

Statement 8: Forecasting Performance and Sensitivity Analysis

Economic and fiscal forecasts and projections in the Budget are underpinned by a range of assumptions and judgements based on best available information at the time of preparation. In practice, economic and fiscal circumstances can evolve in ways that differ from expectations.

This statement assesses:

1. The performance of past forecasts based on the variance between forecasts and actuals
2. The uncertainty around current forecasts using confidence interval analysis
3. The sensitivity of current forecasts to changes in key assumptions:
 - Iron ore prices
 - Yields on Australian Government Securities

The economic impact of other key variables, including metallurgical and thermal coal, liquefied natural gas prices, population and participation are considered in *Budget Statement 2: Economic Outlook*. The fiscal impact of key developments and Australia's climate change outlook are considered in *Budget Statement 3: Fiscal Strategy and Outlook*.



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Statement 8: Forecasting Performance and Sensitivity Analysis

Assessing past forecasting performance

This section assesses the variance between historical forecasts and outcomes (forecast errors) for real and nominal GDP, tax receipts, non-tax receipts, payments and the underlying cash balance.

Forecasts are prepared using a range of techniques:

- Macroeconomic forecasts are prepared consistent with a national accounting framework using econometric models, spreadsheet analysis and professional judgement.
- Tax receipts forecasts are generally prepared using a 'base plus growth' methodology. The last outcome for each head of revenue is the base to which growth rates are applied, using appropriate economic parameters.
- Payments forecasts are generally prepared through analysis of payment program data, costings for new policies and historical trends in programs, in consultation with relevant agencies.

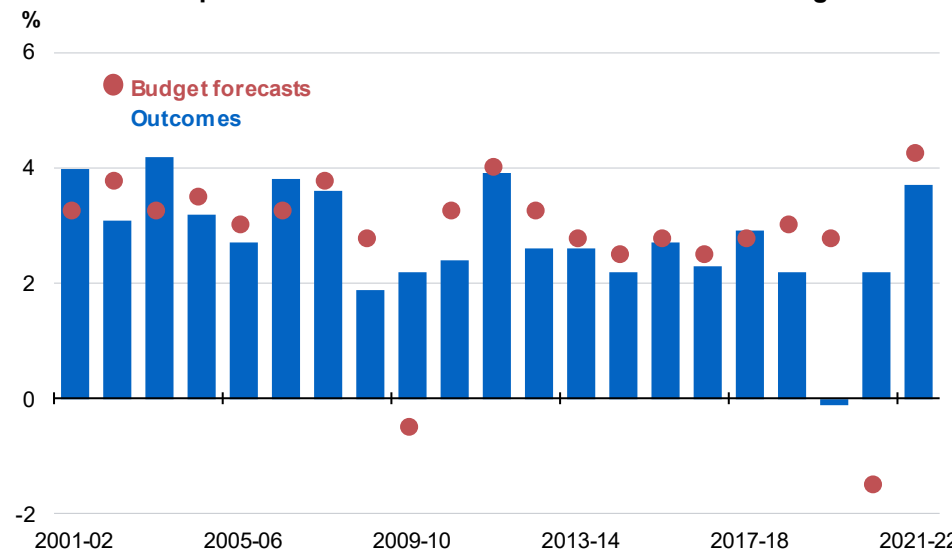
Forecasts are based on assumptions and judgements. Forecast accuracy depends on whether assumptions and judgements prove to be correct, and the reliability of the modelled economic and fiscal relationships.

Economic forecasting performance

Real GDP forecasts incorporate assumptions for exchange rates, interest rates, commodity prices and population growth. The forecasts also incorporate judgements about how domestic and international developments will affect Australia’s economy.

Real GDP grew by 3.7 per cent in 2021–22 rather than the 4¼ per cent growth forecast at the 2021–22 Budget (Chart 8.1). The overestimate of real GDP growth in 2021–22 was primarily due to weaker-than-expected household consumption during the Delta wave of the pandemic.

Chart 8.1: Comparison of forecasts and outcomes for real GDP growth

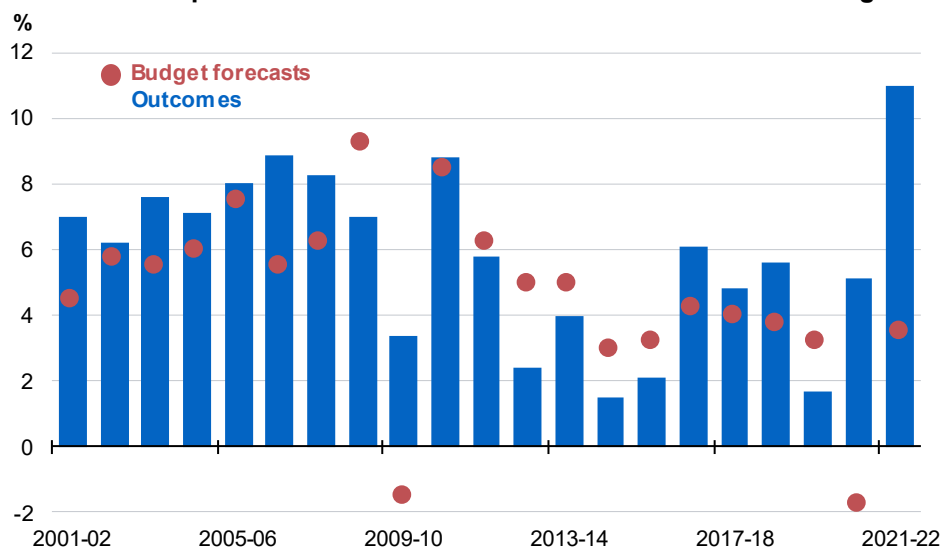


Note: Outcome is as published in the December quarter 2022 National Accounts. Forecast is from Budget published in that year.

