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Preliminary Participation Rate Projections for the 2021 Intergenerational Report

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¹ The views in this paper are those of the author and do not necessarily reflect those of NSW Treasury. This publication can be accessed from Treasury's website www.treasury.nsw.gov.au.



Preface

Workforce participation has shown significant changes over the last 40 years. This has been driven by trends such as young people staying in education for longer; an increasing proportion of women in the workforce; older people extending their working lives; and increased workplace flexibility as seen in the growing incidence of part-time work. The impact of these trends on participation will continue to be felt over the next 40 years, along with other developments such as the ageing of the millennials and the retirement of the baby-boomers.

Participation is a fundamental driver of economic growth and material living standards. It is one of the “three P’s” of long-term economic modelling, along with population and productivity. Updated long-term participation rate projections are required for the next Intergenerational Report (IGR) to be released in 2021. This paper provides information on the proposed methodology and participation rate projections for public review. The projections contained in this paper are preliminary and will be finalised for the 2021 IGR in the second half of 2020.

The IGR projects long-term demographic, workforce and housing trends across New South Wales to show the likely pressures facing the state’s economic and fiscal position over the coming 40 years. As the release of the 2021 IGR nears, Treasury will be releasing a series of technical research papers to unpack the key drivers of long-term economic growth and the fiscal outlook. This is the first such paper.

This paper was prepared prior to the onset of COVID-19. The NSW participation rate has since declined, reaching an almost 16-year low of 62.1 per cent in May. It is unlikely that the rate will remain at these record lows; however, the potential long-term impacts of COVID-19 on the workforce are difficult to assess and have not been accounted for in the participation rate projections contained in this paper. Potential impacts will be considered when projections are finalised for the 2021 IGR.

Acknowledgement

NSW Treasury acknowledges the Traditional Owners of the land on which we live and work, the oldest continuing cultures in human history.

We pay respect to Elders past and present, and the emerging leaders of tomorrow.

We celebrate the continuing connection of Aboriginal and Torres Strait Islander peoples to Country, language and culture and acknowledge the important contributions Aboriginal and Torres Strait Islander peoples make to our communities and economies.

We reflect on the continuing impact of policies of the past, and recognise our responsibility to work with and for Aboriginal and Torres Strait Islander peoples, families and communities, towards better economic, social and cultural outcomes.

Note

The author thanks Johnathan McMenamain for his extensive advice on the modelling strategy and detailed comments on an earlier draft, Michael Gadiel, James Morley and Devang Tailor for their technical advice, and Luke Maguire, Michael Wartlers, Stephen Walters, Ben Fitzgerald, James Glenn, Danielle Doherty, Brendan Elliot, Rashad Hassanov, Ray Harris, James Bishop, John Janssen, Melissa van Rensburg, and Ben Temple for their detailed comments on various drafts.

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Abstract

Long-run trends in the workforce participation rate are a key driver of potential economic growth and the fiscal outlook. The NSW participation rate is expected to structurally decline over the next 40 years. This reflects population ageing and the lower propensity of older cohorts to participate in work, despite a projected growing share of older people remaining in the workforce.

In the short run, the participation rate tends to deviate around its long-run trend rate in response to changes in economic and labour market conditions, providing an indication of the extent of spare capacity in the labour market. This paper finds that this cyclical response in labour supply varies across demographic characteristics. The largest response occurs for NSW youths of both genders aged 15 to 19, females aged 20 to 49, and males aged 55 to 59 and 65 and over.

After adjusting for this effect to reduce the impact of cyclical factors on long-term projections, the downward trend over the longer term remains. The participation rate is projected to decline by around 3 percentage points between 2018-19 and 2060-61, detracting around 0.1 percentage points per year from growth in real GSP per capita.

Notwithstanding this downward trend, these results represent an upward shift in long-term participation rate projections relative to those contained in the 2016 Intergenerational Report. These results are largely driven by higher-than-expected rates of female participation and slower-than-expected population ageing, largely arising from higher net inward migration. This is also consistent with changes in other structural factors that support greater workforce participation such as higher levels of childcare support and the roll-out of the National Disability Insurance Scheme.

JEL Classification Numbers: E24, J11, J21, J23

Keywords: participation, labour demand, ageing, cyclical component, long-term projections

1. Introduction

The participation rate measures the size of the labour force as the share of people aged 15 and over who are employed or seeking employment. Changes in the participation rate have important macroeconomic implications, driving growth in the labour force and hours worked, and therefore impacting incomes, consumption and economic output.

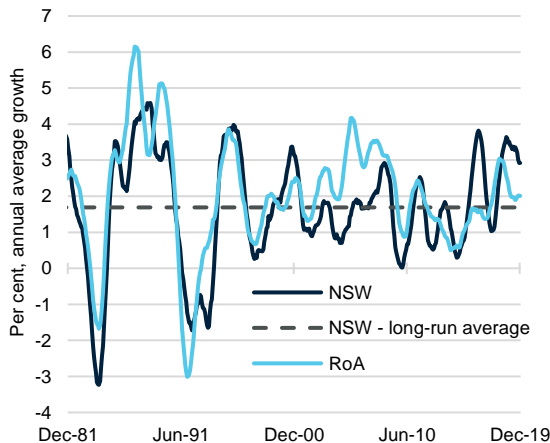
Over the long term, along with population and its age composition (which determines the working age population) and labour productivity (economic output per hour worked), the participation rate is a key driver of potential economic growth.

The increase in the NSW participation rate over recent decades has been a key factor in the State's growing productive capacity and rise in material living standards. The population, however, is ageing, driven by lower fertility rates, rising life expectancy, and the ageing of the baby boomers. Older cohorts tend to participate less in the labour force relative to younger cohorts. Hence, as the population ages, the aggregate participation rate will gradually decline which will slow the rate of economic growth, all else being equal. Ageing is projected to reduce growth in NSW real gross state product (GSP) per capita by an average of around 0.15 percentage points every year over the next four decades².

Treasury last published long-term participation rate projections in the 2016 Intergenerational Report (IGR). These showed a gradual decline in the rate over the projection period to 2055-56. This paper updates and extends projections to 2060-61³, considering changes in the propensity to participate and age structure of the population since the 2016 IGR, and examines the drivers of long-term trends.

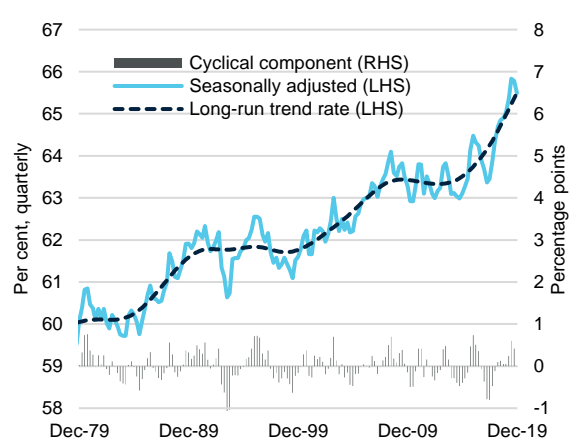
The NSW labour market remains relatively strong (as at the December quarter 2019), supported by modest wages growth, robust demand for workers in labour-intensive service industries and above-trend population growth. The unemployment rate is at 4.5 per cent, around estimates of full employment (as measured by estimates of the non-accelerating inflation rate of employment). Employment is growing at an annual average rate of around 3 per cent, well above the long-run average of 1.7 per cent (Chart 1).

Chart 1: Employment growth



Source: ABS 6202.0; NSW Treasury

Chart 2: NSW participation rate



Source: ABS 6202.0; NSW Treasury

Notes: The long-run trend rate is the quarterly NSW total participation rate with an HP filter applied (smoothing parameter of 1600)

The participation rate has increased rapidly since the most recent low point in the March quarter of 2017, reaching a record high of 66.2 per cent in May 2019. This is partly the result of an encouraged

² Based on Treasury's population projections at the 2019-20 Budget. This impact is down from 2016 IGR projections for a quarter of a percentage point on average each year.

³ 2060-61 is the final year in the 2021 IGR projection period.

worker effect; that is, the favourable labour market conditions are encouraging entrants into the labour force. Although easing to 65.5 per cent in December 2019, the rate remains close to historical highs.

In the short run, labour supply responds to changes in economic and labour market conditions. This results in short-run cyclical deviations of the participation rate from its long-run trend (Chart 2). Long-run trends are driven by changes in structural factors, such as the population's age structure and levels of health and education; fertility; workplace flexibility; personal financial factors; social norms; and childcare and retirement settings.

The size of the cyclical component in movements of the participation rate varies over time (Chart 2). A large negative cyclical component in 2017 rapidly turned positive between early-2018 and mid-2019, indicating an encouraged worker effect. The cyclical component gives an indication of labour market flexibility and the extent of spare capacity. If the participation rate did not adjust (indicating limited spare capacity in the labour market) changes in economic conditions would have a larger impact on the unemployment rate and therefore on wages and prices, exacerbating periods of economic expansion and downturns. This cyclical component can influence long-term participation rate projections.

Understanding this cyclical component, and how it varies across gender and age, helps to provide a better understanding of the impact of long-run underlying trends. Removing this cyclical component from participation rate projections, and therefore potential long-term economic growth, supports more robust projections that largely reflect structural factors.

This paper estimates the cyclical component (cyclical coefficient) by testing the sensitivity of labour supply to short-term changes in labour demand (as measured by the cyclical component of the employment-to-population ratio) between the March quarter 1985 and June quarter 2019; that is, testing the encouraged worker effect. It finds this effect is large, accounting for around 40 per cent of the increase in the NSW participation rate between the March quarter 2017 and June quarter 2019⁴, although it varies with gender and age. The cyclical coefficient for female participation is larger than for males. Amongst cohorts, both genders aged 15 to 19, females aged 20 to 49, and males aged 55 to 59 and 65 and over are the most responsive to short-term changes in labour demand.

These findings guide the modelling of updated NSW long-term participation rate projections in preparation for the 2021 IGR. This paper adopts the dynamic cohort analysis approach of the Commonwealth Productivity Commission (2005), with this approach also used for the 2011 and 2016 NSW IGRs. Cohort analysis captures the impact of varying labour market behaviours of different age-groups, genders and generations on participation rate projections. A key component of this methodology is the smoothing of historical full- and part-time participation rates for each cohort with a Hodrick-Prescott (HP) filter to minimise volatility associated with short-run business cycles and any sampling error. This results in smoother time series, more sensitive to long-term rather than short-term fluctuations, from which to cast projections.

This paper proposes an update to the methodology to more effectively account for the large cyclical component in the rise in participation rates since 2017. From the December quarter 2017 to June quarter 2019, participation rates for those cohorts with a statistically significant cyclical component are first adjusted using their cyclical coefficients to obtain estimates of long-run trend (structural) rates. After adding to the historical time series (September quarter 1978 to September quarter 2017) and converting to fiscal year averages, an HP filter is then applied to smooth the series for each cohort.

Cohort participation rate projections are aggregated for the total workforce and both genders using Treasury's projections of the level and age structure of the population as at the 2019-20 Budget. Projections confirm the overall downward trend in the NSW participation rate as the population ages over the next 40 years, while also representing an upward shift relative to the 2016 IGR projections. This is primarily driven by a shift upwards in projected female participation rates and slower-than-

⁴ This is the last quarter of participation rate actual outcomes before the annual projection period commences in 2019-20.

expected population ageing, largely from higher net inward migration. This is also consistent with changes in other structural factors likely to impact propensity to work such as higher levels of childcare support and the roll-out of the National Disability Insurance Scheme (NDIS).

In summary, these long-run structural projections show:

- Total participation to decline from 64.6 per cent in 2018-19 to 62.4 per cent in 2055-56 (3.0 percentage points higher than the 2016 IGR projection) and to 61.8 per cent in 2060-61.
- Female participation to decline from a peak of 60.0 per cent in 2023-24 to 57.9 per cent in 2055-56 (4.4 percentage points higher than the 2016 IGR projection) and to 57.1 per cent in 2060-61.
- Male participation to decline from 70.1 per cent in 2018-19 to 67.1 per cent in 2055-56 (1.3 percentage points higher than the 2016 IGR projection) and to 66.6 per cent in 2060-61.

The decline in the total participation rate is projected to detract around 0.1 percentage points on average from growth in real GSP per capita every year between 2018-19 and 2060-61. This compares to 2016 IGR projections for an annual average detraction of around 0.15 percentage points between 2014-15 and 2055-56 resulting from the decline in the participation rate.

The remainder of this paper is structured as follows: Section 2 provides an overview of participation rates and changes since the 2016 IGR that impact long-term projections; Section 3 estimates the encouraged worker effect across gender and age; Section 4 summarises the updated participation rate projections; and Section 5 compares New South Wales' participation rates with Australia.

2. Overview of Labour Force Participation

Changes in aggregate participation rates are a function of two key factors: the change in the age structure of the population, and the change in the proportion of each cohort aged 15 and over participating in the labour force either by working or searching for work.

I) Age structure of the population

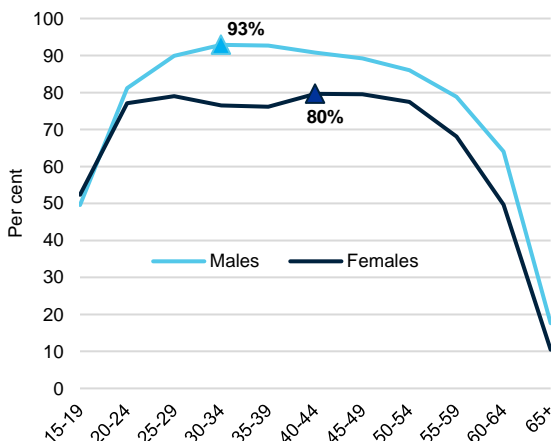
For the analysis in this paper, the age structure of the population is measured by the proportion of the population made up by each five-year age and gender cohort (ages between 15 and 64, and an additional cohort for those aged 65 and over). In general, participation rates tend to be lower for those aged under 25 years, reflecting higher educational attendance, before rising to peak in the middle years. As people get closer to retirement, they tend to reduce their working hours before eventually leaving the labour force altogether, usually for health, lifestyle, or financial reasons (Box 2.1). Today, male participation rates peak in the 30-34 age cohort at around 93 per cent, and female participation rates in the 40-44 age cohort at around 80 per cent (Chart 3).

These trends mean that an ageing population over time will place downward pressure on aggregate participation rates. The NSW participation rate today would be around 3 percentage points higher if the age composition of the population had remained unchanged over the last 20 years (Chart 4).

Participation rates of older cohorts have increased over the last decade alongside improvements in health, life expectancy and workplace flexibility. Financial factors may have also contributed, with longer life expectancies incentivising people to work for longer to ensure adequate retirement savings⁵. Further, the negative impact of the Global Financial Crisis on superannuation balances and investment returns likely encouraged older workers to delay retirement to rebuild their savings. Higher participation rates of older workers have resulted in weaker downward pressure from the ageing population on the total participation rate.

⁵ Brown A and Guttman R (2017)

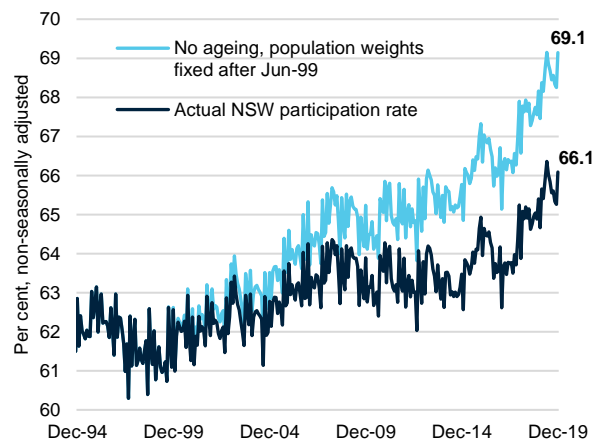
Chart 3: Cohort participation rates (2018-19)^(a)



Source: ABS 6291.0.55.001; NSW Treasury

Notes: (a) Participation rates are structural rates; that is, using smoothed data as per the methodology described in Section 4. (b) The 'no ageing' scenario fixes the distribution of age and gender to June 1999.

Chart 4: The effect of ageing on participation^(b)



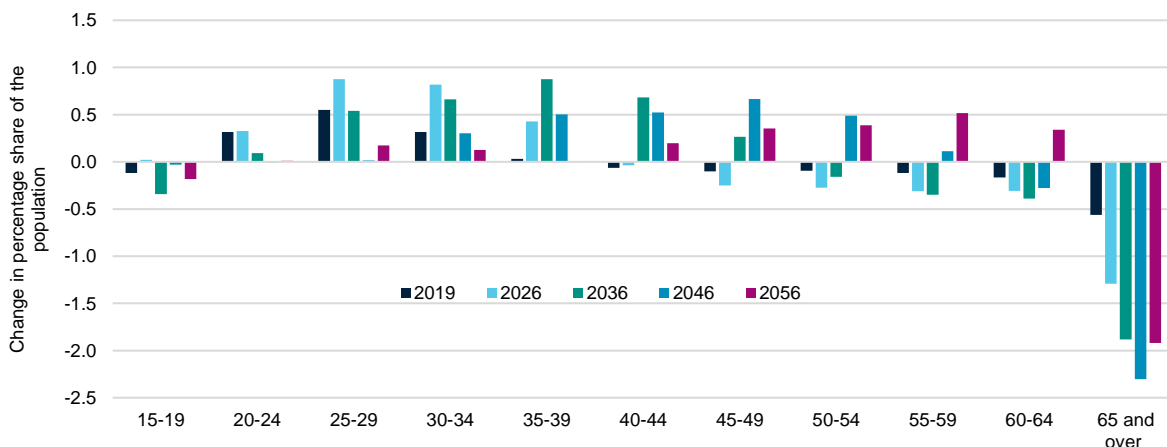
Source: ABS 6291.0.55.001; NSW Treasury

What has changed since the 2016 Intergenerational Report?

The population is ageing more slowly than 2016 IGR expectations. The population data underpinning participation rate projections in the 2016 IGR were based off Treasury's projections of fertility, mortality and net inward migration (interstate and overseas) as at the 2015-16 Budget. The preliminary projections for the 2021 IGR (discussed in Section 4) are underpinned by updated projections of those same variables as at the 2019-20 Budget.

