

Attachment A

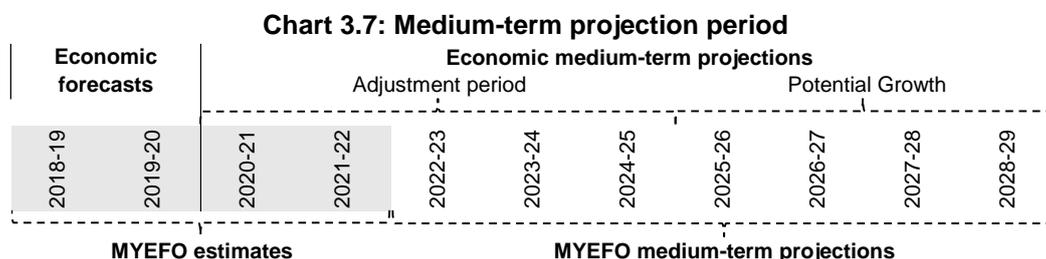
FORECAST UNCERTAINTIES, SENSITIVITIES AND SCENARIOS

Overview

Macroeconomic and fiscal forecasts are important for Government policy and decision making. The macroeconomic and fiscal forecasts in the MYEFO are based on information available at the time of preparation, which also informs assumptions and judgments. Better forecasting and a better understanding of the uncertainties around the forecasts contribute to better policy and decision making.

This Attachment assesses the historical performance of budget forecasts and estimates of uncertainty around these forecasts. This assessment is consistent with the practice of other fiscal agencies to improve forecasting performance and to raise awareness of the uncertainties inherent in forecasting.

The fiscal estimates presented in the MYEFO are underpinned by short-term economic forecasts for the budget year and the subsequent financial year, and economic projections for the following two years. These four years are followed by medium-term projections for seven additional years to provide an indication of the longer term fiscal trajectory. The projections are prepared using a medium-term projection methodology, which means that they are sensitive to the underlying assumptions. (Chart 3.7)



Source: Treasury.

This Attachment also presents an analysis of the sensitivity of 2018-19 MYEFO estimates to changes in key assumptions as required under the *Charter of Budget Honesty Act 1998*. It also provides sensitivity analysis of the medium-term projections.

CONFIDENCE INTERVALS AROUND ECONOMIC AND FISCAL FORECASTS

Measures of uncertainty around economic forecasts

The Government's macroeconomic forecasts are prepared using a range of modelling techniques including macro-econometric models, spreadsheet analysis and accounting frameworks. These are supplemented by survey data, business liaison, professional opinion and judgment.

Part 3: Fiscal strategy and outlook

Forecasts are subject to inherent uncertainties. Generally, these uncertainties tend to increase as the forecast horizon lengthens. Forecast errors (the differences between forecasts and outcomes) can arise for a range of reasons – for example, differences between the assumed path of key variables and outcomes, changes in the relationships between different parts of the economy and unexpected events.

Confidence intervals seek to illustrate that there is a range of plausible outcomes around any forecast. Confidence intervals are based on observed historical patterns of forecast errors. They are a guide to the degree of uncertainty around a forecast and can span a wide range of outcomes.