Source: ABS Australian National Accounts: National Income, Expenditure and Product and Budget papers.

Nominal GDP forecasts include a price component that adds additional uncertainty compared to real GDP forecasts. Price uncertainty relates to domestic prices and wages, prices of imported goods, and world prices for Australia’s exports including commodities. Since the early 2000s, nominal GDP forecast errors have largely reflected volatility in global commodity prices.

Nominal GDP grew by 11 per cent in 2021–22 rather than the 3½ per cent growth forecast at the 2021–22 Budget (Chart 8.2). The large underestimate in nominal GDP reflected higher-than-expected commodity prices, with Russia’s invasion of Ukraine pushing up global energy prices and the price of Australian coal and LNG exports. Treasury regularly reviews the methodology and assumptions that feed into the economic outlook. An example of this approach are the revisions to technical assumptions for commodity prices outlined in Box 2.4 *Budget Statement 2: Economic Outlook*.

Chart 8.2: Comparison of forecasts and outcomes for nominal GDP growth

Note: Outcome is as published in the December quarter 2022 National Accounts. Forecast is from Budget published in that year.

Source: ABS Australian National Accounts: National Income, Expenditure and Product and Budget papers.

Fiscal forecasting performance

Fiscal forecast errors are driven by economic and demographic forecast errors, along with unanticipated changes in demand for government programs. Government policies announced after the Budget can also affect fiscal forecast errors. These errors are larger in years where additional unexpected spending is required to support the economy. Further information on Budget outcomes can be found in the *2021–22 Final Budget Outcome*.

Total receipts

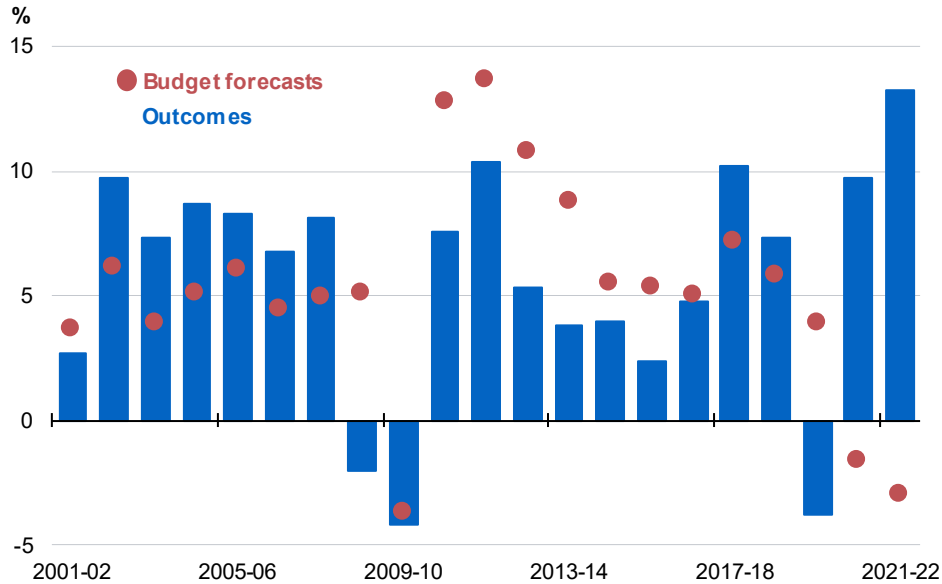
Total receipts are comprised of tax and non-tax receipts (for example, dividends from investment funds). Tax receipts account for over 90 per cent of total receipts and are therefore the main driver of forecasting performance.

Total receipts grew 12.4 per cent in 2021–22 rather than the 3.6 per cent decline forecast at the 2021–22 Budget. Total receipts were \$102.3 billion higher than forecast.

Tax receipts

Tax receipts grew 13.2 per cent in 2021–22 rather than the 3 per cent decline forecast at the 2021–22 Budget (Chart 8.3). Tax receipts were \$91.0 billion higher than forecast. This outcome reflected growth in most revenue heads, driven by stronger-than-expected economic outcomes and higher-than-expected commodity prices.

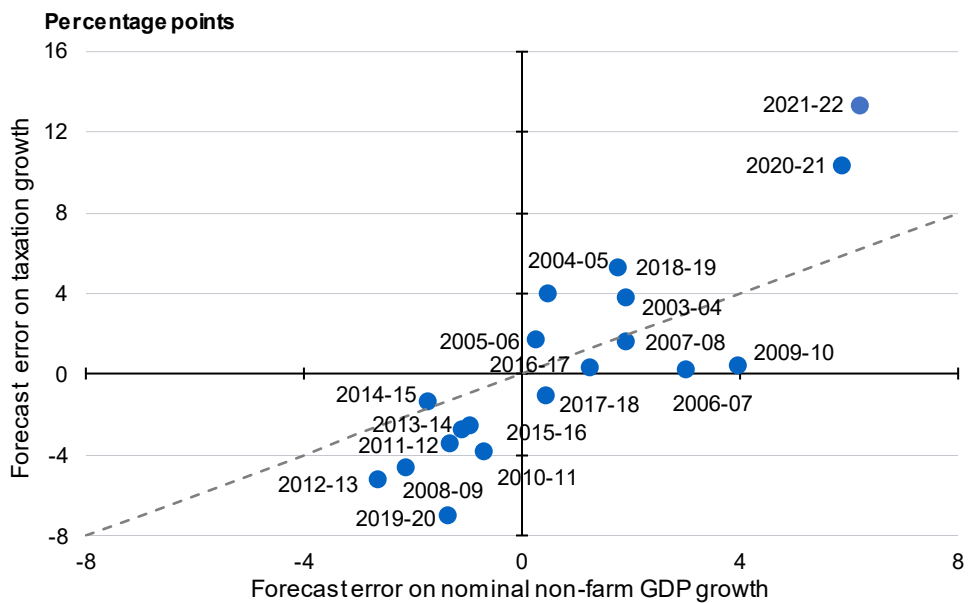
Chart 8.3: Comparison of forecasts and outcomes for tax receipts growth



Source: Budget papers and Treasury.