Since 2016, projections have been impacted by the new base data from the 2016 Census and the release of new population and demographic data. The proportion of the population of traditional working age (15-64) has been revised upwards and the proportion of people aged 65 and over has been revised down; that is, the population today is younger than projected in the 2016 IGR. This is largely a result of higher than anticipated net overseas migration. As the age profile of migrants tends to be lower than the local population, inward migration leads to a lower average age of the population, lower average mortality and a greater number of births, thereby helping to moderate the ageing of the population⁶. The primary impact of these changes since 2016 on age cohort projections is a higher proportion of those in traditional working age cohorts relative to those aged 65 and over (Chart 5).

Chart 5: Changes in the projected age structure of the NSW population since the 2016 IGR^(a)



Source: ABS 3101.0; NSW Treasury

Note: (a) The change in each age cohort is shown as a percentage of the total population aged 15 and over.

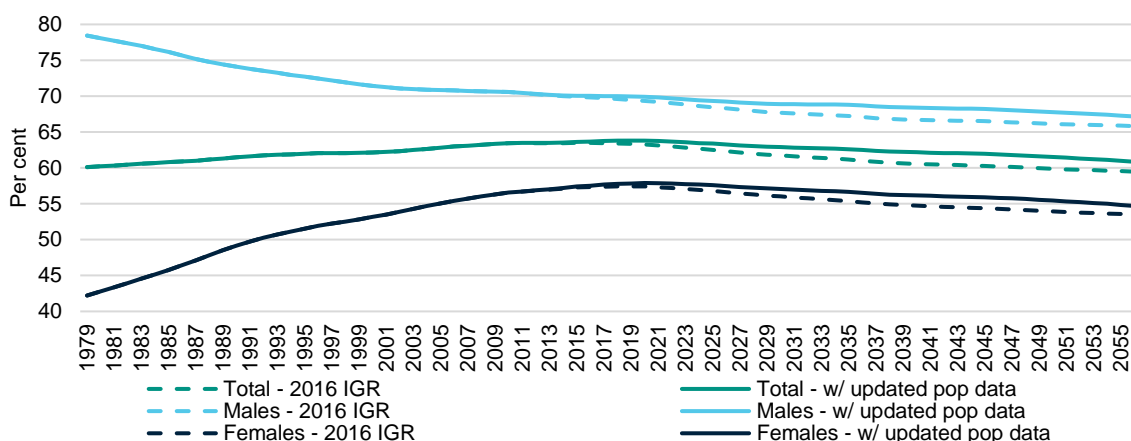
⁶ 2016 Intergenerational Report, NSW Treasury

As people of traditional working age have a higher propensity to participate than those aged 65 and over, a younger population places upwards pressure on aggregate participation rate projections, all else being equal. This impact can be illustrated by holding the participation rate projections for each age cohort unchanged from the 2016 IGR and applying the updated population projections (Chart 6).

Projections under this scenario relative to the 2016 IGR show that by 2055-56:

- Male participation is projected to be 1.4 percentage points higher at 67.2 per cent
- Female participation is projected to be 1.2 percentage points higher at 54.7 per cent
- Total participation is projected to be 1.4 percentage points higher at 60.9 per cent.

Chart 6: Impact of updated population data on NSW participation rate projections



Source: ABS 6291.0.55.00; NSW Treasury

Box 2.1 How will working lifespans change in the future?⁷

Four decades ago, 12 per cent of men and 3 per cent of women aged 65 and over were still in the workforce. These figures have increased to 18 and 10 per cent today. This paper projects that the proportion of people still working after the age of 65 will continue to rise, reaching 25 per cent for men and 15 per cent for women in 40 years' time (Section 4).

For those Australians who are retired today, the most common reason was having reached the eligible age to access the age pension or superannuation (28.3 per cent)⁸. The average age at retirement for those who retired for this reason was 63.5, a higher age than for any other group. The Reserve Bank of Australia (RBA) found that recent increases to the pension eligibility age boosted the Australian participation rate by around 0.1 percentage points⁹. It is therefore plausible that additional increases to the pension age or superannuation preservation age in the future will result in a higher proportion of the population delaying their retirement.

The length of working lifespan appears positively related to health. For those Australians who are retired, the average age at retirement for those in very good or excellent health was around 57.3, compared to those in fair (53.3) and poor (51.3) health and the average retirement age of 55.3.

⁷ All data quoted in this box is from ABS Retirement and Retirement Intentions (6238.0), unless stated otherwise.

⁸ This excludes those retirees whose last job was 20 or more years ago, accounting for around 31 per cent of current retirees.

⁹ Debelle (2019)

Box 2.1 (con't)

There are also some factors that at first glance may seem contradictory. For example, the average age at retirement is higher for those without a mortgage (56.4) than those with a mortgage (53.4) or renting (51.7). Some of those mortgage-holders and renters, however, may be involuntary retirees – 16 per cent of retirees ceased working due to their own sickness, injury or disability and 6.3 per cent because they were retrenched, dismissed, or no work was available.

Other factors likely to influence working lifespans include: longer life expectancy; increasing workplace flexibility and changing societal attitudes around the role and contribution of older people in the workforce; improved workforce training, education and skills; wealth and other financial considerations, including higher household debt; and shifts in the economy further towards the services sector, with a relative shift away from physically-demanding manual occupations (Box 2.2).

The modelling methodology in this paper does not explicitly capture the impact of changes in these factors on participation rate projections. Hence, future modelling could estimate the response in the participation rate of older cohorts to changes in variables, including: mortality rates; financial factors such as home ownership rates and superannuation balances; the pension age; the economy's industrial structure; and the level of educational attainment. Modelling could also disaggregate the impact between full and part-time participation (and therefore on hours worked) as future retirees extend their working lives by shifting to part-time employment.

II) Propensity to participate

The size of the labour force is influenced by the economic cycle in the short term. Over the longer term, it is impacted by a range of factors, including: the population's age structure, health and education levels; fertility; financial circumstances; workplace flexibility; social norms; childcare and retirement settings; and the economy's industrial structure. The population's response in propensity to participate to these short and long-term factors varies across age and gender, resulting in cohort-specific participation rates.

In general, the rate of male participation tends to be higher than for females, although the female rate has risen at a steady pace over the last several decades, as with many other advanced economies (Chart 7). Since 1979, the NSW female-to-male participation rate ratio has risen from around 0.54 to 0.85 as the gap between the two rates has narrowed.

Chart 7: Change in female participation rates in advanced economies

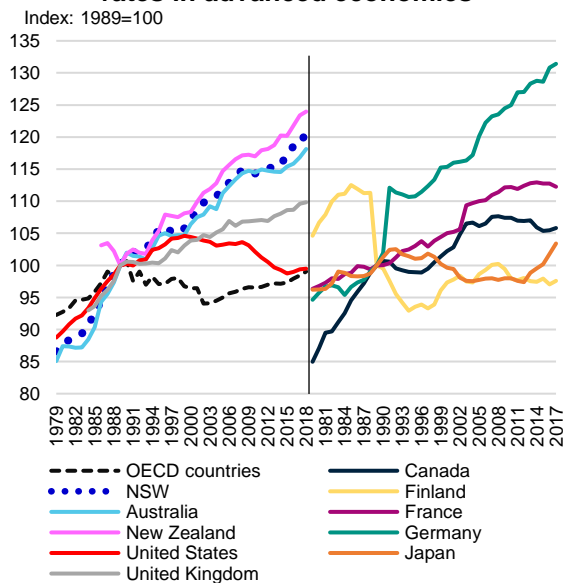
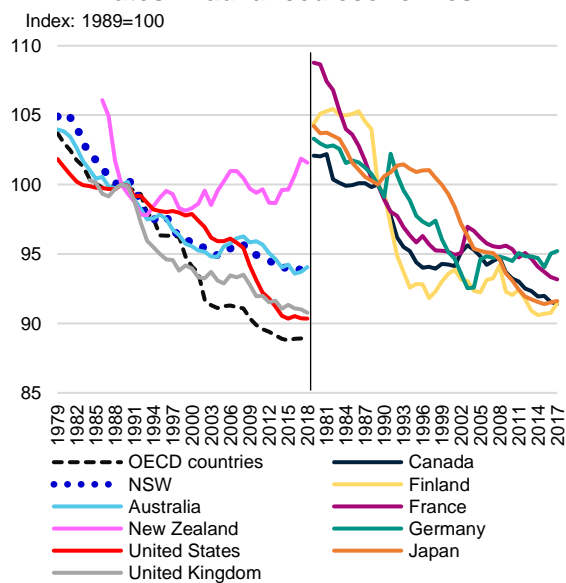


Chart 8: Change in male participation rates in advanced economies



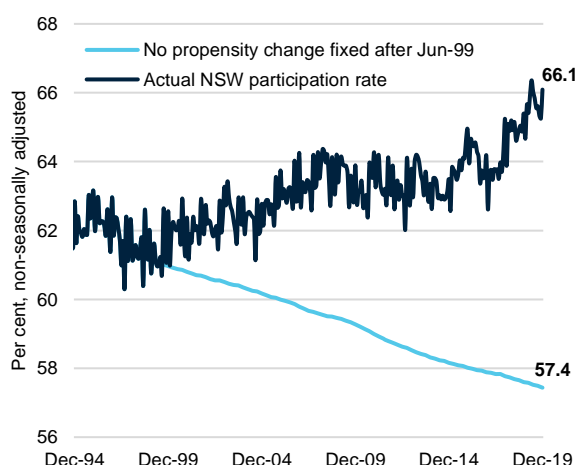
Source: OECD Labour Market Statistics database; ABS 6202.0; NSW Treasury

The rise in female participation has likely been driven by a range of factors, including: greater workplace flexibility; improved access to paid parental leave and childcare subsidies; higher levels of education; financial factors (such as tax incentives for families, growing cost of living expenses and higher levels of household debt); the shift towards more labour-intensive services industries; and evolving societal attitudes around gender roles at home and in the workplace. This has been a consistent trend for most female age cohorts, except for a decline in participation rates for those aged between 15 and 24, reflecting the increase in younger people delaying entering the labour force to continue their education.

Over the same period, the male participation rate has declined. The extent of the decline varies across age cohorts, and for older males (60 and over) participation rates have increased. The general decline in male participation rates, however, mirrors the experience of most advanced economies (Chart 8). This is consistent with the trend for younger people to stay in education for longer, a skills mismatch as the economy shifts from male-dominated manual industries (such as manufacturing) to less physically demanding services-based industries (Box 2.2), and evolving societal attitudes.

The decline in the propensity of males to participate in the workforce has been more than offset by the rise in the propensity of females and older workers (Chart 9). The total NSW participation rate today would be around 9 percentage points lower if age and gender-specific participation rates had not changed over the last 20 years.

Chart 9: The effect of propensity to participate^(a)

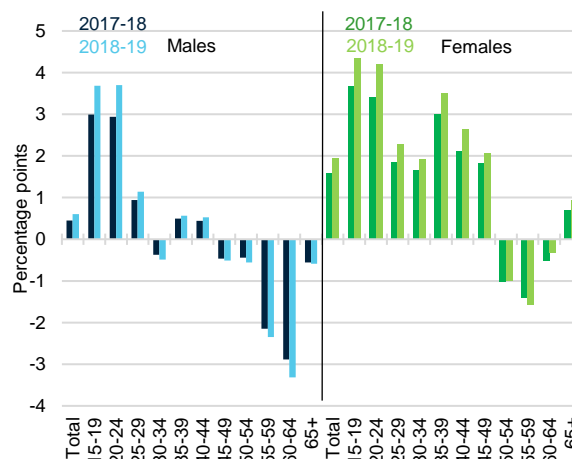


Source: ABS 6291.0.55.001; NSW Treasury

Notes: (a) The 'no propensity change' scenario fixes participation rates of each age and gender group to June 1999.

(b) Percentage point difference between participation rate actual outcomes and 2016 IGR projections in 2017-18 and 2018-19. Participation rate data has been smoothed with a Hodrick-Prescott filter, with a smoothing parameter of 100.

Chart 10: NSW participation rate outcomes compared to 2016 IGR projections^(b)



Source: ABS 6291.0.55.001; NSW Treasury

What has changed since the 2016 Intergenerational Report?

Chart 10 shows the percentage point difference between actual outcomes and 2016 IGR projections for NSW male and female cohort participation rates in 2017-18 and 2018-19. Projections and actual data have been smoothed with a Hodrick-Prescott filter (smoothing parameter of 100, annual data from 1978-79 to 2018-19) to allow comparisons of underlying long-run trend rates.

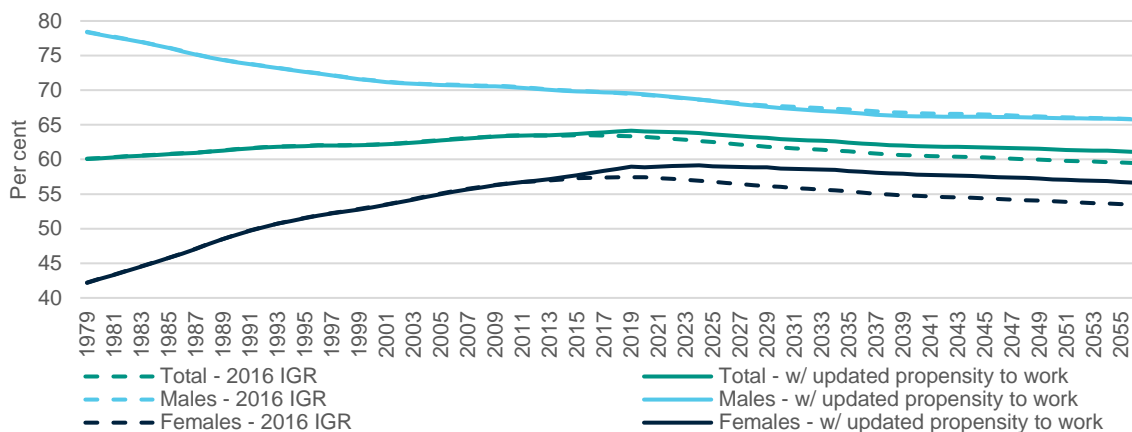
The 2017-18 and 2018-19 actual outcomes for the aggregate male and female participation rates sit above 2016 IGR projections. The differences to projections are more pronounced for female participation, with most female cohorts (except those aged 50-64) participating at a higher rate than projected. Younger male workers participated at a higher than anticipated rate, while those aged 55 and over participated at a lower than anticipated rate. Outcomes for males aged 30-54 were broadly in line with projections. See Section 4 for a summary of the structural factors that may have contributed to changes in participation rates since the 2016 IGR.

The NSW labour market has strengthened since 2016. Employment is growing at an annual average rate of around 3 per cent, well-above the long-run average of 1.7 per cent. As shown in Section 3,

younger workers of both genders and females under the age of 50 are particularly sensitive to changes in labour market conditions in the short term, whereas prime age males 25 to 54¹⁰ and older workers of both genders (except for males 65 and over) are not.

The impact of the change in propensity to participate for each cohort on aggregate participation rate projections can be illustrated by holding projections of the age structure of the population unchanged since the 2016 IGR and applying the preliminary updated projections of cohort participation rates for the 2021 IGR, summarised in Section 4 (Chart 11).

Chart 11: Impact of updated propensity to participate on NSW participation rate projections



Source: ABS 6291.0.55.001; NSW Treasury

Updated participation rate projections, reflecting changes in propensity to participate since the 2016 IGR, place upwards pressure on long-term projections of the female participation rate. For males, the impact of the lower-than-projected participation rates of older male cohorts offsets the impact of the higher-than-projected participation of younger male cohorts, therefore leading to broadly unchanged projections of the male participation rate.

Projections under this scenario relative to the 2016 IGR show that by 2055-56:

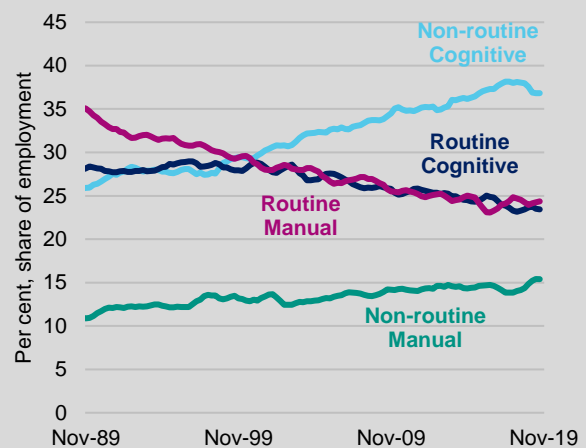
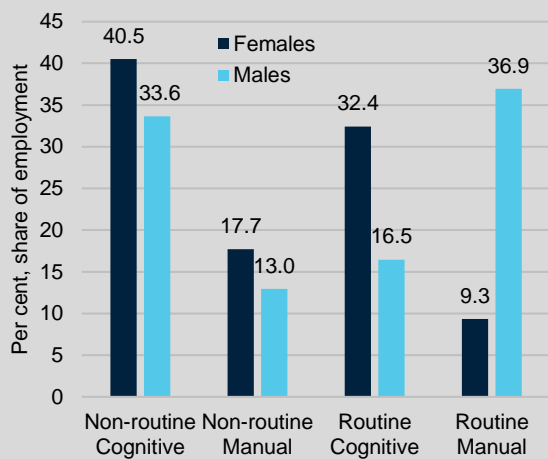
- Male participation is projected to be unchanged at 65.8 per cent
- Female participation is projected to be 3.2 percentage points higher at 56.6 per cent
- Total participation is projected to be 1.6 percentage points higher at 61.1 per cent.

¹⁰ This paper defines 'prime age' workers as those aged 25 to 54, consistent with the Australian Bureau of Statistics (for example, see "Employment Measures" in Australian Labour Market Statistics (6105.0) July 2013).

Box 2.2 The impact of technological change and the changing nature of jobs on workforce participation¹¹

Technology has advanced rapidly over the last three decades, fundamentally changing the nature of jobs and the skills needed to compete in the modern workforce. New technologies have replaced a range of manual and routine tasks previously performed by people, particularly in the manufacturing, mining and agricultural sectors. Routine jobs in the services sector have also been affected, with new technologies making possible the outsourcing of some back-office functions to overseas markets with relatively lower labour costs. Males are more exposed to automation, with 53.4 per cent of current male employment in routine occupations (compared to 41.7 per cent of female employment), particularly manual roles (Chart A).