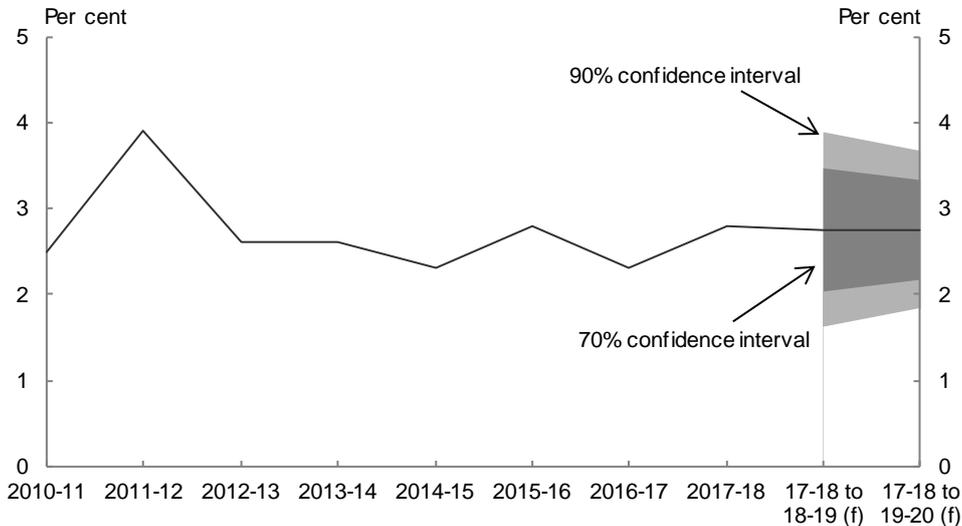
Real GDP forecasts

Real GDP forecasts in the MYEFO factor in a number of key assumptions including exchange rates, interest rates and commodity prices. The forecasts also incorporate judgments about how developments in one part of the Australian economy affect other parts and how the domestic economy is affected by events in the international economy.

The accuracy of the forecasts depends on the extent to which the assumptions and judgments underpinning them prove to be correct – and also the reliability of the economic relationships embodied in the macroeconomic models used to produce them. Forecast errors for real GDP can also be caused by unexpected shifts in the pace and nature of economic activity during the forecast period.

Chart 3.8 shows that the average annualised growth rate in real GDP in the two years to 2019-20 is expected to be around $2\frac{3}{4}$ per cent, with the 70 per cent confidence interval ranging from $2\frac{1}{4}$ to $3\frac{1}{4}$ per cent. In other words, if forecast errors are similar to those made over recent years, there is a 70 per cent probability that the growth rate will lie in this range.

Chart 3.8: Confidence intervals around real GDP growth rate forecasts



Note: The central line shows the outcomes and the 2018-19 MYEFO forecasts. Annual growth rates are reported for the outcomes. Average annualised growth rates from 2017-18 are reported for 2018-19 onwards. (f) are forecasts. Confidence intervals are based on the root mean squared errors (RMSEs) of MYEFO forecasts from 1998-99 onwards, with outcomes based on September quarter 2018 National Accounts data.

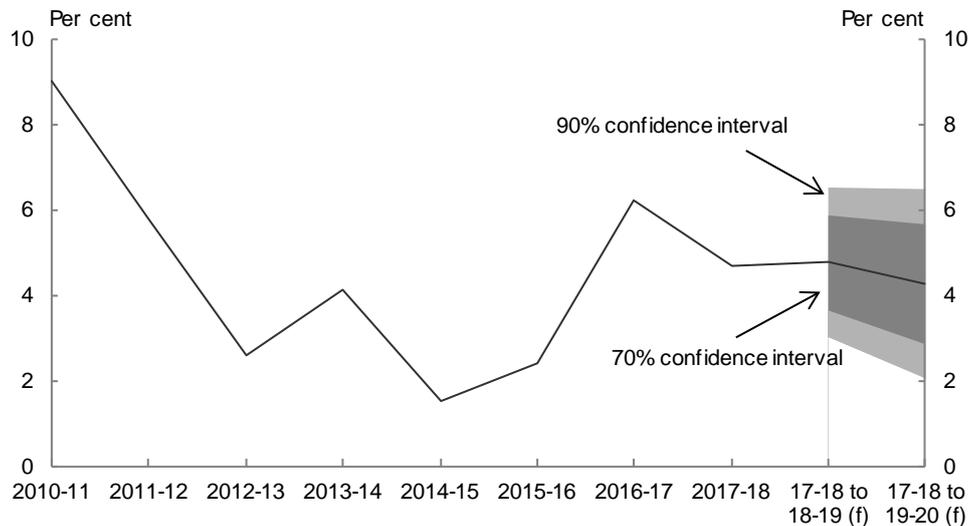
Source: ABS cat. no. 5206.0, Budget papers and Treasury.

Nominal GDP forecasts

Compared with real GDP forecasts, nominal GDP forecasts are subject to additional sources of uncertainty from the evolution of domestic prices and wages, and world prices for Australia's exports, including commodities. Difficulty in predicting their movements, particularly global commodity prices, has been the primary driver of nominal GDP forecast errors over the past decade. This additional uncertainty is reflected in the wider confidence intervals around nominal GDP forecasts.