On average, nominal GDP forecast errors are magnified in tax receipts forecast errors, owing to the progressive nature of Australia’s personal income tax system (Chart 8.4).

Chart 8.4: Forecast errors for nominal non-farm GDP and tax receipts growth^(a)



a) Excludes CGT.

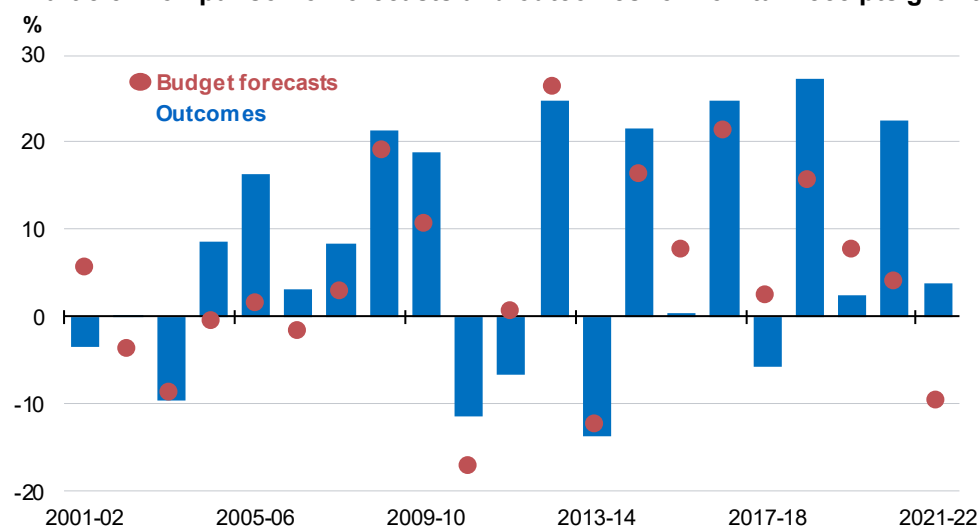
Source: ABS Australian National Accounts: National Income, Expenditure and Product, Treasury.

Non-tax receipts

Forecast variances for non-tax receipts are generally driven by uncertainty around market outcomes which impact investment earnings and resource royalties.

Non-tax receipts grew 3.9 per cent in 2021–22 rather than the 9.7 per cent decline forecast at the 2021–22 Budget (Chart 8.5). Non-tax receipts were \$11.3 billion higher in 2021–22 than forecast in the 2021–22 Budget. This outcome reflected higher-than-expected Future Fund investment earnings. Further information on Budget outcomes can be found in the *2021–22 Final Budget Outcome*.

Chart 8.5: Comparison of forecasts and outcomes for non-tax receipts growth



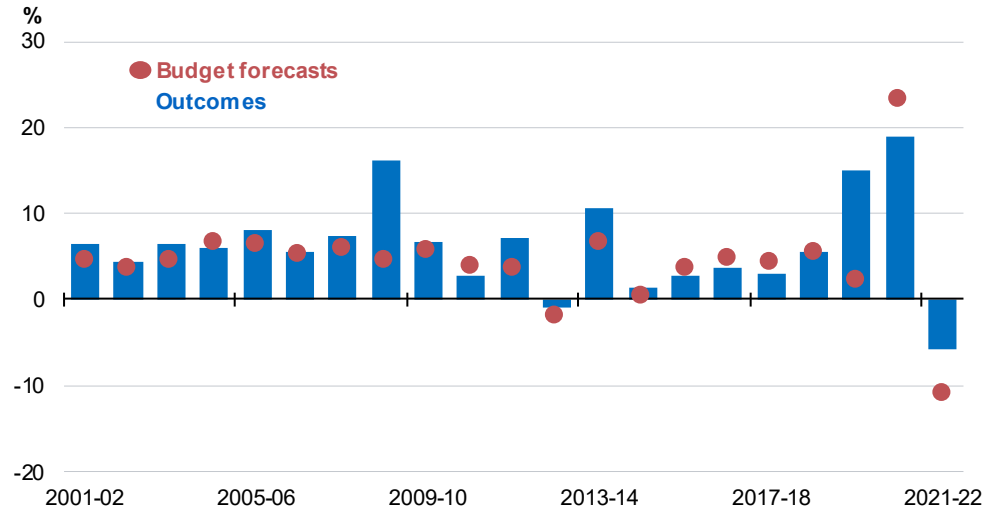
Source: Budget papers and Treasury.

Payments

Payments forecasting performance is affected by growth in indexation factors (for example, CPI growth) and demand for government programs. Demand-driven programs, such as payments to individuals for social welfare, form the bulk of Australian government expenditure and vary with economic conditions.

Payments declined 5.8 per cent in 2021–22 rather than the 10.9 per cent decline forecast at the 2021–22 Budget (Chart 8.6). Payments were \$27.6 billion higher in 2021–22 than forecast in the 2021–22 Budget. This outcome reflected additional COVID-19 response measures – particularly the *COVID-19 Response Package – National COVID-19 Disaster Payment* and *COVID-19 Response Package – COVID-19 Business Support* – which were announced in the 2021–22 Mid-Year Economic and Fiscal Outlook, as well as higher-than-anticipated spending on existing measures including the *Pandemic Leave Disaster Payment* which were announced in the 2020–21 Budget.

