



**Parliament of Australia**  
**Parliamentary Budget Office**

# The sensitivity of budget projections to changes in economic parameters

Estimates from 2014–15 to 2024–25

*Report no. 03/2014*

© Commonwealth of Australia 2014

ISBN 978-0-9925131-3-9 (Online)

This work is licensed under the Creative Commons Attribution-NonCommercial-NoDerivs 3.0 Australia License.



The details of this licence are available on the Creative Commons website:  
<http://creativecommons.org/licenses/by-nc-nd/3.0/au/>

#### **Use of the Coat of Arms**

The terms under which the Coat of Arms can be used are detailed on the following website: [www.itsanhonour.gov.au/coat-arms](http://www.itsanhonour.gov.au/coat-arms)

**Produced by:** Parliamentary Budget Office

**Design consultants:** Wilton Hanford Hanover Pty Ltd

#### **Assistant Parliamentary Budget Officer**

Fiscal Policy Analysis Division

Parliamentary Budget Office

Parliament House

PO Box 6010

CANBERRA ACT 2600

Phone: (02) 6277 9500

Email: [pbo@pbo.gov.au](mailto:pbo@pbo.gov.au)

# Contents

Foreword	v
Overview	vii
<b>1 The economy and the budget</b>	<b>1</b>
<b>2 Summary analysis</b>	<b>7</b>
<b>3 Labour productivity</b>	<b>13</b>
<b>4 Labour force participation rate</b>	<b>21</b>
<b>5 Terms of trade</b>	<b>31</b>
References	55

## List of tables

Table 2–1: Changes in the budget relative to the baseline for 2024–25	8
Table 2–2: Indicative short term impact of the low terms of trade scenario	10
Table 3–1: Labour productivity growth - changes relative to the baseline for 2024-25	17
Table 4–1: Labour force participation rate - changes relative to the baseline for 2024–25	26
Table 5–1: Terms of trade - changes relative to the baseline for 2024–25	35
Table 5–2: Indicative short run impact of the low terms of trade scenario	38
Table A–1: Main economic parameters used to produce fiscal outcomes	42
Table A–2: Payments and receipts modelled	45
Table A–3: Payment models	46
Table A–4: Receipts models	47

## List of figures

Figure 1–1: Contributors to real gross national income (GNI) per capita growth	1
Figure 1–2: Cumulative changes to revenue and expense estimates for each year at budget updates, 2002–03 to 2014–15	3
Figure 1–3: Baseline underlying cash balance	4
Figure 1–4: Baseline net debt	4
Figure 1–5: Baseline total receipts	5
Figure 1–6: Baseline total payments	6
Figure 3–1: Labour productivity growth, 1979–80 to 2013–14	13
Figure 3–2: Labour productivity growth scenarios	15
Figure 3–3: Deviation in underlying cash balance from the baseline	17
Figure 3–4: Deviation in net debt from the baseline	18
Figure 4–1: Labour force participation by sex and age cohort	21
Figure 4–2: Labour force participation rate scenarios	24
Figure 4–3: Deviation in underlying cash balance from the baseline	27
Figure 4–4: Deviation in net debt from the baseline	27
Figure 5–1: The terms of trade over the past 50 years	32
Figure 5–2: Terms of trade scenarios over the medium term	34
Figure 5–3: Deviation in underlying cash balance from the baseline	36
Figure 5–4: Deviation in net debt from the baseline	36
Figure A–1: Broad methodology for producing fiscal outcomes for alternate economic scenarios	43

## List of appendixes

Appendix A – Technical notes	41
Appendix B – Comparisons with other sensitivity analyses	49

# Foreword

Budget projections are dependent on assumptions about the performance of the economy. Variations in key economic parameters affect national income and therefore the budget projections.

This report provides an analysis of the sensitivity of the Australian Government's 2014-15 Budget medium-term projections to variations in labour productivity growth, the labour force participation rate and the terms of trade.

The fiscal impacts of the scenarios developed and modelled by the Parliamentary Budget Office (PBO) were based on the macroeconomic impacts of the scenarios as modelled by Independent Economics using its Macro-econometric Model.

The Independent Economics report and the detailed fiscal results are available on the PBO website.

I would like to thank the PBO staff involved in the preparation of this report. The report was prepared by Tim Pyne, Paul Gardiner, Philip Chindamo, Mary Farrugia, Mark Bott, Will Huang, Rithy Lim, Rebecca McCallum, Cindy Li and Daniel Zeaiter. The report was prepared for publication by Helen Moorhouse.

I also wish to thank the external referees who provided helpful comments and suggestions on the report, namely the Canadian Parliamentary Budget Office; the Grattan Institute; Saul Eslake, Chief Economist, Bank of America Merrill Lynch Australia; and Chris Richardson, Partner, Deloitte Access Economics. The assistance of external reviewers does not imply any responsibility on their part for the content of the final report, which rests solely with the PBO.

Phil Bowen PSM FCPA  
Parliamentary Budget Officer

26 November 2014



# Overview

The medium-term projections in the Australian Government's 2014–15 Budget show the budget achieving balance in 2018–19 and a surplus of 1.4 per cent of GDP in 2024–25, with tax receipts capped at 23.9 per cent of GDP.

Total receipts are projected to rise from 23.6 per cent of GDP in 2014–15 to 25.8 per cent of GDP in 2024–25. The ratio of payments to GDP is projected to fall from 25.3 per cent in 2014–15 to 24.2 per cent in 2024–25. Net debt is projected to fall from 13.9 per cent of GDP in 2014–15 to 0.7 per cent of GDP in 2024–25.

As the 2014–15 Budget Papers state, the projected fiscal consolidation over the medium term is based on Australia experiencing a further 10 years of uninterrupted economic growth.

The performance of the economy is a key factor in the sustainability of the budget over the medium term. Growth in the nominal economy is the main driver of government revenue.

Australia's economic performance and hence its fiscal position is sensitive to changes in a number of economic parameters. This report examines the sensitivity of the 2014–15 Budget medium-term projections to a range of positive and negative shocks to three key economic parameters: labour productivity growth, the labour force participation rate and the terms of trade.

The key findings of the PBO's analysis, assuming current policy settings remain unchanged, are set out below.

## Labour productivity growth

If labour productivity grew by 0.5 per cent annually above its long-run average growth rate of 1.5 per cent (the 2014–15 Budget assumption), the projected underlying cash balance in 2024–25 would improve by 1.1 per cent of GDP to a surplus of 2.5 per cent of GDP. Net debt would fall by 5.0 per cent of GDP to a net asset position of 4.3 per cent of GDP.

On the other hand, an equivalent fall in labour productivity growth would reduce the underlying cash balance and increase net debt in 2024–25 by similar amounts. This would result in an underlying cash surplus in 2024–25 of 0.3 per cent of GDP and net debt of 5.8 per cent of GDP.

With the exception of the 1990s when annual labour productivity growth averaged 2.2 per cent, over the past 30 years labour productivity has not sustained a growth rate above its long-run average, achieving only 1.3 per cent in the 1980s and 1.4 per cent in the 2000s. Despite an uptick over the past three years, the risk to labour productivity growth appears to be on the downside.

## Labour force participation rate

If the rate of labour force participation increased to its 2008–09 peak of 65.5 per cent (ie by 0.8 percentage points above the 2014–15 Budget assumption of 64.7 per cent in 2024–25), the projected underlying cash balance in 2024–25 would increase by 0.3 per cent of GDP to a surplus of 1.7 per cent of GDP. Net debt would fall by 1.5 per cent of GDP to a net asset position of 0.8 per cent of GDP.

On the other hand, an equivalent decline in the labour force participation rate would reduce the underlying cash balance and increase net debt in 2024–25 by similar amounts. This would result in an underlying cash surplus in 2024–25 of 1.1 per cent of GDP and net debt of 2.1 per cent of GDP.

There have been significant increases in the rate of participation in the work force by women in most age categories and men aged 65 and above over the past 30 years, and a number of policy initiatives have been taken to encourage increased work force participation. However, with the ageing of the population, more people will need to remain in the work force longer simply to hold the participation rate constant. In these circumstances the risks of higher or lower labour force participation relative to the 2014–15 Budget projection appear to be reasonably balanced.

## Terms of trade

A permanent increase of 10 per cent in the terms of trade would increase the projected underlying cash balance in 2024–25 by 0.5 per cent of GDP to a surplus of 1.8 per cent of GDP. Net debt would fall by 3.0 per cent of GDP to a net asset position of 2.3 per cent of GDP.

On the other hand, an equivalent decrease in the terms of trade would reduce the underlying cash balance and increase net debt in 2024–25 by similar amounts. This would result in an underlying cash surplus in 2024–25 of 1.0 per cent of GDP and net debt of 3.3 per cent of GDP.

The impact on the budget of a permanent shock to the terms of trade could be more pronounced in the short term if there are lags in the resource adjustments throughout the economy in response to price signals from resultant exchange rate movements.

The risk to the budget from movements in the terms of trade appears to be largely on the downside, particularly in the light of recent declining trends in commodity prices.

## General observations

These results highlight the sensitivity of the budget to changes in key economic parameters, and the importance of labour productivity growth in particular, as a driver of economic growth and fiscal sustainability.



The budget impacts of the economic shocks modelled by the PBO have been modelled individually. It is feasible that a series of shocks could occur simultaneously. However, the cumulative impact of one or more simultaneous shocks has not been modelled and cannot be derived by adding the impacts of each individual occurrence.

Overall, the risks to the budget from the economic shocks that were modelled appear to be weighted to the downside. In particular, there is a risk that labour productivity growth and the terms of trade could fall below the budget projections with significant negative impacts on tax receipts.

The 2014–15 Budget expenditure projections are based on the continuation of current policy settings and assume no new net spending decisions. However, history shows that the fiscal restraint necessary to achieve such an outcome has generally not been realised, particularly during economic upturns. For instance, since 2002–03 policy decisions by government have accounted for \$307 billion of net spending over and above projected spending.

Continuing efforts to enhance productivity and maintain fiscal discipline will be necessary to ensure the structural soundness of the budget over the medium term and to build a buffer to provide the fiscal space to accommodate unexpected economic shocks and other risks to the budget.



# 1 The economy and the budget

The fiscal outlook in the 2014–15 Budget is based on forecasts and projections of Australia’s economic outlook. Accordingly, significant changes to the medium-term economic outlook can result in material changes to the fiscal position.

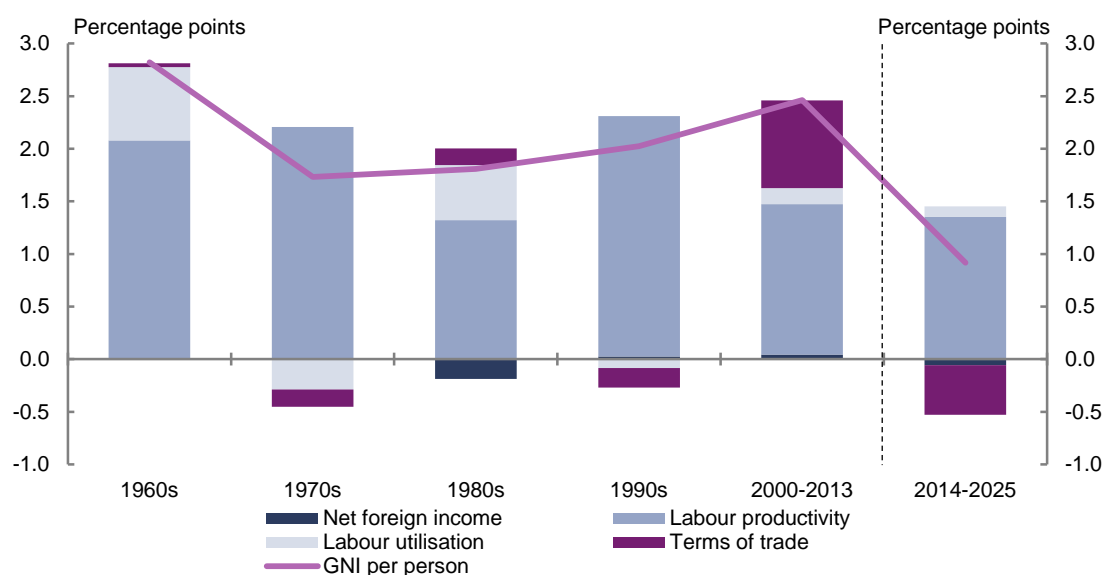
This report examines the sensitivity of the federal budget position to changes in labour productivity growth, labour force participation and the terms of trade. These economic parameters have been chosen because of their importance as major drivers of growth in Australia’s national income per capita.

## Sources of growth in Australia’s living standards

Economic growth is a central factor that contributes to improved standards of living. Over the past few decades, Australia has experienced significant growth in national income, which has led to higher standards of living.

The growth in Australia’s real income per capita is shown below in Figure 1–1. Since the 1960s, growth has averaged 2.2 per cent annually. The main sources of growth in income per capita over this period have been labour productivity, labour utilisation and the terms of trade.

**Figure 1–1: Contributors to real gross national income (GNI) per capita growth**



Source: Gruen, 2014a.

Historically, the dominant source of growth in national income per capita has been labour productivity, particularly in the decades preceding the boom in the terms of trade. Through the 1990s labour productivity growth was strong averaging 2.2 per cent annually.

Advances in technology and its adoption combined with structural economic reform were the main driving forces behind this period of strong labour productivity growth.

In contrast, the 1980s and the 2000s were decades where labour productivity growth averaged 1.3 per cent and 1.4 per cent annually, respectively. The slowdown through the 2000s has been largely attributed to strong investment in some sectors of the economy that is yet to fully deliver an increase in production (mining and utilities), as well as a broader dampening influence from much slower technological innovation and adoption, and a slowdown in structural reform.

As labour productivity growth slowed in the 2000s, the terms of trade rose significantly supplementing the lower contribution of labour productivity growth leading to continued strong growth in national income per capita.

The sustained rise in the terms of trade from 2004 to 2011 was concentrated in mining commodity prices, particularly iron ore and coal, due to strong demand from emerging Asia, and culminated in the terms of trade reaching a historical peak in 2011, 67 per cent higher than the long-term average over the past 50 years.

The contribution of labour utilisation to income per capita growth has occurred as a result of a number of demographic, social and policy trends influencing the structure of Australia's workforce. Labour utilisation is represented by changes in: labour force participation; population; unemployment; and hours worked by employed people.

Australia's labour force participation increased steadily from 61 per cent in the late 1970s to 65 per cent by 2014. A large increase in overall female participation (from 43 to 59 per cent) has been partially offset by a decrease in male participation. While participation among those under 25 has fallen more recently as younger people remain in school longer and more undertake tertiary education, participation among those aged over 50 has increased, generally in response to longer life expectancy.

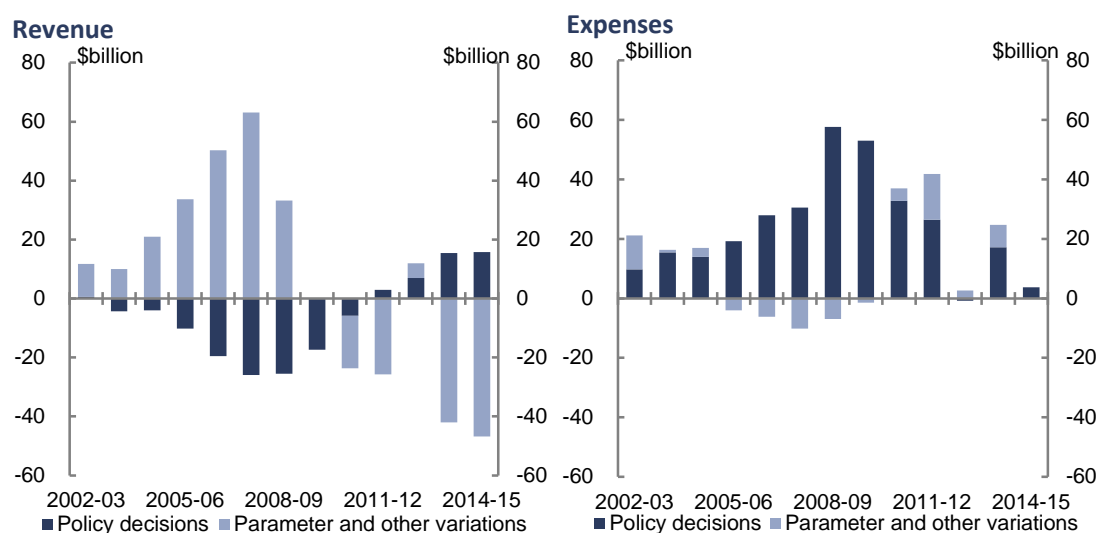
While growth in income per capita has been historically strong, Australia's national income per capita growth is projected to slow sharply over the medium term as a result of projected declines in the terms of trade, and a smaller contribution from labour utilisation due to an ageing population.