Chart A: Males more exposed to automation **Chart B: Non-routine occupations are growing as a share of the workforce**



Source: ABS 6291.0.55.003; RBA; NSW Treasury

Source: ABS 6291.0.55.003; RBA; NSW Treasury

This has not caused a permanent net loss of jobs in the NSW economy; rather, this has resulted in a broad-based shift in the types of jobs performed. Over the last three decades, NSW employment in routine manual occupations – those most exposed to automation, including labourers, machine operators and drivers – has grown at an annual average rate of just 0.5 per cent. The share of employment in this category has fallen from just over a third to around a quarter (Chart B). Over the same period, employment in non-routine cognitive occupations – such as managerial roles, health and education professionals, engineers and creatives – has grown at an annual average rate of 3 per cent. This category now accounts for the largest share of NSW employment at just over a third of all jobs, up from around a quarter three decades ago.

The rapid pace of technological change and labour market disruption is likely to continue, and even accelerate, with the diffusion of new technologies like Artificial Intelligence and autonomous vehicles. This will have implications for labour market dynamics, including workforce participation rates. As in the past, technology will continue to replace tasks previously performed by people, particularly tasks that are risky, routine or repetitive¹². This will see a continuation in the relative shift in jobs away from male-dominated manual industries to new, less physically demanding and less routine services industries¹³. This shift to less strenuous job activity will support extended working lives, with the average age of retirement likely to increase over time (Box 2.1).

¹¹ This box refers to job classification data and other related concepts outlined in Autor (2010) and Heath (2017).

¹² AlphaBeta, The Automation Advantage, August 2017.

Box 2.2 (con't)

At the same time, technology and automation may support greater productivity and shorter working hours. This will mean that although working lives are extended, average weekly hours worked per employee may decline, further increasing the role of part-time employment in our economy. Alternatively, the working hours saved could be reinvested into new work-related activities to generate more output¹⁴.

These potential changes in labour market dynamics, and impact on economic output, are not explicitly captured in the projection methodology used in this paper. Hence, a future stream of work could consider how to better account for the impact of such changes on participation rate projections.

3. Modelling the Cyclical Component of Changes in Participation Rates

As discussed in the previous section, actual participation rates have generally exceeded 2016 IGR expectations. This reflects a mix of cyclical and structural factors.

This section estimates the short-run response in the participation rate to changes in labour market conditions; that is, the cyclical component of changes in the participation rate. The aim is to better understand the sensitivity of labour supply to short-term changes in labour market conditions, how this varies by age and gender, and the impact of long-run underlying trends.

I) Background

Long-run trends in the participation rate are largely driven by supply-side, or structural, factors. This structural component is a key driver of potential long-term economic growth.

As shown in Section 1 (Chart 2) there has historically been significant cyclical variation of the participation rate around its long-run trend rate. The cyclical variation in labour supply represents an 'encouraged (discouraged) worker effect'. As labour market conditions improve (deteriorate), the perceived benefit of entering the labour force increases (decreases), thereby encouraging (discouraging) participation. There is evidence of an encouraged worker effect in the NSW labour market, with strong employment growth and low unemployment coinciding with a participation rate at record highs around mid-2019.

The employment-to-population ratio, as an indicator of labour market conditions, is a widely used metric to estimate the presence of an encouraged worker effect in Australia¹⁵. This ratio is the percentage of the civilian population aged 15 years and over that is employed. Applying the change in the employment-to-population ratio, rather than employment, removes the mechanical impact of growth in population on employment growth, thereby providing a more accurate indication of changes in labour demand.

As noted by Evans, Moore and Rees (2018), the relationship between participation rates and the employment-to-population ratio is not mechanical. In the short-run, changes in the ratio could, in principle, be met entirely by changes in unemployment, rather than participation.

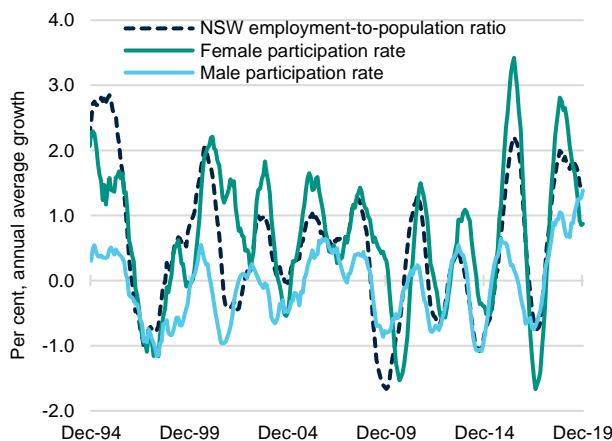
¹³ As noted in Acemoglu and Restrepo (2018), history shows (at least in the United States) that the impacts on labour from growth in automation are usually counterbalanced by the creation of new tasks in which labour has a comparative advantage.

¹⁴ AlphaBeta, The Automation Advantage, August 2017.

¹⁵ For example, see Bullen J, Greenwell J, Kouparitsas M, Muller D, O'Leary J and Wilcox R (2014).

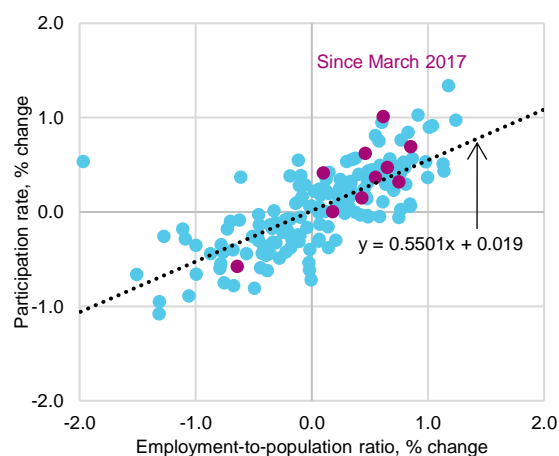
There is some correlation between growth in the gender-specific participation rates and the employment-to-population ratio (Chart 12). This relationship is noticeably closer for females, reflecting that female employment has largely been the driver of total employment growth over the last two decades. The relationship between the quarterly per cent change in the total NSW participation rate and employment-to-population ratio between the June quarter 1978 and June quarter 2019 is shown in Chart 13. The linear trend line shows the average relationship between these two variables. The slope of this line suggests that, on average, a 1 per cent increase in the employment to population ratio will be met with a 0.55 per cent increase in the participation rate, with any remaining adjustment met by a fall in the unemployment rate.

Chart 12: Growth in the NSW employment-to-population ratio and participation rates



Source: ABS 6291.0.55.001; NSW Treasury

Chart 13: Relationship between change in NSW employment-to-population ratio and the participation rate



Source: ABS 6291.0.55.001; NSW Treasury

II) Estimating the encouraged worker effect

The encouraged worker effect is modelled by gender and five-year age cohort on a quarterly basis (Equation 1). Decisions to enter or leave the labour force are assumed to be based on conditions in the overall labour market rather than conditions specific to individual cohorts¹⁶. Hence, the total employment-to-population ratio is used for both genders and all age cohorts, rather than gender and age-specific ratios.

Equation 1 – General age and gender labour force participation equation

$$\Delta pr_t^{ga} = c + b_1 \Delta empratio_t + b_2 \Delta empratio_{t-1}$$

Note: The superscript 'ga' indicates gender and age specific parameters.

Where:

- 'pr' is the participation rate at time t by gender and five-year age cohort; and
- 'empratio' is the cyclical component of the employment-to-population ratio.

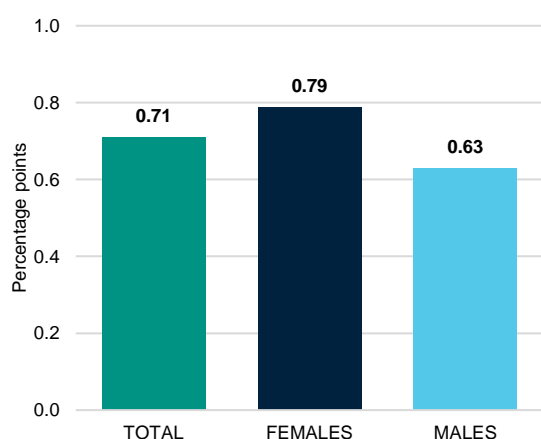
Changes in the employment-to-population ratio are driven by a mix of structural and cyclical factors. To better isolate the impact of cyclical factors on participation rates, the cyclical component of the employment-to-population ratio is used. A Hodrick-Prescott (HP) filter with a smoothing parameter of 1600 is applied to the original quarterly series to extract the cyclical component, which at each quarter is the difference between the original and smoothed series (see Appendix C for a discussion of the short-comings of the HP filter and alternative smoothing approaches). Hence, Equation 1 estimates

¹⁶ Evans et al (2018) and Cavalleri et al (2017) also test the response in cohort-level participation and employment rates to changes in aggregate labour market and economic conditions.

the percentage point change in the participation rate from a 1 percentage point change in the cyclical component of the employment-to-population ratio at time t and $t-1$ ¹⁷. A one-quarter lag is included to allow for a lag in the response in labour supply to a change in labour demand. The sample period is the March quarter 1985 to June quarter 2019.

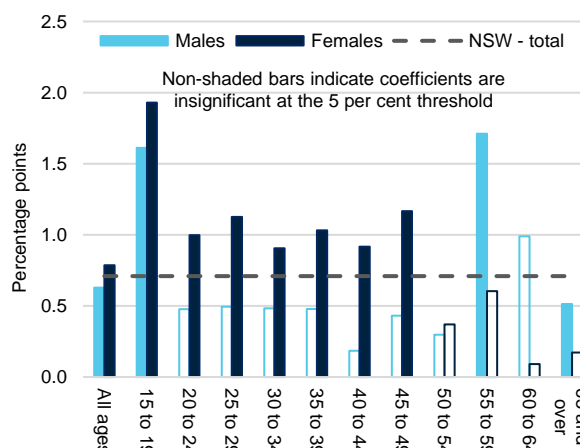
Equation 1 is first estimated on an aggregate basis for New South Wales (Chart 14). Adding the coefficients b_1 and b_2 indicates a total short-run cyclical coefficient of 0.71; that is, a 1 percentage point increase in the cyclical component of the employment-to-population ratio leads to a 0.71 percentage point increase in the participation rate in the short run, with any remaining adjustment made through a reduction in the unemployment rate. Wald Tests confirm that coefficients are jointly significant at the 1 per cent threshold. Coefficients for Australia and the rest of Australia (excluding NSW) are broadly similar (see Appendix A for detailed tables of all modelling outputs).

Chart 14: NSW females are more responsive than males to changes in labour demand^(a)



Source: ABS 6291.0.55.001; NSW Treasury

Chart 15: The encouraged worker effect varies across gender and age in NSW^(a)



Source: ABS 6291.0.55.001; NSW Treasury

Notes: (a) Charts 14 and 15 show the percentage point change in the participation rate from a 1 percentage point change in the cyclical component of the employment-to-population ratio.

The cyclical component of the recent increase in participation rates can be recovered by combining the cyclical coefficients b_1 and b_2 with the actual quarterly change in the cyclical component of the employment-to-population ratio. This indicates that around 40 per cent of the increase in the NSW participation rate between the most recent low point in the March quarter 2017 and June quarter 2019¹⁸ is cyclical. This suggests that a large proportion of the recent gains in the participation rate will reverse should labour market conditions deteriorate.

Cyclical coefficients are then estimated across gender, with results for New South Wales shown in Chart 14. Results suggest that, in aggregate, females are more responsive than males to changes in labour demand in the short run. This response is expected to vary with age. To test this, Equation 1 is estimated by gender across each five-year age cohort (Chart 15).

The participation rates of younger workers of both genders, prime-age females and older males are most responsive to changes in labour market conditions in the short run. Cyclical coefficients for workers of both genders aged 15 to 19, females aged 20 to 49, and males aged 55 to 59 and 65 and

¹⁷ As the cyclical component series includes negative values, variables are in unit differences rather than natural log differences.

¹⁸ The June quarter 2019 is the last quarter of participation rate actual outcomes before the projection period commences (2019-20 to 2060-61).

over¹⁹ are jointly significant at the 5 per cent threshold²⁰. Coefficients are higher for those aged 15-19 relative to prime-age females, noting that coefficients for prime-age males are not statistically significant at the 5 per cent threshold. As noted in Cavalleri and Guillemette (2017), this is consistent with younger workers having relatively less attachment to the workforce and hence are more responsive to short-term fluctuations in labour demand, compared to prime-age workers who are generally in more stable employment.

Results for Australian females show a similar pattern to New South Wales (see Appendix A). For Australian males, all cohorts excluding the 25-29 and 35-44 cohorts show a statistically significant response to changes in labour market conditions. Coefficients for prime-age males, however, are relatively small indicating that these age groups are much less sensitive to short-term changes in labour demand compared to their female counterparts.

These results are comparable to RBA estimates (Evans et al (2018)) for the Australian labour market which suggest that a 1 per cent increase in the cyclical component of GDP leads to a 0.4 percentage point increase in the participation rate over the following two quarters. The same paper also finds that younger workers of both genders, females aged 25–54 and older males are most sensitive to changes in economic and labour market conditions. While not directly comparable, due to differences in the form of explanatory variables and estimation method, the results in this paper on the response in participation rates to cyclical factors are broadly consistent with the RBA's estimates.

Alternative regressions were run to test the robustness of these results. This included the exclusion of a constant, and the inclusion of an extra lag in the cyclical component of the employment-to-population ratio, with results not overly sensitive to these changes.

While these results indicate a strong encouraged worker effect for some cohorts, particularly females, they do not reveal why this effect varies across cohorts or different parts of Australia, or why people enter the labour force. This is not explored further in this paper; however, some of the possible reasons are likely to be related to financial incentives, employer demand for certain skills, family reasons such as decisions around childbearing, and short-term industry-specific trends.

As discussed in the next section, these findings inform the modelling approach for preliminary long-term participation rate projections.

4. Preliminary Long-Term Participation Rate Projections - Summary of Results

This paper adopts the dynamic cohort analysis approach of the Commonwealth Productivity Commission (2005)²¹ to produce participation rate projections to 2061. This is consistent with the methodology for the 2011 and 2016 NSW Intergenerational Reports, and for cohorts aged 60-64 and over for the 2015 Commonwealth Intergenerational Report²².

This approach is a relatively straightforward method for incorporating cohort effects into labour supply projections. It allows projections to take account of the shape of the lifetime labour participation profile for each successive five-year age cohort²³. Hence, this approach accounts for varying labour market

¹⁹ Results for workers 65 and over should be read with caution due to the relatively smaller sample sizes. Further, due to the small size of this cohort relative to the total working age population the impact on the aggregate participation rate is also small. Some empirical analysis also suggests that the labour force status of older workers is much less sensitive to the economic cycle. In some cases, their response may even be countercyclical due to wealth-related factors; for example, see Cavalleri and Guillemette (2017).

²⁰ There is some evidence of serial correlation in the residuals for males 55-59 and 65 and over. Adjusting for estimation bias does not materially impact the value of cyclical coefficients. Therefore, the overall findings are unchanged.

²¹ Productivity Commission (2005), Cohort Analysis Technical Paper 3, Economic Implications of an Ageing Australia, April.

²² See 2015 Intergenerational Report Australia in 2055, Appendix C for further information.

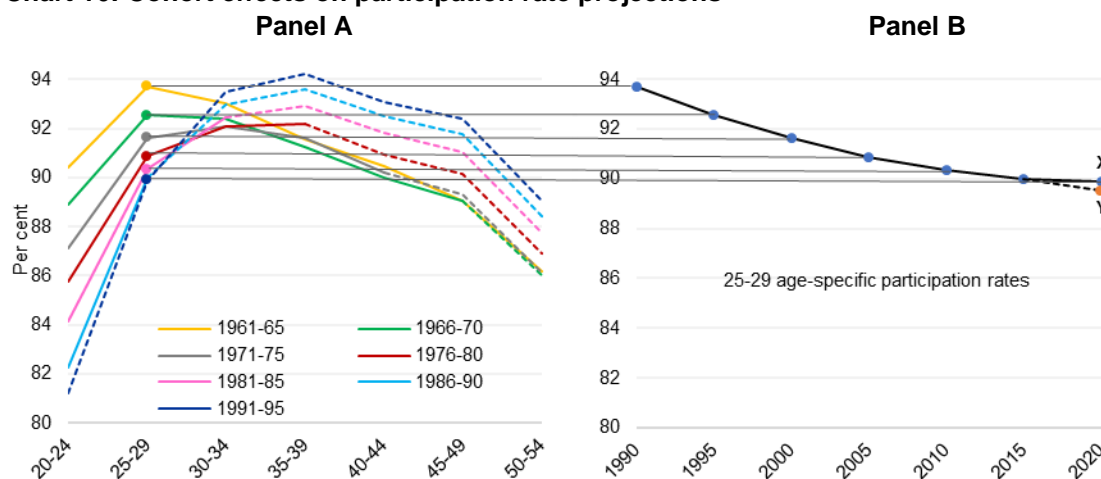
²³ Productivity Commission (2005).

behaviours across different age groups at a fixed point in time and for different generations across time, such as varying social attitudes and aptitudes, educational levels and the effects of historical events on labour market attachment.

As an example, this approach captures the difference in behaviour between the 20-24 and 25-29 age cohorts today, as well as differences between the behaviour of the 20-24 age cohort today and the behaviour of today's 25-29 cohort when it was the 20-24 cohort five years earlier. These age-related and generational differences in behaviours have implications for projecting labour supply. Cohort analysis enables more accurate projections of participation rates than what is obtainable by simply extrapolating age-specific participation rates over time. The cohort analysis approach is also well-tested empirically; for example, see Burniaux, Duval and Jaumotte F (2004), Cavalleri and Guillemette (2017), and Grigoli, Koczan and Tapalova (2018).

