social attitudes, particularly to older workers.

It is not clear whether these people should have lower or higher average productivity than those already in the labour force in the IGR projection. To the extent that some of the rise in participation rates over the next forty years is a consequence of rising levels of education in the workforce, as Figure 12 suggests, at least these additional people are likely to have higher productivity levels.

4.1.2 Productivity growth

In the alternative projections, we assume that aggregate (or cohort-specific) labour productivity rises at an annual rate of 1¾ per cent, which is the assumption used in the Intergenerational Report. This has been its average growth rate over the past three decades, although growth has been a stronger 2¼ per cent over the past decade or so.

There are a few reasons for expecting that Australian productivity growth in the future may be faster than 1¾ per cent, beyond its stronger performance over the past decade.[15] Firstly, there are reasons to be optimistic about the rate of productivity growth at the world's technological frontier, with spillover benefits for Australia, as general-purpose information and computer technologies are applied more widely throughout the economy (DeLong and Summers, 2001). Secondly, there appears to be a strong, robust relationship between labour force growth and productivity growth, with slower labour force growth being correlated with faster labour productivity growth. This correlation has been

---

[15] Assuming a rate of aggregate (or cohort-specific) labour productivity growth different from 1¾ per cent would not affect the percentage increases in output by cohort for the alternative projections relative to the IGR reported in the previous section, provided the alternative productivity assumption was incorporated into both the alternative projections and the IGR.

demonstrated over long periods of time in the United States (Romer, 1987), and is consistently observed in cross-country growth regressions across both OECD countries (Englander and Gurney, 1994), and a larger sample of countries (Bernanke and Gürkaynak, 2001). Indeed, both Romer and Bernanke and Gürkaynak use this correlation to argue that the neo-classical Solow-Swan growth model has some important shortcomings. Other things given, one per cent faster (slower) annual labour force growth is associated with a fall (rise) in annual labour productivity growth of about ½ per cent.[16]

The explanation for this correlation remains a matter for conjecture. While correlation need not imply causation, Romer, for example, argues that slower labour force growth does cause faster productivity growth.[17] Certainly, the correlation is sufficiently strong and pervasive that it is of interest to see how important it could be in the context of the projections reported here. Table 2 reports labour force growth rates over twenty-year periods for the IGR and the alternative projections. Given the observed labour-force/productivity correlation, the future projected falls in labour force growth are sufficiently large

---

[16] This estimate comes from Table 10 in Englander and Gurney (1994). Their regressions explain labour productivity growth in OECD countries over four time periods from 1960 to 1990, and control for growth in the capital-labour ratio as well as the rate of human-capital formation (proxied by secondary school enrolment rates). Across a range of specifications, the coefficient on labour force growth varies in the range, – 0.68 to – 0.42, and is always highly statistically significant. Bernanke and Gürkaynak (2001) report similar results for total-factor-productivity growth regressions using a larger sample of countries.

[17] He argues that 'some forms of knowledge may be substitutes for labour rather than complements. That is, these forms of knowledge are labour saving in the strong sense that at a constant wage rate, an increase in knowledge leads to a reduction in the quantity of labour demanded' (p 176). He then suggests that the incentives to generate, or accumulate, these labour-saving forms of knowledge are likely to be stronger when labour force growth is slower.

that they would imply sizeable improvements in labour productivity growth over the next forty years.[18]

Table 2: Labour force growth (per cent per annum)

	1981-82 to 2001-02	2001-02 to 2021-22	2021-22 to 2041-42
IGR	1.9	0.8	0.2
Alternative Projections		1.3	0.2

The implications for productivity of rising average education levels in the community constitute a third reason for expecting that labour productivity growth in the future may be stronger than its 1¾ per cent average over the past thirty years. There is evidence that higher average levels of education raise not only the average level of productivity, but also its growth rate. The argument on the growth rate, which dates back to Nelson and Phelps (1966), is that a higher average level of education raises the rate at which new technologies are identified, developed and implemented, and thereby raises the rate of productivity growth. Dowrick and Rogers (2002) present results from a cross-country growth regression on 35 relatively rich countries with 'high data quality' which imply that a rise of one year in average education should raise the annual rate of Australian productivity growth by about 0.3 per cent. Frantzen (2000) provides a similar cross-country analysis, of total factor productivity growth in the business sectors of 21 OECD countries, which implies, for the

