

Box C

What Explains Recent Inflation Forecast Errors?

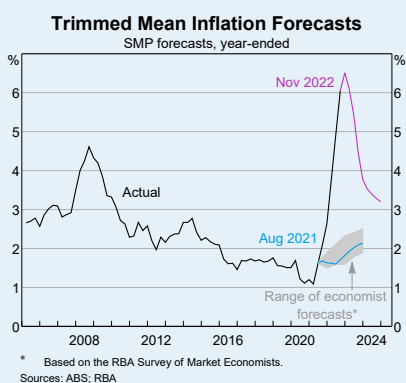
Inflation in Australia over the past year or so has been significantly higher than the Bank and other forecasters expected a year ago. Underlying inflation over the year to the June quarter of 2021 was 1.6 per cent, and in the August 2021 *Statement* inflation was projected to remain at around 1½ per cent to September 2022. Instead, as inflation rose the Bank materially upgraded inflation forecasts in each subsequent *Statement* and by September 2022 underlying inflation had risen to 6.1 per cent. None of the market economists the Bank surveys nor any market-based measures predicted the extent of the pick-up in inflation (Graph C.1).

Australia's experience was broadly similar to that internationally, though the pick-up in inflation occurred later than in many peer countries. Inflation in advanced economies over the past year has exceeded the average of forecasters' expectations by around 5–8 percentage points (Graph C.2). A year ago, there was a widespread view among

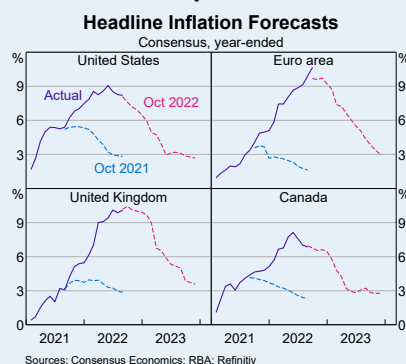
market participants (and the Federal Reserve) that the increase in US inflation that began in mid-2021 would prove temporary, with inflation forecast to return to just above the Federal Reserve's target by late 2022. For other economies, forecasters similarly expected inflation to drift down in 2022 to be broadly consistent with central bank targets. While a few economists predicted a rise in inflation in early 2021 owing to pandemic disruptions and strong policy stimulus, the magnitude of the increase was broadly underestimated.

The pick-up in inflation in Australia was initially concentrated in a small number of goods (new dwellings and then consumer durables) and some of these pressures were expected to be transitory. However, inflationary pressures broadened over time as a combination of factors raised inflation by more than expected. As one of the largest economic shocks in a century, the inflationary effects of the pandemic-driven imbalance between supply and demand for

Graph C.1



Graph C.2



goods both globally and domestically played an important role in the forecast miss. Other unforecastable shocks – such as the effects of Russia’s invasion of Ukraine and the Australian east coast floods – also contributed. The Bank’s inflation models (like most forecasting models) underestimated inflation over the past year as it is difficult for forecasting frameworks to capture the signal from unprecedented events; to address this, upward adjustments based on liaison, surveys and international experience have increasingly been incorporated into the forecasts (discussed further below).

Unpredictable shocks contributed to the strength in inflation

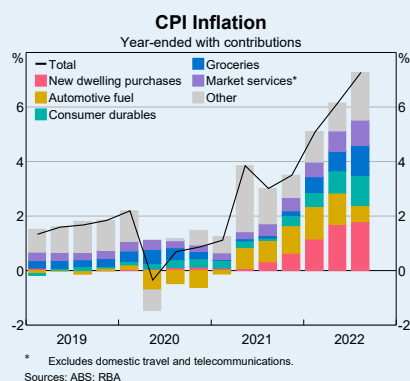
Russia’s invasion of Ukraine, the timing and extent of flooding on Australia’s east coast, domestic energy market pressures and other disruptive events were unpredictable or seemed too unlikely to include in the central forecasts. These events have led to large increases in fuel, energy and food prices and have prolonged cost pressures that initially stemmed from supply chain disruptions (Graph C.3). The European Central Bank and the Bank of Canada have assessed that higher energy prices explain around half to three-quarters of their forecast misses.^[1] In Australia, fuel prices contributed 1.2 percentage points to year-ended headline inflation by the June quarter of 2022 and directly accounted for around 15 per cent of the revisions to headline inflation forecasts by that time; however, fuel prices have since eased a little. Australian retail energy prices were shielded from international developments for a time, but large unexpected increases in wholesale costs earlier in 2022 are now expected to directly contribute around ½ percentage

point to domestic consumer prices over the year to June 2023. Australia’s east coast floods and the effects of Russia’s invasion on rural commodity prices and transport costs have also driven retail food prices higher.