Chart 3.9 shows average annualised growth in nominal GDP in the two years to 2019-20 is expected to be around 4¼ per cent, with the 70 per cent confidence interval ranging from 2¾ to 5¾ per cent.

Chart 3.9: Confidence intervals around nominal GDP growth rate forecasts



Note: See note to Chart 3.8.

Source: ABS cat. no. 5206.0, Budget papers and Treasury.

Measures of uncertainty around fiscal forecasts

The fiscal estimates contained in the 2018-19 MYEFO are based on economic and demographic forecasts and projections as well as estimates of the impact of government spending and revenue measures. Changes to the economic or demographic forecasts and projections underlying the estimates will affect forecasts for receipts and payments. As such, this will have a direct impact on the profile of the underlying cash balance and government debt. Even small movements in these economic forecasts and projections or outcomes that differ from the forecasts and projections can result in large changes to budget estimates.

Receipts

The Government's tax receipts estimates are generally prepared using a 'base plus growth' methodology. The last known outcome (2017-18 for the 2018-19 MYEFO) is used as the base to which estimated growth rates are applied, resulting in tax receipts estimates for the current and future years. Estimates for the current year also incorporate recent trends in tax collections.

Over the past two decades, tax receipts forecasts have both under-predicted and over-predicted outcomes (Chart 3.10). The 2017-18 growth in tax receipts well exceeded the forecast estimate.

Chart 3.10: Budget forecasts of tax receipts growth

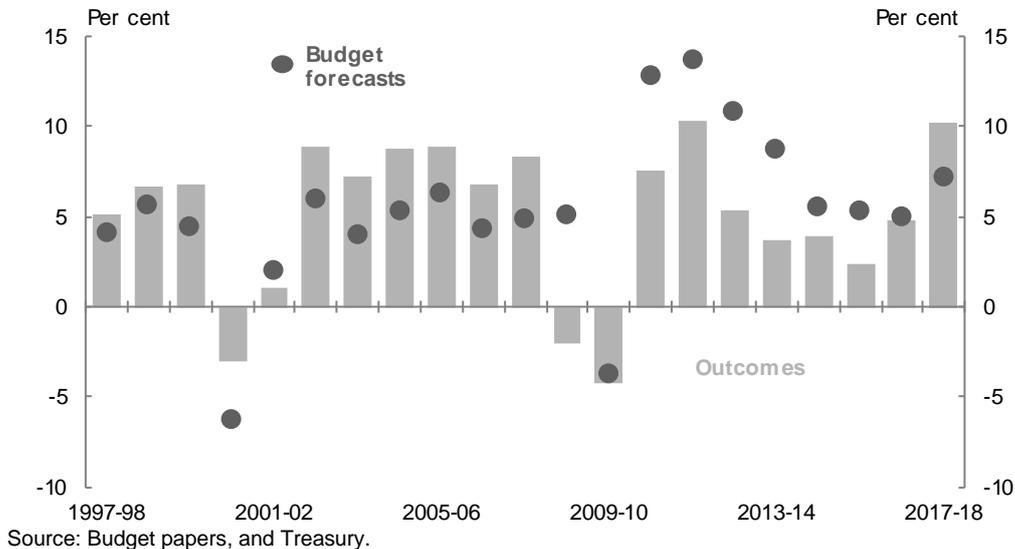
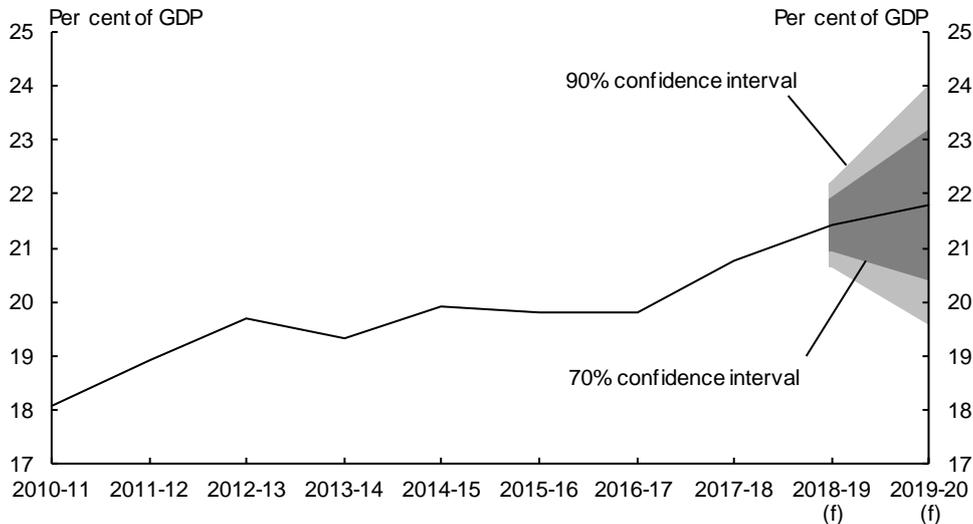