Chart 16 illustrates these cohort effects. Participation rates are plotted for a range of age-cohorts through their past, present and future lives in Panel A. The “age-specific participation rate” for the 25-29 age cohort is plotted against time on Panel B. If the curve in Panel A, representing the age-specific participation rate, is simply extrapolated, then point Y represents a likely projected participation rate for the 25-29 age cohort in 2019-20; however, this would neglect cohort information. The 25-29 age cohort in 2020 is the 1991-95 birth cohort, whose participation rate is different, at each age, than the previous cohort (born in 1986-90), representing generational differences in workforce behaviour (Panel A). The actual estimate for projected participation rates for the 25-29 age cohort in 2019-20 is at point X rather than point Y.

Chart 16: Cohort effects on participation rate projections



Source: ABS 6291.0.55.001; NSW Treasury

Note: Dashed lines in Panel A indicate projections, commencing 2019-20

Using this approach, historical monthly full-time and part-time participation rate data (July 1978 to June 2019) for each five-year age cohort for both genders are first converted to annual fiscal year averages.

The next step is to eliminate volatility associated with short-run business cycles and any sampling error in each annual series. The approach taken in the 2016 IGR, consistent with the Productivity Commission, was to apply an HP filter to obtain a smoothed time series more sensitive to long-term rather than short-term fluctuations. As identified in Section 3, the participation rates of a number of cohorts exhibit a statistically significant larger increase in response to short-term cyclical factors compared to others. This creates a ‘launch pad’ effect for projections – that is, even after smoothing with an HP filter, the impact of the recent upswing in data leads to long-term participation rate projections that are substantially higher than 2016 IGR results and which cannot reasonably be explained by structural factors alone.

Hence, to minimise the impact of this short-term cyclical volatility and more effectively address the well-known end-point bias with HP filters²⁴, the methodology is updated to more effectively account for the large cyclical component in the rise in participation rates since 2017. From the December quarter 2017 to June quarter 2019, participation rates for those cohorts with a statistically significant cyclical component are adjusted using the cyclical coefficients, identified in Equation 1, to obtain an estimate of the long-term trend (structural) participation rate for each quarter. The steps involved in this process are summarised in Appendix B.

After converting to fiscal year averages and separating full-time and part-time participation rates²⁵, the resulting structural participation rate time series from 2017-18 to 2018-19 is added to the historical time series from 1978-79 to 2016-17 for each cohort. An HP filter is then applied to the entire time series (1978-79 to 2018-19) for each cohort (see Appendix C for a discussion on the appropriateness of using the HP filter to smooth time series data). These additional steps are excluded for those cohorts without a statistically significant cyclical component and the HP filter is applied to the entire unadjusted time series. Consistent with the approach of Hodrick and Prescott (1997) and Backus and Kehoe (1992) for annual data, this paper uses a smoothing parameter (lambda) value of 100 in the HP filters for all adjusted and unadjusted time series.

Historical entry and exit rates are extracted from the smoothed full-time and part-time participation rates series for each cohort and then extrapolated by fitting the historical data to a Richards' curve, a type of 'S'-shaped curve. An s-shaped curve is used, rather than linear or log trend models, as appropriately defined entry and exit rates must be bounded. A Richards' curve is a more general form of the logistic curve which allows for more flexible inflection points compared to other s-shaped curves and therefore provides a better fit with the historical data²⁶.

Having projected the future path of entry and exit rates, projected participation rates for each cohort are recovered. Projections start from 2019-20. These age and gender-specific trend participation rates are then weighted by the share of these cohorts of the total population aged 15 and over (actuals up to and including 2018-19 and Treasury projections onwards) to obtain aggregate trend participation rates for the total NSW working age population and both genders.

Projections are on a no-policy change basis (Box 4.1) and do not account for differences in population demographics or propensity to participate in the workforce between metro and regional areas (Box 4.2). Detailed information on this methodology is provided in Appendix B.

Relative to 2016 IGR long-term projections, updated projections show²⁷:

- A shift upwards in projections of the total labour force participation rate;
- A shift upwards in projections of the aggregate female participation rate; and
- A smaller shift upwards in projections of the aggregate male participation rate, with some compositional changes in propensity to participate amongst cohorts.

²⁴ 'End-point bias' refers to the exaggerated impact that the last point in a time series has on an HP-trended series.

²⁵ A simple assumption is made that cohort cyclical coefficients are the same for full-time and part-time participation rates.

²⁶ Productivity Commission (2005).

²⁷ All participation rate projections in Section 4 refer to long-term trend (structural) rates, unless otherwise stated.

Box 4.1 Estimating the potential long-run impact of future policy changes on participation rate projections

The participation rate modelling in this paper accounts for the differences in behaviour across cohorts at a single point in time, as well as for different generations across time, based on historical trends. Participation rates are projected on a no policy change basis; that is, modelling does not explicitly account for potential future policy changes that may impact people's propensity to participate in the workforce. In reality, future governments at all levels are likely to make policy decisions that will directly or indirectly impact the workforce decisions of different cohorts. For example, any future decision by the Commonwealth Government to further increase the eligibility age for the age pension or the superannuation preservation age would likely influence the retirement decisions of older workers. Likewise, further policy changes to childcare and parental leave would likely influence the workforce participation of parents. An option for future modelling is to account for the potential impact of changes in government policy on long-run participation rate projections for New South Wales.

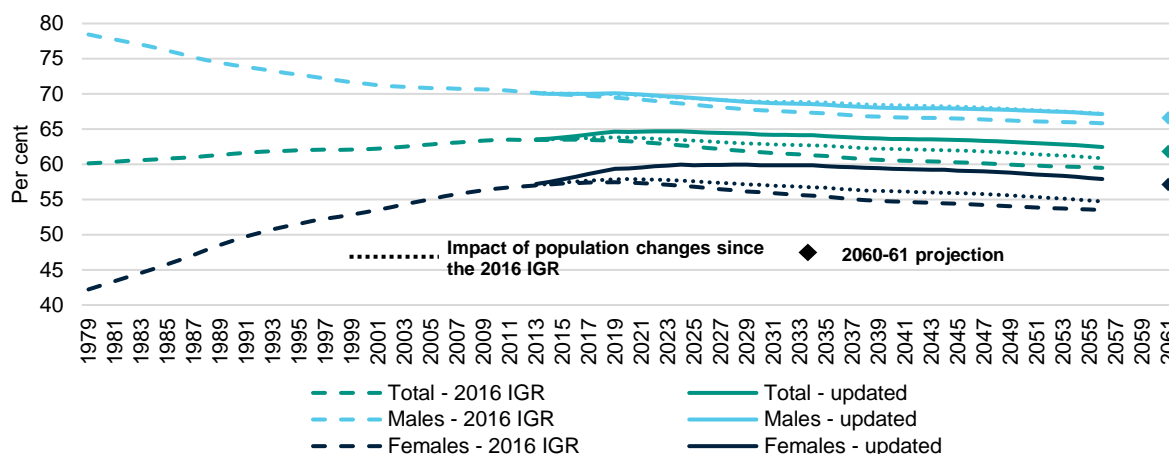
There are already a range of studies that estimate the impact of policy changes on labour supply, for Australia and internationally. For example, consistent with the approach taken in this paper, Cavalleri and Guillemette (2017) establish a baseline projection of employment rates across a range of countries by gender and age, accounting for cohort and demographic influences. Modelling is then extended by assessing the potential long-run impact of policy changes on employment rates. Policies include unemployment benefits (negative effects on the employment rate for all workers, especially those aged 55 and over), minimum wage (negative effect on rates for youths and prime-age women), pension age (positive effect on rates for workers aged 55 and over) and family benefits (positive effect for prime-age women).

In an Australian context, the Commonwealth Productivity Commission (2013) estimates that gradually increasing the eligibility age for the age pension from 67 to 70 could increase participation rates for relevant cohorts by between 3 and 10 per cent. Gong and Breunig (2012) find that child care costs have a negative impact on female labour supply, estimating that a 1 per cent increase in the net price of child care leads to, on average, a 0.1 per cent decrease in labour hours provided by partnered women and a 0.06 per cent decrease in the employment rate. This suggests that any new government policy providing further childcare support could have a positive impact on participation rates.

I) Total participation rate

Updated long-term projections of the NSW participation rate show an upward shift compared to the 2016 IGR, although they confirm the longer-term downward trend (Chart 17). The participation rate is projected to decline 2.2 percentage points between 2018-19 and 2055-56 to 62.4 per cent. This is a smaller decline relative to 2016 IGR projections over the same period (3.9 percentage points), resulting in a smaller economic drag. The total participation rate is projected to fall by 2.9 percentage points between 2018-19 and 2060-61 to 61.8 per cent, resulting in an annual average deduction of around 0.1 percentage points to real GSP per capita growth. This compares to 2016 IGR projections for an annual average deduction of around 0.15 percentage points between 2014-15 and 2055-56 resulting from the decline in the participation rate.

Chart 17: New South Wales – change in participation rate projections since the 2016 IGR



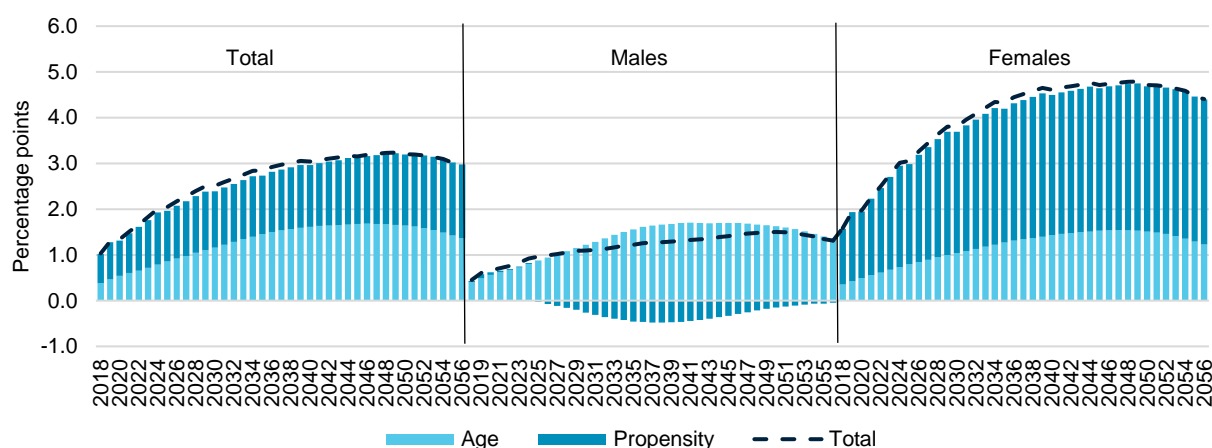
Source: ABS 6291.0.55.001; NSW Treasury

The changes in aggregate participation rate projections since the 2016 IGR are a function of two key factors:

- 1) the change in the projected age structure of the population which is younger and ageing at a slower pace than 2016 IGR projections, primarily as a result of higher than expected net overseas migration; and
- 2) the change in projections of the propensity to participate of each five-year age cohort.

The largest changes in participation rate projections since the 2016 IGR are for females, with the improvement in age demographics and changes in propensity to participate both having a positive impact (Chart 18). For males, the positive impacts from changes in age demographics are partially offset by a fall in projections of the propensity to participate, resulting in a relatively smaller upwards revision in participation rate projections.

Chart 18: Change in NSW participation rate projections since the 2016 IGR (2017-18 to 2055-56)



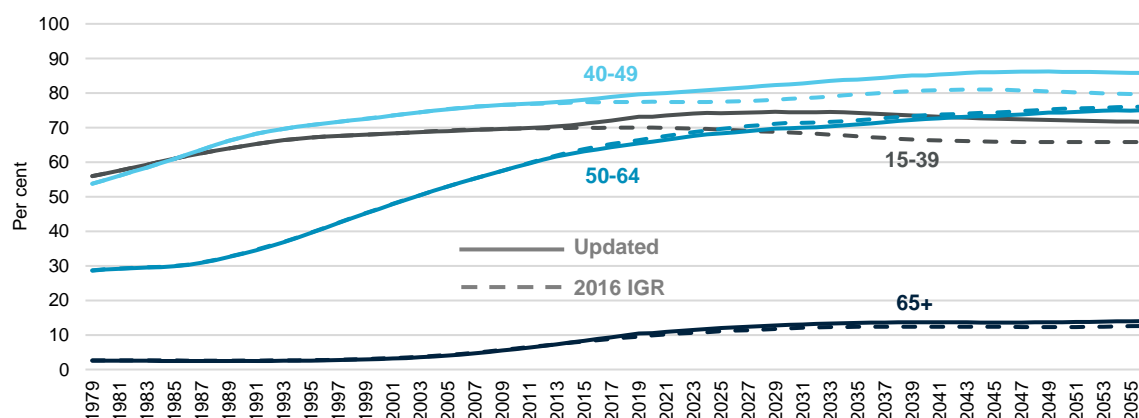
Source: ABS 6291.0.55.001; NSW Treasury

I) Female participation rate

Updated female participation rate projections represent a shift upwards compared to the 2016 IGR (Chart 17). The rate is projected to peak at 60.0 per cent in 2023-24 and then decline to 57.9 per cent in 2055-56. This compares to 2016 IGR projections for a peak rate of 57.4 per cent in 2017-18 before declining to 53.5 per cent in 2055-56. Updated projections show the rate falling to 57.1 per cent by 2060-61, equivalent to rates last experienced in the early-2010s.

This upwards shift in female participation is primarily driven by those aged 15 to 49 (Chart 19). Updated projections follow a larger-than-expected increase in women entering the labour force since the release of the 2016 IGR, led by women under the age of 50, resulting in the female participation rate reaching a record high in 2019. As shown in Section 3, a large share of this increase is likely in response to short-term changes in labour demand²⁸, with these impacts adjusted for in the projections (Section 3 and Appendix B). Therefore, the changes in projections since the 2016 IGR reflect longer-term structural factors.

Chart 19: New South Wales females – cohort participation rate projections



Source: ABS 6291.0.55.001; NSW Treasury

Although slower-than-expected ageing of the population has impacted workforce participation at an aggregate level, changes in the propensity to participate have the larger impact (Chart 18). Structural factors contributing to this are likely to include women of child-bearing age having fewer children, with the total fertility rate at 1.7 today compared to 2016 IGR expectations of around 1.9; the recent increase in Commonwealth Government childcare financial support; and the ongoing shift in the economy towards more labour-intensive service industries (Box 2.2). More recently, shifts in patterns of employment growth relating to the rollout of the NDIS are also a likely factor.

ABS data on barriers and incentives to participation show that cost and accessibility of childcare is the biggest barrier to females either entering the labour force or increasing their work hours²⁹. Therefore, improvements in childcare support, as well as a fall in the rate of women giving birth, can reasonably be expected to have a positive impact on participation rates, all else being equal, particularly for those aged below 50³⁰. This is supported by ABS job search and mobility data showing that since 2015, women not participating in the workforce due to reasons relating to childcare has fallen by 20 per cent as a proportion of the civilian population aged 15 and over³¹.

Further participation support has come from growth in the healthcare and social assistance sector, which is a major source of female employment. Since early-2017, this sector has been the largest contributor to NSW employment growth, accounting for almost one-fifth of growth³². According to RBA analysis, this sector is more likely than others to draw on workers from outside the labour force³³. The RBA points to data from the Household, Income and Labour Dynamics in Australia (HILDA) survey

²⁸ Repeating the same process as described in Section 3 indicates that around 44 per cent of the increase in the female participation rate since the March quarter 2017 is cyclical.

²⁹ ABS, Barriers and Incentives to Labour Force Participation in Australia (6239.0), July 2016 to July 2017.

³⁰ See Gong et al (2010) and Gong et al (2012) for evidence on the relationship between childcare and workforce participation of women.

³¹ ABS, Participation, Job Search and Mobility, Australia (6226.0), 2019

³² ABS Labour Force, Detailed (6291.0.55.003).

³³ RBA, Statement on Monetary Policy, May 2018 (Box B: The Recent Increase in Labour Force Participation).

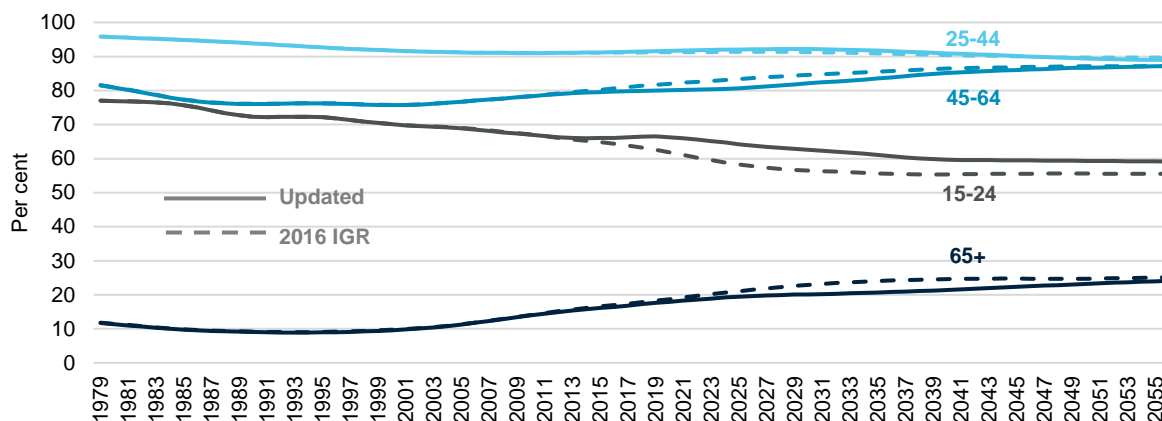
suggesting that of those outside the labour force joining healthcare employment, half are women aged between 25 and 44. Healthcare and social assistance employment is expected to receive an ongoing boost from the rollout of the NDIS and population ageing, providing support to the participation rate.

A shift upwards in projections of the propensity to participate of females 65 and over follows a pick-up in the participation rate that is greater than projected in the 2016 IGR. As shown in Section 3, the response in the participation rate of this cohort is not measurably sensitive to cyclical factors. This indicates that this rise is structural, and coincides with the rise in the eligibility age of the age pension from 65 to 65½ on 1 July 2017, followed by another rise to 66 on 1 July 2019. The eligibility age is scheduled to rise by six months every two years until reaching 67 on 1 July 2023, supporting the upward trend in participation rates of older workers.