## The influence of the economy on the budget

Over the past 30 years, growth in the nominal economy has been the main driver of receipts, as revenue collections are highly dependent on the size and growth of the economy, profits and income (Parliamentary Budget Office, 2014a).

The impact of parameter and other variations, which largely reflect changes to estimates outside the government's control, has driven changes to the revenue estimates contained in the budget updates. As shown in Figure 1–2, parameter and other variations at budget updates accounted for a total absolute change of \$360 billion in revenue estimates between 2002–03 and 2014–15, whilst policy decisions accounted for an absolute change of \$154 billion in the revenue estimates.

**Figure 1–2: Cumulative changes to revenue and expense estimates for each year at budget updates, 2002–03 to 2014–15<sup>1</sup>**



Source: Budget Papers, 2002–03 to 2014–15.

In contrast, changes to expense estimates at each budget update have been primarily driven by discretionary spending decisions by the government. Figure 1–2 shows policy decisions accounted for a total absolute change of \$308 billion in expense and net capital investment estimates between 2002–03 and 2014–15 (a net increase of \$307 billion), whilst parameter and other variations accounted for an absolute change of only \$74 billion in expense and net capital investment estimates.

## Budget outlook

The ‘baseline’ in this report is constructed using economic parameters consistent with the 2014–15 Budget projections for the underlying cash balance, net debt, receipts and payments. The projection for receipts is based on the 2014–15 Budget ‘no tax cap’ scenario as the scenarios presented in this report do not attempt to model policy changes but rather the implications for the budget of changes in economic parameters.

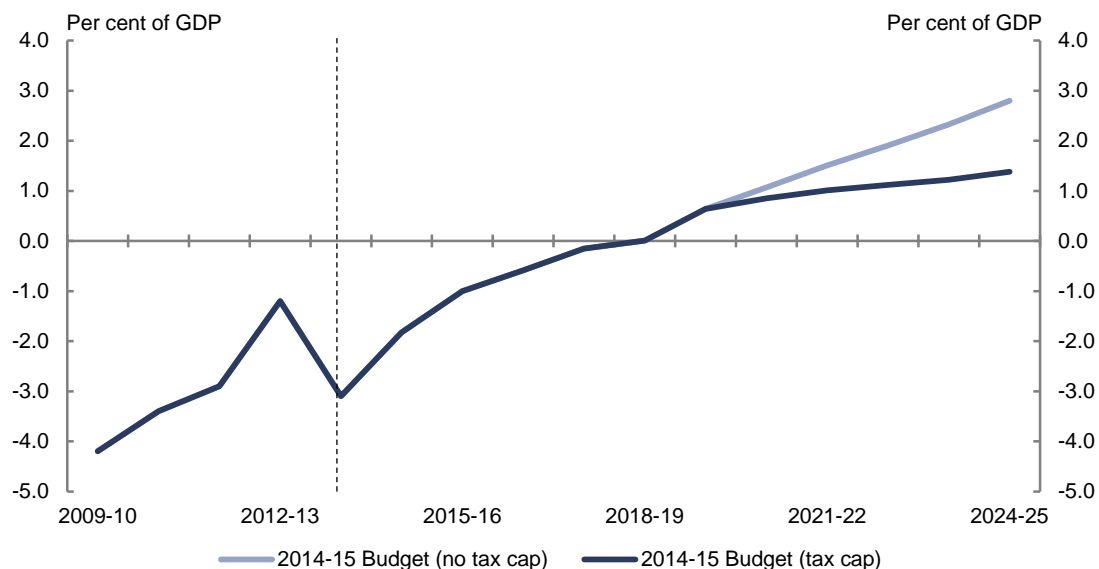
The modelling of receipts in this report is undertaken on an individual revenue head basis in all scenarios. To apply the 23.9 per cent tax cap to the scenarios would require the details of the tax adjustments to revenue heads to achieve the tax cap.

In the absence of this information, the results were produced using projections of receipts on a ‘no tax cap’ basis. These results were tested by applying the tax cap to total tax receipts for all scenarios and the impacts of the scenarios on the underlying cash balance and net debt were found to not change significantly under the tax cap. The impact of the economic shocks on GDP are assumed to be the same whether or not the tax cap is applied. The average tax rate would be lower under a tax cap but not sufficiently so to significantly offset the change in tax receipts resulting from the impact of the scenarios on GDP.

<sup>1</sup> Excludes the GST, which was included as a Commonwealth tax in 2008–09.

The baseline underlying cash balances (no tax cap and tax cap) as a percentage of GDP are provided in Figure 1–3. The baseline shows the underlying cash balances improving from deficit to surplus over the medium term.

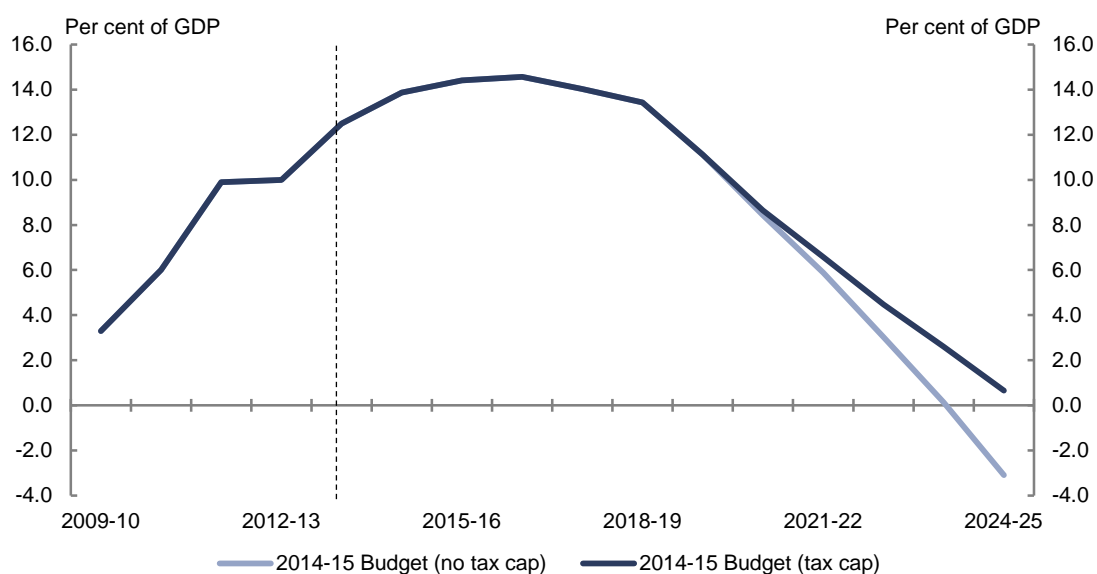
**Figure 1–3: Baseline underlying cash balance**



Source: 2014–15 Budget.

The baseline net debt (no tax cap and tax cap) as a percentage of GDP is provided in Figure 1–4. The ‘no tax cap’ net debt to GDP is projected to fall from a peak in 2016–17 to a net asset position at the end of the medium term. The ‘tax cap’ net debt to GDP is also projected to fall but remains in a small debt position at the end of the medium term.

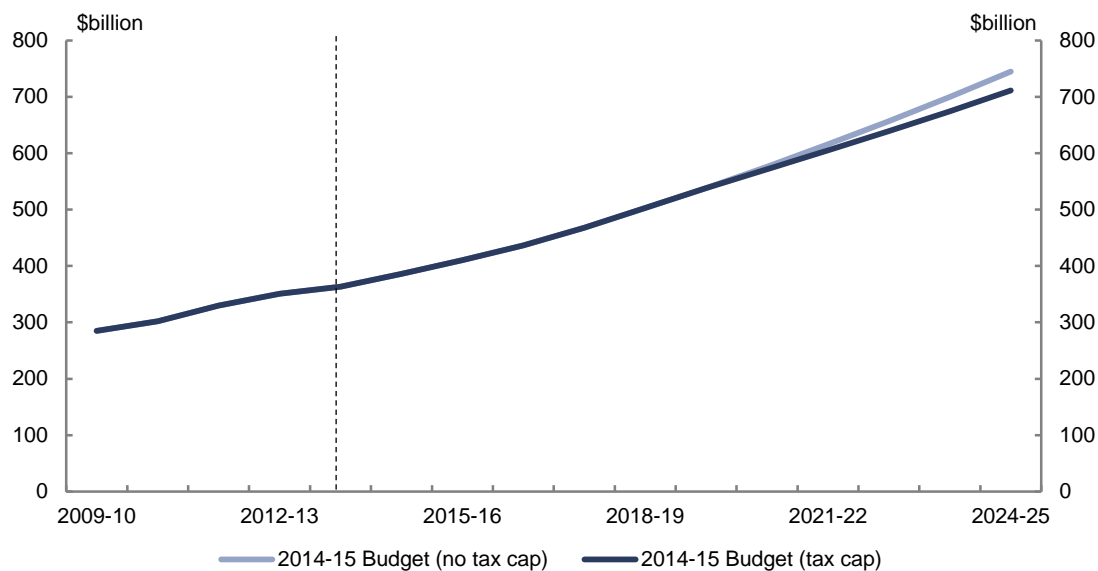
**Figure 1–4: Baseline net debt**



Source: 2014–15 Budget.

The baselines for total receipts (no tax cap and tax cap) are provided in Figure 1–5. Total receipts in the ‘no tax cap’ scenario are projected to rise from \$386 billion in 2014–15 (23.6 per cent of GDP) to \$745 billion or 27.0 per cent of GDP in 2024–25. Total receipts in the ‘tax cap’ scenario are projected to rise from \$386 billion in 2014-15 (23.6 per cent of GDP) to \$712 billion or 25.8 per cent of GDP in 2024-25.

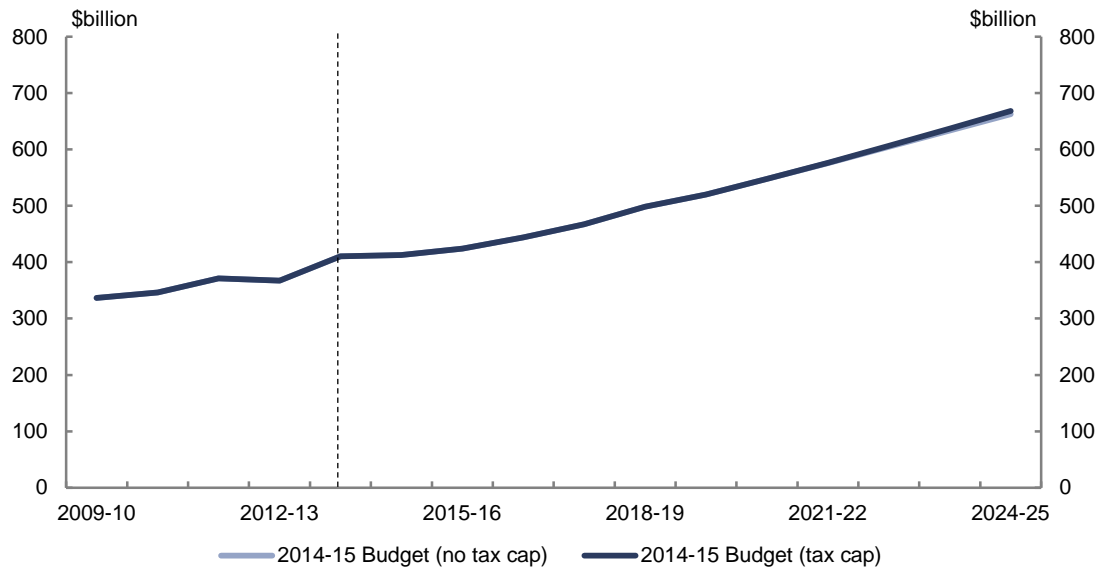
**Figure 1–5: Baseline total receipts**



Source: 2014–15 Budget.

The baselines for total payments (no tax cap and tax cap) are provided in Figure 1–6. Total payments in the ‘no tax cap’ scenario are projected to rise from \$412 billion in 2014–15 to \$663 billion in 2024–25 but decline as a proportion of GDP, from 25.3 per cent to 24.0 per cent. Total payments in the ‘tax cap’ scenario are projected to rise from \$412 billion in 2014-15 to \$668 billion in 2024–25 but decline as a proportion of GDP, from 25.3 per cent to 24.2 per cent.

**Figure 1–6: Baseline total payments**



Source: 2014–15 Budget.



## 2 Summary analysis

### A dynamic sensitivity analysis

The sensitivity analysis in this report reveals the extent to which the budget position could change depending on different economic conditions and is one method for providing an indication of the risks to the budget position and the possible consequences for fiscal policy settings.

The annual budget papers include a section on the sensitivity of the budget to economic developments and the confidence intervals around the economic and fiscal forecasts. The budget papers note that ‘estimates of economic and fiscal variables over the forward estimates period are subject to inherent uncertainties, which generally tend to increase as the forecast horizon lengthens’ (Australian Government, 2014).

While the analysis in the budget papers provides a useful basis for understanding the sensitivity of the fiscal position over the short term from a static perspective, this report extends the analysis to include:

- a longer timeframe to consider the impact of economic risks which can have long lasting implications
- a more detailed analysis that includes components of receipts and payments; and
- a dynamic analysis to illustrate the impact on the fiscal position over time of changes to the economic outlook.

### The scenarios

This report considers the impact on the federal budget of mutually exclusive, permanent, non-additive and broadly symmetric ‘high’ and ‘low’ economic scenarios over the medium term (from 2014–15 to 2024–25) for labour productivity growth, labour force participation and the terms of trade, relative to the baseline for these parameters.<sup>2</sup> The scenarios modelled are symmetric with each scenario assumed to be a permanent (for the whole projection period) deviation from the baseline:

- annual labour productivity growth is 0.5 percentage points higher/lower than the baseline rate of 1.5 per cent
- the labour force participation rate is 0.8 percentage points higher/lower in 2024–25 than the baseline rate of 64.7 per cent; and
- the terms of trade are 10 per cent higher/lower than the baseline through changes in mining commodity prices.

---

2 The focus is the impact of the economic scenarios on the federal budget. While the impact on the budgets of the States and Territories is not modelled, the economic scenarios would also have implications for the medium-term fiscal positions of the States and Territories.

The high labour productivity growth scenario assumes labour productivity growth rates return to average rates last experienced in the 1990s, a period of rapid technology advancements and structural reform of the economy. Conversely, the low labour productivity growth scenario assumes growth remains below the annual average of 1.3 per cent over the past 10 years.

The high participation rate scenario projects the total participation rate to rise to the 2008–09 historical peak of 65.5 by 2024–25 exclusively through a larger increase in the participation rates of people aged 50 to 69 compared to the baseline. In the low scenario, the trend rise in the 50 to 69 year old participation rates is projected to end, and the labour force participation rate falls as the population ages.

The variations in the terms of trade between scenarios are assumed to occur as a result of changes in world demand for mining commodity exports, leading to variations in world mining commodity prices. Specifically, relative to the baseline, world mining commodity prices are increased (reduced) by 35 per cent to achieve a 10 per cent rise (fall) in the terms of trade.

## Summary results

A summary of the results for 2024–25 is provided in Table 2–1. The results show changes for all the scenarios against the baseline in 2024–25 in the projected underlying cash balance, receipts and payments, and net debt.

**Table 2–1: Changes in the budget relative to the baseline for 2024–25**

	Productivity		Participation		Terms of trade	
	High scenario	Low scenario	High scenario	Low scenario	High scenario	Low scenario
Change in underlying cash balance:						
– Percentage point of GDP	1.1	-1.1	0.3	-0.3	0.5	-0.4
– \$billion	35.9	-33.1	10.3	-10.0	13.4	-12.4
Change in receipts (\$billion)	34.6	-32.4	10.9	-11.2	6.3	-10.0
Change in payments (\$billion)	-1.3	0.8	0.7	-1.1	-7.2	2.5
Change in net debt:						
– Percentage point of GDP	-5.0	5.1	-1.5	1.5	-3.0	2.7
– \$billion <sup>1</sup>	-149.0	138.5	-42.9	41.6	-84.0	74.2

<sup>1</sup> Change in net debt by 2024–25.

The results do not apply the tax cap of 23.9 per cent of GDP as shown in the 2014–15 Budget. To the extent that the tax cap is applied to the baseline and to the scenarios, the estimated impact of the scenarios in this report on tax receipts and, in turn, the underlying budget balance will be slightly smaller but not significantly so.