Chart 8.6: Comparison of forecasts and outcomes for payments growth



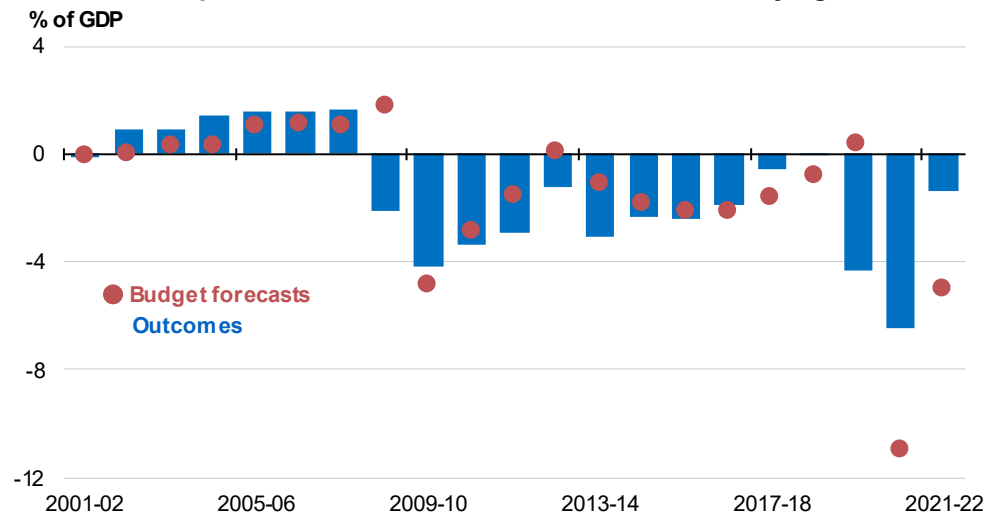
Source: Budget papers and Treasury.

Underlying cash balance

Underlying cash balance forecasting performance is driven by the forecast errors of total receipts and payments.

The underlying cash deficit was 1.4 per cent of GDP in 2021–22 rather than the forecast deficit of 5 per cent of GDP (Chart 8.7). The underlying cash deficit was \$74.7 billion smaller than forecast. The better-than-expected underlying cash balance outcome in 2021–22 reflected the challenges of forecasting during COVID-19.

Chart 8.7: Comparison of forecasts and outcomes for underlying cash balance

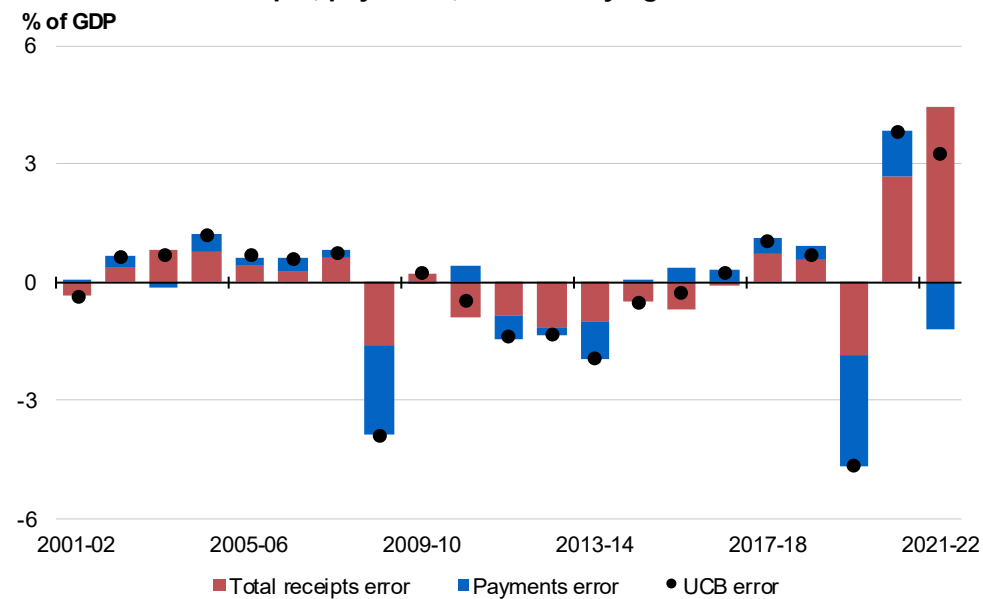


Source: Budget papers and Treasury.

Over the past 2 decades, outside major downturns, forecast errors for the underlying cash balance⁴⁹ largely reflect forecast errors of total receipts (Chart 8.8). A key contributing factor is the volatility of global commodity prices and its impact on tax receipts.

Large forecast errors for payments in 2008–09 and 2019–20 reflected unexpected Government payment assistance during the Global Financial Crisis and COVID-19. Overestimates of receipts tend to coincide with underestimates of payments during economic shocks, magnifying underlying cash balance forecast errors.

Chart 8.8: Total receipts, payments, and underlying cash balance forecast errors



Source: Budget papers and Treasury.

⁴⁹ Between 2005–06 and 2019–20, the underlying cash balance was equal to receipts less payments, less net Future Fund earnings. In all other years, the underlying cash balance is equal to receipts less payments.