II) Male participation rate

Updated long-term projections show a relatively small shift upwards in the male participation rate compared to the 2016 IGR, primarily a result of the improvement in age demographics (Chart 18). The rate is projected to decline from 70.1 per cent in 2018-19 to 67.1 per cent in 2055-56, compared to the 2016 IGR projection of 65.8 per cent. Updated projections show male participation falling to 66.6 per cent by 2060-61.

Chart 20: New South Wales males – cohort participation rate projections



Source: ABS 6291.0.55.001; NSW Treasury

As shown in Chart 18, the net impact of changes in propensity to participate compared to the 2016 IGR are negative on an aggregate basis, although this effect tapers out towards the end of the projection period. These impacts are outweighed by the positive impact of the updated population projections with more younger workers and less older workers relative to 2016 IGR projections.

The net impact of these changes results in a small shift upwards in projections of the male participation rate relative to the 2016 IGR, with the largest shift for the 15-24 cohort, although the overall downward trend remains (Chart 20). The shift upwards in projections for those aged 15-24 coincides with a decline in that age group of both genders in full-time education since the 2016 IGR, from 53.6 per cent in 2015-16 to 52.9 per cent in 2018-19. Further, the labour force participation rate of those aged 15-24 of both genders who are also in full-time education has increased from 48.7 per cent to 50.6 per cent over the same period.

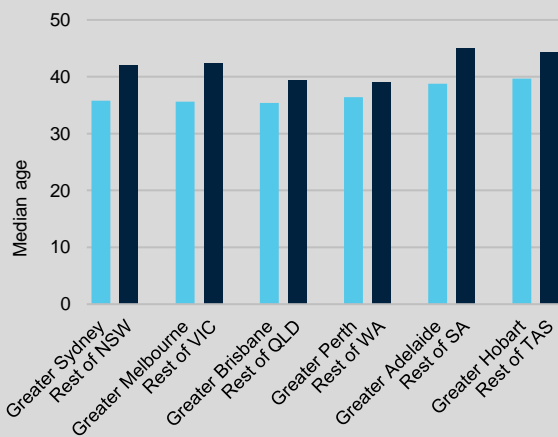
Box 4.2 Disaggregating participation rate projections on a geographical and industry basis

This paper projects participation rates across age and gender characteristics on a whole-of-state basis, accounting for changes in these characteristics over time. Modelling does not take account of any differences in demographics or the propensity to work between metro and regional areas.

The population in regional areas, on average, tends to be older with a lower propensity to participate in the workforce compared to metro areas. The median age in Greater Sydney³⁴ of 35.8 is around 6 years younger than in the rest of NSW (Chart A). Participation rates in the rest of NSW are lower than for Greater Sydney, although this does not hold for all age cohorts (Chart B). For those aged 15-24, rates are higher in the rest of NSW, likely to largely reflect a lower proportion of youths in full-time education. Participation rates are lower in the rest of NSW for most other age cohorts aged 25 and over, with the biggest differences for people aged 25 to 34 (around 4 per cent lower) and 60 and over (around 10 per cent lower).

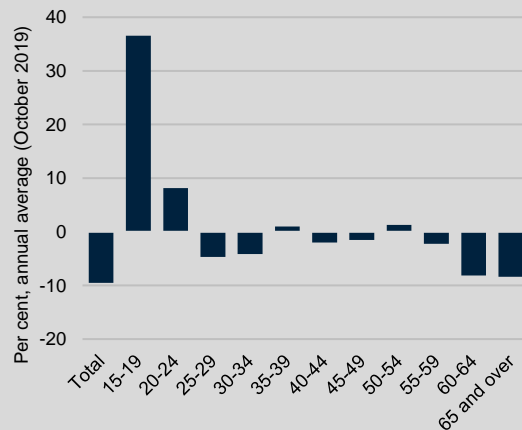
The net effect of these differences in demographics and workforce dynamics results in the total participation rate to be around 10 per cent lower outside of Greater Sydney. By accounting for these differences, a possible update to modelling methodology could estimate the long-run impact on participation rates of projected changes in the urbanisation rate or a shift in migration patterns.

Chart A: Older population outside capital cities



Source: ABS 3235.0

Chart B: Lower propensity to participate outside Greater Sydney (a)



Source: ABS 6291.0.55.001; NSW Treasury

Notes: (a) Bars show the gap in participation rates between the rest of NSW and Greater Sydney. A negative bar indicates that the participation rate for that cohort is lower in the rest of NSW.

Participation rate projections could also be disaggregated by industry and occupation. For example, the Australian Government produces five-year employment projections across 19 broad industries including health, education and construction, using ABS Labour Force survey data. Projections are a combination of outputs from autoregressive integrated moving average models and exponential smoothing with damped trend models, supplemented with additional research and known future industry developments³⁵.

Projections split across industries would allow modelling to estimate the long-run impact of shifts in the economy and industrial structure (for example, further towards services) on total workforce participation. Consideration would need to be given, however, to the trade-off between the richer data set such modelling provides against the added complexity of producing projections on such a granular basis, which, as noted by the Australian Government, are subject to an inherent degree of uncertainty.

I) Long Term Trends

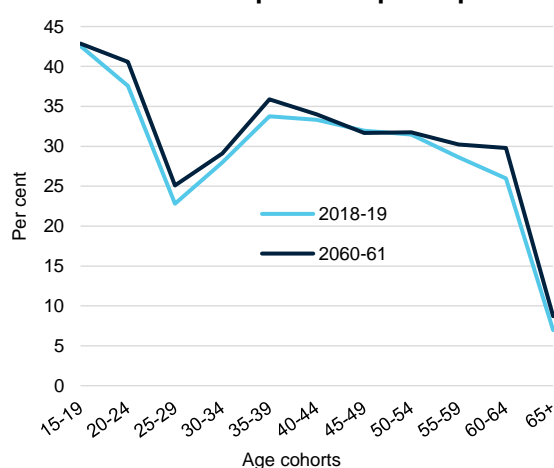
New South Wales has an ageing population, driven by lower fertility rates, rising life expectancy and the ageing of the baby boomers. In 1979, there were around seven people of traditional working age (15-64) for every person aged 65 and over. This has fallen to around four people today. This places downward pressure on aggregate participation rates.

Updated projections show a decline in the participation rate of around 3 percentage points between 2018-19 and 2060-61. This is driven by the ageing of the population, even though the share of older people participating in the workforce is expected to increase over the same period, including many who will work beyond the traditional age of retirement (as measured by the eligibility age for the age pension).

The key underlying trends influencing the long-term projections are increased rates of part-time work, falling participation amongst younger cohorts and increasing participation amongst older cohorts.

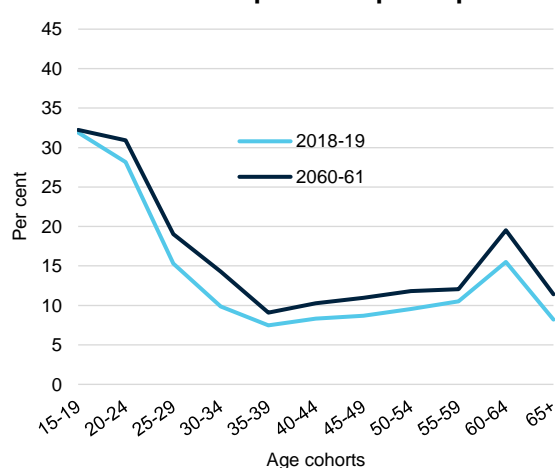
The trend towards part-time work (either employed or searching) features across nearly all female (Chart 21) and male (Chart 22) cohorts, although this trend is stronger for males. The projected increase between 2018-19 and 2060-61 is most apparent for males aged 25 and over, and for females aged 20-39 and 60 and over. In contrast, full-time participation is projected to decline for males aged 15 to 54 and for females aged 15 to 24.

Chart 21: Female part-time participation



Source: ABS 6291.0.55.001; NSW Treasury

Chart 22: Male part-time participation



Source: ABS 6291.0.55.001; NSW Treasury

These outcomes are consistent with the trend for people to exercise greater choice in their working lives as workplaces become increasingly supportive of flexible arrangements, particularly for parents and older workers phasing their retirement through part-time work. There is also likely to be an involuntary component to the rise in part-time work, reflected in an underemployment rate of 8 per cent (December 2019). Although this rate has declined from highs of 9.4 per cent in September 2014 it remains well above the four-decade average of 5.8 per cent.

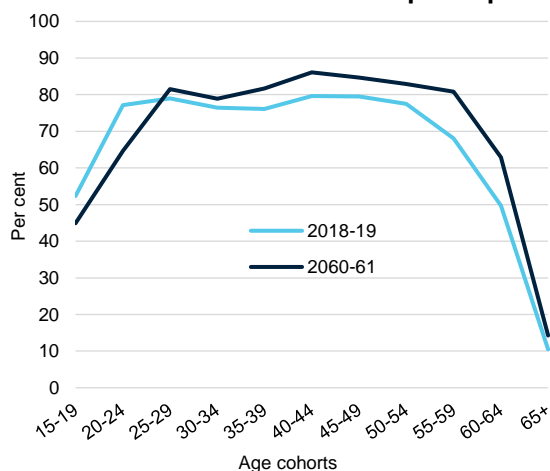
Overall participation rates amongst younger cohorts are projected to decline over the longer term, particularly for those aged 15-24 (Chart 23 and 24). This is consistent with young people delaying entry into the workforce to increase their educational attendance, a key trend since the late-1980s. Since then, the percentage of NSW people aged 15-24 in full-time education has increased from

³⁴ See ABS (1270.0.55.001) for information on the ABS' geographical disaggregation methodology.

³⁵ The Australian Government Labour Market Information Portal, Department of Employment, Skills, Small and Family Business.

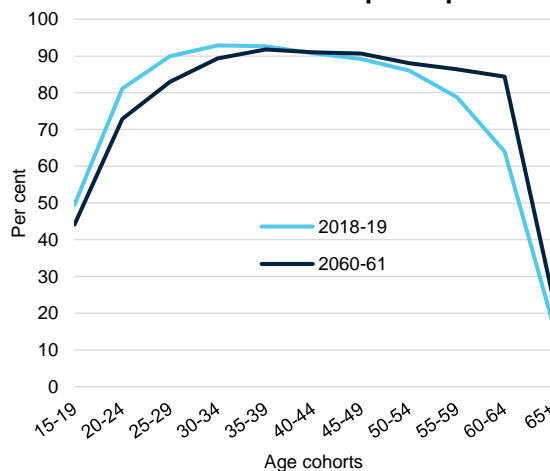
31.0 per cent to 52.9 per cent³⁶. In the long run, a growing share of young people delaying entry into the workforce for education and training purposes will lead to greater workforce skills which, in turn, will support workforce attachment and productivity.

Chart 23: Female cohort participation



Source: ABS 6291.0.55.001; NSW Treasury

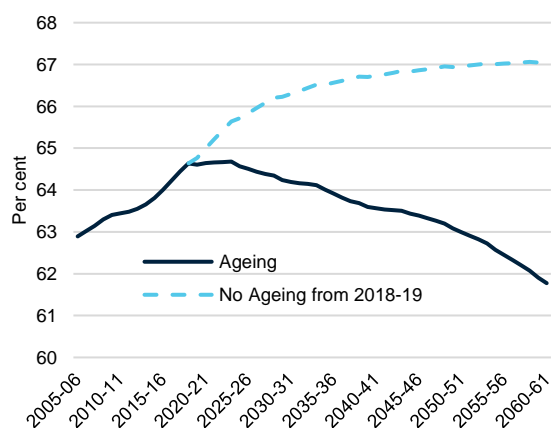
Chart 24: Male cohort participation



Source: ABS 6291.0.55.001; NSW Treasury

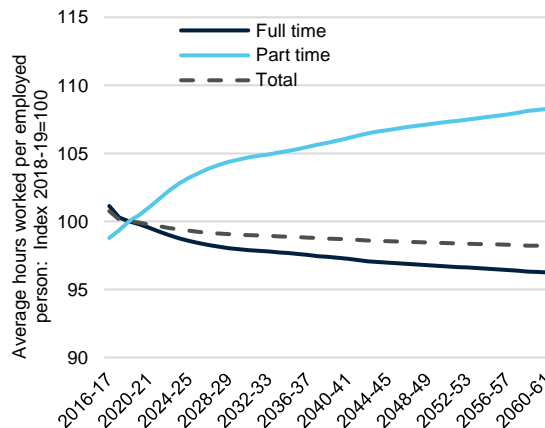
The participation rates of older cohorts for both genders are expected to increase over the longer term (Chart 23 and 24). Since 1979, the proportion of all NSW people aged 65 and over still in the labour force has more than doubled to 14 per cent today. This ratio is projected to reach 20 per cent by 2060-61. Over time, the traditional span of working age of 15-64 years will adjust for a later start in, and retirement from, the labour force (Box 2.1).

Chart 25: Lower participation rate due to ageing



Source: ABS 6291.0.55.001; NSW Treasury

Chart 26: Increase in part-time hours



Source: ABS 6291.0.55.001; NSW Treasury

The ageing of the population will shift workers into older age cohorts with relatively lower participation rates, putting downward pressure on the aggregate participation rate. By 2060-61, the total participation rate is projected to be around 5 percentage points lower that it would be without population ageing (Chart 25)³⁷. At the same time, the incidence of part-time work is projected to increase relative to full-time work. The combined impact of these trends is projected to result in total average hours worked per employed person to decline by around 1.5 per cent over the projection

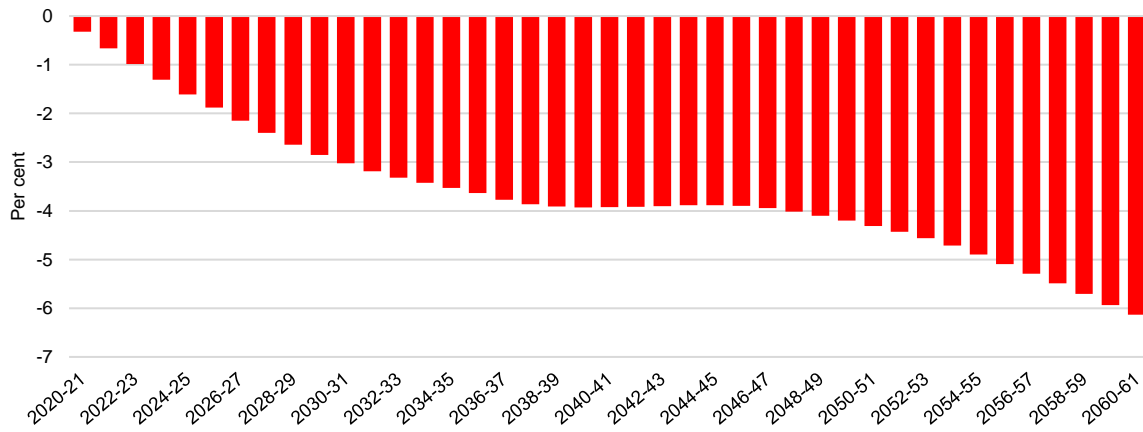
³⁶ The impact on participation rates is not as great as the rate of increase in educational attendance suggests, as those aged 15-24 in full-time education who also work has increased from 29.8 per cent to 50.6 per cent over the same period.

³⁷ Ageing effects are removed by holding population age shares constant from 2018-19 onwards.

period to 2060-61 (Chart 26). This will drag on real GSP per capita growth, averaging around 0.05 percentage points each year.

The impact of ageing on the participation rate is the dominant driver of the projected slowdown in growth in real GSP per capita, reducing growth by an average of around 0.15 percentage points each year over the projection period³⁸. As a result, by 2060-61 real GSP per capita is projected to be around 6 per cent lower than it would be without ageing. The impact of ageing will not be even over time, easing in the 2030s as the last of the baby boomers retire from the workforce and accelerating as the ageing of the millennials takes effect from the 2050s (Chart 27).

Chart 27: Impact of ageing on real gross state product per capita



Source: NSW Treasury

³⁸ This compares to an annual average detraction of around 0.25 percentage points projected in the 2016 IGR.

Box 4.3 Capturing the broader economic impacts of changes in non-market activities as a result of higher participation rates

This paper illustrates the economic benefits of a higher workforce participation rate compared to a lower counterfactual, with higher rates partially offsetting the impact of population ageing on the workforce and broader economy. Higher workforce participation can also have important benefits for individuals and the broader community. This includes providing a pathway out of poverty for new entrants to the workforce, lower crime rates, and higher tax revenues to support health, education and social welfare budgets³⁹.

Conventional estimates of the economic impact of higher participation rates, including in this paper, do not account for the change in the non-market activities of households. People value the financial benefits from participating in the workforce, which benefits the economy when earnings are spent on goods and services. A trade-off of participation in paid employment can be a reduction in the capacity for those workers to participate in other unpaid activities they value, which may benefit the broader community in ways that are difficult to directly capture in financial terms. This unpaid work is generally not included in economic statistics but would be of significant economic value if measured at market rates.

PwC (2017) estimates that the market replacement value of unpaid work in Australia is \$566 billion, with women responsible for over 70 per cent. PwC splits unpaid work between volunteering, domestic household tasks such as cooking and cleaning, care of the elderly and people with a disability (both within and outside of the immediate family), and childcare. Unpaid childcare accounts for almost three-quarters of the total market replacement value of unpaid work. This makes it the largest industry in Australia and almost three times the size of the largest sector in the formal economy, the financial and insurances services industry. This suggests that if the value of unpaid work was accounted for in measures of economic output, the actual impact of higher workforce participation on output and GSP per capita could be lower than estimated in this paper.

5. Comparison of New South Wales and Australian Participation Rates

Participation rates reflect the work preferences of individuals⁴⁰. These preferences are influenced by a range of factors that may be unique to individual economies including social and cultural norms, government policies, and institutional arrangements such as those relating to welfare benefits and labour market regulations⁴¹. This makes cross-jurisdictional participation rate comparisons challenging and, in instances such as between jurisdictions at different stages of economic and social development, meaningless. Such issues are less relevant when comparing participation rates of a sub-national jurisdiction with its national counterpart. Therefore, insights into New South Wales participation rates can be gained through a comparison with those for the other states and Australia.