## Labour productivity growth

The federal budget is sensitive to variations in aggregate labour productivity growth through personal income and company tax receipts, because small annual incremental changes have large and compounding impacts on incomes, profits, wages and, in the opposite direction, on consumer prices.

In the high labour productivity scenario, the underlying cash balance is projected to improve by \$35.9 billion or 1.1 per cent of GDP in 2024–25. Net debt in 2024–25 is estimated to be \$149.0 billion or 5.0 per cent of GDP lower than the baseline. In the low labour productivity growth scenario the underlying cash balance is projected to be \$33.1 billion or 1.1 per cent of GDP lower than the baseline.

The high labour productivity growth scenario assumes growth rates return to average rates experienced in the 1990s, an exceptional period of rapid technological advancements and structural reform of the economy. Labour productivity growth has averaged slightly below the baseline rate of 1.5 per cent over the past 10 years and the 1980s and 2000s decades. This suggests the balance of risks leans towards the low productivity growth rate scenario.

Chapter 3 provides a full analysis of the estimated impact on the budget of the labour productivity growth rate scenarios.

## Labour force participation rate

The main impact of changes in labour force participation is through variations in income taxes due to changes in employment.

The high participation rate scenario results in a projected improvement in the underlying cash balance of \$10.3 billion or 0.3 per cent of GDP compared to the baseline. Over the medium term, net debt is estimated to be \$42.9 billion or 1.5 per cent of GDP lower than the baseline in 2024–25.

The low participation rate scenario results are of a similar magnitude (but in the opposite direction) to those of the high participation rate scenario, resulting in a deterioration in the underlying cash balance of \$10.0 billion or 0.3 per cent of GDP relative to the baseline in 2024–25.

The most significant increases in the participation rate since the late 1990s have been in the 50 to 69 age cohorts. The participation rates of these cohorts could increase further or flatten out depending on the response to increasing life expectancy and policy changes, including the increase in the pension age. The risk of the upside and downside participation rate scenarios appear to be reasonably evenly balanced.

Chapter 4 provides a full analysis of the estimated impact on the budget of the labour force participation rate scenarios.

## Terms of trade

Variations in the terms of trade cause changes to the size and composition of the economy which impact on personal and company tax receipts. They also give rise to changes in the exchange rate which affect prices and the growth in payments indexed to the Consumer Price Index (CPI) and/or wages growth.

### Medium term

In the high terms of trade scenario the underlying cash balance is estimated to improve by \$13.4 billion in 2024–25 or 0.5 per cent of GDP. The improvement in the underlying cash balance results in net debt being \$84.0 billion or 3.0 per cent of GDP lower than the baseline in 2024–25.

The low terms of trade results are of a broadly similar magnitude (but in the opposite direction) to those of the high terms of trade scenario, with the underlying cash balance estimated to deteriorate by \$12.4 billion or 0.4 per cent of GDP in 2024–25 compared to the baseline.

### Short-term budget impact

The 10 per cent terms of trade variation scenarios discussed above are based on an economic modelling framework that assumes a flexible economic environment in which prices adjust rapidly, causing a reallocation of economic activity among industries.

With the alternative assumptions that the exchange rate, interest rates, the CPI, wages and dwelling investment are all held fixed in the first year, a 10 per cent decrease in the terms of trade could have a more pronounced impact on the underlying cash balance in the short term (Table 2–2).

**Table 2–2: Indicative short term impact of the low terms of trade scenario**

	2014–15	2015–16
Change in underlying cash balance:		
– Percentage point of GDP	-0.5	-0.6
– \$billion	-6.9	-9.8

The results in Table 2–2 align with the short-term sensitivity analysis approach presented in 2014–15 Budget Paper No.1. Depending on the speed of economic adjustment, part of the impact could persist for several years and affect the level of government debt and future debt servicing costs. An increase in the terms of trade could provide a similar short run improvement in the budget balance.

Variations in the terms of trade between scenarios are assumed to occur as a result of changes in world demand for mining commodity exports. Mining commodity price outcomes since the release of the 2014–15 Budget suggest downside risk to the terms of trade baseline projection.

Chapter 5 provides a full analysis of the estimated impact on the budget of the terms of trade scenarios.



## 3 Labour productivity

### What is productivity?

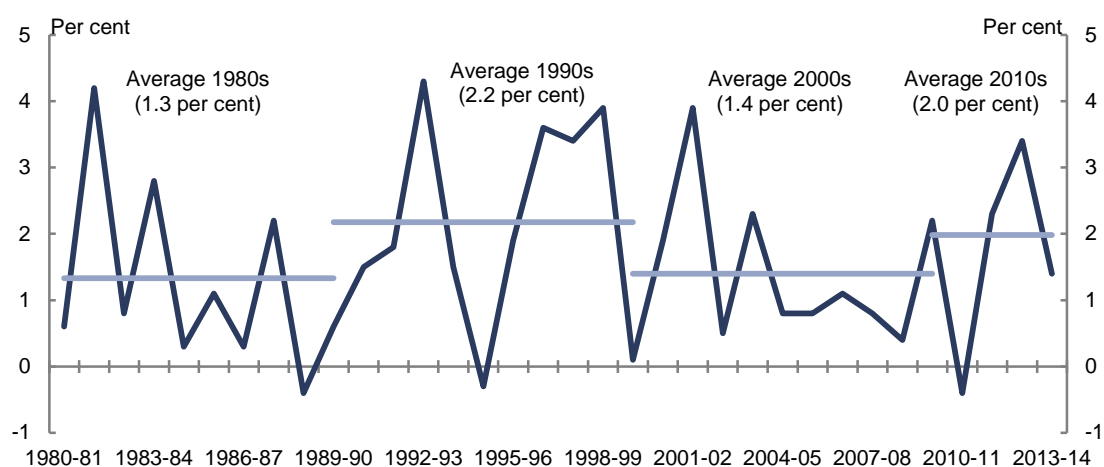
Productivity is the ratio of outputs produced to inputs used. Productivity growth occurs as more output is produced for each unit of input used or the same level of output can be achieved with fewer inputs. Labour productivity growth, which is the focus of this section, is measured as the growth in GDP per hour worked.<sup>3</sup>

Productivity growth is the main driver of sustained improvements in the standard of living in an economy in the long run (D'Arcy & Gustafsson, 2012). The level and growth of labour productivity is dependent on a broad range of factors, including technological advancements and innovation, the quantity and quality of physical infrastructure, human capital accumulation (such as workforce education levels), how well labour and equipment are utilised, the business operating environment and the level of competition businesses face.

### Historical labour productivity growth outcomes

Australia's labour productivity growth in recent decades is illustrated in Figure 3–1.

**Figure 3–1: Labour productivity growth, 1979–80 to 2013–14**



Source: Australian Bureau of Statistics (ABS) Cat. No. 5204.0.

Over the 1990s, labour productivity growth averaged 2.2 per cent annually (compared to an average of 1.3 per cent annually over the 1980s). A number of factors have been identified as leading to the surge in labour productivity growth during the 1990s.

3 Labour productivity is the sum of capital deepening (growth in the ratio of capital to labour inputs) and multifactor productivity, which is a broader measure of productive efficiency that accounts for both labour and capital inputs.

These factors include technological innovation (Tressel, 2008); structural reforms leading to a reorganisation of production by businesses (Productivity Commission, 1999); and widespread adoption of information and communications technology (ICT) throughout the 1990s (Bean, 2000).

Over the 2000s, labour productivity growth slowed to an average of 1.4 per cent annually. This has been partly attributed to sectors in the economy experiencing a surge in investment without commensurate growth in measured output. In the mining industry, for example, high commodity prices have created an incentive for mining companies to invest in mines of lesser quality (Topp, et al., 2008). Investment in water and electricity utilities was undertaken in response to drought, and to better manage periods of peak demand (Topp & Kulys, 2012). Rates of utilisation of these investments have so far been low, as electricity demand has weakened and water catchments have received significant rainfall.

However, even allowing for these industry-specific trends, the slowdown in Australian labour productivity growth has been attributed to a broader range of factors (D'Arcy & Gustafsson, 2012). Economy-wide factors dampening labour productivity include the completion of the adoption of the first wave of ICT improvements by the early 2000s; recent innovations generally being incremental (improving the power or capacity of existing technology) rather than transformational; and a slowdown in structural reforms to enhance the growth potential of the economy (Garnaut, 2005).

This report uses as the baseline for analysis the 2014–15 Budget assumption of 1.5 per cent annual labour productivity growth over the medium term.

## The importance of labour productivity growth to the budget

The federal budget is highly sensitive to variations in labour productivity growth because even small annual incremental changes have large and compounding effects on incomes, profits, wages and consumer prices (Productivity Commission, 2013). Receipts are impacted by the effect of changes in labour productivity growth on wages and profits. This effect on receipts is partly offset by the effect on payments that are linked to wages, although this effect is significantly smaller as a result of the 2014–15 Budget decisions to change the indexation of several large programs from indexes based on wages to the CPI.

Policy reform affects labour productivity in the medium term through incentives at the firm level to undertake research and development and adopt workplace improvements. Policy reform can also increase the incentives – or reduce the obstacles – to shifting resources from low- to high-productivity activities. Economic reforms of the 1980s and 1990s (including financial market and labour market deregulation, and product market reforms) have facilitated more flexible allocation of resources, and have increased competitive pressure on firms to undertake organisational changes to improve productivity. As widespread structural reform eased after the 1990s, it subsequently contributed to slower productivity growth in the economy (Banks, 2012).

In terms of scenarios, labour productivity growth could potentially be higher than the baseline projection due to an improvement in mining productivity, as the sector shifts from the investment phase of the mining boom to the production phase.



In addition, as 'lumpy' capital investment projects – such as the replacement of ageing infrastructure in the utilities sector – are completed and become operational, labour productivity growth may also improve in the utilities sector. Other factors which may contribute to raising labour productivity growth include further improvements in technical innovation, human capital accumulation and reductions in infrastructure bottlenecks.

However, there are also risks which may cause labour productivity growth to fall below the baseline projection. One such risk is the ongoing structural changes in the Australian economy, where low productivity services sectors, such as aged care and health, continue to expand as a share of the economy (Parkinson, 2014). In addition to these sectoral shifts, lower rates of innovation and economic reform could also play a role in slowing the rate of labour productivity growth (Carmody, 2013).

The 2014–15 Budget projections are based on the historical long-run average labour productivity growth rate of 1.5 per cent per annum. Labour productivity growth has averaged slightly below the baseline rate of 1.5 per cent over the past 10 years and in the 1980s and 2000s decades. This suggests the balance of risks leans towards the low productivity growth rate scenario.

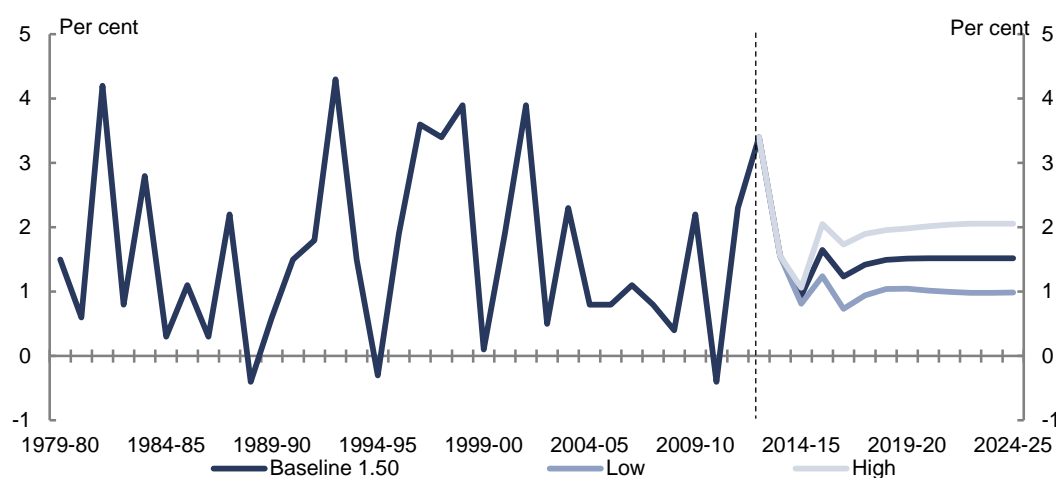
## The scenarios

The sensitivity of the budget to changes in the growth rate of labour productivity is examined using two scenarios against the baseline assumption in the 2014–15 Budget of 1.5 per cent annual labour productivity growth:

- *high labour productivity growth*: the annual labour productivity growth rate across the economy is permanently 0.5 percentage points higher each year; and
- *low labour productivity growth*: the annual labour productivity growth rate across the economy is permanently 0.5 percentage points lower each year.

The scenarios are illustrated in Figure 3–2.

**Figure 3–2: Labour productivity growth scenarios**



Source: ABS Cat. No. 5204.0, 2014-15 Budget, PBO.

The high labour productivity growth scenario assumes labour productivity growth rates return to average rates last seen in the 1990s and that the higher labour productivity growth rate is maintained each year to 2024–25. Conversely, the low labour productivity growth scenario assumes growth remains below the annual average of 1.3 per cent over the past 10 years. In both cases, the sole underlying driver of the movement in labour productivity growth in each industry is assumed to be variations in the rate of improvement of technology.

## Results

### Summary of results

#### *Economic outcomes*

Changes in labour productivity growth directly influence economic growth. By 2024–25, labour productivity is projected to be cumulatively 5.1 per cent higher in the high scenario than it would be in the baseline scenario. Real GDP also increases by 5.1 per cent in the high scenario compared with the baseline scenario.

The economic modelling assumes that in the medium term unemployment converges to its equilibrium rate and as a consequence employment is largely unaffected.

The changes in labour productivity growth result in wages growth of similar magnitude in the same direction. In the high productivity scenario, wages are estimated to increase by 4.8 per cent from the baseline in 2024–25 while profits rise by 3.9 per cent. The high labour productivity scenario results in lower prices with the CPI estimated to be lower by around 1 per cent in 2024–25.

Economic outcomes for the low labour productivity scenario are broadly equivalent in magnitude, but in the opposite direction.

#### *Fiscal outcomes*

The fiscal results in the high and low labour productivity growth scenarios are mostly symmetrical. That is, the fiscal impact is of the same magnitude in both scenarios (but in opposite directions). The largest contribution to the change in total receipts arises from income taxes as a result of changes in wages growth. The largest contribution to the change in total payments arises from changes in public debt interest payments due to changes in net debt.

The impacts on the budget projections for 2024–25 of the labour productivity growth rate scenarios are summarised in Table 3–1.

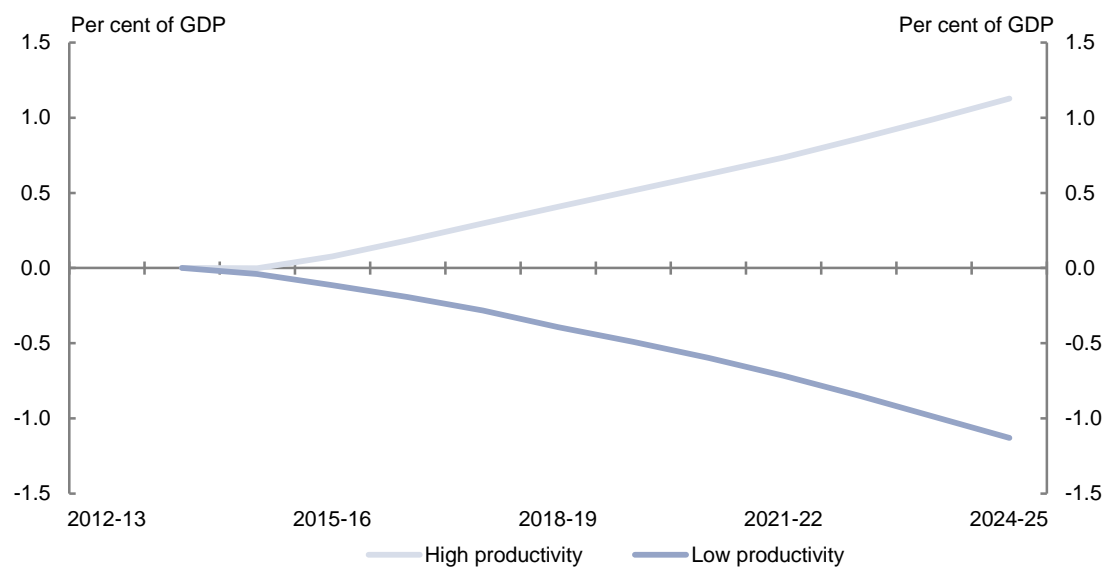
**Table 3–1: Labour productivity growth - changes relative to the baseline for 2024-25**

	High scenario	Low scenario
Change in underlying cash balance:		
– Percentage point of GDP	1.1	-1.1
– \$billion	35.9	-33.1
Change in receipts (\$billion)	34.6	-32.4
Change in payments (\$billion)	-1.3	0.8
Change in net debt:		
– Percentage point of GDP	-5.0	5.1
– \$billion <sup>1</sup>	-149.0	138.5

<sup>1</sup> Change in net debt by 2024–25.