[18] Two implications follow if we take literally the observed labour-force/productivity correlation and the results in Table 2. The first is the one highlighted in the text – that labour productivity growth in the baseline projections in the IGR might be significantly higher than 1¾ per cent. The second implication, however, is that the proportionate rises in output from the alternative projections relative to an IGR baseline with higher assumed productivity growth should be about one-half of those reported in Table 1, because of the offset to productivity growth arising from the faster labour force growth in these alternative projections.

same rise in average education, a rise in annual Australian business-sector productivity growth of about 0.8 per cent.[19]

Table 3: Estimated rise in average years of education in the Australian 25+ population

1960 to 1980	1980 to 2000	2001-02 to 2021-22	2021-22 to 2041-42
0.6	0.6	0.6	0.3

Note: Numbers for 1960 to 1980 and 1980 to 2000 are from Barro and Lee (2000). In their econometric work, both Dowrick and Rogers and Frantzen use Barro-Lee estimates of average education in the 25+ population as their measure of educational attainment. The numbers for 2001-02 to 2021-22 and 2021-22 to 2041-42 are calculated as described in Appendix 5. There are, however, some differences in the results generated by the two methodologies. Barro and Lee report an estimate of 10.6 years for 2000, while our estimate is 11.3 years for 2001-02.

The average level of education in the Australian population has been rising gradually over the past forty years, and should continue to rise over the next forty, as shown in Table 3. The estimates shown for the next forty years may be conservative ones, for a reason already canvassed — that they ignore the likely increase in the average educational attainment of future cohorts entering adulthood relative to those doing so now. Abstracting from this effect, however, the projected rises in average educational attainment are sufficient to suggest a noticeable increase in the rate of labour productivity growth over the coming decades.

[19] Both studies imply that a higher average level of education raises the speed of catch up to the technology leader, the United States. Using Australia's current productivity levels relative to the US implies the numbers in the text. If Australia were to gradually catch up to the productivity levels of the US, the two regression equations would imply progressively less productivity enhancement from each additional year of schooling (although in Frantzen's case, this 'progressively less' effect is very weak). Benhabib and Spiegel (1994) provide similar results, although their empirical estimates may be of less relevance for Australia as they are based on a large sample of countries, with many at low levels of development.

5. CONCLUSIONS

We have examined the implications of a significant rise in Australian labour force participation over the next four decades. Using the distribution of current participation rates across a sample of OECD countries to derive participation rates to be reached gradually over time, we have generated alternative, more optimistic, participation rate projections than those contained in the Commonwealth Government's 2002-03 Intergenerational Report. Some of the rise in participation rates in the alternative projections could occur as a consequence of recent rises in educational attainment flowing through to older age groups over time. However, much of the rise, were it to occur, would be a consequence of changes in policy and in community attitudes, particularly to older workers.

These alternative projections, if realised, would imply gradually rising aggregate labour force participation in Australia for most of the next twenty years, rather than gradually falling participation, as projected in the IGR. The alternative projections imply an aggregate 15+ participation rate rising from its current level near 64 per cent to about 66½ per cent in the second half of the next decade, before declining gradually to about 61 per cent in 2041-42. By contrast, the IGR projects aggregate 15+ participation rates to remain around current levels until the second half of the current decade, before declining gradually to about 55½ per cent in 2041-42.

The alternative projections imply that output in 2021-22 would be about 9 per cent higher than that projected in the IGR, and would remain about 9 per cent higher for the following twenty years. About one-third of the rise in output in these alternative projections would be accounted for by higher participation by 45-64 year old males, and between one-sixth and one-quarter by higher participation by people aged 65 and over.

Both the alternative projections and the Intergenerational Report assume that productivity growth over the next forty years will match its average rate over the past thirty years of 1¾ per cent. There are some grounds, related to rising educational levels in the community and declining rates of labour force growth, for suspecting that productivity growth over coming decades may be stronger than this. It might, however, be a big step to assume faster productivity growth than that achieved over the past thirty years without a continuing policy focus on economic reform.