Although catching up quickly, the New South Wales participation rate remains the third lowest of all the Australian states, with only South Australia and Tasmania lower (Chart 28). The Australian participation rate has tended to be higher than the New South Wales rate since monthly records began in the late-1970s. This gap widened following the mining boom in the early-2000s as participation rates in mining states, such as Queensland and Western Australia, increased more than New South Wales⁴². More recently, strong labour demand has led a pickup in the New South Wales

³⁹ Productivity Commission (2007).

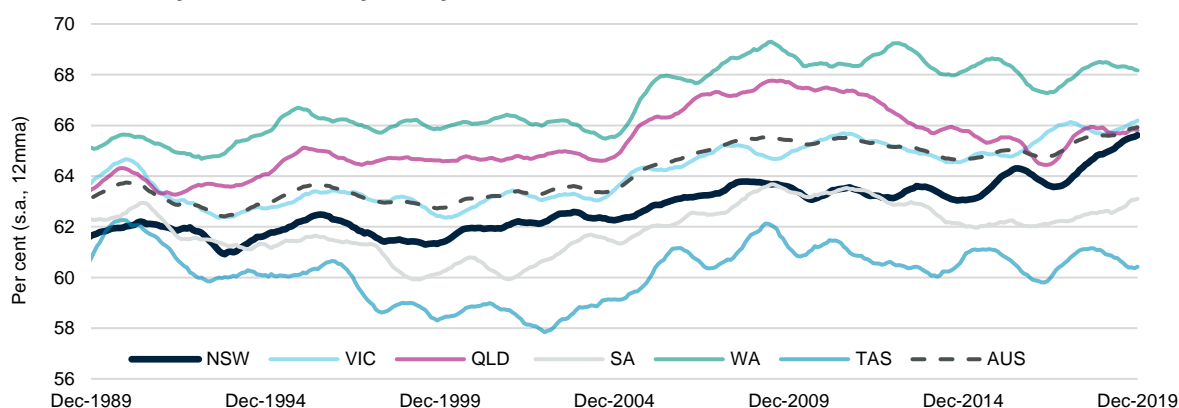
⁴⁰ Participation rates also reflect trends in labour demand from employers.

⁴¹ Abhayaratna and Lattimore (2006).

⁴² Connolly and Orsmond (2011).

rate, and the gap with Australia has narrowed (in monthly terms the New South Wales rate exceeded the Australian rate in May 2019, although it fell back to be slightly below in the following month).

Chart 28: Comparison of the participation rates of Australia, NSW and the other states



Source: ABS 6202.0; NSW Treasury

The differences between NSW and Australian participation rates are consistent with three broad trends in New South Wales relative to Australia overall – an older population, higher rates of youths enrolled in full-time education, and higher net household wealth:

- a) **Older population** – NSW has an older population profile compared to Australia overall. The proportion of the NSW population aged 65 and over was 16.3 per cent as at June 2019. This is 0.4 percentage points higher than the Australian average, although this gap has narrowed since the time of the 2016 IGR, from around 0.6 percentage points⁴³. Participation of this age cohort also tends to be lower in New South Wales compared to the Australian average. These factors together contribute to a lower NSW participation rate relative to Australia.
- b) **Education** – Participation rates of younger cohorts (15-24) tend to be lower in New South Wales compared to the Australian average, consistent with that NSW cohort having a higher rate of enrolment in full-time education. Further, those NSW people aged 15-24 in full-time education have a lower rate of labour force participation compared to the Australian average.

In 2018-19, New South Wales had the third highest percentage of 15-24 year olds enrolled in full-time education amongst the states and territories. At 52.9 per cent, this is only lower than the ACT (61.3 per cent) and Victoria (57.2 per cent). This is 0.3 percentage points higher than the Australian average, although this gap has narrowed since the time of the 2016 IGR, from 1.0 percentage point. At the same time, the NSW labour force participation rate for 15-24 year olds in full-time education of 50.6 per cent is lower than the Australian average of 51.5 per cent⁴⁴.

- c) **Wealth** – In 2016-17, 49.9 per cent of people aged 45 and over in New South Wales were not in the labour force, compared to the Australian average of 47.9 per cent⁴⁵. This gap has almost doubled since 2006-07. This could be partly attributed to a wealth effect. Mean NSW household net worth of \$1.3 million in 2017-18 is the highest of all the states and territories⁴⁶. It is also 23 per cent higher than the Australian average of \$1.02 million, with this ‘wealth gap’ almost doubling since 2005-06.

This likely impacts decisions around labour force participation, with wealthier people having less incentive to remain in the workforce. This is particularly the case for those cohorts approaching, or

⁴³ ABS Australian Demographic Statistics (3101.0)

⁴⁴ ABS Labour force (6202.0)

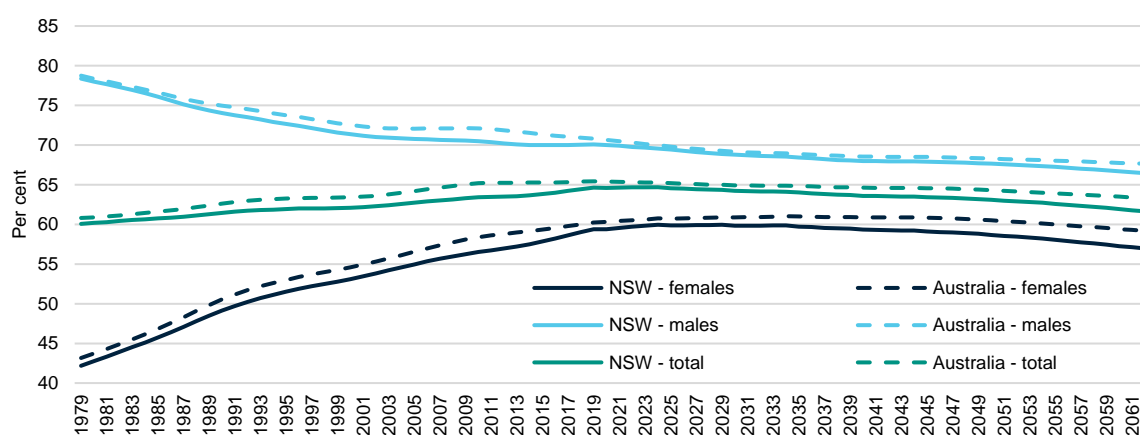
⁴⁵ ABS Retirement and Retirement Intentions (6238.0)

⁴⁶ ABS Household Income and Wealth, Australia, 2017-18 (6523.0)

at, retirement age. Participation rates for NSW cohorts aged 55 and over tend to be lower for both males and females compared to the rates for Australia overall.

On a long-term structural trend basis, New South Wales participation rates are projected to remain below those for Australia over the projection period (Chart 29) (see Appendix D for charts and tables summarising projections). This implicitly assumes that the above current trends explaining the difference in rates between New South Wales and Australia will continue over the projection period. Should these trends not continue – for instance, the wealth gap narrows or the New South Wales population ages at a slower-than-projected pace relative to Australia – then actual outcomes could be different, with New South Wales participation rates converging with, and even exceeding, those for Australia.

Chart 29: Comparison of NSW and Australian long-term trend participation rates



Source: ABS 6291.0.55.001; NSW Treasury

6. Conclusion

This paper presents a model of workforce participation that estimates the impact of cyclical factors on decisions to enter or leave the workforce in the short term. Understanding this cyclical component, and the composition of any changes in participation rates across age and gender, is important for labour market policy settings and for projecting long-term trends in labour supply.

This paper estimates this cyclical component by testing the sensitivity of labour supply to changes in the cyclical component of the employment-to-population ratio. A large statistically significant cyclical coefficient is found for the NSW participation rate, with cyclical factors accounting for around 40 per cent of the increase in the participation rate between the most recent low point in the March quarter 2017 and June quarter 2019. The cyclical coefficient for the female participation rate is larger than for males. Amongst cohorts, coefficients are statistically significant for workers of both genders aged 15 to 19, females aged 20 to 49, and males aged 55 to 59 and 65 and over.

These results have informed the modelling of long-term participation rate projections, a key input into NSW Treasury's long-term economic and fiscal projections. Prior to projecting participation rates for each five-year age cohort for each gender, the impact of cyclical factors is removed for those cohorts with a statistically significant cyclical component. Historical rates between the December quarter 2017 and June quarter 2019 are adjusted by their cyclical coefficients. An HP filter is then applied to the entire historical series for each cohort to produce a smoothed series more sensitive to long-term structural factors rather than short-term fluctuations in labour demand.

Projections confirm the overall long-term downward trend in the participation rate, although indicate higher participation rates and a slower decline than projected in the 2016 IGR. This is largely driven by a shift upwards in projected female participation rates. Nevertheless, the overall decline in participation is projected to detract around 0.1 percentage points on average from growth in real GSP per capita every year over the projection period to 2061. Changes in the participation rate therefore

impact on the fiscal gap. As shown in the 2016 IGR, all else being equal, a lower participation rate will lead to a higher fiscal gap. This demonstrates the importance of workforce participation in addressing long-term fiscal challenges.

Consistent with 2016 IGR projections, updated projections show that although the ageing population will result in lower overall participation rates over the long term, the participation rates of older cohorts are projected to rise in line with improvements in workplace flexibility, health outcomes and longer life expectancy. The relatively lower participation rates amongst some cohorts suggests some scope to increase NSW labour supply, particularly from those cohorts with less attachment to the workforce such as older cohorts and mothers. This would support a higher participation rate, thereby helping to limit the negative economic and fiscal impacts of an ageing population.

The participation rate projections presented in this paper are based off actual data up to and including June quarter 2019. Projections will be updated for the 2021 IGR in the second half of 2020 and will therefore capture the impact of the easing in labour market conditions seen since the second half of the 2019 calendar year. As a result, final projections for the 2021 IGR may differ to those presented in this paper.

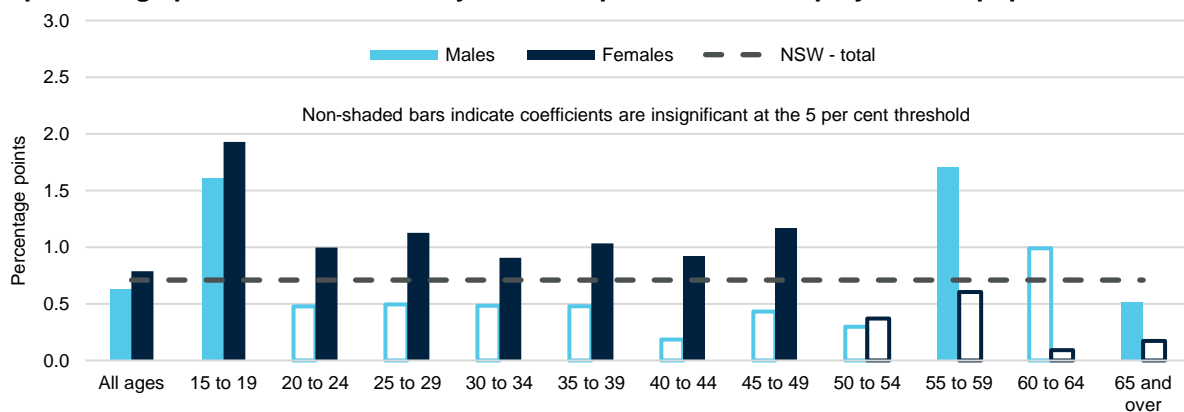
Appendix A: The Encouraged Worker Effect – Results

Table A1: New South Wales – detailed modelling results

	Δ empratio, t (b1)		Δ empratio, t-1 (b2)		Total short run	WALD Test
	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
Total	0.68	0.00	0.03	0.40	0.71	0.00
Males	0.55	0.00	0.08	0.23	0.63	0.00
15-19	1.45	0.00	0.16	0.65	1.61	0.00
20-24	0.96	0.00	-0.48	0.11	0.48	0.22
25-29	0.29	0.30	0.20	0.47	0.49	0.17
30-34	0.28	0.14	0.20	0.30	0.48	0.05
35-39	0.19	0.33	0.28	0.15	0.48	0.06
40-44	0.20	0.39	-0.01	0.95	0.18	0.53
45-49	0.23	0.25	0.21	0.30	0.43	0.09
50-54	0.10	0.71	0.20	0.47	0.30	0.40
55-59	1.79	0.00	-0.08	0.85	1.71	0.00
60-64	0.95	0.04	0.04	0.93	0.99	0.09
65 and over	0.54	0.00	-0.03	0.87	0.51	0.01
Females	0.79	0.00	0.00	0.94	0.79	0.00
15-19	1.09	0.00	0.84	0.02	1.93	0.00
20-24	0.81	0.02	0.18	0.60	1.00	0.03
25-29	1.87	0.00	-0.74	0.03	1.13	0.01
30-34	0.76	0.02	0.15	0.65	0.91	0.03
35-39	0.98	0.00	0.06	0.85	1.03	0.01
40-44	0.74	0.01	0.17	0.54	0.92	0.01
45-49	0.83	0.01	0.34	0.29	1.17	0.01
50-54	0.86	0.01	-0.49	0.15	0.37	0.40
55-59	1.03	0.00	-0.43	0.24	0.60	0.20
60-64	0.11	0.74	-0.02	0.96	0.09	0.83
65 and over	0.26	0.01	-0.09	0.34	0.17	0.15

Note: Grey shaded text indicates a coefficient is insignificant at the 5 per cent threshold.

Chart A1: New South Wales – total short run response in the participation rate to a 1 percentage point increase in the cyclical component of the employment-to-population ratio



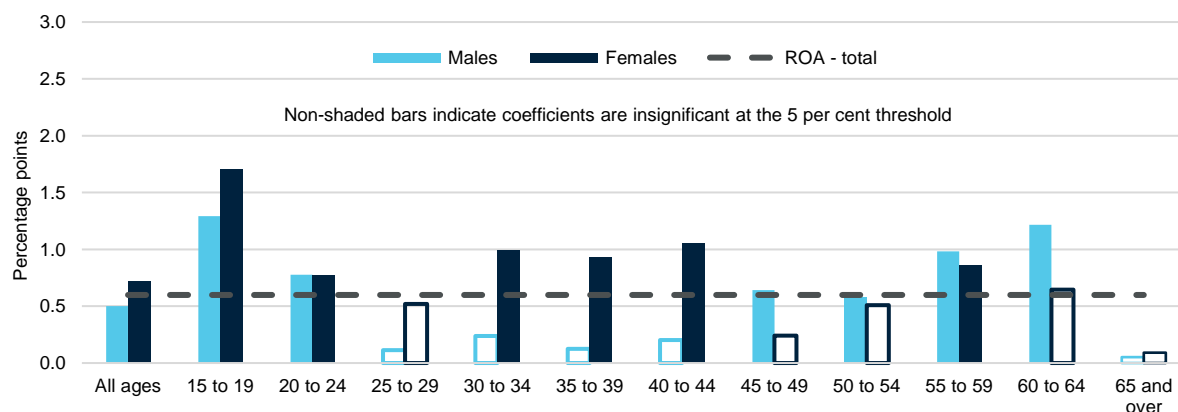
Source: ABS 6291.0.55.001; NSW Treasury

Table A2: Rest of Australia – detailed modelling results

	Δ empratio, t (b1)		Δ empratio, t-1 (b2)		Total short run	WALD Test
	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
Total	0.57	0.00	0.03	0.59	0.60	0.00
Males	0.42	0.00	0.08	0.21	0.50	0.00
15-19	1.22	0.00	0.07	0.81	1.29	0.00
20-24	0.35	0.15	0.43	0.08	0.78	0.00
25-29	0.41	0.04	-0.30	0.14	0.11	0.59
30-34	-0.12	0.44	0.36	0.02	0.24	0.14
35-39	0.07	0.66	0.06	0.70	0.12	0.43
40-44	0.21	0.20	-0.01	0.95	0.20	0.24
45-49	0.64	0.00	0.01	0.97	0.64	0.00
50-54	0.84	0.00	-0.26	0.22	0.58	0.01
55-59	0.78	0.01	0.21	0.50	0.98	0.00
60-64	0.84	0.02	0.38	0.27	1.22	0.00
65 and over	0.20	0.19	-0.15	0.32	0.05	0.75
Females	0.68	0.00	0.04	0.65	0.72	0.00
15-19	1.53	0.00	0.17	0.64	1.70	0.00
20-24	1.01	0.00	-0.24	0.40	0.77	0.01
25-29	0.24	0.37	0.28	0.28	0.52	0.06
30-34	0.45	0.08	0.55	0.03	0.99	0.00
35-39	0.79	0.01	0.13	0.64	0.93	0.00
40-44	0.66	0.01	0.39	0.15	1.05	0.00
45-49	0.51	0.08	-0.26	0.35	0.24	0.42
50-54	0.64	0.06	-0.13	0.70	0.51	0.16
55-59	0.79	0.03	0.07	0.85	0.86	0.02
60-64	1.01	0.00	-0.36	0.28	0.65	0.07
65 and over	0.22	0.03	-0.13	0.19	0.09	0.40

Note: Grey shaded text indicates a coefficient is insignificant at the 5 per cent threshold.