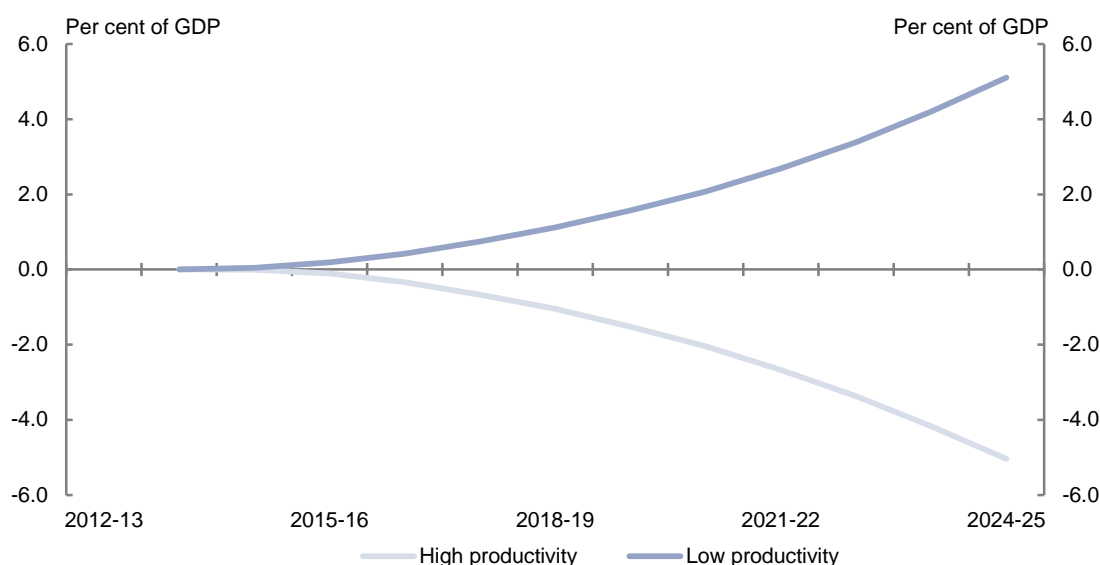
The profiles over time of the underlying cash balance and net debt as a percentage of GDP in the labour productivity growth scenarios are provided in Figure 3–3 and Figure 3–4.

**Figure 3–3: Deviation in underlying cash balance from the baseline**



Source: PBO.

**Figure 3–4: Deviation in net debt from the baseline**



Source: PBO.

## High labour productivity growth

### *Underlying cash balance and net debt*

In the high labour productivity growth scenario, the underlying cash balance is projected to be \$35.9 billion or 1.1 per cent of GDP higher in 2024–25 than the baseline.

Net debt is estimated to be \$149.0 billion or 5.0 per cent of GDP lower in 2024–25 than the baseline.

### *Receipts*

Total receipts are higher in the high labour productivity growth scenario because of a rise in wages and profits. Receipts are expected to be \$34.6 billion higher in 2024–25 compared to the baseline.

The largest component of the increase in receipts is personal income tax receipts, which are \$22.5 billion higher in 2024–25 due to higher compensation of employees.

Company tax receipts are also expected to be stronger by \$5.1 billion in 2024–25 due to higher profits.

GST receipts increase by \$3.2 billion in 2024–25, which does not impact on the underlying cash balance because GST is both a receipt and equivalent payment (to the States and Territories).

### *Payments*

In the high labour productivity growth scenario, government payments are projected to be lower by \$1.3 billion in 2024–25 relative to the baseline.

The largest contributor to the lower payments is a reduction of \$7.6 billion in 2024–25 in public debt interest, due to lower net government debt in the high labour productivity scenario.

The age pension is lower by \$1.2 billion in 2024–25 due to the combination of lower inflation and less people receiving a full pension as a result of higher returns on their investments.

In addition, payments related to health and education are projected to be collectively \$1.2 billion lower in 2024–25 in the high labour productivity scenario due to lower inflation.

This result partly reflects the decisions included in the 2014–15 Budget to index a number of payments in the future by the CPI, including the Age Pension, the Disability Support Pension, Carer Payment, Commonwealth school funding and the Commonwealth contribution to public hospitals (Parliamentary Budget Office, 2014b). This highlights the impact of budget policy that delinks increases in government spending programs from labour productivity growth.

Offsetting these decreases is an increase of \$4.4 billion in 2024–25 in payments relating to programs not modelled individually, which are projected to grow with nominal GDP.<sup>4</sup> In addition, there is a rise in GST payments to the States and Territories of \$3.2 billion, which does not impact the underlying cash balance, and spending on aged care rises by \$1 billion in 2024–25, relative to the baseline.

## Low labour productivity growth

### *Underlying cash balance and net debt*

The low labour productivity growth results are broadly of a similar magnitude (but opposite direction) to those of the high labour productivity scenario. In the low labour productivity scenario, the underlying cash balance is projected to be \$33.1 billion lower in 2024–25, a deterioration of 1.1 per cent of GDP in 2024–25. Net debt in 2024–25 is \$138.5 billion or 5.1 per cent of GDP higher than the baseline.

### *Receipts*

The changes in the underlying cash balance and net debt are mainly due to changes in government receipts, which are estimated to fall by \$32.4 billion in 2024–25, compared to the baseline. Of this, the largest fall is in personal income tax, which accounts for \$20.6 billion of the fall in 2024–25. Due to the decreased productivity growth, the increase in wages is lower than in the baseline.

The second largest component of the fall in receipts relative to the baseline is a \$4.8 billion decrease in company tax receipts in 2024–25 due to lower company profits.

GST receipts fall by \$3.2 billion in 2024–25 relative to the baseline, which does not impact on the underlying cash balance because GST is both a receipt and equivalent payment (to the States and Territories).

---

4 These payments, which are approximately 15 per cent of total payments, comprise spending on programs not individually modelled. As a simple assumption (consistent with previous Intergenerational Report modelling) these are projected to grow with nominal GDP growth.

## **Payments**

The low labour productivity growth scenario is projected to result in higher government payments of \$0.8 billion in 2024–25. The largest contributor is an increase of \$7.0 billion in 2024–25 in public debt interest payments due to higher net debt. There are also increases in payments which are indexed to the CPI, including pension payments which are also higher due to more people qualifying for the full pension as a result of lower returns on their investments.

Partially offsetting these increases is a \$4.3 billion fall in 2024–25, relative to the baseline, in payments relating to programs that are not modelled individually, but are projected to grow with nominal GDP (which grows more slowly in a low labour productivity scenario).

GST payments to the States and Territories are also projected to fall by \$3.2 billion in 2024–25. In the low labour productivity growth scenario, payments for aged care are \$1.0 billion lower in 2024–25 due to lower wages growth.

## 4 Labour force participation rate

### What is the labour force participation rate?

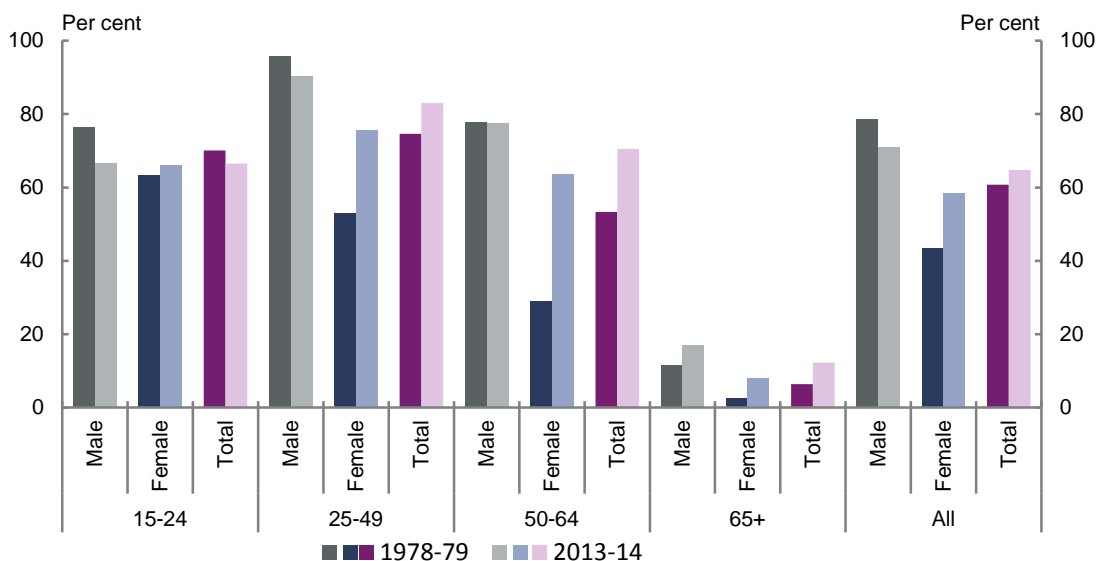
The labour force participation rate is the proportion of the adult population (aged 15 years and over) that is available for paid employment – those who are currently employed or actively searching for work. It is influenced by both cyclical factors such as a change in the number of discouraged workers unable to find jobs during an economic downturn (these workers may choose to retrain while out of the workforce), and structural factors, such as a change in the proportion of the population that has entered retirement, or that is pursuing further educational opportunities.

A reduction in the labour force participation rate because workers are pursuing educational attainment should lead to a long-term improvement in the productive capacity of the economy, but this is not the case for a reduction due to an increasing proportion of discouraged workers (if they are not pursuing retraining opportunities) or retirees. As Australia's population ages, the proportion of retirees relative to the rest of the adult population is expected to rise.

### Historical labour force participation outcomes

Australia's labour force participation has increased steadily since the late 1970s, from around 61 per cent to 65 per cent by 2014. A large increase in female participation from 43 to 59 per cent has been partially offset by a decrease in male participation from 79 to 71 per cent. Figure 4–1 summarises labour force participation in Australia.

**Figure 4–1: Labour force participation by sex and age cohort**



Note: Average of monthly estimates of the stated financial year.

Source: ABS Cat. No. 6291.0.

Male participation among 15 to 24 year olds has fallen, largely driven by higher levels of educational attainment, with more men undertaking post-school studies and delaying their entry to the workforce than in previous generations (Gruen, 2014b). Male participation between the ages of 25 and 49 has also fallen.

Conversely, female participation has increased in all age groups as a result of demographic and social factors such as declining fertility rates and greater availability of flexible work practices. Policy interventions such as minimum maternity leave provisions, paid parental leave and universal government subsidises for child care (along with minimum standards for the quality of such care) have also been introduced to assist and encourage women to return to work after giving birth.

The age structure of the workforce has also changed. As life expectancy has increased, both men and women have chosen to remain in the labour force longer, with increasing numbers of older workers choosing to work part-time as they transition to retirement. Female participation in the 50 to 64 age cohort has increased from 29 per cent to 64 per cent since 1979. Participation by those aged 65 and over nearly doubled over the same period.

Since 2007–08, there has been a steady decline in participation rates among 15 to 24 year olds. Initially this was driven by the weaker labour market as a result of the global financial crisis, while policy changes in 2009 that removed caps on university places likely contributed to further declines.

Australia's population is ageing. The 'baby boomer' generation is larger and expected to live longer than previous generations. In recent decades, fertility rates have fallen and net migration of younger people has not been sufficient to offset this fall. As older generations advance in years, more people would need to remain in the workforce for longer simply to hold the participation rate constant. As the proportion of the population aged over 65 increases, the risks are that increases in the overall participation rate will continue to slow or even reverse.

## The importance of the labour force participation rate to the budget

The labour force participation rate is an important driver of economic growth and the budget. A higher labour force participation rate indicates a higher level of engagement among the working age population, and increases the available supply of labour and, in periods of rapid economic growth, can help constrain wage inflation as a larger number of people compete for the available jobs.

In net terms, a rise in the labour force participation rate helps boost the budget position. Higher participation increases government revenue through income taxes from higher employment. Higher participation may decrease expenditure on income support if more people are employed, but increase expenditure on unemployment benefits if more people are in the labour force but unable to find employment.



Despite recent demographic, social and policy trends, individuals who are aged over 65 are still more likely to exit than to remain in the workforce. This has implications for fiscal sustainability. Hence, encouraging older workers to remain in the workforce is likely to be a key factor in minimising the negative impacts of an ageing population on economic growth and the budget balance.

To counteract the impacts of an ageing population, a number of government policies introduced over the past two decades have been designed to encourage mature-aged people to continue to work. Employees aged 55 and over have been able to access concessional taxation through higher concessional superannuation contribution caps and a tax rebate. Employers have been encouraged to hire mature age workers through government funded education campaigns outlining the benefits of such employees, and cash incentives for companies willing to engage mature age income support recipients.

Since 2002, changes to the welfare system have aligned most requirements for recipients of income support across age groups, removing the Mature Age Allowance and requiring recipients of unemployment benefits under 60 to actively look for work (however those between 55 and 60 may choose instead to undertake 30 hours of voluntary or paid work per fortnight). Eligibility rules for income support for women (which allowed earlier access to pensions) have been aligned with those for men and only the widow allowance (which provides assistance for women born on or before 1 July 1955 with no recent work experience) is available for women below the pension eligibility age who are not looking for work.

Further increases in participation among 65 to 70 year olds are likely to occur over the medium term with the phased increase in the eligibility age for the age pension from July 2017 (reaching 67 in July 2023).

The participation rate is projected in the 2014–15 Budget to remain relatively flat at 64.7 per cent in 2024–25. This reflects projected improvements in the participation rate for people aged over 50, offset by the ageing effect of an increasing proportion of the population in this age group.

The upside potential for an increase in the total participation rate is in a further increase in the participation rate of those aged over 50. Workers may choose to transition to retirement through a period of part time work, in response to longer life expectancies and the financial implications of being retired for up to 30 years. However, improvements in participation among older age categories will be limited by health considerations of older people. On the other hand it is possible that there could be a recovery in participation of people aged 15 to 24 who have undertaken further education in the recent economic downturn.

The main downside risk is that the projected increase in the participation rate for the older age groups does not eventuate. In this case, the aggregate participation rate would fall as the population ages.

The risks of higher or lower labour force participation relative to the 2014–15 Budget projection appear to be reasonably balanced.

## The scenarios

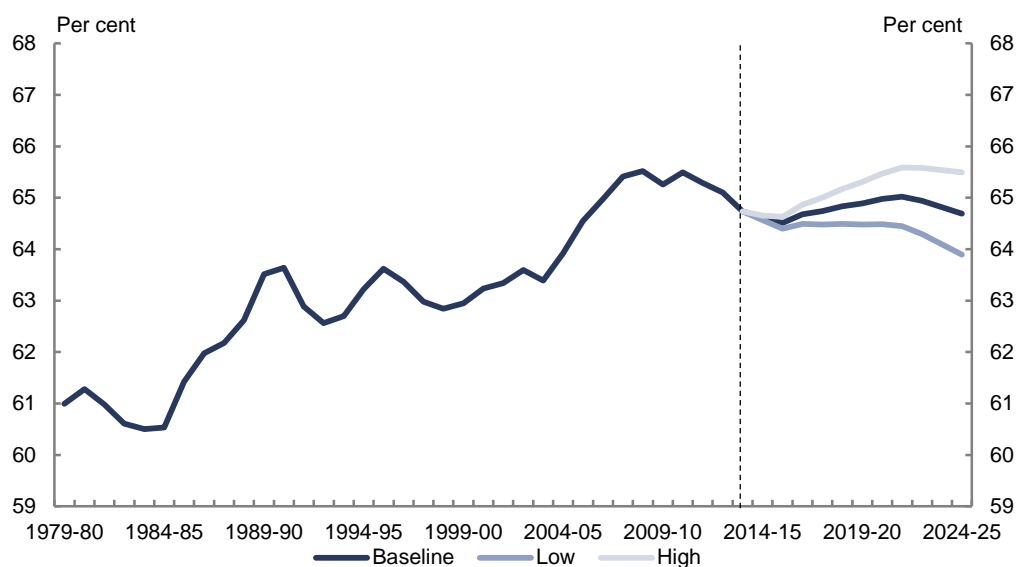
The 2014–15 Budget assumes the labour force participation rate will move from 64.6 per cent in 2014–15 to 64.7 per cent by 2024–25<sup>5</sup> with increasing participation rates of older age groups offset by the effect on participation of the ageing of the population. By 2024–25, the participation rate of those people aged 60 to 64 is assumed in the 2014–15 Budget to rise from 54.7 per cent to 61.5 per cent and the participation rate of people aged 65 to 69 is assumed to rise from 27.4 per cent to 33.3 per cent.