APPENDIX 1:
FEMALE PARTICIPATION RATES AND PAID MATERNITY LEAVE

To quote from the Australian Bureau of Statistics (2001):

> The international definition of employment specifies criteria for determining 'temporary absence from work'. Different criteria are used for absences from paid employment and self-employment. Persons absent from paid employment are considered employed provided they retain formal attachment to a job or business. Formal attachment occurs *when one or more of the following criteria are met*:
>
> - the continued receipt of wage or salary during the absence from work;
> - an assurance of a return to work following the end of the absence from work, or an agreement as to the date of return (or at least a reasonable expectation of a return to work); and
> - a short duration of absence from the job (which, wherever relevant, may be the duration for which workers can receive compensation benefits without obligation to accept other jobs). (italics added)

For international labour force participation data, it follows that if women take up paid maternity leave and have 'an assurance of a return to work following the end of the absence from work, or an agreement as to the date of return' then they are included in the workforce during their paid maternity leave.

For Australian labour force participation data, the ABS uses the following criteria to determine if employees absent from work retain a formal job attachment, and hence are included in the labour force (ABS, 2001):

> For employees absent from work, a condition of formal job attachment is considered to exist in any of the following circumstances:

- short periods of absence (less than four weeks to the end of the reference week);
- long periods of absence (four weeks or more to the end of the reference week) **and** receipt of wages or salary for some or all of the four week period to the end of the reference week, such as persons on paid leave;
- any period of absence **and** away from work as a standard work or shift arrangement;
- any period of absence **and** on strike or locked out;
- any period of absence **and** continued receipt of workers' compensation payments and expected to return to work for the current employer.

It follows that women on maternity leave paid by their employer would be included in the Australian labour force, but women taking unpaid maternity leave would not.

In seeking to quantify the size of this effect for our purposes, we focus on the countries near the 80th percentile for our sample of OECD countries for women's participation rates for the age groups 25-34 and 35-44.[20] Table A1 provides relevant information.

[20] For women aged less than 25, our alternative labour force projections are the same as those in the Intergenerational Report. We therefore ignore adjustments for these younger age groups.

Table A1: Female participation rates and paid maternity leave

Country	Female Participation Rates (%)[a]		Total Fertility Rate[b]	Paid Maternity Leave[c]
	25-34	**35-44**		
Canada	79.9	80.8	1.6	15 weeks
Denmark	82.2	86.7	1.7	18 weeks
Norway	81.7	85.4	1.8	44 weeks[d]
Sweden	82.1	88.1	1.5	64 weeks[e]
Memo items: 80th percentile	82	86		
Australia	70.8	72.2		
	Fertility Rates[f]			
	Age Specific			
	25-34	35-44	Total	
Australia	1.1	0.3	1.7	

Notes: (a) 2001 values from Labour Force Statistics (2002); (b) from the World Factbook 2002, available at http://www.bartleby.com/151/a30.html; (c) from http://unstats.un.org/unsd/demographic/ww2000/table5c.htm; (d) first 14 weeks for the mother; remaining 26 weeks for either parent; (e) paid parental leave; (f) 2001 values from the Australian Bureau of Statistics.

To arrive at an appropriate correction to female participation rates, we assume, based on the numbers in Table A1, that women have an average of 1.1 children in the 25-34 age group and 0.3 children in the 35-44 age group. If 84 per cent of women are in the workforce before their child(ren) and they get x weeks paid maternity leave per child, then women on paid maternity leave will contribute an average of $100\text{x}0.84\text{x}(1.1+0.3)\,x/(52\text{x}20)$ percentage points to women's participation rates over the 20 years covered by the two age groups. While there is a wide range of paid leave entitlements for the countries in the table, we assume $x = 22$ weeks, which implies an average paid-maternity-leave contribution of about 2½ percentage points. Given the age-specific fertility rates reported in the table, we lower the 80th percentile number for 25-34 year old women by 4 percentage points and the 35-44 year old number by 1 percentage point to generate the participation rates to be achieved in 2021-22 in the alternative projections.

APPENDIX 2:
MALE PARTICIPATION RATES AND THE ARMED FORCES

Participation rates are calculated by dividing the labour force by the population. There are, however, some differences in the treatment of the armed forces in the calculation of these rates. For the Intergenerational Report, participation rates for each cohort are the ratio of the civilian labour force to the civilian population for each age group and gender.