Chart 3.11 shows confidence intervals around the forecasts for receipts (excluding GST¹ and including Future Fund earnings). Confidence intervals constructed around the receipts forecasts exclude historical variations caused by subsequent policy decisions. These intervals take into account errors caused by parameter and other variations in isolation.

The chart shows that there is considerable uncertainty around receipts forecasts and that this uncertainty increases as the forecast horizon lengthens. It suggests that in 2018-19, the width of the 70 per cent confidence interval for the 2018-19 MYEFO receipts forecast is approximately 1.0 per cent of GDP (\$20 billion) and the 90 per cent confidence interval is approximately 1.6 per cent of GDP (\$31 billion).

¹ GST was not reported as a Commonwealth tax in budget documents prior to the 2008-09 Budget. As a result, GST data have been removed from historical receipts and payments data to abstract from any error associated with this change in accounting treatment.

Chart 3.11: Confidence intervals around receipts forecasts



Note: The central line shows the outcomes and the 2018-19 MYEFO point estimate forecasts. Confidence intervals use RMSEs for MYEFO forecasts from the 1998-99 MYEFO onwards. (f) are forecasts.

Source: Treasury.

Payments

Payments outcomes can differ from forecasts for a number of reasons. Demand-driven programs, such as payments to individuals and some social services, form the bulk of government expenditure. Forecasts of payments associated with many of these government programs depend on forecasts of economic conditions. For example, lower than forecast unemployment levels will mean that expenditure on related services, including allowances, will be lower than forecast.

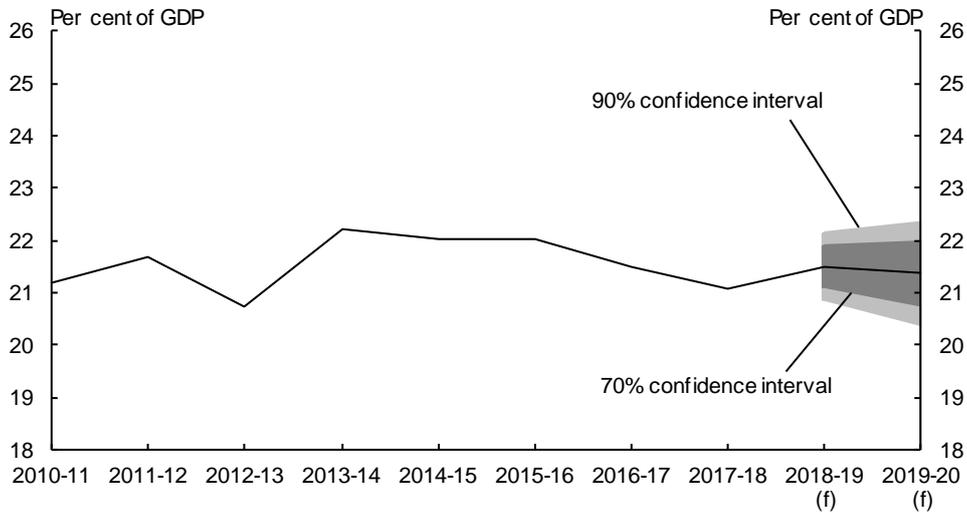
Chart 3.12 shows confidence intervals around payments forecasts (excluding GST). As with receipts estimates, historical policy decisions are excluded², and future policy decisions are out of scope. Payments estimates include the public debt interest impact of policy decisions.³

The chart shows that there is moderate uncertainty around payments forecasts. In 2018-19, the width of the 70 per cent confidence interval for the 2018-19 MYEFO payments forecast is approximately 0.8 per cent of GDP (\$16 billion) and the 90 per cent confidence interval is approximately 1.3 per cent of GDP (\$26 billion).