The sensitivity of the budget to changes in the labour force participation rate is examined using two scenarios. In each scenario, the participation rate deviates by 0.8 percentage points in 2024–25 from the budget projection:

- *high participation rate*: the participation rate gradually rises to 65.5 per cent in 2024–25; and
- *low participation rate*: the participation rate gradually falls to 63.9 per cent in 2024–25.

Variations in the participation rate (both up and down) are assumed to occur exclusively in people aged 50 to 69. The scenarios are illustrated in Figure 4–2.

**Figure 4–2: Labour force participation rate scenarios**



Note: June survey estimates of the stated year for historical data.

Source: ABS Cat. No. 6291.0, 2014-15 Budget, PBO.

In the high participation rate scenario, the total participation rate is projected to increase to around its previous historical peak of 65.5 per cent in 2008–09. To achieve this increase above the baseline projection the participation rates for those aged 50 to 69 are projected to rise at a faster rate relative to the baseline.

5 The medium-term economic projection methodology used by Treasury is discussed in Bullen, et. al., 2014b.

Among the 50 to 54 age cohort, the participation rate in 2024–25 is projected to be 1.6 percentage points above the baseline (that is, 86.4 per cent compared to 84.8 per cent in the baseline). For the 55 to 59 age cohort, the participation rate in 2024–25 is projected to be 1.7 percentage points above the baseline (that is, 79.1 per cent compared to 77.4 per cent in the baseline).

For the 60 to 64 age cohort, the participation rate in 2024–25 is projected to be 4.1 percentage points above the baseline (65.6 per cent in the high scenario compared to 61.5 per cent in the baseline). For the 65 to 69 age cohort, the participation rate in 2024–25 is projected to be 4.6 percentage points above the baseline (37.8 per cent in the high scenario compared to 33.3 per cent in the baseline).

In the low participation rate scenario, the total participation rate is projected to fall to 63.9 per cent in 2024–25. This decline is achieved by projecting only modest growth in participation rates for those aged 50 to 69 over the medium term. These increases are not sufficient to offset the ageing population effect and total participation declines over the medium term.

In terms of the details, the participation rate for the 50 to 54 age cohort is projected to be 1.6 percentage points lower than the baseline (83.2 per cent compared to 84.8 per cent in the baseline). For the 55 to 59 age cohort, the participation rate in 2024–25 is projected to be 1.7 percentage points lower than the baseline (75.7 per cent compared to 77.4 per cent in the baseline).

For the 60 to 64 age cohort, the participation rate in 2024–25 is projected to be 4.1 percentage points lower than the baseline (57.4 per cent in the low scenario compared to 61.5 per cent in the baseline). For the 65 to 69 age cohort, the participation rate in 2024–25 is projected to be 4.6 percentage points below the baseline (28.7 per cent in the low scenario compared to 33.3 per cent in the baseline).

## Results

### Summary of results

#### *Economic outcomes*

Changes in labour force participation directly influence economic growth by changing the labour resources available for producing goods and services.

In the high scenario, the labour force participation rate increases to be 0.8 percentage points above the baseline by 2024–25, resulting in a larger labour force by 1.2 per cent.

In the medium term, the economic modelling assumes the unemployment rate converges to its equilibrium rate so there is a commensurate 1.2 per cent increase in employment over the medium term.

In the high participation scenario, the CPI is estimated to rise by approximately 0.6 per cent relative to the baseline in 2024–25 due to a depreciating exchange rate raising import prices.

The economic modelling assumes that with a rise in participation domestically, but not internationally, the additional supply of Australia’s exports exceeds the demand for Australia’s exports, so that there is downward pressure on export prices and the terms of trade. In turn, the exchange rate depreciation raises import prices and the general price level. The impact on the budget from the rise in the CPI is not significant.

Economic outcomes for the low participation rate scenario are broadly equivalent in magnitude, but in the opposite direction.

### ***Fiscal outcomes***

The impacts on the budget projections for 2024–25 of the labour force participation rate scenarios are summarised in Table 4–1.

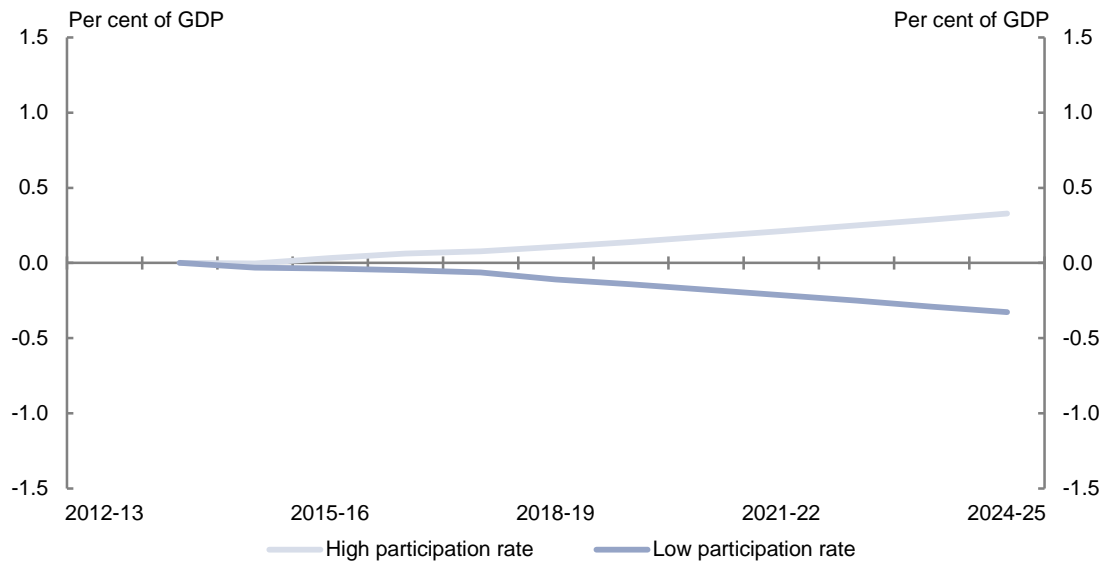
**Table 4–1: Labour force participation rate - changes relative to the baseline for 2024–25**

	High scenario	Low scenario
Change in underlying cash balance:		
– Percentage point of GDP	0.3	-0.3
– \$billion	10.3	-10.0
Change in receipts (\$billion)	10.9	-11.2
Change in payments (\$billion)	0.7	-1.1
Change in net debt:		
– Percentage point of GDP	-1.5	1.5
– \$billion <sup>1</sup>	-42.9	41.6

<sup>1</sup> Change in net debt by 2024–25.

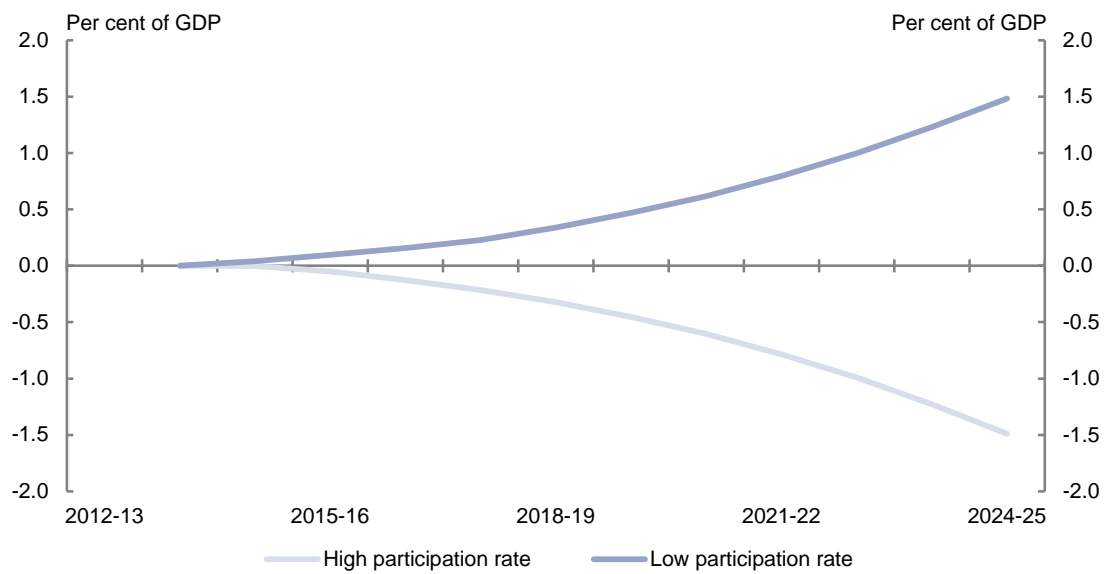
The profiles over time of the underlying cash balance and net debt as a percentage of GDP in the participation rate scenarios are provided in Figure 4–3 and Figure 4–4.

**Figure 4–3: Deviation in underlying cash balance from the baseline**



Source: PBO.

**Figure 4–4: Deviation in net debt from the baseline**



Source: PBO.

## High labour force participation rate

### *Underlying cash balance and net debt*

Higher labour force participation results in a projected improvement in the underlying cash balance of \$10.3 billion or 0.3 per cent of GDP in 2024–25 above the baseline.

Over the medium term, net debt is estimated to be \$42.9 billion lower or 1.5 per cent of GDP lower in 2024–25 than the baseline.

### *Receipts*

With faster economic growth and more people in employment, total receipts are projected to rise by \$10.9 billion in 2024–25 compared to the baseline.

Income tax receipts are higher by \$6.0 billion in 2024–25 due to stronger employment growth. Higher profits raise company tax receipts by \$2.2 billion in 2024–25. GST receipts rise by \$1.3 billion in 2024–25 due to increased consumer spending.

### *Payments*

Projected total payments are \$0.7 billion higher in 2024–25 relative to the baseline.

The largest contributor is an increase of \$1.4 billion in 2024–25 in payments relating to programs not modelled individually but projected to grow with nominal GDP. GST payments to the States and Territories are projected to increase by \$1.3 billion in 2024–25. Higher health related payments (\$0.5 billion in 2024–25) due to rise in the CPI also contribute to the rise in aggregate payments.

Partly offsetting the rise in these payments is a decrease, relative to the baseline, of \$2.3 billion in 2024–25 in public debt interest payments due to a decrease in net government debt. In addition, age pension payments are estimated to be lower by \$1.3 billion in 2024–25 relative to the baseline due to increased participation by people of pension age.

## Low labour force participation rate

### *Underlying cash balance and net debt*

The lower participation rate is projected to result in a deterioration of the underlying cash balance of \$10.0 billion or 0.3 per cent of GDP in 2024–25 compared with the baseline.

Net debt is estimated to be \$41.6 billion or 1.5 per cent of GDP higher in 2024–25 than the baseline.

### *Receipts*

Receipts are projected to be lower by \$11.2 billion in 2024–25 relative to the baseline. Lower receipts are driven by both slower economic growth and lower employment. The reduction in the labour force reduces total earnings and hence personal income tax receipts are expected to fall by \$6.1 billion in 2024–25.

Slower economic growth is estimated to reduce profits by 1.7 per cent and consequently company tax receipts by \$2.1 billion in 2024–25.

GST receipts fall by \$1.4 billion in 2024–25, which does not affect the underlying cash balance because GST is both a receipt and equivalent payment (to the States and Territories).

### ***Payments***

Payments are projected to be lower by \$1.1 billion in 2024–25 relative to the baseline.

The largest contributor to lower payments is a decrease of \$1.5 billion in 2024–25 in payments relating to programs not modelled individually but projected to grow with nominal GDP. GST payments flowing through to the States and Territories are projected to fall by \$1.4 billion in 2024–25. Health payments area also projected to decrease by \$0.6 billion in 2024–25 due to the lower CPI.

Partly offsetting the decrease in these payments is an increase of \$2.0 billion in 2024–25 in public debt interest payments due to a rise in net government debt. Age pension payments are estimated to be higher by \$1.3 billion in 2024–25 relative to the baseline due to lower participation by people of pension age.





## 5 Terms of trade

### What is the terms of trade?

The terms of trade is the ratio of the prices Australia receives for its exports relative to the prices it pays for its imports. Historically, Australia as a small open economy has been susceptible to terms of trade volatility, with this volatility impacting the stance and sustainability of fiscal policy settings. As Australia has experienced, large and sustained terms of trade movements can have significant impacts on income, consumption and profits – resulting in a reallocation of economic activity between industries and geographical regions.

Australia's terms of trade is influenced by a broad range of demand and supply factors. Demand factors include international economic conditions – particularly the economic growth outlook of Australia's trading partners and in turn their demand for Australian exports. Supply factors include the state of capacity utilisation of Australia's major export competitors, how quickly global supply can respond to demand and the associated sensitivity of global prices to shifts in global supply.

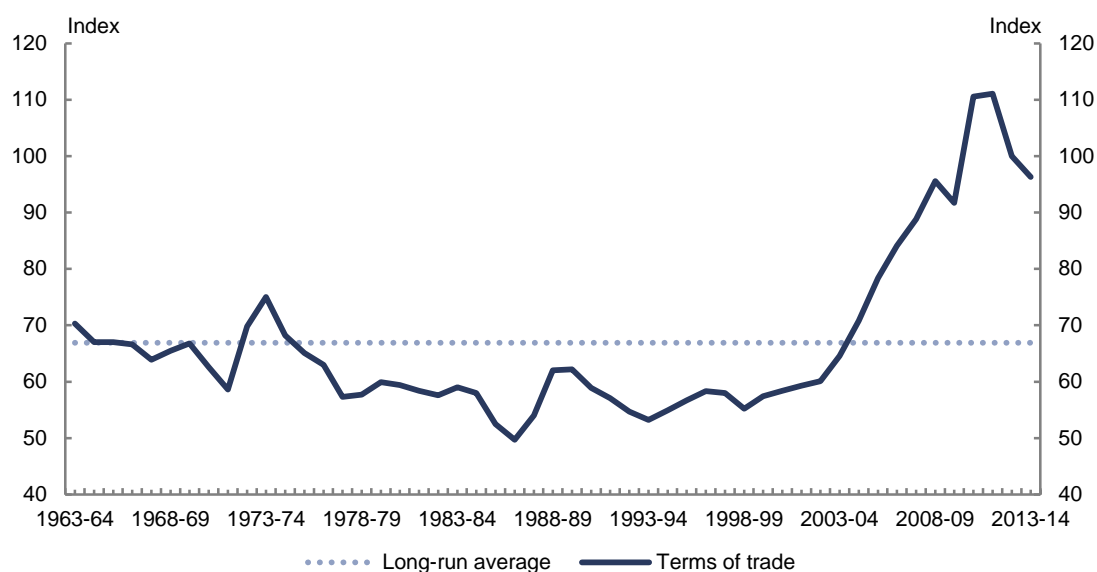
### Historical terms of trade outcomes

Australia has been affected by various significant episodes of movements in the terms of trade associated with fluctuations in world prices for commodities (Stapledon, 2012). The latest significant episode has involved a sustained rise in the terms of trade over the past two decades concentrated on mining commodity prices and culminating in the terms of trade reaching a historical peak in 2011, 67 per cent higher than the long-term average over the past 50 years (Figure 5–1).

The rise in the prices of Australia's mining exports, particularly from 2004, is largely due to the strong demand for mineral resources such as coal and iron ore. The increased demand for these resources has come from emerging parts of Asia, particularly China and India, that are undergoing a rapid process of economic development.

The higher terms of trade have significantly boosted Australia's national income. A sustained appreciation of the exchange rate has been closely linked to the terms of trade rise, contributing to a structural change within the Australian economy towards mining and related industries from other trade-exposed industries such as manufacturing. As a result, employment and wages in the mining industry have risen more rapidly than in manufacturing and other industries.

**Figure 5–1: The terms of trade over the past 50 years**



Source: ABS Cat. No. 5204.0.

Higher export prices for mining commodities have resulted in a decade of sustained growth in investment within the mining industry which has positioned the industry to respond to strong demand. The economy is now transitioning from the investment phase to a production phase, characterised by a greater supply of mining commodities (Bullen, et al., 2014a). With the supply response on a global scale, the terms of trade are expected to fall until 2019–20 (Australian Government, 2014).

## The importance of the terms of trade to the budget

The fiscal impact of a permanent change in the terms of trade depends heavily on the nature and speed of adjustment in the economy to the change in prices. In the short term, the fiscal impact can be more pronounced than in the medium term because the effect on income in the mining industry and company tax is immediate whereas the adjustments in other industries to the associated change in the exchange rate may take some time.