By contrast, in the OECD's Labour Force Statistics (2002), these participation rates are calculated as the ratio of some measure of the labour force (which varies by country) to the total population (which includes both the civilian population and the armed forces) for each age group and gender. The differences in definition are of most relevance for young working-age males, given their disproportionate representation in the armed forces. Table A2 provides relevant information for those countries with male 25-34 year old participation rates near the 80th percentile for our sample of OECD countries.

There is considerable variation between countries in the definitions of age-specific participation rates in the OECD's Labour Force Statistics, as the table makes clear. For most countries in the table, though not Australia, some or all of the armed forces personnel are included in the numerator of the participation rate. The 2001 participation rate for 25-34 year old Australian males, as reported in the OECD's Labour Force Statistics, defined to *exclude* the armed forces from the numerator, is 91.1 (see Table A2). Using an alternative definition, similar to that used by many countries near the 80th percentile, namely the civilian labour force plus the armed forces to the total age-specific population, gives a participation rate for 25-34 year old Australian males of 92.1 over the marginally different time period 2001-02. This is almost identical to the number used in the IGR, 92.0, which is the 25-34 year old male civilian labour force to civilian population in 2001-02.

Table A2: Male participation rates and the armed forces

Country	Male Participation Rate, 2001 (%)[a] 25-34 year olds	Ratio of males in armed forces to total male labour force (%)[a]	Coverage for Numerator of Participation Rate[a]
France	93.8	2.1	Resident non-institutional population living in private households including all armed forces
Greece	94.0	na	Resident population living in private households
Netherlands	94.2	0.8	Resident non-institutional population living in private households including all armed forces
Poland	94.2	1.0	Resident non-institutional population living in private households including armed forces living in private households
Iceland	94.7	na	Resident population living in private households including all armed forces
Czech Republic	96.1	1.5	Resident non-institutional population living in private households, also including temporary members of the armed forces surveyed at their residences before they left for the army
Japan	96.3	na	Resident population (institutional and non-institutional) living in private households, including all armed forces
Memo items: 80th percentile	94½		
Australia	91.1 [b] 92.1 [c] 92.0 [d]	0.8	Resident civilian population living in private households

Notes: (a) From Labour Force Statistics (2002); (b) civilian labour force to total population in 2001, from Labour Force Statistics (2002); (c) civilian labour force plus armed forces to total population in 2001-02; (d) civilian labour force to civilian population in 2001-02, which is used in Intergenerational Report.

We conclude that the participation rate for 25-34 year old Australian males as calculated for the OECD's Labour Force Statistics would have been almost identical to the number used in the IGR had the Australian number included the

armed forces in the numerator, as do most of the countries in Table A2, at least to some extent. Therefore, while in principle the different definitions for participation rates in the OECD's Labour Force Statistics and the IGR suggest that some adjustments might need to be made when using data from the former and applying them to a baseline defined by the latter, the appropriate adjustments seem so small that they can be safely ignored.

APPENDIX 3: PARTICIPATION RATES FOR 65+ AGE GROUPS

A final measurement issue relates to the different age groups in the Labour Force Statistics and the Intergenerational Report. Labour Force Statistics provide cross-country data on participation rates for the 65+ age group. The 80th percentiles for this age group in 2001 are participation rates of 18 per cent for males and 9 per cent for females compared with Australian values of 9.8 per cent and 3.0 per cent in that year (see Figure 1).

The Intergenerational Report, however, disaggregates this age group into the sub-groups, 65-69 and 70+, and so we need values for these sub-groups for our alternative participation rate profiles. To generate these values, we examine the experience of the United States, which had participation rates for 65+ year olds in 2001, 17.7 per cent for males and 9.8 per cent for females, that were close to the 80th percentile 65+ values above. The US Bureau of Labour Statistics also publishes participation rates for 65-69 and 70+ year olds, which in 2001 took the values 30.3 per cent and 12.2 per cent for males and 20.0 per cent and 5.9 per cent for females. We assume that the *ratios* of these US participation rates, 30.3/12.2 = 2.5 for males and 20.0/5.9 = 3.4 for females, are also satisfied by our values for 65-69 and 70+ year old Australian participation rates to be achieved in 2021-22. Using the aggregate values for 65+ year olds, 18 per cent for males and 9 per cent for females, along with the projected relative population proportions for 65-69 and 70+ year olds from the Intergenerational Report, enables us to derive values for these sub-groups in 2021-22: 30.4 per cent and 12.2 per cent for males and 18.1 per cent and 5.3 per cent for females.