² The allowance for historical policy includes only new policy decisions made at each update. No allowance is made for other decisions, such as assistance for the impact of natural disasters or changes to the timing of projects announced in previous updates. These decisions will contribute to historical forecast errors and therefore increase the size of the confidence intervals around payments.

³ The impacts of past policy decisions on historical public debt interest through time cannot be readily identified or estimated. For this reason, no adjustment has been made to exclude these impacts from the analysis.

Chart 3.12: Confidence intervals around payments forecasts



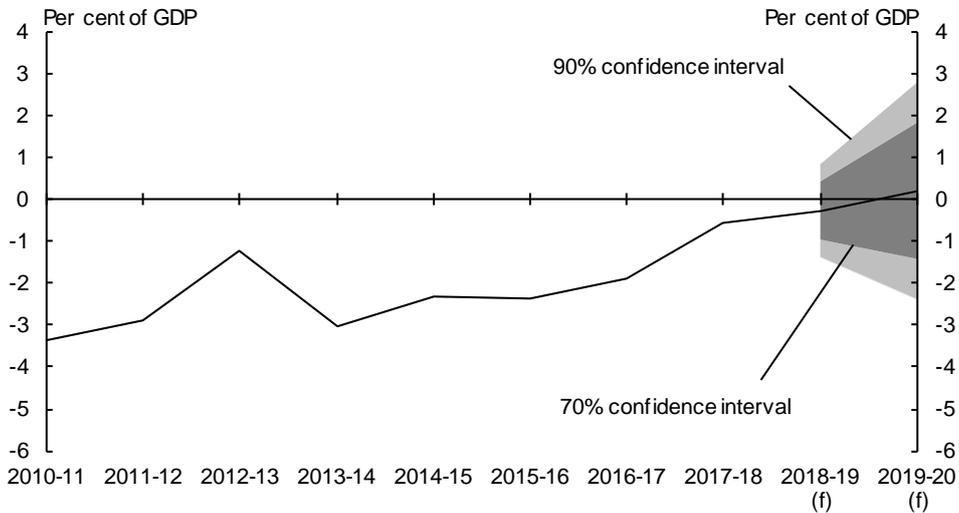
Note: See note to Chart 3.11.
Source: Treasury.

Underlying cash balance

The underlying cash balance estimates are sensitive to the same forecast errors that affect estimates of receipts and payments. Confidence interval analysis shows that there is considerable uncertainty around the underlying cash balance forecasts (Chart 3.13).

In 2018-19, the width of the 70 per cent confidence interval for the 2018-19 MYEFO underlying cash balance forecast is approximately 1.4 per cent of GDP (\$27 billion) and the 90 per cent confidence interval is approximately 2.2 per cent of GDP (\$43 billion). In line with receipts forecasts, uncertainty increases over the estimates period.

Chart 3.13: Confidence intervals around the underlying cash balance forecasts



Note: See note to Chart 3.11.
Source: Treasury.

SENSITIVITY AND SCENARIO ANALYSIS

Chart 3.13 demonstrates that fiscal estimates reflect assumptions and judgments made about the economy as much as they do Government policy.

Small movements in economic forecasts or projections can improve or worsen the underlying cash balance, depending on their impacts on payments and receipts. This in turn can drive changes in gross and net debt. Consideration of particular scenarios and sensitivity analysis demonstrates the potential impact of these changes. The analysis presented considers the impact of changes to the economic outlook over the forecast years to 2019-20 and the projections beyond that.