The global imbalance between supply and demand for goods has been more persistent than expected

The global imbalance between supply and demand for goods has persisted for longer than anticipated by most forecasters and central banks, reflecting ongoing COVID-19-related disruptions to supply, shipping congestion, shifts in consumption patterns and stronger-than-expected demand. Consumer demand exceeded expectations in many advanced economies in the first year of the pandemic, reflecting strong fiscal and monetary stimulus; demand for consumer goods then stayed surprisingly strong as restrictions eased. The pandemic and related restrictions also interrupted production and distribution. Even without these production disruptions, supply chains would have struggled to accommodate the sudden and substantial surge in demand for goods seen in many economies.

Graph C.3



Research has indicated that supply shocks (including Russia's invasion of Ukraine) were responsible for at least half the increase in inflation in other advanced economies; preliminary modelling suggests that this has also been the case in Australia.^[2] These shocks have had a persistent effect on inflation. It is also possible that multiple supply shocks have had a compounding effect on inflation.

Moreover, international evidence suggests that both the magnitude and pace of firms' pass-through of input cost pressures has increased recently.^[3] It has long been known that inflation is more responsive to supply and demand imbalances at very low levels of unemployment (i.e. that the Phillips curve is non-linear). However, as there has been little experience of such low levels of spare capacity for several decades, this effect is difficult to quantify.^[4]

Inflation in Australia picked up later than in many other countries and retailers here were initially slow to pass through higher upstream costs to final prices. Many Australian firms delayed raising prices while cost pressures were still expected to be transitory and margins were supported by hedging practices and pandemic-related fiscal support. Concerns about the outlook for demand following the Delta-variant lockdowns may have also contributed. The price-setting behaviour of firms appeared to change in late 2021 and early 2022 as global imbalances continued, with price increases led by consumer durables. Reports of price increases by retailers broadened and retailers decided to pass through any further cost increases in full; firms appeared to be more willing to raise prices in an environment of widespread price increases.

Domestic capacity constraints have been more binding than expected

GDP increased by 3½ per cent over the year to June 2022, which was somewhat weaker than the forecast at the time of the August 2021 *Statement* (though the forecast miss on activity was small compared with that on inflation) (Graph C.4). Dwelling and business investment were weaker than expected, despite very strong demand, in part reflecting that capacity constraints were more binding than had previously been anticipated.

The inflationary effects of binding sectoral capacity constraints were underappreciated, and inflation increased rapidly in some sectors. Typically, the aggregate output gap is most relevant for the assessment of the implications for inflation – however, because of their highly uneven nature in this episode, the shocks in specific sectors mattered.^[5] This was most evident in the construction sector, where capacity constraints combined with higher materials costs and measurement impacts from the HomeBuilder program led to new dwelling inflation reaching 21 per cent over the year to the September quarter of 2022. Stronger-than-expected new dwelling inflation (compared with the model-based forecasts) accounted for around one-quarter of the miss on headline inflation.

Consumption bounced back quickly following the easing of restrictions relating to the Delta outbreak in late 2021. While the bounce-back was anticipated based on experience from lockdowns earlier in the pandemic, this particular recovery was still a little stronger than expected. Inflationary pressures from strong household demand began to materialise in some items as households returned to more normal

patterns of services consumption. Market services inflation increased to be around its strongest rate in around three decades; price increases were particularly strong for household services such as hair dressing, and there was underlying strength in meals out & takeaway prices.

The Bank also underestimated the underlying momentum in the labour market, which was partly obscured by the effects of lockdowns in the second half of 2021. The unemployment rate has declined at a much faster pace than previously anticipated to reach levels last observed in the mid-1970s (Graph C.5). Government support packages and accommodative monetary policy avoided labour market scarring during the early stages of the pandemic and the Delta lockdowns, and provided the momentum for future employment growth. Models suggest that the direct contribution of this to the forecast miss on inflation has been relatively small so far, as wages measures are yet to pick up significantly (though broader measures of labour costs and unit labour costs have started to increase) and flow through to inflation with a lag. Nonetheless, the impact on sectoral supply constraints from the difficulties in obtaining labour has

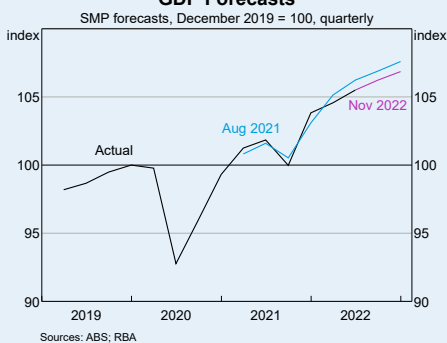
contributed to inflation by running up against strong demand.