Chart A2: Rest of Australia – total short run response in the participation rate to a 1 percentage point increase in the cyclical component of the employment-to-population ratio



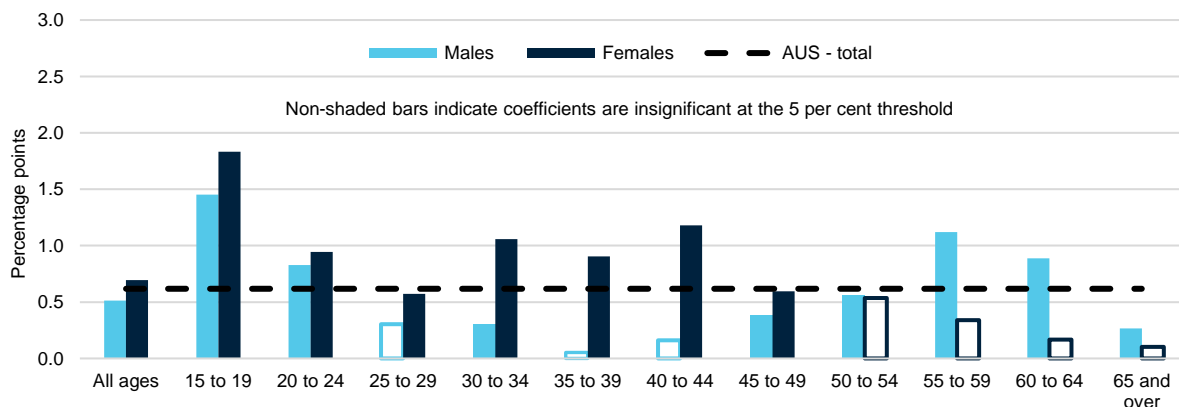
Source: ABS 6291.0.55.001; NSW Treasury

Table A3: Australia – detailed modelling results

	Δ empratio, t (b1)		Δ empratio, t-1 (b2)		Total short run	WALD Test
	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
Total	0.64	0.00	-0.02	0.70	0.62	0.00
Males	0.51	0.00	0.01	0.91	0.51	0.00
15-19	1.42	0.00	0.04	0.89	1.45	0.00
20-24	0.82	0.00	0.01	0.98	0.83	0.00
25-29	0.28	0.15	0.02	0.91	0.30	0.15
30-34	0.14	0.29	0.16	0.23	0.30	0.04
35-39	0.13	0.34	-0.07	0.58	0.05	0.71
40-44	0.13	0.40	0.03	0.86	0.16	0.35
45-49	0.47	0.00	-0.08	0.61	0.39	0.02
50-54	0.55	0.01	0.02	0.94	0.56	0.01
55-59	1.27	0.00	-0.15	0.64	1.12	0.00
60-64	0.68	0.03	0.21	0.50	0.89	0.01
65 and over	0.32	0.01	-0.05	0.65	0.27	0.04
Females	0.72	0.00	-0.03	0.73	0.69	0.00
15-19	1.65	0.00	0.18	0.53	1.83	0.00
20-24	1.01	0.00	-0.07	0.80	0.94	0.00
25-29	1.02	0.00	-0.45	0.08	0.57	0.04
30-34	0.69	0.00	0.37	0.12	1.06	0.00
35-39	0.90	0.00	0.00	1.00	0.91	0.00
40-44	0.69	0.01	0.49	0.05	1.18	0.00
45-49	0.58	0.02	0.02	0.94	0.60	0.03
50-54	0.77	0.01	-0.23	0.39	0.54	0.07
55-59	0.80	0.01	-0.46	0.13	0.34	0.30
60-64	0.33	0.24	-0.17	0.55	0.17	0.58
65 and over	0.14	0.07	-0.03	0.65	0.10	0.22

Note: Grey shaded text indicates a coefficient is insignificant at the 5 per cent threshold.

Chart A3: Australia – total short run response in the participation rate to a 1 percentage point increase in the cyclical component of the employment-to-population ratio



Source: ABS 6291.0.55.001; NSW Treasury

Appendix B: Participation Rate Projections - Modelling Methodology

I) The Long-Term Fiscal Pressures Model

Long-term projections of the participation rate are a key input into Treasury's Long-Term Fiscal Pressures Model (LTFPM). The LTFPM is an economic-demographic model which projects trends in demography, the economy, revenue and expenses (recurrent and capital) over a 40-year time horizon. The LTFPM is underpinned by the "3 P's" framework. That is, long-term economic growth is driven by population and the age composition (which determines the working age population), participation (the size of the labour force) and productivity (the efficiency with which the labour force produces output). The LTFPM captures the impact of an ageing population on the New South Wales long-term economic and fiscal outlook.

The model's key output is the projected long-term fiscal gap, a key metric required under the *Fiscal Responsibility Act 2012* which measures the State's long-term fiscal sustainability. This is the projected change in revenues less expenditures — including net capital expenditure but excluding interest — as a percentage of Gross State Product (GSP).

Flowing from demography is the participation module. This is updated at each Intergenerational Report (IGR) to project trends in full-time and part-time participation rates for males and females by five-year age cohort (15 and over). Combined with Treasury's long-term population projections these produce projections of the NSW participation rate over the next 40 years. Participation rate modelling forms the basis of the long-term projections for employment and hours worked and combined with productivity generates GSP projections.

The population projections underpinning the updated participation rate projections in this paper are as at the 2019-20 Budget. Projections are produced using a cohort component method. This method divides the population into single year of age and gender cohorts and models how the components of population change impact each cohort. Projections are a function of age and gender-specific assumptions and projections of fertility, mortality, net interstate migration and net overseas migration, where:

$$\text{Population}_{t+n} = \text{Population}_t + \text{births} - \text{deaths} + \text{arrivals} - \text{departures}$$

Historical data on births, deaths and migration is from the Australian Bureau of Statistics.

II) Participation rate projections – modelling approach

Treasury's long-term participation rate modelling methodology is based on that of the Commonwealth Productivity Commission as published in the technical papers supporting the report on the Economic Impacts of an Ageing Australia (2005)⁴⁷. This approach was adopted for the 2011 and 2016 NSW Intergenerational Reports and in part by the Australian Treasury for the Commonwealth 2015 Intergenerational Report.

This methodology uses dynamic cohort analysis as the basis for participation rate projections. Cohort analysis accounts for varying labour market behaviours across different age-groups and generations, and reflects varying social attitudes and aptitudes, educational levels and the effects of historical events on different generations. This has implications for projecting labour supply. Cohort analysis enables more accurate projections of participation rates than what is obtainable by simply extrapolating age-specific participation rates over time.

⁴⁷ Productivity Commission, (2005), Cohort Analysis Technical Paper 3, Economic Implications of an Ageing Australia, April.

The steps involved in applying the methodology are⁴⁸:

1. Averaging ABS Labour Force participation data. The model uses historical data from the ABS Labour Force survey⁴⁹. Monthly full-time and part-time participation rates for males and females by five-year age cohorts in New South Wales and Rest of Australia (ROA) are averaged over the fiscal years from 1978-79 to 2018-19.

2. Smoothing participation rate data. The long-term trend component is extracted from each annual participation rates series using a Hodrick-Prescott (HP) filter to eliminate volatility associated with short-run business cycles and any sampling error. The smoothing parameter (lambda) is set at 100.

Prior to applying the HP filter, from the December quarter 2017 to June quarter 2019 participation rates for those cohorts with a statistically significant cyclical component are adjusted using the cyclical coefficients identified in Section 3 to obtain estimates of trend (or structural) participation rates (see 'Modifications to methodology' below).

3. Entry and exit rates. 'Entry' and 'exit' rates are derived for each five-year age cohort, with respect to their labour force status five years earlier. The entry rate is defined at time t as 'the net addition to the labour force relative to the initial number of people who were not in the labour force five years previously' (1). The exit rate is defined as 'the net reduction in the labour force relative to the number of people who were initially in the labour force in that cohort' (2):

$$(1) \quad \text{Entry}_{x,x+4}^t = \frac{PR_{x+5,x+9}^t - PR_{x,x+4}^{t-5}}{PR^* - PR_{x,x+4}^{t-5}}$$

$$(2) \quad \text{Exit}_{x,x+4}^t = \frac{PR_{x,x+4}^{t-5} - PR_{x+5,x+9}^t}{PR_{x,x+4}^{t-5}}$$

Where, 'x' is the lower bound of the quinquennial age groups and PR^* is the maximum potential participation rate, initially set at 0.99 for males and 0.95 for females.

Entry and exit rates are calculated over five-year periods because the historical participation data available is in five-year age ranges. For example: the entry rate for 45-49 year olds in 2008 is the rate at which 40-44 year olds, who were not in the in the labour force in 2003, had entered the labour force by 2008; similarly the exit rate for 45-49 year olds in 2008 is the rate at which 40-44 year olds, who were in the labour force in 2003, exited the labour force by 2008.

Equations (1) and (2) implicitly assume that the population over each five-year interval remains static; yet migration and deaths mean that this is not strictly the case. The impact of migration and deaths on age-specific participation rates is, however, generally small and to avoid complicating the entry and exit rate calculations, are ignored⁵⁰. This may lead to slight variations between actual and projected participation rates.

The final question is whether to project the participation rates using entry, or exit, rates as the model will be over-specified if both are extrapolated. The decision is guided by the fact that where exit rates are negative, it means that entry is occurring and it is more informative to graph the entry rate, and vice versa. The decision rule is therefore to model exit (entry) rates when long run exit (entry) rates are likely to be positive, by examining the trends in the data.

⁴⁸ This section summarises key concepts, figures and methodology from Productivity Commission (2005).

⁴⁹ ABS Labour Force (6291.0.55.001), Detailed Electronic Monthly, July, Data Cube LM2.

⁵⁰ Burniaux et al (2004).

4. Entry and Exit rates are modelled as Richards' curves. Richards' curves are fitted to the known data using non-linear least squares to extrapolate entry and exit rates over the 40-year projection period⁵¹. The fit is started at a date following a sign change in the first derivative (or slope) in the data.

5. Extract future participation rates from projected entry and exit rates. Having projected the future path of entry or exit rates, projected participation rates are recovered using equations (3) and (4). Projections start from 2019-20.

$$(3) \quad PR_{x+5,x+9}^t = Entry_{x,x+4}^t \times (\max - PR_{x,x+4}^{t-5}) + PR_{x,x-4}^{t-5}$$

$$(4) \quad PR_{x+5,x+9}^t = (1 - Exit_{x,x+4}^t) \times PR_{x,x+4}^{t-5}$$

The parameter *max* in equations (3) is assigned initial values of 0.95 and 0.99, representing the maximum rate of participation for females and males respectively, in line with the approach taken by the Productivity Commission (2005).

6. Aggregate participation rates – females, males and total. The age and gender-specific participation rates are then weighted by the share of these cohorts of the total population (actuals to 2018-19 and Treasury projections for 2019-20 onwards) to obtain aggregate trend participation rates for total and both genders.

III) Modifications to methodology

The 2016 IGR participation rate model, with updated data and projections for cohort participation rates and population, is used as the base model. Labour force data since early-2017 shows an acceleration in the rate of increase in NSW participation, with the participation rate in 2019 at around record highs led by female workers (Section 1). As shown in Section 3, this increase includes a statistically significant cyclical component, representing the response in participation to short-term changes in labour demand.

This large cyclical component amplifies the end-point bias inherent in HP filters in which the last point in the time series has an exaggerated impact on the trend series. This leads to participation rate projections which are substantially higher than 2016 IGR results and which cannot reasonably be explained by structural factors alone.

Hence, the methodology is updated to minimise the impact of cyclical factors and more effectively account for end-point bias⁵². From the December quarter 2017 to June quarter 2019, NSW participation rates for those cohorts with a statistically significant cyclical component are adjusted using the cyclical coefficients identified in Section 3 (Equation 1) to obtain estimates of trend (structural) participation rates. This involves the following steps:

1. **Set the December quarter 2017 as the base period for the structural participation rate**, with the change in the rate in subsequent quarters split between cyclical and structural components. This quarter was selected as the NSW participation rate was approximately equal to the long-term structural rate for that quarter and the NSW unemployment rate of around 4.7 per cent was around Treasury's estimates of the non-accelerating inflation rate of unemployment (NAIRU).
2. **Calculate the cyclical factor ('CF') for each quarter between December 2017 and June 2019.** This is obtained by applying the estimated coefficients b_1 and b_2 for each impacted cohort to the

⁵¹ A Richards' curve is a more general form of the logistic curve. It has a mathematical specification very similar to a logistic curve and a similar shape. The main difference is that, unlike a logistic curve, it is not symmetrical about the point of inflexion, therefore allowing a better fit with the historical data.

⁵² See Bruchez (2003) and Bloechl (2014) for alternative methods to address end-point bias for macroeconomic time series.

percentage point change in the cyclical component of the employment-to-population ratio at time t and $t-1$. This cyclical component is extracted with a HP filter using a smoothing parameter (λ) of 1600. The estimated coefficients are in unit differences and therefore measure the percentage point change in the participation rate from a 1 percentage point change in the cyclical component of the employment-to-population ratio. Hence, the CF is measured as a percentage point of the participation rate.

3. **Adjust the actual participation rate in each quarter by the cyclical factor, while taking into account the cumulative adjustments of previous quarters.** The structural rate is set as at the December quarter 2017 as per step 1. From the March quarter 2018, the actual participation rate is adjusted by the cyclical factor for that quarter. As the actual participation rate includes the cumulative impact of cyclical factors from previous quarters, the cyclical adjustments made in previous quarters (starting from the base period) must also be accounted for to ensure those adjustments flow through to subsequent quarters. At time t , the cumulative impact of previous cyclical adjustments (CA) is:

$$\sum CA_{t-1}^{ga} = \text{Structural } PR_{t-1}^{ga} - \text{Actual } PR_{t-1}^{ga}$$

Note: The superscript 'ga' indicates gender and age specific parameters.

Thus, the structural participation rate at time t is:

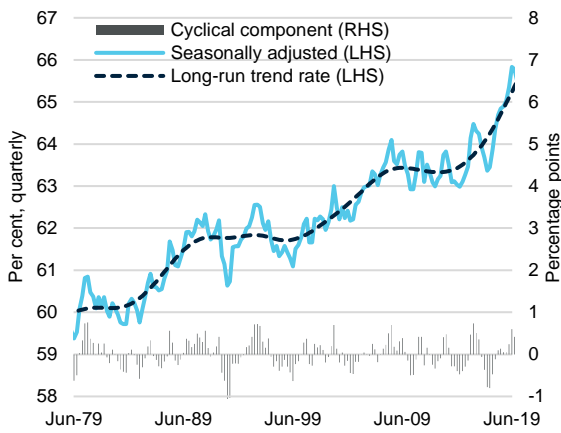
$$\text{Structural } PR_t^{ga} = (\text{Actual } PR_t^{ga} + \sum CA_{t-1}^{ga}) - CF_t^{ga}$$

4. **Extract full-time and part-time structural participation rates.** The new structural participation rate series for each cohort from the December quarter 2017 to June quarter 2019 is converted to fiscal year averages (with the average for 2017-18 including the actual participation rates for the September quarter 2017). A simple assumption is made to split this new series into full-time and part-time rates based on the full-time/part-time split in each cohorts' actual participation rate for the relevant year.
5. **Smooth all time series with an HP filter.** The resulting structural participation rate time series from 2017-18 to 2018-19 are added to the historical time series for 1978-79 to 2016-17 for each cohort. An HP filter is then applied to the entire time series (1978-1979 to 2018-19) for each cohort, with a smoothing parameter of 100.

For those cohorts without a statistically significant cyclical component, these cyclical adjustment steps (1 to 5) are excluded, and the HP filter is applied to the unadjusted time series with a smoothing parameter of 100.

These extra steps are not applied to participation rates for the rest of Australia (ROA). The recent rate of increase in the ROA participation rate has been substantially slower than for New South Wales. The ROA participation rate increased 1.4 per cent between its most recent low point in September quarter 2016 and June quarter 2019. In comparison, the NSW participation rate rose 4.1 per cent between its most recent low point in March quarter 2017 and June quarter 2019. Further, unlike for New South Wales (Chart B1), the ROA participation rate was around its long-term structural rate as at June quarter 2019 (the last quarter of actual data, with the annual projection period commencing in the following quarter) (Chart B2). As a result of these factors it is judged that rate adjustments are unnecessary.

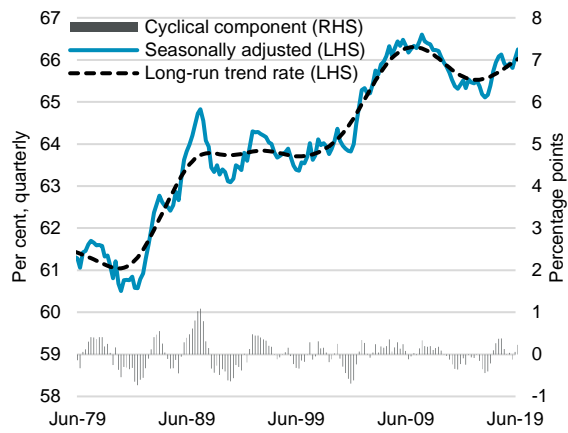
Chart B1: NSW participation rate



Source: ABS 6202.0; NSW Treasury

Notes: For NSW and ROA, the long-run trend rate is the total quarterly participation rate with an HP filter applied (smoothing parameter of 1600)

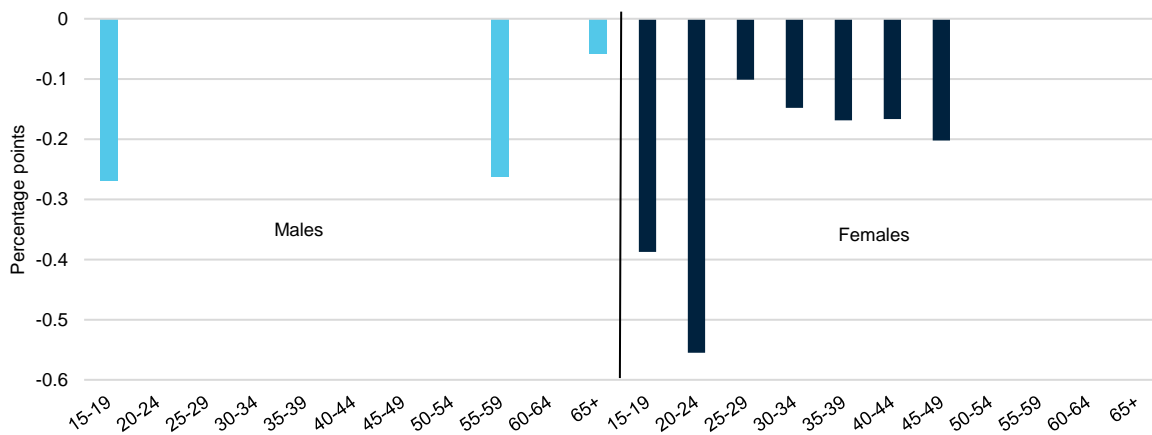
Chart B2: ROA participation rate



Source: ABS 6202.0; NSW Treasury

The impact of these cyclical adjustments, compared to the base case in which these extra steps are not applied, results in lower smoothed NSW participation rate values for 2018-19 from which projections are cast from (Chart B3).