As the assumptions and judgments that underpin fiscal forecasts and projections are subject to considerable uncertainty, it is important to understand how changes to these can affect these estimates and projections. Consideration of alternative scenarios and sensitivity analysis demonstrates the potential impact of these changes and highlights the uncertainties that governments face should risks eventuate — for example, in meeting budget forecasts or fiscal targets.

The analysis presented in the MYEFO considers the impact of changes to the economic outlook over the forecast years. Scenario 1 explores the sensitivity of fiscal aggregates to an alternative path for the terms of trade. These risks are outlined in Part 2. Risks around the household consumption and non-mining business investment forecasts are also outlined in Part 2. Scenarios around these risks are included in the 2018-19 Budget Paper No. 1 Statement 8: *Forecasting Performance and Scenario Analysis*.

Scenario 2 illustrates the sensitivity of fiscal projections to changes in assumed yields on government debt.

Sensitivity analysis over the forecast period

The following scenario provides an indication of the sensitivity of receipts, payments and the underlying cash balance to changes in the terms of trade over the forecast period, which is 2018-19 and 2019-20.

Scenario 1: Alternative path for the terms of trade

This scenario considers the consequences of a permanent 10 per cent movement in world prices of non-rural commodity exports through 2018-19 relative to the MYEFO forecast levels. Such a price rise (fall) is consistent with a rise (fall) in the terms of trade of $4\frac{3}{4}$ per cent and an increase (decrease) in nominal GDP of 1 per cent by 2019-20. The sensitivity analysis shows the flow-on effects to GDP, the labour market and prices. The impacts in Table 3.20 are stylised and refer to percentage deviations from the MYEFO forecast levels due to a permanent rise in non-rural commodity prices.

Table 3.20: Illustrative impact of a permanent 10 per cent rise in non-rural commodity prices (per cent deviation from the MYEFO level)⁴

	Impact after 1 year (2018-19) per cent	Impact after 2 years (2019-20) per cent
Real GDP	0	1/4
GDP deflator	1/2	3/4
Nominal GDP	1/2	1
Employment	0	1/4
Wages	1/4	1/2
CPI	0	1/4
Company profits	1 3/4	3 1/4
Nominal household consumption	0	1/2

Source: Treasury.

Assuming no change in exchange rates or interest rates, the increase in export prices leads directly to higher overall output prices (as measured by the GDP deflator) and higher domestic incomes compared with MYEFO levels. Higher domestic incomes cause both consumption and investment to rise, resulting in higher real GDP and employment and an increase in wages. The rise in aggregate demand puts upward pressure on domestic prices.

On the receipts side, an increase in nominal GDP increases tax collections. The largest impact is on company tax receipts as the increase in export income increases company profits. The impact on company tax is larger in 2019-20, partly owing to lags in tax collections and a larger impact on company profits in the second year of the scenario period. Higher company profits are assumed to flow through to higher Australian

⁴ These results represent a partial economic analysis only and do not attempt to capture all the economic feedback and other policy responses related to changed economic conditions, and assume no change in the exchange rate, interest rates or policy over the forecast period.

Part 3: Fiscal strategy and outlook

equity prices, therefore increasing capital gains tax from individuals, companies and superannuation funds.

On the payments side, a significant proportion of government expenditure is partially indexed to movements in costs (as reflected in various price and wage indicators). Some forms of expenditure, in particular income support payments, are also driven by the number of beneficiaries.

The overall estimated expenditure on income support payments (including pensions, unemployment benefits and other allowances) decreases in both years, reflecting a lower number of unemployment benefit recipients. The fall in spending on unemployment benefits is partially offset by increased expenditure on pensions and allowances reflecting stronger growth in benefit payment rates, resulting from slightly higher inflation. At the same time other payments linked to inflation also rise in line with the stronger growth in prices.

Given these assumptions, the overall impact of the increase in the terms of trade is an improvement in the underlying cash balance of around \$2.2 billion in 2018-19 and around \$5.9 billion in 2019-20 (see Table 3.21). Broadly opposite impacts would be expected for a fall in the terms of trade of the same magnitude.