There are several reasons why there may be lags in the speed of some adjustments. Lower terms of trade accompanied by a depreciating exchange rate may mean some businesses will delay making decisions on their future investment and production plans to ascertain whether the fall in the exchange rate is sustained. Alternatively, businesses may have already committed to investment, production and employment agreements before a significant episode in the terms of trade and cannot immediately unwind these activities or agreements.

Moreover, substantial changes in investment in response to a significant movement in the terms of trade may take some time to plan and implement. Short-term movements in the exchange rate may also not necessarily reflect trade fundamentals. These factors dampen in the short run the reallocation of resources that occurs from a terms of trade movement.

In the medium term, the exchange rate adjusts to the change in the terms of trade and brings about a change in the industry structure of the Australian economy, as labour and capital are reallocated between industries. The net effect on the budget depends on the relative size of the tax bases in the expanding and contracting industries.

As a small open economy and a price taker on world markets for many exports, Australia has few policy levers that can directly influence the terms of trade. Nonetheless, policy settings can influence how terms of trade movements affect the domestic economy. For example, the adoption of a floating exchange rate regime has facilitated the reallocation of resources across industries in response to terms of trade movements and acted as a buffer against inflationary pressures from the resources boom.

A number of factors could potentially result in the terms of trade being different than projected in the 2014–15 Budget. On the upside, there could be further strong global demand for Australia’s exports that outpace any supply response and continued economies of scale in the domestic exploration for additional mining commodity exports. Both China and India have still some way to go in the process of industrialisation and so demand for iron ore and coal exports from Australia could potentially be elevated over the medium term, notwithstanding supply responses.

On the downside, there remains considerable uncertainty related to the global economic growth outlook, including in China and India. A sharper than expected slowdown in growth or a shift from investment to domestic consumption in China could negatively affect world mineral resource prices (International Monetary Fund, 2014). Global supply responses to the resources boom are also a factor – supply ‘catching-up’ to demand causing a dampening in world prices (International Monetary Fund, 2006).

Moreover, historic experience suggests downward movements in rural commodity export prices or significant rises in import prices also translate to negative terms of trade movements for Australia.

These factors, together with recent declining trends in commodity prices, suggest the risk to the budget from movements in the terms of trade is largely on the downside.

## The scenarios

The sensitivity of the budget to changes in the terms of trade is examined using two scenarios against the budget baseline projection<sup>6</sup>:

- *high terms of trade*: from 2014–15 the level of the terms of the trade is permanently 10 per cent higher; and
- *low terms of trade*: from 2014–15 the level of the terms of the trade is permanently 10 per cent lower.

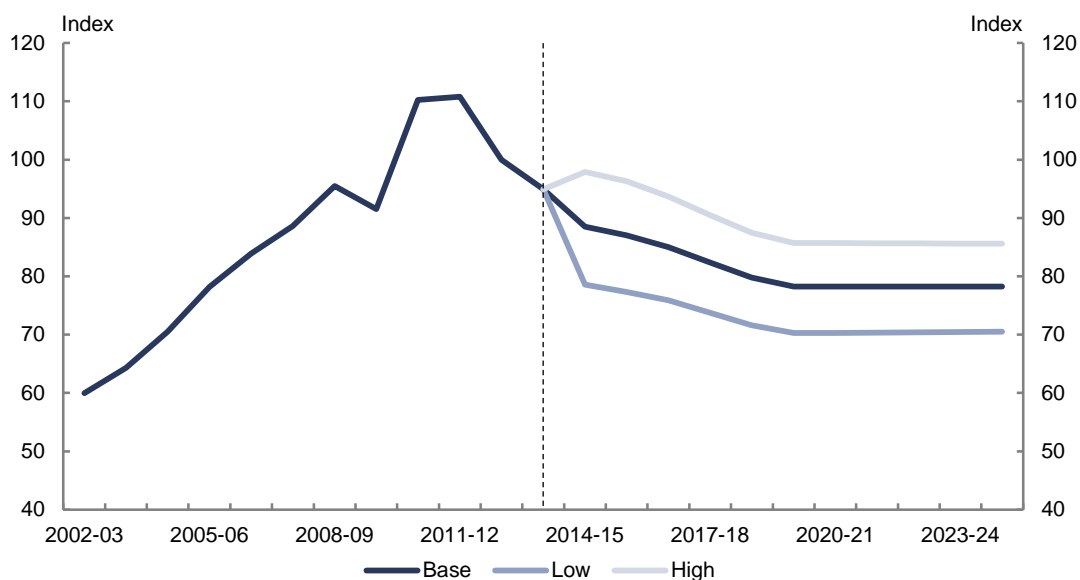
The scenarios are illustrated in Figure 5–2. The variations in the terms of trade between scenarios is assumed to occur due to changes in world demand for mining commodity exports, leading to variations in world mining commodity prices.

---

6 The baseline terms of trade projections to 2024–25 are based on the budget estimates in the 2014–15 Budget and in Bullen, et. al., 2014a.

Specifically, relative to the baseline, world mining commodity prices are increased (reduced) by 35 per cent to achieve a 10 per cent rise (fall) in the terms of trade. Because Australia is a net exporter of mining commodities, positive movements in world mining commodity prices have a positive impact on Australia's terms of trade and vice versa.

**Figure 5–2: Terms of trade scenarios over the medium term**



Source: ABS Cat No. 5204.0, 2014–15 Budget, PBO.

## Results

### Summary of results

#### *Economic outcomes*

Changes to the terms of trade influence the size and the structure of the economy. Higher mining export prices lead to nominal GDP being 0.9 per cent higher in 2024–25 compared to the baseline, with a commensurate rise in real GDP of 0.7 per cent.

In the lower terms of trade scenario, the estimated impacts on the economy are not completely symmetrical with nominal and real GDP lower in 2024–25 by 1.5 per cent and 1.1 per cent respectively, compared to the baseline. The asymmetry of the impact on GDP is the result of a different magnitude of response in the exchange rate between the high and low terms of trade scenarios.

Exchange rate movements occur in the same direction as the terms of trade movements, resulting in changes in the composition of economic activity across industries. In the high terms of trade scenario, the exchange rate appreciates by 9.6 per cent by 2024–25, relative to the baseline. In the low terms of trade scenario, the exchange rate depreciates by 7.2 per cent by 2024–25, relative to the baseline.

While wages in the mining industry rise with higher terms of trade, other industries that are trade exposed and negatively affected by the appreciating exchange rate experience reduced wages growth. Hence in the high terms of trade scenario, compensation of employees is 1.0 per cent lower relative to the baseline in 2024–25. This contrasts to a rise of 0.4 per cent in compensation of employees in the low terms of trade scenario in 2024–25 compared to the baseline.

Higher mining commodity export prices translate to higher business profits for the mining industry.

The CPI is 1.2 per cent lower than the baseline in 2024–25 under the high terms of trade scenario largely because the higher exchange rate reduces import prices. In the low terms of trade scenario, there is little net impact on the CPI relative to the baseline in 2024–25.

In the medium term, in both the high and low terms of trade scenarios, the economic modelling assumes unemployment converges to its equilibrium rate and as a consequence employment is largely unaffected.

Under the 10 per cent terms of trade variation scenarios, but assuming more sluggish responses in the exchange rate and in the non-mining trade exposed industries, the impact on the economy in the initial years is larger. This difference in responsiveness within the economy can in turn result in a greater fiscal impact in the initial years.

### ***Fiscal outcomes***

The impacts on the budget projections of the terms of trade scenarios are summarised in Table 5–1.

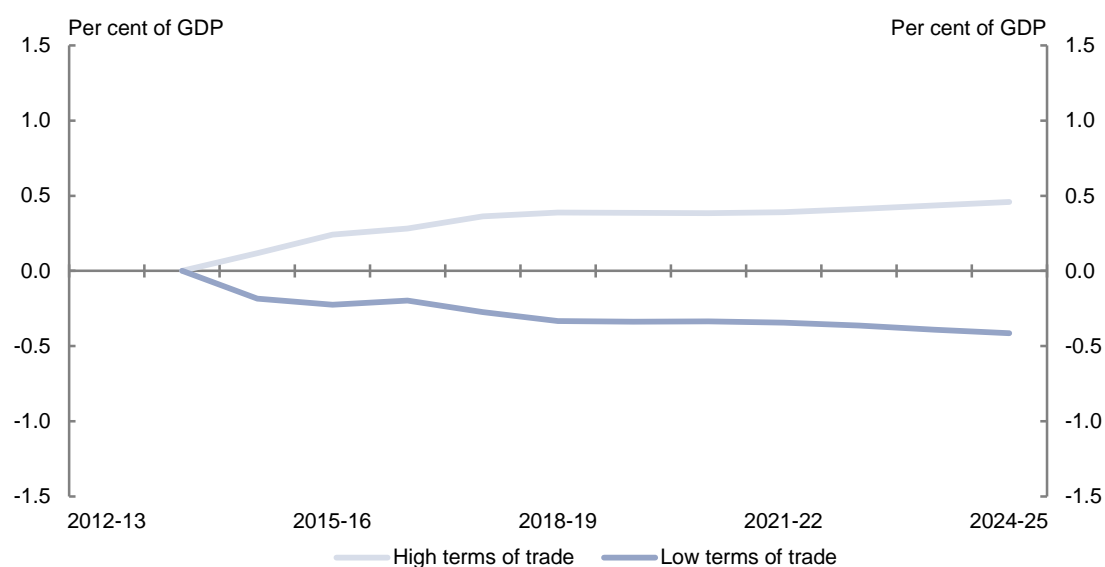
**Table 5–1: Terms of trade - changes relative to the baseline for 2024–25**

	High scenario	Low scenario
Change in underlying cash balance:		
– Percentage point of GDP	0.5	-0.4
– \$billion	13.4	-12.4
Change in receipts (\$billion)	6.3	-10.0
Change in payments (\$billion)	-7.2	2.5
Change in net debt:		
– Percentage point of GDP	-3.0	2.7
– \$billion <sup>1</sup>	-84.0	74.2

<sup>1</sup> Change in net debt by 2024–25.

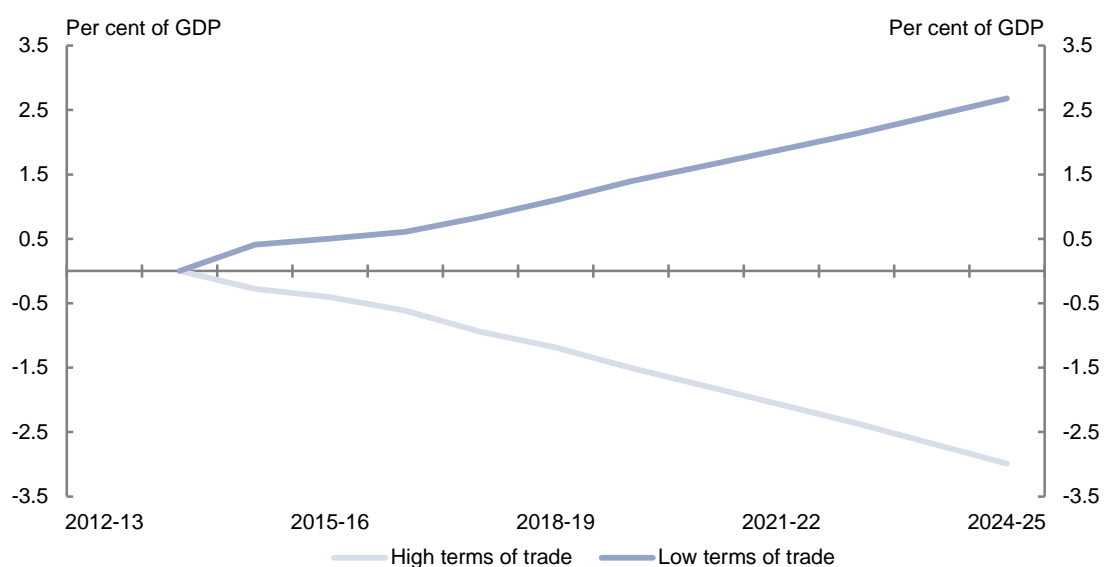
The profiles over time of the underlying cash balance and net debt as a percentage of GDP in the terms of trade scenarios are provided in Figure 5–3 and Figure 5–4.

**Figure 5–3: Deviation in underlying cash balance from the baseline**



Source: PBO.

**Figure 5–4: Deviation in net debt from the baseline**



Source: PBO.

## High terms of trade

### *Underlying cash balance and net debt*

In the high terms of trade scenario the underlying cash balance is estimated to improve by \$13.4 billion or 0.5 per cent of GDP in 2024–25, relative to the baseline.

The improvement in the underlying cash balance means that by 2024–25 net debt as a per cent of GDP is estimated to be 3.0 per cent of GDP lower than in the baseline.

## ***Receipts***

Receipts are estimated to be \$6.3 billion higher than the baseline in 2024–25.

Company tax receipts are estimated to rise by \$8.0 billion in 2024–25. Company tax receipts are dependent on profits (gross operating surplus) which increase due to the rise in world mining commodity prices raising mining profits. However, other trade exposed industries experience lower profits and in turn the company tax paid by these industries is also lower, partly offsetting the gains from the mining sector.

The rise in company tax receipts is partly offset by lower personal income tax receipts of \$4.0 billion in 2024–25 relative to the baseline. Since the mining industry is less labour intensive, a rise in wages in this industry relative to the baseline is more than offset by a decline in wages in other industries that together employ more labour.

## ***Payments***

In the high terms of trade scenario, government payments are projected to decrease by \$7.2 billion in 2024–25 relative to the baseline.

The largest contribution to the decrease in payments is a reduction in public debt interest payments of \$4.3 billion in 2024–25 due to lower net government debt in the high terms of trade scenario.

Age pension payments are projected to be \$1.8 billion lower in 2024–25 due to the combination of lower inflation and less people receiving a full pension as a result of higher returns on their investments. In addition, health payments are projected to decrease by \$1.2 billion in 2024–25 due to slower growth in the CPI.

## **Low terms of trade**

The impact of the lower terms of trade scenario on the budget is not entirely symmetrical to the higher terms of trade scenario because of asymmetry in the economic outcomes under each scenario, particularly for prices.

### ***Underlying cash balance and net debt***

In the low terms of trade scenario the underlying cash balance is estimated to deteriorate by \$12.4 billion or 0.4 per cent of GDP in 2024–25, relative to the baseline. The deterioration in the underlying cash balance means that by 2024–25 net debt as a percentage of GDP is estimated to be \$74.2 billion or 2.7 per cent higher than in the baseline.

## ***Receipts***

Receipts are estimated to be \$10.0 billion lower than the baseline in 2024–25.

Company tax receipts are estimated to fall by \$7.9 billion in 2024–25 relative to the baseline due to the fall in world mining commodity prices reducing mining profits and in turn tax receipts. However, with a more competitive exchange rate, other trade exposed industries experience a rise in profits and in turn the company tax paid by these industries also rises relative to the baseline. GST receipts also decline by \$1.6 billion in 2024–25, relative to the baseline.

The decrease in company tax receipts relative to the baseline is partly offset by increased personal income tax receipts which are higher by \$1.4 billion in 2024–25 due to higher wages growth in the non-mining industries. Since these industries are more labour intensive than mining, a rise in wages in these industries more than offsets the lower wages growth in the mining industry.

### **Payments**

In the low terms of trade scenario, government payments are estimated to increase by \$2.5 billion in 2024–25 relative to the baseline.

The largest contribution to the higher payments is an increase in public debt interest payments of \$3.4 billion in 2024–25 due to higher net government debt. Age pension payments are projected to be \$2.0 billion higher in 2024–25 due to the combination of higher inflation and more people receiving a larger pension as a result of decreases in economic activity and investment incomes.

These increases are partly offset by a reduction in GST payments of \$1.6 billion in 2024–25 and a decrease of \$1.5 billion in 2024–25 in payments relating to programs not individually modelled that are projected to move with nominal GDP.

### **Budget implications in the short run**

The budget implications of the 10 per cent terms of trade scenarios modelled in this chapter are a product of the economic modelling approach that assumes a flexible economic environment with minimal frictions so that prices adjust rapidly, causing a rapid reallocation of economic activity between industries.

The impact on the economy and hence the budget depends heavily on the speed of these adjustments in the economy. In the case of the lower terms of trade, it particularly depends on how fast the loss in income in the mining industry is offset by increases in investment and employment in other industries such as manufacturing.