Assessing forecast uncertainty – confidence interval analysis

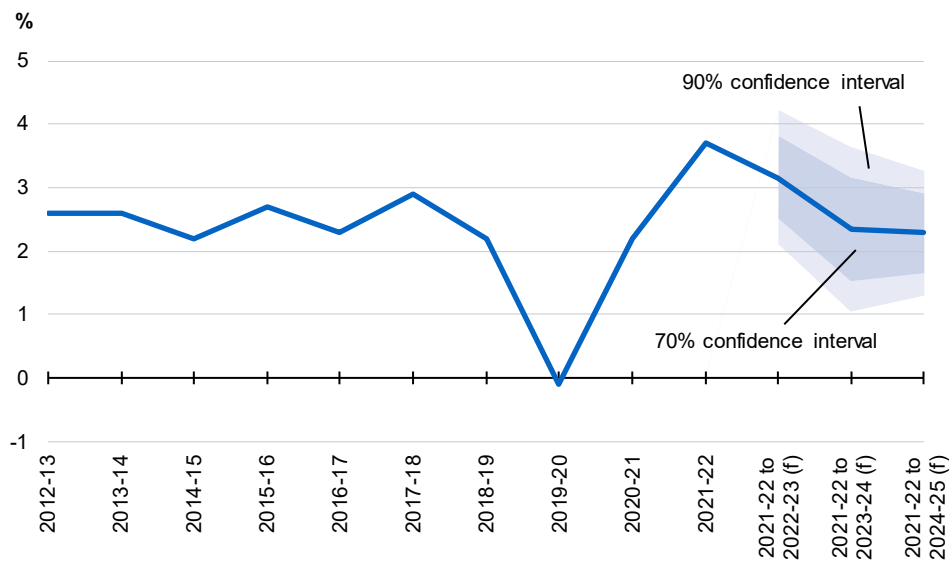
Confidence intervals illustrate the uncertainty around current forecasts based on historical patterns of forecast errors. Confidence interval analysis assumes that future forecast errors are consistent with the distribution of past forecast errors⁵⁰ (1998–99 to 2021–22). Based on past forecasting performance, there is a 70 and 90 per cent probability that the forecasts will lie within the 70 and 90 per cent confidence interval bands.

Future forecast errors may not have the same distribution as historical forecast errors. The large forecast errors in 2019–20 and 2020–21, related to COVID–19, are an example of events not previously captured in the historical error sample. Large disruptive events are difficult to predict and could occur again in the future.

Economic uncertainty based on historical forecast errors

Average annualised growth in real GDP in the 3 years to 2024–25 is expected to be around 2¼ per cent. The 70 per cent confidence interval ranges from 1¾ per cent to 3 per cent. The 90 per cent confidence interval ranges from 1¼ per cent to 3¼ per cent (Chart 8.9).

Chart 8.9: Confidence intervals around real GDP growth rate forecasts



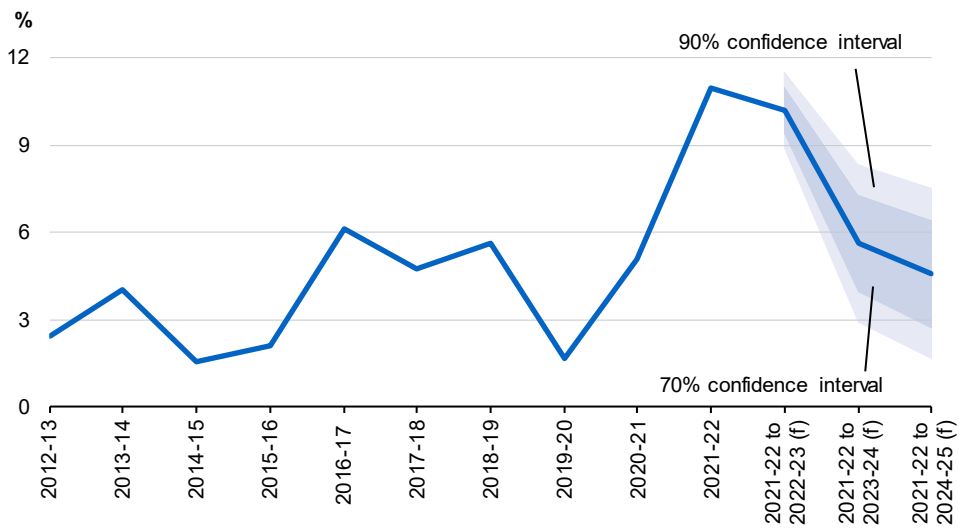
Note: The line shows the outcomes and the 2023–24 Budget forecasts. Annual growth rates are reported for the outcomes. Average annualised growth rates from 2021–22 are reported for 2022–23 onwards. Confidence intervals are based on the root mean squared errors (RMSEs) of Budget forecasts from 1998–99 onwards and are a statistical assessment that does not take account of any change in circumstance in the economic outlook. (f) are forecasts.

Source: ABS Australian National Accounts: National Income, Expenditure and Product, Treasury.

50 See Treasury Working Paper: *Estimates of Uncertainty around Budget Forecasts* (2013).

The confidence intervals around the nominal GDP forecasts are wider than those around the real GDP forecasts, reflecting the additional uncertainty around domestic prices and commodity prices. Average annualised growth in nominal GDP in the 3 years to 2024–25 is expected to be around 4½ per cent, with the 70 per cent confidence interval ranging from 2¾ per cent to 6½ per cent. The 90 per cent confidence interval ranges from 1½ per cent to 7½ per cent (Chart 8.10).

Chart 8.10: Confidence intervals around nominal GDP growth rate forecasts



Note: See note to Chart 8.9.

Source: ABS Australian National Accounts: National Income, Expenditure and Product, Treasury.