We assume that these values, once achieved in 2021-22, remain constant out to 2041-42. Since the relative proportion of 70+ year olds rises gradually over time, this implies a gradual fall in the (aggregate) 65+ participation rates from 18 per cent for males and 9 per cent for females in 2021-22 to 16.9 per cent and 8.1 per cent by 2041-42.

APPENDIX 4:
OUTPUT WHEN PRODUCTIVITY IS PROPORTIONAL TO WAGES

Table A3 presents changes in output for the IGR and the alternative projections under the assumption that productivity levels across cohorts are proportional to wage rates, rather than equal to each other. (Of course, the IGR did not use this productivity-proportional-to-wages assumption. The results should therefore be interpreted as outcomes for the IGR and the alternative projections had this assumption been imposed for both projections.)

Table A3: Changes in GDP relative to baseline; productivity levels proportional to wage rates (per cent)

Age Group		IGR relative to no-change baseline		Alternative projections relative to IGR baseline	
		2021-22	2041-42	2021-22	2041-42
15-24	M	-0.4	-0.6		
	F	0.0	0.0		
25-44	M	-0.6	-0.9	2.0	2.2
	F	1.3	1.6	1.4	1.2
45-64	M	-0.1	-0.2	3.4	3.7
	F	2.1	2.7	1.4	1.0
65+	M	0.1	0.2	1.0	1.4
	F	0.1	0.1	0.4	0.6
Total		**2.5**	**2.9**	**9.6**	**9.9**

Notes: All projections (no-change baseline, IGR and alternative) assume the date-specific population proportions by age group and gender from the IGR (shown in Figure 5). Labour productivity levels are assumed proportional to wage rates from Figure 7 for each age group and gender. For both 2021-22 and 2041-42, the no-change baseline assumes 2001-02 values for age-and-gender-specific participation rates, proportions of full-time workers, full-time and part-time average hours, and relative unemployment rates. Age-and-gender-specific unemployment rates are, however, adjusted in this no-change baseline to generate an aggregate unemployment rate of 5 per cent in both 2021-22 and 2041-42, consistent with the IGR. The alternative projections assume age, gender and date specific values for proportions of full-time workers, full-time and part-time average hours, and unemployment rates from the IGR.

APPENDIX 5:
PARTICIPATION RATES AND EDUCATION

We have data from the 2001 census on the number and labour force participation rate of males and females by single-year age for ten levels of educational attainment: still at school; did not go to school; year 8 or below; year 9 or equivalent; year 10 or equivalent; year 11 or equivalent; year 12 or equivalent; post-school qualifications (advanced diplomas and diploma-level or certificate-level qualifications); bachelor degrees, including graduate diplomas and graduate certificates; and higher degrees.[21]

The big rise in year 12 retention rates discussed in the text began in the 1970s and was completed by the early 1990s. People who completed year 12 in 1991 would have been about 27 years old in 2001 when the census was conducted. We therefore use educational attainment proportions for the ten categories above for 27 year olds in 2001 as our measure of current educational attainment. For cohorts who are currently younger than 27, we assume that when they reach 27 they attain the educational attainment proportions of the cohort of 27 year olds in 2001, and that they retain these educational attainment proportions as they age further.[22]

---

[21] We must decide how to treat people who did not state their level of educational attainment, and/or their labour force status. We eliminate those who did not state either from the analysis (they account for about 4 per cent of the census). Those who did not state *only* their level of educational attainment are assumed to have no post-school qualifications, and are assigned to the other seven educational categories in proportion to the relative numbers in those categories (they account for about 3½ per cent of the census). Those who did not state *only* their labour force status are assumed to be not in the labour force (they account for less than 1 per cent of the census).