Model-based forecasts underestimated inflation and upward adjustments based on other information were incorporated into the forecasts

The Bank draws on a suite of econometric models as part of the forecasting process.^[6] Each of these models materially underestimated inflation over the past year (Graph C.6). Most of these models are designed to capture demand-driven inflationary pressures in the economy, which have been the most important drivers of inflation over recent decades. These models (like most forecasting models) were not well equipped to capture supply-driven inflation, the signal from global inflation surprises, a change in firms' pricing behaviour or shocks that are highly uneven across sectors. This is because it is difficult to capture the inflation signal from unusual drivers or unprecedented events in a forecasting framework, which relies on the statistical relationships that prevailed on average in the past.

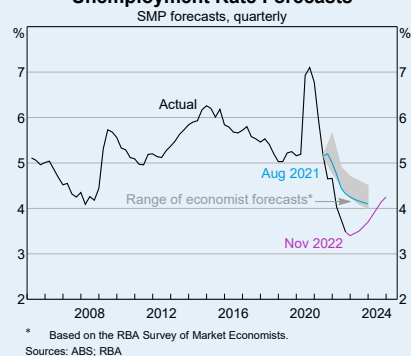
Graph C.4

GDP Forecasts



Graph C.5

Unemployment Rate Forecasts



For example, a number of the models attempted to capture global supply-side inflationary pressures through import prices, but the predicted effect was much more muted than what eventuated. This was because the estimated transmission of import prices to trimmed mean inflation in

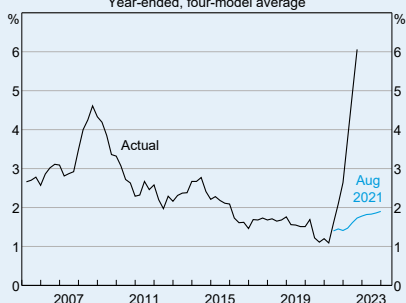
our models was very low (1–5 per cent of the increase in import prices, and only 15 per cent even in the model for tradables price inflation). These average historical estimates reflect that previous supply shocks tended to be small, short lived and narrowly based. As a result, firms tended to absorb these in margins. The large supply shock component to the recent import price increases is unprecedented during the inflation-targeting period on which the models are estimated.

To address these shortcomings, upward adjustments informed by liaison, surveys and international experience have increasingly been incorporated into the forecasts and more weight has been placed on sectoral models. This reduced forecast errors over the past year compared with a fully model-based approach, but did not eliminate them. ❖

Graph C.6

Trimmed Mean Inflation Model Forecast

Year-ended, four-model average



Sources: ABS; RBA

Endnotes

- [1] See Chahad M, A Hofmann-Drahonsky, B Meunier, A Page and M Tirpák (2022), ‘What Explains Recent Errors in the Inflation Projections of Eurosystem and ECB Staff?’, *ECB Economic Bulletin*, Issue 3/2022; Bank of Canada (2022), *Monetary Policy Report*, July.
- [2] See Shapiro A (2022), ‘How Much Do Supply and Demand Drive Inflation?’, FRBSF Economic Letter, Federal Reserve Bank of San Francisco, 21 June; Del Negro M, A Gleich, S Goyal, A Johnson and A Tambalotti (2022), ‘Drivers of Inflation: The New York Fed DSGE Model’s Perspective’, *Liberty Street Economics*, Federal Reserve Bank of New York, 1 March; di Giovanni J, S Kalemli-Özcan, A Silva and M Yıldırım (2022), ‘Global Supply Chain Pressures, International Trade, and Inflation’, *ECB Forum on Central Banking*, June.
- [3] See Amiti M, S Heise, F Karahan and A Sahin (2022), ‘Pass-Through of Wages and Import Prices Has Increased in the Post-COVID Period’, *Liberty Street Economics*, Federal Reserve Bank of New York, 23 August; Bank for International Settlements (2022), ‘Inflation: A look Under the Hood’, *Annual Economic Report*, June.
- [4] See Gopinath G (2022), ‘How Will the Pandemic and War Shape Future Monetary Policy?’, *Jackson Hole Symposium*, 26 August.
- [5] See di Giovanni et al, n 2.
- [6] Comprehensive econometric models – including single-equation aggregate inflation models, sectoral models and the full system economic model (MARTIN) – are used to underpin our forecasts, develop alternative scenarios and perform sensitivity analysis. See Cassidy N, E Rankin, M Read and C Seibold (2019), ‘Explaining Low Inflation Using Models’, *RBA Bulletin*, June. Available at <<https://www.rba.gov.au/publications/bulletin/2019/jun/explaining-low-inflation-using-models.html>>