Chart B3: Impact of updated methodology on estimated NSW structural participation rates for 2018-19^(a)

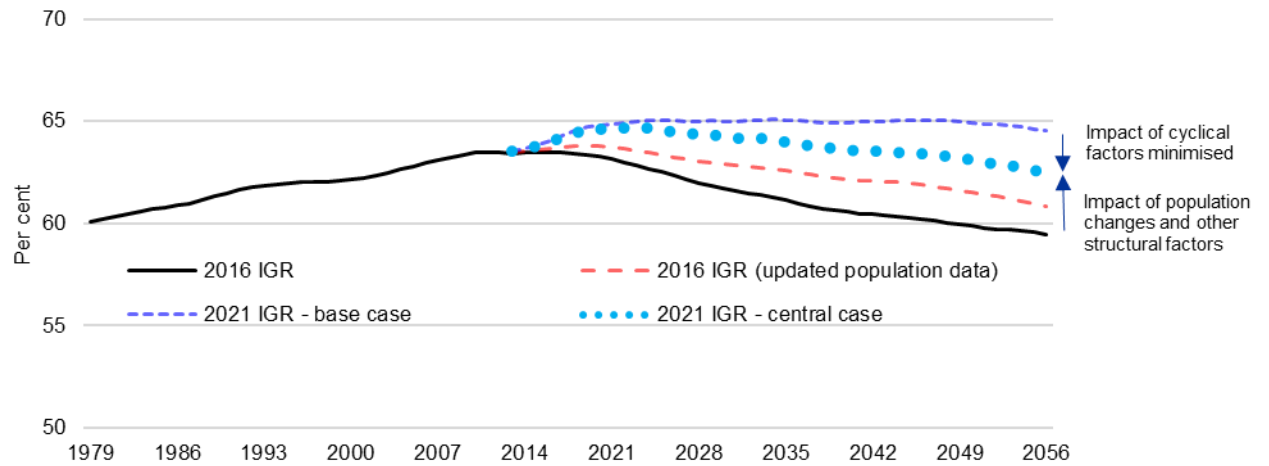


Source: ABS 6291.0.55.001; NSW Treasury

Notes: (a) This chart shows the difference in the smoothed value of participation rates between the updated methodology for the 2021 IGR (central case) and 2016 IGR methodology (base case).

Chart B4 compares the resulting central case NSW participation rate projections against the base case scenario (for which no cyclical adjustments are made prior to applying the HP filter), 2016 IGR projections, and a scenario isolating the impact of updated population data on unchanged propensity to work projections from the 2016 IGR.

Chart B4: Total participation rate projections under the central and base case scenarios



Source: ABS 6291.0.55.001; NSW Treasury

Appendix C: The appropriateness of the HP filter in long-term participation rate modelling

The Hodrick-Prescott (HP) filter is a widely used statistical technique to obtain a smooth non-linear representation of a time series. It is designed to filter out short-term fluctuations in the underlying data to separate the cyclical and long-term trend components, by solving the minimisation problem:

$$\min \sum_{t=0}^T (y_t - y_t^*)^2 + \lambda \sum_{t=2}^{T-1} [(y_{t+1}^* - y_t^*) - (y_t^* - y_{t-1}^*)]^2$$

The first term minimises the deviation of the series from its trend component, while the second minimises the second differences of the trend components. Lambda, a smoothing parameter chosen by the user, is the ratio of the variance of the cycle to the variance of the changes in trend growth. It penalises for the growth rate of the trend component; in other words, higher values of lambda fit a smoother trend to underlying raw data. This paper follows standard convention and uses the EViews default settings of 100 for annual data and 1600 for quarterly data.

Many economic and financial variables, such as GDP and asset prices, grow over time with irregular fluctuations. Largely owing to its simplicity and flexibility, the HP filter has been the preferred statistical technique in extracting the cyclical and trend components of such variables.

There are several well-documented disadvantages of this method. As detailed by Hamilton (2018), this includes that it introduces spurious dynamic relations with no basis in the underlying data-generating process; an arbitrary choice of smoothing parameter with no conceptual foundations in either economics or statistics; and the well-documented end-point bias, in which the decomposition of raw data is highly sensitive to the choice of the end-point of the sample. It is also argued that the HP filter has no underlying economic theory behind it and the use of this method is appropriate only if the economic assumptions behind it reflect economic reality, which may not always be the case.

Despite these long-known shortcomings, the HP filter remains a preferred method for modelling labour market indicators (see Productivity Commission (2005); Turner et al (2016); Callaghan et al (2018) among others) and is employed for participation rate modelling in this paper. This choice was motivated by two major factors. First, modification is made to the methodology to account for the end-point bias issue when applying the filter to historical NSW participation rate series. More specifically, regression estimates of cyclical parameters are used for adjusting unusually high female participation rates and reducing the impact of the last point in the time series (for more details, see Appendix B). This methodology is broadly comparable to other papers addressing end-point bias (see Turner et al (2016); Cavalleri and Guillemette (2017); Grigoli et al (2018) among others)⁵³.

Second, alternative measures proposed for smoothing data series have failed to consistently outperform the HP filter. For example, noting the undesirable features of the HP filter, Drehmann and Yetman (2018) examine alternative measures of the credit-to-GDP gap that have been advocated by other authors (including Hamilton (2018)). The authors conclude that no other gap measure outperforms the results of the HP filter and as such, relative simplicity of implementation makes this method more desirable. Similarly, Callaghan et al (2018) demonstrate that using the linear projection method described in Hamilton (2018) to detrend the participation rate gives similar results to the HP-filtered participation rates.

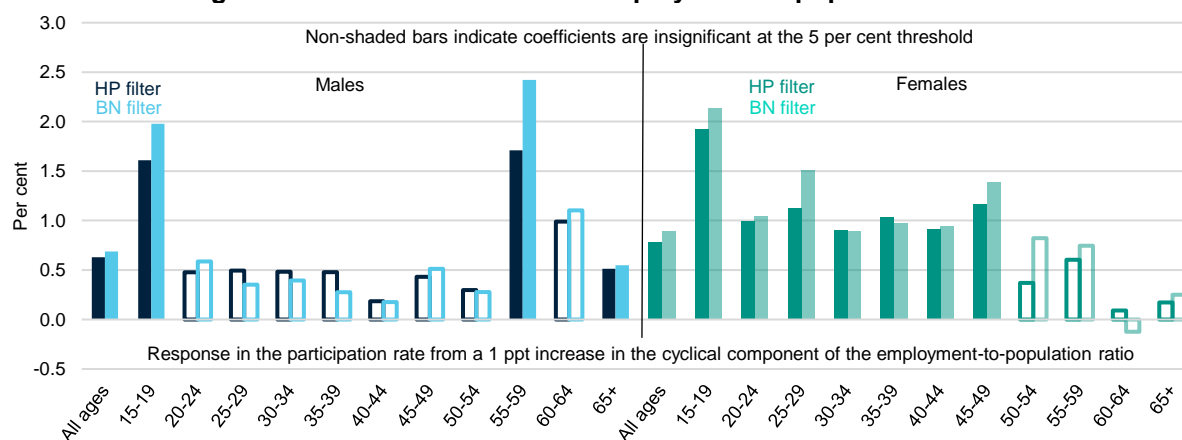
An alternative trend-cycle decomposition approach gaining in popularity is the Beveridge-Nelson (BN) filter. Kamber et al (2018) document the shortcomings of a range of decomposition methods, including the HP filter. They show that the BN filter with a low signal-to-noise ratio (delta) may provide a more

⁵³ Alternative methods to limit the distortions stemming from end-point bias include calculating detrended labour force participation rate as a deviation from a three-year moving average (Grigoli et al (2018)) and augmenting a time series with an ARIMA forecast (Kaiser and Maravall (1999)).

intuitive and reliable estimate of the US output gap compared to other methods. The authors argue that this results in a series that is subject to smaller revisions and that appears to perform better in out-of-sample forecasts of output growth and inflation than real-time estimates for other decomposition methods that also impose a low signal-to-noise ratio, such as the HP filter.

The remainder of this section provides a summary of two tests that confirm the HP filter is the most appropriate decomposition method for the analysis in this paper, compared to the BN filter. First, the BN filter is applied to extract the cyclical component of the quarterly employment-to-population ratio. This component is used as the independent variable to test the participation rate response to short-term changes in labour demand (Section 3). This yields broadly similar cyclical coefficients to those from the HP filter, with the same cohorts having statistically significant coefficients under both filters (Chart C1). Further, estimates for the proportion of the increase in the total participation rate between the March quarter 2017 and June quarter 2019 accounted for by cyclical factors are almost the same under both filters – 41.4 per cent (HP) compared to 39.8 per cent (BN).

Chart C1: Testing the HP and BN filters on the employment-to-population ratio^{(a)(b)}



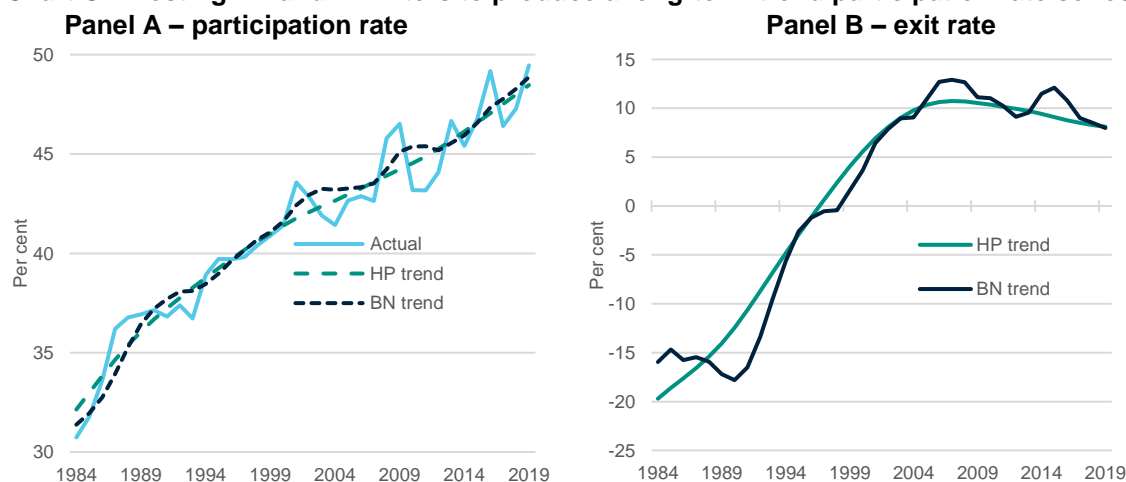
Source: ABS 6291.0.55.001; NSW Treasury

Notes: (a) The cyclical coefficient for females aged 30-34 is significant at a 7 per cent threshold.

(b) This chart shows results with a BN filter delta (signal to noise ratio) of 0.05 and HP filter lambda (the inverse of which is analogous to a signal to noise ratio) of 1600. Delta values between 0.05 and 0.25 were tested, with overall results not materially sensitive to delta value.

Second, the BN filter is applied to historical annual participation rates for each cohort to produce long-term trend series from which to extract entry and exit rates (see Section 4 and Appendix B). The BN filter produces a relatively more volatile trend series compared to the HP filter (Chart C2, Panel A). This results in an erratic pattern in historical entry and exit rates, which is not conducive to fitting Richards' curves to project their future paths (Chart C2, Panel B). For these reasons, the HP filter is judged the most appropriate decomposition method for the analysis in this paper.

Chart C2: Testing HP and BN filters to produce a long-term trend participation rate series^{(a)(b)}



Source: ABS 6291.0.55.001; NSW Treasury

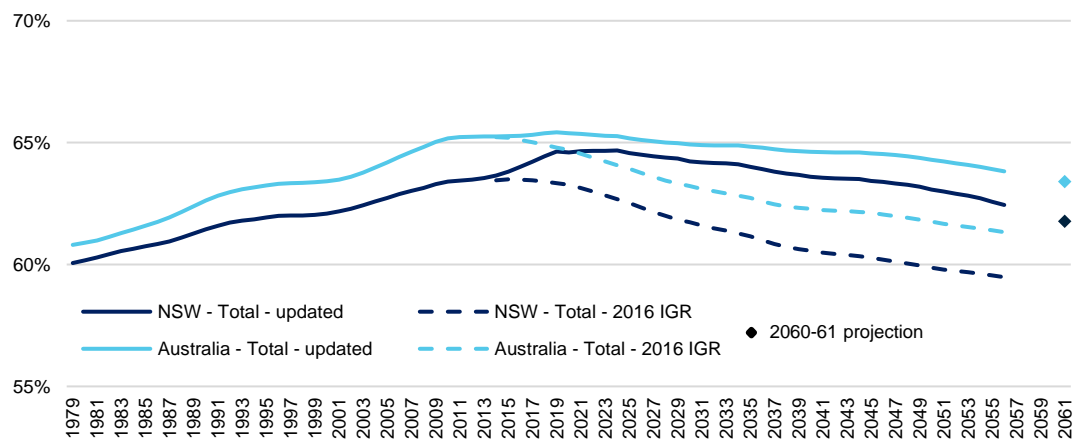
Source: ABS 6291.0.55.001; NSW Treasury

Notes: (a) Charts show test results for the NSW full-time female 30-34 cohort.

(b) Charts show results with a BN filter delta (signal to noise ratio) of 0.05 and HP filter lambda of 100.

Appendix D: Summary of Participation Rate Projections

Chart D1: Total participation rate



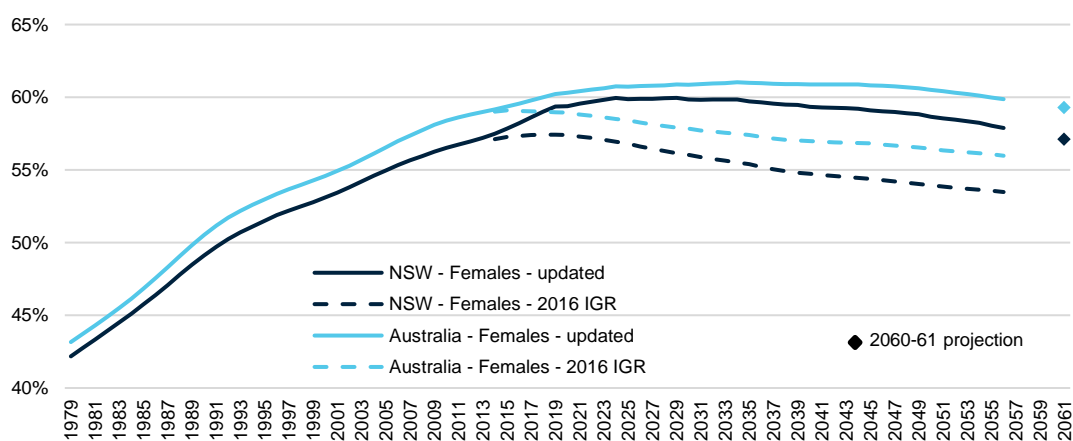
Source: ABS 6291.0.55.001; NSW Treasury

Table D1: Total participation rate

Participation rate (per cent)	2018-19	2025-26	2035-36	2045-46	2055-56
NSW					
IGR 2016	63.3	62.3	61.0	60.2	59.5
Updated	64.6*	64.5	63.9	63.4	62.4
<i>Difference</i>	1.3	2.2	2.9	3.2	3.0
Australia					
IGR 2016	64.8	63.8	62.6	62.1	61.3
Updated	65.4*	65.1	64.8	64.5	63.8
<i>Difference</i>	0.6	1.4	2.2	2.5	2.5

*Actual

Chart D2: Female participation rate



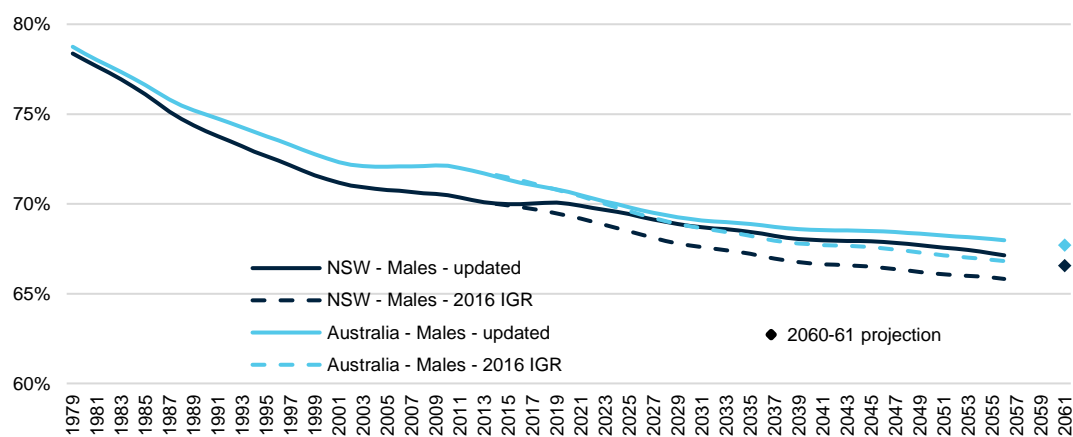
Source: ABS 6291.0.55.001; NSW Treasury

Table D2: Female participation rate

Participation rate (per cent)	2018-19	2025-26	2035-36	2045-46	2055-56
NSW					
IGR 2016	57.4	56.6	55.2	54.3	53.5
Updated	59.4*	59.9	59.6	59.0	57.9
<i>Difference</i>	1.9	3.3	4.4	4.7	4.4
Australia					
IGR 2016	59.0	58.3	57.3	56.7	56.0
Updated	60.2*	60.8	61.0	60.8	59.9
<i>Difference</i>	1.3	2.5	3.7	4.0	3.9

*Actual

Chart D3: Male participation rate



Source: ABS 6291.0.55.001; NSW Treasury

Table D3: Male participation rate

Participation rate (per cent)	2018-19	2025-26	2035-36	2045-46	2055-56
NSW					
IGR 2016	69.5	68.3	67.1	66.4	65.8
Updated	70.1*	69.3	68.3	67.9	67.1
<i>Difference</i>	0.6	1.0	1.3	1.4	1.3
Australia					
IGR 2016	70.8	69.4	68.1	67.5	66.8
Updated	70.8*	69.6	68.8	68.5	68.0
<i>Difference</i>	0.0	0.2	0.7	0.9	1.2

*Actual

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Further information and contacts

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