[22] We also make one further adjustment. In the 2001 census data, the proportion of both males and females with higher degrees rises gradually for age groups older than 27, up to ages of about 36. As cohorts currently younger than 27 age, we assume that their proportion of higher degrees rises in line with these census data until they reach 36, and

We then use the population proportions by single-year age from the IGR to project average educational levels and average participation rates into the future.[23]

To derive the average years of education in the Australian 25+ population reported in Table 3 in the text, we assume the following correspondence between educational attainment and average years of education. Those still at school are assumed to have 10 years of education; did not go to school, 0 years; year 8 or below, 7 years; year 9 or equivalent, 9 years; year 10 or equivalent, 10 years; year 11 or equivalent, 11 years; year 12 or equivalent, 12 years; post-school qualifications (advanced diplomas and diploma-level or certificate-level qualifications), 13 years; bachelor degrees, including graduate diplomas and graduate certificates, 14½ years; and higher degrees, 17 years.

---

then remains at that level as they age further. For these younger cohorts, when they are older than 27, proportions for all other educational attainment levels remain at their 27-year-old rates, with the exception of those for bachelor degrees, which fall to ensure that the sum of the proportions across all educational levels is unity

[23] The census data we have covers ages from 15 to 85, while the IGR provides population proportions by single-year out to 99 year olds. We assume that people over the age of 85 have the (very low) participation rates of 85 year olds, for which we have data.

REFERENCES

Australian Bureau of Statistics (2001), Labour Statistics: Concepts, Sources and Methods. Chapter 3. Employment, available at http://www.abs.gov.au/ausstats/abs@.nsf/0/5B9125C8E59590C1CA256A4D001FAC88?Open.

Barro Robert J and Lee Jong-Wha (2000), 'International Data on Educational Attainment Updates and Implications', available at http://post.economics.harvard.edu/faculty/barro/workpapers.html.

Benhabib Jess and Mark M Spiegel (1994), 'The role of human capital in economic development: Evidence from aggregate cross-country data', Journal of Monetary Economics, 34, No. 2, pp 143-173.

Bernanke Ben S and R S Gürkaynak (2001), 'Is Growth Exogenous? Taking Mankiw, Romer, and Weil Seriously', NBER Macroeconomics Annual, pp 11-57.

Collins, Cherry, Kenway J and J McLeod (2000), 'Factors Influencing Educational Performance of Males and Females in School and Their Initial Destinations after Leaving School', Canberra: Commonwealth of Australia, Ausinfo.

Commonwealth Government (2002), 'Intergenerational Report 2002-03' Budget Paper No. 5.

DeLong J Bradford and Lawrence H Summers (2001), 'The "New Economy": Background, Historical Perspective, Questions, and Speculations', Economic Policy for the Information Economy, Federal Reserve Bank of Kansas City, pp 11-45.

Dowrick S and P McDonald (2002), 'Comments on Intergenerational Report, 2002-03', Australian National University, available at

http://ecocomm.anu.edu.au/people/info.asp?Surname=Dowrick&Firstname=Steve.

Dowrick S and M Rogers (2002), 'Classical and technological convergence: beyond the Solow-Swan growth model', Oxford Economic Papers, 54, pp 369-385.

Encel S (2003), 'Age Can Work: The case for Older Australians Staying in the Workforce', University of NSW, available at http://www.bca.com.au/content.asp?newsid=87370

Englander A Steven and A Gurney (1994), 'Medium-Term Determinants of OECD Productivity', OECD Economic Studies No. 22, Spring, pp 49-109.

Frantzen Dirk (2000), 'R&D, Human Capital and International Technology Spillovers: A Cross-country Analysis', Scandinavian Journal of Economics, 102 (1), pp 57-75.

Henry Ken (2002), 'The Demographic Challenge to our Economic Potential', Chris Higgins Memorial Lecture, 13 November, available at http://www.treasury.gov.au/contentitem.asp?pageId=&ContentID=472

Labour Force Statistics 1981-2001 (2002), Organisation for Economic Co-Operation and Development (OECD).

Nelson R and E Phelps (1996), 'Investment in humans, technological diffusion, and economic growth', American Economic Review, 56, pp 69-75.

Romer Paul M (1987), 'Crazy Explanations for the Productivity Slowdown', NBER Macroeconomics Annual, pp 163-202.

1980-1998: 20 Years of Social Expenditure, The OECD Database (SOCX), OECD.