To consider the possible short-term budget impact of a change in the terms of trade with greater adjustment rigidities, the same 10 per cent scenarios modelled previously have been analysed with the additional assumptions that the exchange rate, interest rates, the CPI, wages and dwelling investment are all held fixed in the first year. The impact on the budget in the first two years is summarised in Table 5–2.

**Table 5–2: Indicative short run impact of the low terms of trade scenario**

	2014–15	2015–16
Change in underlying cash balance:		
– Percentage point of GDP	-0.5	-0.6
– \$billion	-6.9	-9.8
Change in receipts (\$billion)	-6.9	-10.1
Change in payments (\$billion)	0.03	-0.3



Table 5–2 gives an indication of the short-term budget impact of the change in the economy subject to longer adjustment delays. The judgements needed to model this scenario are informed by the 2014–15 Budget Papers sensitivity analysis.

Table 5–2 shows that a permanent 10 per cent decrease in the terms of trade relative to the 2014–15 Budget baseline could reduce the underlying cash balance by as much as \$9.8 billion or 0.6 per cent of GDP in 2015–16. Depending on the speed of economic adjustment, this impact could persist for several years and affect the level of government debt and future debt servicing costs.



# Appendix A – Technical notes

This appendix details the modelling methodology used in the report, including the key assumptions, the main economic parameters and the details of the models used to produce the fiscal outcomes.

## Key assumptions

The following are the key assumptions underpinning the scenarios.

- Measures in the 2014–15 Budget are included in the baseline projection to 2024–25, and in the modelling methodology for payments and receipts. No further policy decisions are incorporated in the modelling, including measures announced after the 2014–15 Budget.
- The impact of the scenario deviations on payments and receipts are based on the modelling methodology outlined below, with no additional judgement applied to the results.
- The population projections (including the age structure) used in the scenarios are the baseline projections.
- Second-round behavioural effects are not modelled, unless otherwise specified.

The projection for receipts is based on the 2014–15 Budget ‘no tax cap’ scenario as the scenarios presented in this report do not attempt to model policy changes but rather the implications for the budget of changes in economic parameters.

The modelling of receipts in this report is undertaken on an individual revenue head basis in all scenarios. To apply the 23.9 per cent tax cap to the scenarios would require the details of the tax adjustments to revenue heads to achieve the tax cap.

In the absence of this information, the results were produced using projections of receipts on a ‘no tax cap’ basis. These results were tested by applying the tax cap to total tax receipts for all scenarios and the impacts of the scenarios on the underlying cash balance and net debt were found to not change significantly under the tax cap. The impact of the economic shocks on GDP are assumed to be the same whether or not the tax cap is applied. The average tax rate would be lower under a tax cap but not sufficiently so to significantly offset the change in tax receipts resulting from the impact of the scenarios on GDP.

## Economic parameters

The six mutually exclusive and non-additive scenarios in this report are based on permanent changes to the economy which impact on key economic parameters and therefore fiscal outcomes.

The modelling approach involves varying the labour productivity growth rate, the labour force participation rate and the terms of trade, to produce six alternative economic scenarios over the medium term.

The six economic scenarios are used to assess the impacts on the federal budget. While the impacts on the budgets of the States and Territories are not modelled, the economic scenarios would also have implications for the medium-term fiscal positions of States and Territories.

The six alternative economic scenarios produce the alternative economic parameters used to produce the fiscal outcomes in the report. The main economic parameters are reported in Table A–1.

**Table A–1: Main economic parameters used to produce fiscal outcomes**

Major components of GDP	Other economic parameters
<p><b>GDP (Income)</b></p> <ul style="list-style-type: none"> <li>• Compensation of employees (COE)</li> <li>• Gross operating surplus (Financial and non-financial corporations) (GOS)</li> <li>• Gross mixed income</li> <li>• GOS from dwellings owned by persons</li> <li>• Taxes less subsidies on production</li> </ul> <p><b>GDP (Expenditure)</b></p> <ul style="list-style-type: none"> <li>• Consumption</li> <li>• Gross fixed capital formation (investment) <ul style="list-style-type: none"> <li>– dwellings</li> <li>– non-dwelling construction</li> <li>– machinery and equipment</li> <li>– other business investment</li> </ul> </li> <li>• Exports</li> <li>• Imports</li> </ul>	<ul style="list-style-type: none"> <li>• Unemployment rate</li> <li>• Consumer price index (CPI)</li> <li>• Wage price index (WPI)</li> <li>• House price index</li> <li>• Interest rates</li> <li>• Dividend receipts</li> <li>• Average weekly earnings (AWE)</li> <li>• Male total average weekly earnings (MTAWE)</li> <li>• Exchange rate (AUD/USD)</li> </ul>

## Broad methodology

Figure A–1 summarises the process of constructing the six economic scenarios as deviations from the baseline, and how these economic scenarios generate the fiscal impacts.

### Step 1: Extending the 2014–15 Budget economic parameters to the medium term

The baseline used in this report is based on 2014–15 Budget forecasts and projections ('2014–15 Budget parameters' in Figure A–1). It is constructed using economic parameters consistent with the 2014–15 Budget projections for the underlying cash balance, net debt, receipts and payments, including the components of receipts and payments.

Medium-term projections which underpin the 2014–15 Budget forecasts and projections include real and nominal GDP growth, labour productivity growth, employment growth, the labour force participation rate, unemployment, compensation of employees and gross operating surplus.

The budget assumptions are applied to a National Accounts data framework to produce medium-term projections of the parameters that are relevant for projecting payments and receipts.

### Step 2: Deviations from the medium-term baseline

Deviations refer to the impact on the baseline parameters under the six different economic scenarios. The PBO commissioned Independent Economics to produce the economic parameter deviations using its Independent Macro-econometric Model. The Independent Economics report is available on the PBO website.

The Independent Economics model captures both the short-term and long-term effects of the specified variations in the input parameters. It also captures the impacts of the scenario deviations on businesses in different industries and on households and allows for structural adjustments to take place.

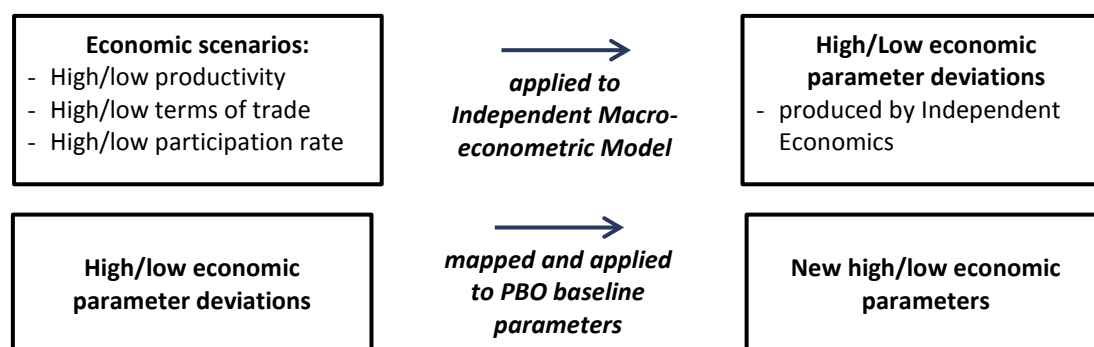
The scenarios in the report begin in 2014–15 and for each year to 2024–25, Independent Economics provided the PBO with the deviations of the key economic parameters. These economic deviations are mapped and applied to the PBO baseline economic parameters produced in Step 1 to create new economic parameters under each of the six scenarios.

**Figure A–1: Broad methodology for producing fiscal outcomes for alternate economic scenarios**

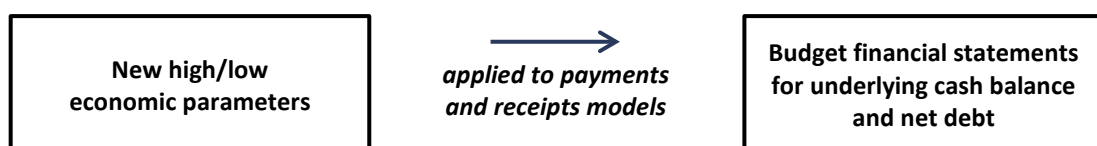
Step 1: Extending the 2014–15 Budget economic parameters to the medium term



Step 2: Deviations from the medium-term baseline



Step 3: Budget outcomes in alternate scenarios



### Step 3: Budget outcomes in alternate scenarios

The final step is to incorporate the new economic parameters into the payments and receipts models to produce alternate budget projections under each scenario. These scenario budget projections can be compared to the medium-term baseline for the budget.

## Methodology for modelling payments and receipts

The report uses payments and receipts models based on frameworks provided to the Parliamentary Budget Office by the Treasury, Department of Finance and other Commonwealth agencies. Some of the frameworks have been further adjusted by the PBO to better capture the change in relevant economic variables arising under the different economic scenarios.

Growth in receipts from different taxes is determined by the size of the relevant tax base which is affected by economic drivers such as nominal GDP, wages and profits. Payments growth, on the other hand, is determined by indexation rules and client numbers, in the case of transfer payments such as pensions and unemployment benefits or, in the case of government services such as aged care, health and education, by change in the cost of the service provided. Second-round effects such as behavioural changes regarding take-up of government benefits are not captured in the modelling, unless otherwise specified.

Table A–2 shows payments and receipts which are modelled and those that are not modelled. For payments and receipts which are modelled, the PBO has captured the impact of the deviations in the economic parameters in the six scenarios. Payments which have not been modelled remain at their medium-term baseline projections.

Other payments, which are approximately 15 per cent of total payments, comprise those payments not individually modelled. As a simple assumption (consistent with previous Intergenerational Report modelling) these are projected to grow with nominal GDP. The PBO is investigating the options for modelling this category of payments for future work.

Tables that provide a breakdown of the fiscal impact of each scenario are available with this report on the PBO website.

**Table A–2: Payments and receipts modelled**

Payments		Receipts
Modelled	Not modelled <sup>1</sup>	Modelled
<b>Health</b> <ul style="list-style-type: none"> <li>• Medicare Benefits Schedule</li> <li>• Pharmaceutical Benefits Scheme</li> <li>• Other</li> </ul>	Government superannuation expenses	Individuals and other withholding taxes <ul style="list-style-type: none"> <li>• Pay As You Go</li> <li>• Other individuals</li> <li>• Refunds</li> </ul>
<b>Education</b> <ul style="list-style-type: none"> <li>• Schools funding</li> <li>• Higher education</li> <li>• Vocational education and training (VET)</li> </ul>	Future fund expenses	Company tax
Age Pension	Infrastructure investment programme	Superannuation fund taxes
<b>Income Support</b> <ul style="list-style-type: none"> <li>• Unemployment allowances</li> <li>• Parenting payment</li> <li>• Austudy and youth allowance</li> <li>• Disability support pension</li> <li>• Carers payment and allowance</li> <li>• Wife pension</li> </ul>	Defence spending	Customs and excise
<b>Family Support</b> <ul style="list-style-type: none"> <li>• Child care benefit and child care tax rebate</li> <li>• Paid parental leave</li> </ul>		Petroleum resource rent tax
Aged Care		Wine equalisation tax
Official Development Assistance (ODA)		Luxury car tax
National Disability Insurance Scheme (NDIS)		Fringe benefits tax <sup>3</sup>
Public Debt Interest		Agricultural levies <sup>3</sup>
Other payments <sup>2</sup>		Other taxes <sup>3</sup>
		Non-tax receipts

<sup>1</sup> Payments which are not modelled mainly include discretionary spending items and they are assumed to be constant in all six scenarios.

<sup>2</sup> These payments are adjusted with changes in nominal GDP.

<sup>3</sup> These receipts are adjusted with changes in nominal GDP.

The main economic parameters associated with each of the payment and receipts models are outlined in Table A–3 and Table A–4.

**Table A–3: Payment models**

Model	Definition	Main economic parameters <sup>7</sup>
Health	Includes the Medicare Benefits Schedule (MBS), Pharmaceutical Benefits Scheme (PBS), Hospitals, Private Health Insurance Rebate (PHI) and Other	MBS, Hospitals, PHI and PBS generic drugs spending are adjusted by CPI
Education	Includes funding for schools (government and non-government), VET and higher education	CPI
Age Pension	Includes the Age Pension (full- and part-), Pension supplement and Rent Assistance	MTAWE, CPI, participation rate
Unemployment Allowances	Includes the Newstart Allowance and Youth Allowance (other)	CPI, number of unemployed persons
Parenting Payment Partnered	Parenting Payment Partnered is for partnered parents with children up to the age of six	CPI, number of unemployed persons
Parenting Payment Single	Income and asset tested payment for single parents with children up to the age of eight	CPI
Austudy and Youth Allowance	Includes Austudy and Youth Allowance for students	CPI
Disability Support Pension	Income support for the disabled	CPI
Carer Payment and Wife Pension	Income support for carers. Wife Pension is no longer open to new recipients	AWE, CPI (after 2016–17, indexation changes from AWE to CPI)
Carers Allowance	Supplementary payment for carers	CPI
Family Tax Benefit	Part A and Part B	CPI
Child Care Benefit	Assistance for costs of child care	CPI
Child Care Rebate	A 50 per cent rebate for out-of-pocket child care costs for approved care up to the annual limit (ie costs on top of the child care benefit)	AWE

<sup>7</sup> These are the economic parameters adjusted in each scenario in this report.



Model	Definition	Main economic parameters <sup>7</sup>
Paid Parental Leave	Paid parental leave scheme (26 weeks paid leave at mother's wage), capped at \$100,000 per annum	AWE
Aged Care	Includes services and programmes in assistance to the aged, such as residential and flexible care, home care and home support	CPI, AWE
Official Development Assistance including regional resettlement	Spending on foreign aid	CPI from 2016–17 onwards
NDIS	Includes Tier 3 and Tier 2 of the NDIS and operating costs of the National Disability Insurance Agency	CPI, AWE
Public Debt Interest	Interest paid on Commonwealth Government Securities (CGS) on issue	10 year bond rate
Higher Education Loan Programme (HELP) (balance sheet model)	Income contingent loans to tertiary students to defer costs of tuition	CPI, 10 year bond rate, Higher Education Grants Index (for 2014 and 2015 only)

**Table A–4: Receipts models**

Model	Definition	Main economic parameters
Gross income tax withholding and gross other individuals and refunds	These revenue heads broadly cover all personal income tax. The PBO has modelled revenue from salary and wages, the Medicare Levy and Medicare Levy Surcharge, including personal income tax offsets, income from profits from unincorporated businesses, primary production and investment activities, as well as capital gains	Compensation of employees (COE), other business income, interest and non dwelling rent, dividend receipts, nominal GDP, Other business income: GOS, Primary producer realised income: GOS, realised rental income, CPI, and AWE
Company tax	Tax on profits of incorporated businesses	Gross operating surplus in mining, finance and other sectors

Model	Definition	Main economic parameters
Superannuation fund taxes	Tax on super fund contributions and investment earnings of Australian Prudential Regulation Authority funds and self-managed super funds	COE, nominal GDP, dividend receipts, realised rental income, rate of return on cash (90 day bank bills)
Customs and excise	Includes customs duties on textile, clothing and footwear; passenger motor vehicles and other imports; and excise and customs duties on tobacco and alcohol (except wine, for which WET applies)	Imports of textiles, clothing and footwear; non-industrial transport equipment and other endogenous good; private consumption of alcohol; private consumption of cigarettes, CPI
Petroleum Resources Rent Tax (PRRT)	Tax on profits from sales of petroleum products	Oil price (Malaysian Tapis) and exchange rate
Goods and services tax (GST)	Indirect tax on consumption subject to GST, including private dwelling investment and associated ownership transfer costs	Consumption subject to GST, private dwelling investment, ownership transfer costs
Wine equalisation tax (WET)	A value-based tax on wine consumed in Australia	Private consumption of alcohol (volume measure)
Luxury car tax	A tax on luxury cars sold or imported, where their value exceeds a threshold	Motor vehicle sales, motor vehicle price indicator
Total fuels	Excise on production of fuels, accounting for reintroduction of CPI indexation	Private consumption of fuel, real GDP, CPI
Non-tax receipts	Includes interest and dividend earnings, NDIS contributions from the States and Territories, sale of non-financial assets, and other non-tax receipts	Nominal GDP for the sale of non-financial assets and other non-tax receipts components. HELP interest and NDIS contributions components are adjusted by the parameters relevant to these models as listed above Dividend earnings and interest receipts (except HELP interest) are assumed to be constant for all six scenarios

# Appendix B – Comparisons with other sensitivity analyses

## The budget forward estimates and medium-term projections

### Benefits of medium-term projections and associated sensitivity analysis

Medium-term projections of the fiscal outlook help to identify progress on fiscal sustainability. Understanding the profile and composition of both payments and receipts trends over the forward estimates and the medium term is important to assess the sustainability of the budget and trade-offs explicitly and implicitly being made by governments.