Fiscal uncertainty based on historical forecast errors

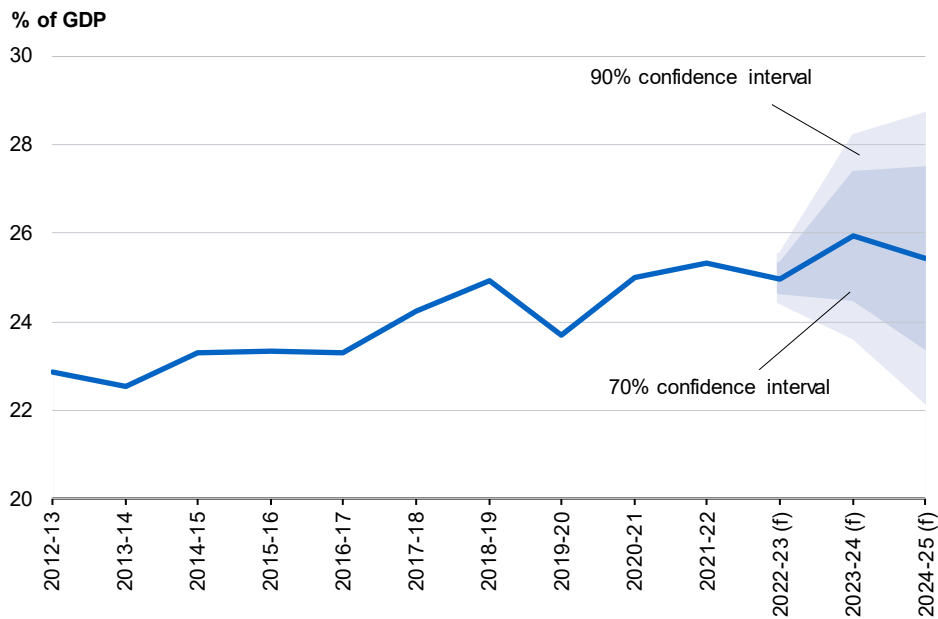
Fiscal estimates are based on economic and demographic forecasts as well as estimates of the impact of spending and revenue measures.

Historical variations caused by subsequent policy decisions not known at the time of forecast are excluded because these decisions do not relate to the forecasting errors presented in this section. Payment estimates do not exclude the public debt interest associated with these subsequent policy decisions because this cannot be separately identified. GST is reported as a Commonwealth tax in the budget. From the 2023-24 Budget, the analysis of forecast errors will incorporate GST data to provide a better indication of the uncertainty surrounding fiscal forecast estimates.

Total receipts

Total receipts (including GST) are expected to be around 25.9 per cent of GDP in 2023-24, with the 70 per cent confidence interval ranging from 24.5 per cent to 27.4 per cent of GDP. The 90 per cent confidence interval ranges from 23.6 per cent to 28.2 per cent. The uncertainty around receipts forecasts increases with time (Chart 8.11).

Chart 8.11: Confidence intervals around total receipts forecasts^(a)



a) Includes Future Fund earnings from 2000-21 onwards.

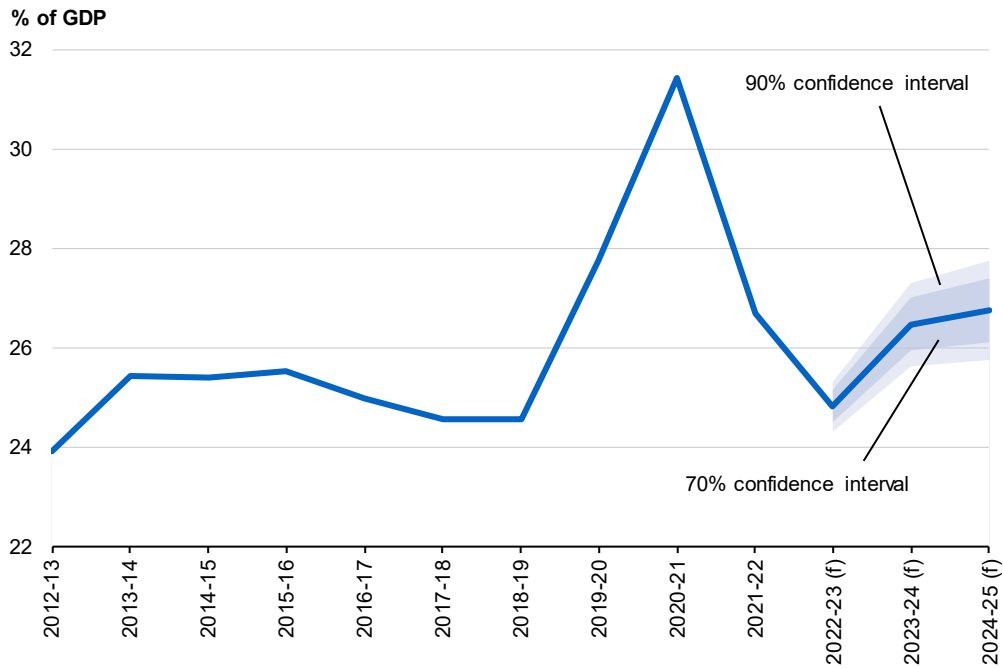
Note: The central line shows the outcomes and the 2023-24 Budget forecasts. Confidence intervals use RMSEs for Budget forecasts from the 1999-2000 Budget onwards. (f) are forecasts.

Source: Budget papers and Treasury.

Payments

The confidence interval for payments is narrower than receipts because there is greater certainty around payments forecasts. Payments (including GST) are expected to be around 26.5 per cent of GDP in 2023-24, with the 70 per cent confidence interval ranging from 25.9 per cent to 27.0 per cent of GDP. The 90 per cent confidence interval ranges from 25.6 per cent to 27.3 per cent (Chart 8.12).