Table 3.21: Illustrative sensitivity of the budget balance to a permanent 10 per cent rise in non-rural commodity prices

	2018-19	2019-20
	\$b	\$b
Receipts		
Individuals and other withholding taxes	0.6	1.9
Superannuation fund taxes	0.1	0.1
Company tax	1.3	3.2
Goods and services tax	0.0	0.3
Excise and customs duty	0.0	0.2
Other taxes	0.1	0.2
Total receipts	2.1	5.9
Payments		
Income support	0.1	0.2
Other payments	0.0	0.0
Goods and services tax	0.0	-0.3
Total payments	0.1	0.0
Public debt interest	0.0	0.1
Underlying cash balance impact(a)	2.2	5.9

(a) Estimated impacts fall within the 70 per cent confidence intervals for years 2018-19 and 2019-20, as shown in Charts 3.11 to 3.13.

Note: Data may not sum due to rounding.

The specific impact of a US\$10 per tonne free-on-board (FOB) higher or lower iron ore price is outlined in Box B.

Box B: Sensitivity analysis of iron ore price movements

The impact of a **US\$10 per tonne FOB movement in the iron ore price** over the course of a year is set out in Table B. This is based on the sensitivity analysis presented in Scenario 1 and is calibrated to take into account the share of iron ore in the value of total exports, which can change over time. An increase of US\$10 per tonne FOB in the iron ore price results in an increase in nominal GDP of around \$5.5 billion in 2018-19 and around \$12.3 billion in 2019-20. Similarly, a decrease of US\$10 per tonne FOB in the iron ore price results in a decrease in nominal GDP of an equivalent amount.

Table B: Sensitivity analysis of a US\$10 per tonne movement in iron ore prices

	US\$10/tonne FOB ^(a) fall		US\$10/tonne FOB increase	
	2018-19	2019-20	2018-19	2019-20
Nominal GDP (\$billion)	-5.5	-12.3	5.5	12.3
Tax receipts (\$billion)	-1.2	-3.6	1.2	3.6

(a) Prices are presented in free-on-board (FOB) terms, which exclude the cost of freight.
Source: Treasury.

Sensitivity analysis over the forward estimates and medium term

The following scenario demonstrates the sensitivity of the fiscal estimates to changes in modelling assumptions about yields on government debt over the budget year and the following years to 2028-29.

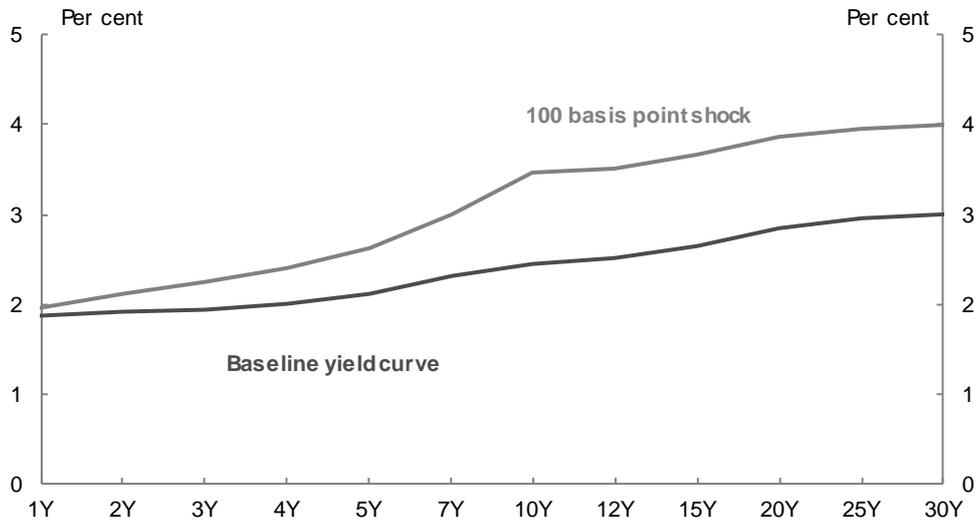
For further information on the economic and fiscal projection frameworks, please refer to *Budget Paper 1, Statement 8: Forecasting Performance and Scenario Analysis* in the 2018-19 Budget.