Greater transparency of the medium-term budget projections enhances the consideration of the longer-term implications of fiscal policy decisions. In addition, fuller disclosure of the financial impact over time for expenditure and revenue measures provides Parliament and the public with better information about budget realities and priorities.

Medium-term fiscal projections also provide the basis to consider the sensitivity of these benchmark projections to exogenous ‘shocks’ to underlying economic and other (demographic) parameters. Sensitivity analysis allows for identification of the robustness of the medium-term fiscal position to different scenarios regarding specific risks and opportunities. In turn, this analysis can assist policymakers to adjust fiscal policy settings early to avoid sudden and dramatic policy changes in the future.

The benefits of medium-term fiscal projections need to be tempered by the uncertainty associated with the accuracy of these projections because, as the forecast horizon is lengthened, the uncertainty associated with economic and fiscal parameters increases. This uncertainty is handled by providing margins of error (or statistical confidence intervals) associated with the medium-term projections, or by undertaking sensitivity analysis.

### The approach to sensitivity analysis in the 2014–15 Budget

In recent years the ‘forward estimates’ system of budgeting in Australia has been augmented by publication of medium-term projections for selected budget aggregates, as well as longer-term projections in the Intergenerational Report (Australian Government, 2010).

The 2014–15 Budget Papers include medium-term projections of total payments, tax receipts, the underlying cash balance and financial aggregates such as net debt, to 2024–25 (Australian Government, 2014). The Budget Papers, however, provide minimal information on how these medium-term projections have been constructed.

The 2014–15 Budget Papers also include a sensitivity analysis of the short-term budget estimates to changes in key economic parameters<sup>8</sup>. The short-term sensitivity analysis included in the 2014–15 Budget Papers focuses on two scenarios:

- Scenario one: a 1 per cent reduction in nominal GDP caused by a permanent fall in the terms of trade.
- Scenario two: a 1 per cent increase in real GDP caused by an equal permanent contributing rise in labour productivity and labour force participation.

The scenarios' focus on the terms of trade, labour productivity and labour force participation reflects the importance of these three parameters in driving Australia's national income and their significance for the budget.

Under scenario one, a permanent mining commodity price decline consistent with a decline of 1 per cent in nominal GDP by 2015–16 decreases the underlying cash balance by around \$2.6 billion in 2014–15 and by around \$5.4 billion in 2015–16.

- This result is primarily driven by estimated declines in receipts – particularly company tax where lower nominal GDP results in lower company profits.

Under scenario two, a 1 per cent rise in real GDP due to labour productivity and labour force participation improvements results in the underlying cash balance improving by \$3.1 billion in 2014–15 and by \$3.8 billion in 2015–16. Underpinning these results, individuals' and company tax are the main contributors to stronger receipts while on the payments side, higher consumption leads to an increase in GST receipts passed on to the States and Territories.

In addition, the Budget Papers include a largely qualitative analysis of the sensitivity of the balance sheet to economic and fiscal risks.

### **Limitations of the Budget Papers sensitivity analysis**

There are a number of limitations with the sensitivity analysis in the Budget Papers:

- As acknowledged in the paper itself, each scenario is 'partial' in that it assumes no change in the exchange rate - hence representing a 'rule of thumb' indication of the impact on receipts, payments and the underlying cash balance. Exchange rate changes would mute the positive/negative impacts under each scenario. Hence, the analysis does not capture the 'economic feedback' related to changes in the exchange rate.
- The sensitivity analysis covers only the impact of the exogenous shocks in the current budget year and one-year ahead. Yet for a *permanent* change in the economic variables, the impact on the budget is expected to be long-lasting and it would be informative to identify the likely dynamic impact over the medium term.
- The sensitivity analysis of the balance sheet to economic and fiscal risks is largely qualitative with no quantitative estimates of how balance sheet components would vary as a result of the various economic and fiscal risks materialising.

---

8 Appendix A of 2014–15 Budget Statement 3 provides an analysis of the sensitivity of the budget to economic parameters.

## International practice with sensitivity analysis of medium-term fiscal projections

The Review of Treasury Macroeconomic and Revenue Forecasting (Australian Government, 2012) highlighted the value of scenario analysis as a useful way of assessing the risks around the economic and revenue forecasts. It is informative to compare the approach to sensitivity analysis presented in this report with practices internationally.

### Canada

The Canadian Government's annual budget publication discusses risks to the economic outlook and, to help quantify these risks, it illustrates the sensitivity of the budget balance to a number of economic shocks (Canada Government, 2014). In the latest publication, these shocks are:

- a one-year, 1 percentage point decrease in real GDP growth driven equally by lower productivity and employment growth
- a decrease in nominal GDP growth resulting solely from a one-year, 1 percentage point decrease in the rate of GDP inflation (assuming that the CPI moves in line with GDP); and
- a sustained 100-basis-point increase in all interest rates.

Similar to the United States and Australia, the sensitivity results are generalised as being 'rules of thumb' that are intended to provide a broad illustration of the impact of economic shocks on the outlook for the budget balance. Unlike the Australian budget papers that present sensitivity estimates for only the current budget year and one-year ahead, the Canadian publication includes estimated impacts over five years.

The Canadian Parliamentary Budget Office prepares an economic and fiscal outlook that includes its own economic projections, five year fiscal projections and estimates of the structural budget balance (Canada Parliamentary Budget Office, 2014a). On the basis of this economic and fiscal outlook, the Canadian Parliamentary Budget Office produces, on an annual basis, a report on long-term fiscal sustainability (Canada Parliamentary Budget Office, 2014b).

Sensitivity analysis is also conducted and presented in the fiscal sustainability reporting. To assess the sensitivity of the 75-year baseline fiscal gaps and other fiscal projections (and to highlight the uncertainty associated with these projections), the Canadian Parliamentary Budget Office tests a number of alternative demographic, economic, and policy assumptions. The scenarios chosen in the latest fiscal sustainability report for 2013 include:

- older (higher cost) and younger (lower cost) demographic projections
- alternative economic growth and interest rate projections
- alternative enrichment growth in elderly benefits; and
- alternative excess cost growth in health spending.

## **New Zealand**

The New Zealand budget papers also analyse the implications of risks to economic and other parameters over a five year period (New Zealand Government, 2014). The latest budget update examines two scenarios:

- a larger decline in the terms of trade than in the main (or baseline) forecast; and
- a more robust domestic demand cycle driven by a stronger migration cycle.

While the estimated impact of these two scenarios is discussed in some detail, the sensitivity of the overall budget balance to ‘small changes’ in other specific variables is also briefly documented. In addition, similar to the Australian budget papers, there is a qualitative discussion of balance sheet risks.

The New Zealand Treasury also produces long-term (40 or more years) fiscal projections every four years examining the long-term fiscal position and sustainability. The latest formal statement presents projections for government expenses, revenue and net debt as a percentage of nominal GDP to 2060 (New Zealand Treasury, 2013a).

In the discussion of New Zealand’s growing fiscal sustainability challenge, the formal statement explores options to address the challenge: the government taxing more; the government cutting spending; and the government responding to population ageing by adjusting the scope and eligibility criteria for NZ Super. Each option is explored through presentation of alternative growth scenarios for fiscal indicators as well as potential policy responses.

A background paper published by the New Zealand Treasury accompanying the latest formal statement provides detail on the modelling approach, the assumptions behind the projections, and the sensitivities around the assumptions used (New Zealand Treasury, 2013b). This clearly enables a reader to understand the modelling framework and the explicit approach used in arriving at economic, demographic and other parameters used to produce the revenue, expense and aggregate fiscal projections. The New Zealand Treasury outlines how variations in economic, demographic and fiscal assumptions might change the projections by presenting the deviations from baseline at 10 year intervals as well as year by year.

## **United Kingdom**

The Office for Budget Responsibility (OBR) has responsibility for producing the official five-year forecasts for the economy and public finances that were previously produced by Her Majesty’s Treasury twice a year. The UK budget papers therefore focus on a summary of the economic and fiscal forecasts and progress against the fiscal mandate to achieve cyclically-adjusted current balance by the end of the rolling five-year forecast period. The papers also have a discussion of the longer-term debt challenge facing the UK, including the impact of different levels of public sector borrowing on the path of debt from 2018–19 to 2035–36 for selected illustrative scenarios (HM Treasury, 2014).

Similar to other jurisdictions, the OBR also publishes a report on an annual basis that assesses fiscal sustainability. The report provides 50-year projections of revenue, spending and financial indicators such as net debt based on ‘central’ assumptions (Office for Budget Responsibility, 2014).

Alternative assumptions to the central case are also explored. The results of the projections are discussed in some detail, including identifying the contribution from the key drivers of the expenditure and revenue trends.

In addition, the sensitivities of the central projections are tested using a number of different scenarios. The sensitivity test scenarios are around long-term interest rates being higher relative to economic growth; weaker long-term productivity growth; an older age structure of the population; or if net inward migration, which is concentrated among people of working age, was lower than the central projection.

Given the significant role of health expenditure in the overall consequences of ageing of the population, the sensitivity analysis is further extended to consider differential productivity growth in the health sector relative to the rest of the economy.

### United States

The United States Government annual budget publication provides a decade of economic projections and a discussion of how these projections differ to those produced by the Federal Reserve's Open Market Committee, the Congressional Budget Office (CBO) and a consensus of US business economists (United States Government, 2014). This includes an analysis of past forecast errors dating back to 1982.

Noting the inherent uncertainty of the economic projections, the United States budget publication examines the implications of changes in key economic assumptions. For example, the budget for fiscal year 2015 has a sensitivity analysis over a 10 year period, of the budgetary effects of alternatively 1 per cent lower real GDP growth, 1 percentage point higher rate of inflation and interest rates over different time periods, and the interest cost of higher federal borrowing.

The latest United States annual budget publication notes that:

*Decisions made today can have important repercussions beyond the 10-year horizon. Consequently, it is important to anticipate budgetary requirements beyond the 10-year horizon, and the effects of changes in policy on those requirements, despite the uncertainty surrounding the assumptions needed for such estimates. Long-run budget projections can be useful in drawing attention to potential problems that could become unmanageable if allowed to grow (United States Government, 2014).*

Hence the publication also provides an analysis of budget projections for 75 years through to 2089. The sensitivity of aggregate receipts, outlays, the primary budget balance and federal debt to alternative scenarios regarding health spending, immigration reform and social security payments is examined.

The CBO also annually produces detailed 10-year baseline budget projections on a no policy change basis. These include projections for key outlays and revenues, including outlays broken down into mandatory, discretionary and net interest payments (United States Congressional Budget Office, 2014). Moreover, the CBO provides an informative discussion of the causal factors behind the trends in each of the outlays and revenues.

Separately, building on its medium-term fiscal projections, the CBO publishes a report on the long-term budget outlook that presents its long-term budget projections under the 'extended baseline' for the next 25 years (through to 2039). Moreover, the report includes detailed analysis of the expected long-term trends in the major expenditure and revenue components of the budget.

The medium-term projections produced by the CBO include an analysis of the consequences of a large and growing federal debt and the effects of alternative fiscal policy scenarios. It attempts to incorporate economic feedback – that is, it shows how the budgetary policies that would be in place under the extended baseline would affect the economy in the long run and how those economic effects would, in turn, feed back into the budget.

Second, the CBO analysis shows how the budget and the economy would evolve under three additional sets of fiscal policies: an extended alternative fiscal scenario that would result in larger deficits and more debt than in the extended baseline and two illustrative scenarios that would result in smaller deficits and lower debt.

Unlike the Australian budget papers, the CBO reports not only a central estimate for the outcome of each set of policies but also a likely range, because the magnitude of the economic effects of specified changes in fiscal policies is uncertain. The sensitivity analysis examines the impact of exogenous shocks such as:

- a decline in mortality rates
- changes to the growth rate of total factor productivity
- changes to interest rates on federal debt held by the public; and
- changes to the growth rates of federal spending per beneficiary for Medicare and Medicaid.

Moreover, in contrast to Australia, the sensitivity analysis includes a scenario where all four factors above simultaneously differ from the extended baseline in ways that raise/lower projected budget deficits relative to that baseline.



## References

- Australian Government, 2010. Australia to 2050: future challenges.
- Australian Government, 2012. Review of Treasury Macroeconomic and Revenue Forecasting.
- Australian Government, 2014. 2014–15 Budget Papers, Canberra: Australian Government.
- Banks, G., 2012. Advancing the Reform Agenda: Selected Speeches, Melbourne: Productivity Commission.
- Bean, C., 2000. The Australian Economic 'Miracle': a View from the North. Sydney, Reserve Bank of Australia.
- Bullen, J., Kouparitsas, M. & Krolkowski, M., 2014a. Long-Run Forecasts of Australia's Terms of Trade. Treasury Working Paper, 2014–01.
- Bullen, J., Greenwell, J., Kouparitsas, M., Muller, D., O'Leary, J. & Wilcox, R., 2014b. Treasury's Medium-Term Economic Projection Methodology. Treasury Working Paper, 2014–02.
- Canadian Parliamentary Budget Officer, 2014a. Economic and Fiscal Outlook.
- Canadian Parliamentary Budget Officer, 2014b. Fiscal Sustainability Report 2014.
- Carmody, C., 2013. Slowing Productivity Growth - A Developed Economy Perspective. Treasury Economic Roundup, Issue 2.
- D'Arcy, P. & Gustafsson, L., 2012. Australia's Productivity Performance and Real Incomes. RBA Bulletin, June Quarter.
- Garnaut, R., 2005. Breaking the Australian Great Complacency of the Early Twenty First Century. Melbourne, Economic and Social Outlook Conference.
- Government of Canada, 2014. The Road to Balance: Creating Jobs and Opportunities.
- Gruen, D., 2014a. After the Resources Investment Boom: Seamless Transition or Dog Days?, Speech to Australian Conference of Economists, Hobart, 3 July 2014.
- Gruen, D., 2014b. The Implications of Economic and Financial Trends and Globalisation for the Demand and Supply of Skills. Sydney, Australian Workforce and Productivity Agency/ASSA Scenario Development Forum.
- HM Treasury, 2014. Budget 2014.
- International Monetary Fund, 2006. Australia: Selected Issues (IMF Country Report No. 06/373), Washington: International Monetary Fund.
- International Monetary Fund, 2014. World Economic Outlook, April 2014, Washington: International Monetary Fund.
- New Zealand Government, 2014. Budget Economic and Fiscal Update.
- New Zealand Treasury, 2013a. Affording Our Future: Statement on New Zealand's Long-term Fiscal Position.
- New Zealand Treasury, 2013b. Long-term Fiscal Projections: Reassessing Assumptions, Testing New Perspectives, Background Paper for the 2013 Statement on the long-term fiscal position.

- Office for Budget Responsibility, 2014. Fiscal Sustainability Report.
- Organisation for Economic Cooperation and Development (OECD), 2012. OECD Economic Surveys: Australia, Paris: OECD.
- Parham, D., 2012. Australia's Productivity Growth Slump: Signs of a Crisis, Adjustment or Both?, Melbourne: Productivity Commission.
- Parkinson, M., 2014. Challenges and Opportunities for Australia over the Next Decade. Perth, Association of Mining and Exploration Companies Convention.
- Parliamentary Budget Office, 2014a. Trends in Australian Government Receipts: 1982–83 to 2012–13, Canberra: Parliamentary Budget Office.
- Parliamentary Budget Office, 2014b. Projections of Government Spending over the Medium Term, Canberra: Parliamentary Budget Office.
- Productivity Commission, 1999. Microeconomic Reforms and Australian Productivity: Exploring the Links, Canberra: AusInfo.
- Productivity Commission, 2013. PC Productivity Update: May 2013, Melbourne: Productivity Commission.
- Stapledon, N., 2012. Australia's Major Terms of Trade and Resource Shocks, 1800–2012. Canberra, Conference on Commodity Price Volatility, Past and Present.
- Topp, V.; & Kulys, T., 2012. Productivity in Electricity, Gas and Water: Measurement and Interpretation, Melbourne: Productivity Commission.
- Topp, V., Soames, L., Parham, D. & Bloch, H., 2008. Productivity in the Mining Industry: Measurement and Interpretation, Melbourne: Productivity Commission.
- Tressel, T., 2008. Does Technological Diffusion Explain Australia's Productivity Performance? IMF Working Paper Series.
- United States Congressional Budget Office, 2014. The 2014 Long-Term Budget Outlook.
- United States Government, 2014. Fiscal Year 2015 Analytical Perspectives: Budget of the U.S. Government.



[www.pbo.gov.au](http://www.pbo.gov.au)