Chart 8.12: Confidence intervals around payments forecasts^(a)



a) Includes GST payments.

Note: See note to Chart 8.11.

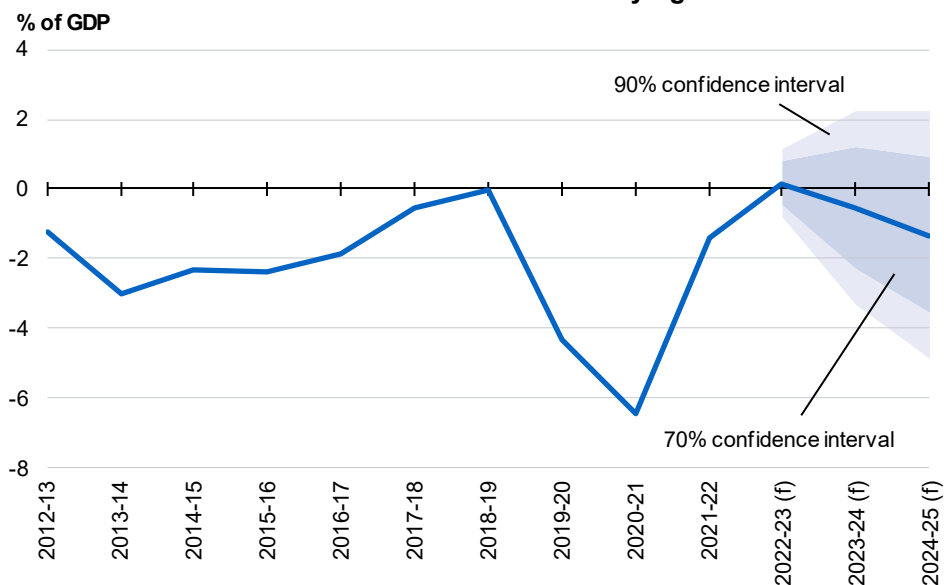
Source: Budget papers and Treasury.

Underlying cash balance

The underlying cash deficit in 2023-24 is expected to be 0.5 per cent of GDP, with the 70 per cent confidence interval ranging from a deficit of 2.3 per cent to a surplus of 1.2 per cent of GDP. The 90 per cent confidence interval ranges from a deficit of 3.3 per cent to a surplus of 2.2 per cent.

The uncertainty around underlying cash balance forecasts reflects forecast errors in receipts and payments which increase with time (Chart 8.13).

Chart 8.13: Confidence intervals around the underlying cash balance forecasts



Note: See note to Chart 8.11.
Source: Budget papers and Treasury.

Assessing current forecasts through sensitivity analysis

Undertaking sensitivity analysis allows for an assessment of the importance of key assumptions. The following sensitivity analyses are considered due to their variability and importance for the Budget:

- Higher and lower iron ore prices in 2023–24 and 2024–25.
- Higher and lower yields over the medium term.

For illustrative purposes, the upper and lower sensitivities are broadly symmetric, even where not equally probable.

Movements in iron ore prices

The forecasts for nominal GDP and tax receipts are sensitive to commodity price assumptions, particularly iron ore prices. Iron ore is Australia’s largest export by value, representing around 22 per cent of the total value of goods and services exports in 2021–22. See *Budget Statement 2: Economic Outlook* for more information on developments in commodity prices.

Iron ore prices are volatile and sensitive to global market developments. Table 8.1 considers the impact of a permanent US\$10 per tonne increase and decrease in the iron ore price on nominal GDP and tax receipts relative to the baseline forecast.

Table 8.1: Sensitivity analysis of a US\$10 per tonne movement in iron ore prices

	US\$10/tonne FOB ^(a) increase		US\$10/tonne FOB decrease	
	2023-24	2024-25	2023-24	2024-25
Nominal GDP (\$billion)	5.1	2.5	-5.1	-2.5
Tax receipts (\$billion)	0.5	0.5	-0.5	-0.5

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

Source: Treasury.

The effects of a US\$10 per tonne increase and decrease in the iron ore price are broadly symmetric. The following discusses the effects of an increase for illustrative purposes. The US\$10 per tonne increase in the assumed price for iron ore exports is expected to result in an increase in nominal GDP of around \$5.1 billion in 2023-24 and around \$2.5 billion in 2024-25.

The economic response to a permanent change in the price of iron ore is derived from a commodity price shock in Treasury’s Macroeconometric Model of Australia⁵¹. The model incorporates forward-looking financial markets, which anticipate the permanent increase (or decrease) in commodity prices. An increase in iron ore export prices leads to a higher terms of trade, which leads directly to higher output prices and nominal GDP. However, the appreciation in the exchange rate partially offsets the increase in export prices and acts to reduce domestic inflation through lower import prices.

The volume of output and exports of the mining sector increase in response to higher iron ore prices. The higher exchange rate leads to a substitution towards imports, which partially offsets the increase in exports and GDP.

A US\$10 per tonne increase in the assumed price for iron ore exports is expected to result in an increase in tax receipts of around \$0.5 billion in both 2023-24 and 2024-25. An increase in iron ore prices increases mining company profits and therefore company tax receipts. Lower domestic prices result in lower individuals and other withholding taxes and indirect tax receipts, partially offsetting the increase in company tax.

⁵¹ See Treasury Paper: *The Macroeconometric Model of Australia: Modelling Approach* (2021).