Scenario 2: Steeper yield curve assumption

Over the forward estimates period, yields on Commonwealth Government Securities (CGS) are assumed to remain fixed at the levels observed immediately prior to the MYEFO. The medium-term fiscal projections assume yields on government debt converge to an assumed long-run yield curve, based on a 10-year yield of 5 per cent. This is consistent with the Long-Term Cost Report prepared by the Australian Government Actuary. The gap between the current yield curve and the long-run yield curve is closed by a quarter in each year over the medium term.

Scenario 2 examines the consequences of a 100 basis point steepening of the yield curve between the cash rate and the 10-year bond yield over the two years until 2019-20 (Chart 3.14). Yields remain higher until the end of the forward estimates, after which yields converge to the assumed long-run yield curve.

Chart 3.14: Steeper yield curve compared to MYEFO baseline in 2019-20



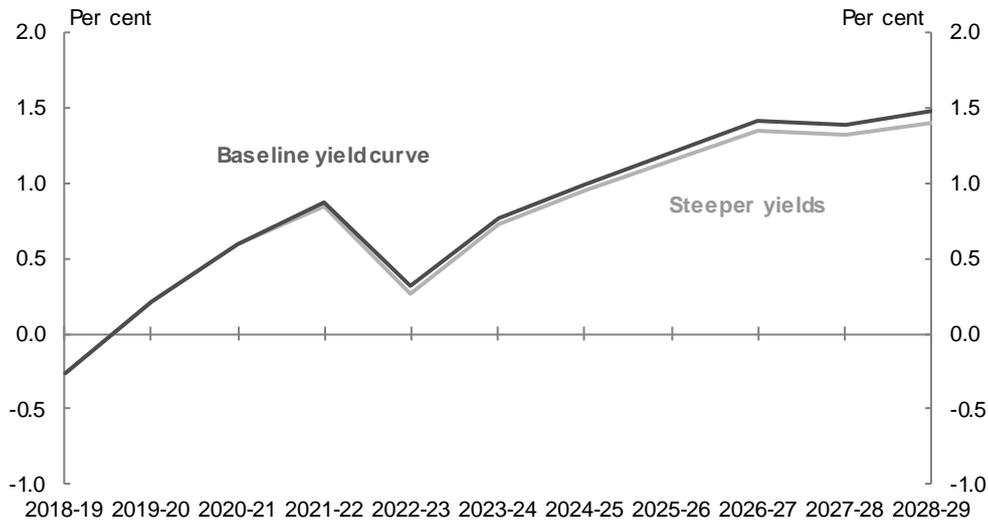
Source: Treasury.

Yields affect both the income and expenses of the Government. Yields affect the amount of public debt interest (PDI) the Government has to pay on its borrowings, but also have an impact on projections of the receipts the Government earns on its investments.

As shown in Table 3.41 of *Attachment E: Debt Statement*, the Government borrows a large proportion of its debt in medium and long-dated debt. Conversely, many government investments are held in short-dated assets. As such, a steepening of the yield curve affects Government debt more than assets.

Compared to MYEFO projections, a steeper than assumed yield curve results in a small deterioration to the underlying cash balance in the forward estimates, and a net deterioration of around 0.1 percentage points of GDP in 2028-29 (Chart 3.15).

Chart 3.15: Underlying cash balance impacts of higher yields



Note: Excludes expected net Future Fund earnings before 2020-21. The tax-to-GDP cap of 23.9 per cent is reached from 2025-26.

Source: Treasury projections.

Gross debt, as measured by the face value of Commonwealth Government Securities on issue, increases by \$0.5 billion compared to the MYEFO estimates for 2018-19, and increases by \$9.4 billion by 2021-22. Gross debt is \$17.4 billion higher than the baseline by 2028-29.

The increase in gross debt results in a similar increase in net debt. However, this is offset over the forward estimates by lower market values of Commonwealth Government Securities from higher yields. As a result, compared to baseline, net debt decreases by 0.7 percentage points of GDP in 2018-19, and remains 0.6 percentage points of GDP lower by 2021-22. Over the medium term, as the baseline yields converge to their long-run rates, the impact of the yield shock is unwound. The combination of increased gross debt and unwinding the valuation effect results in net debt projections being 0.7 percentage points higher compared to MYEFO by 2028-29.

A flattening of the yield would have broadly opposite effects.