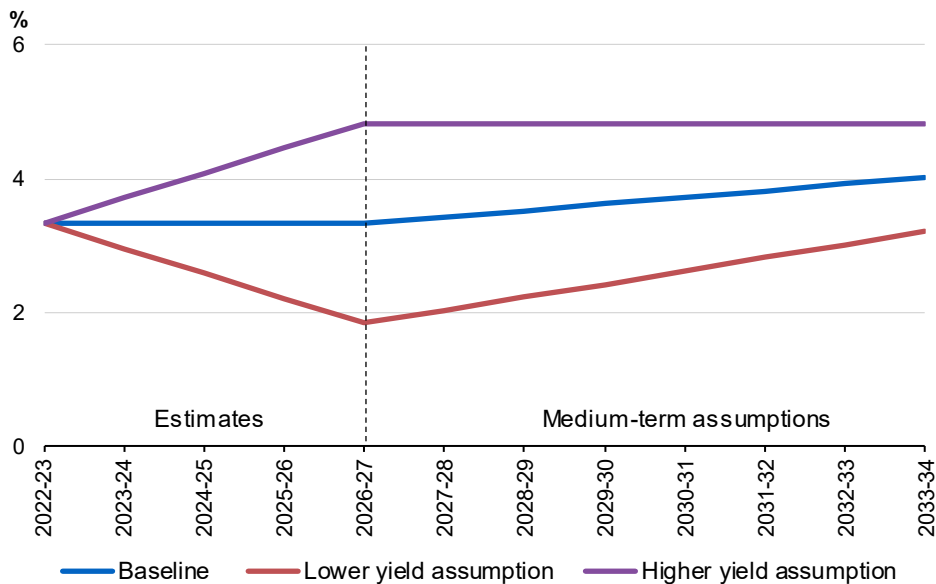
Movements in yields

Government borrowing costs are sensitive to yields on Australian Government Securities and the level of debt. See *Budget Statement 3: Fiscal Strategy and Outlook* for further information on yields. Given the uncertainty surrounding the global and domestic outlook and the impact on yields, Treasury makes the following technical assumptions:

- Over the forward estimates, government bond yields are fixed at rates observed immediately prior to the Budget update. This approach captures the latest market outlook while removing the effects of near-term volatility.
- Over the medium term, the 10-year bond yield converges linearly towards long-run nominal GDP growth. This leads to conservative debt dynamics, consistent with the approaches of comparable advanced economies. The 10-year bond yield approximates the average yield on new issuance. Other tenor yields are assumed to maintain their historical relativity to the 10-year bond yield.

The higher yield assumption has bond yields increasing by 150 basis points by the end of the forward estimates. The lower yield assumption has bond yields decreasing by 150 basis points by the end of the forward estimates. From the start of the medium term, yields in both analyses linearly converge over 15 years to the long-run yield assumption of nominal GDP growth (Chart 8.14). Other economic parameters are assumed to remain unchanged from baseline forecasts to isolate the direct impact on fiscal aggregates.

Chart 8.14: Baseline and alternative movements in the 10-year bond yield



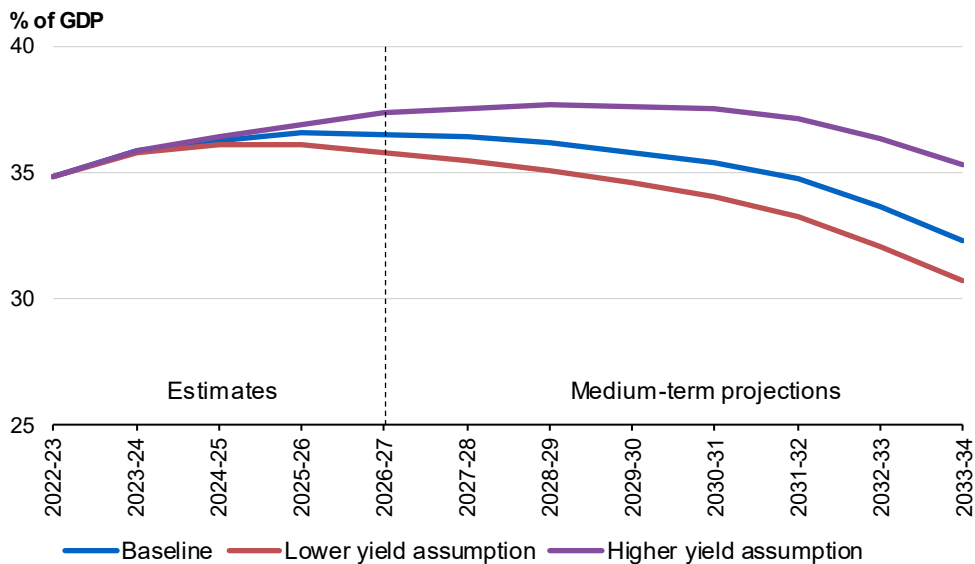
Source: Treasury.

Higher yields increase public debt interest paid and receipts earned on investments. As government interest bearing liabilities usually exceed interest bearing assets, higher yields lead to a deterioration in the underlying cash balance. Lower yields have the reverse effect, improving the underlying cash balance.

The higher yield assumption results in a deterioration to the underlying cash balance of 0.2 percentage points of GDP by 2033–34 and increases gross debt by 3.0 percentage points of GDP at 30 June 2034 (Chart 8.15).

The lower yield assumption results in an improvement to the underlying cash balance of 0.2 percentage points of GDP by 2033–34. Under the lower yield assumption, cumulative improvements to the underlying cash balance reduce gross debt by 1.6 percentage points of GDP at 30 June 2034.

Chart 8.15: Gross debt, impact of alternative yield assumptions



Source: Australian Office of Financial Management and Treasury.

Even under the higher yield assumption, projected Commonwealth gross debt as a share of GDP is less than 30 per cent of the average general government gross debt in the G7 countries today.