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# AUSTRALIA

## SELECTED ISSUES

February 2023

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# AUSTRALIA

## SELECTED ISSUES

January 9, 2023

Approved By
**Asia and Pacific Department**

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## CONTENTS

**FIGURE**

# INFLATION AND WAGE DYNAMICS IN AUSTRALIA[1]

*Australia, like other advanced economies, is witnessing high inflation that has become broad-based, though wage pressures in Australia have so far been contained. Although wages in Australia are less sensitive to labor market tightness compared with other economies, the tight labor market conditions are likely to feed into higher wages in the future, as evidenced by a robust Phillips curve relationship and business surveys pointing to emerging pressures. The RBA needs to remain vigilant, continuing to tighten policy to rebalance demand and supply, and ensuring that inflation expectations and wage pressures remain contained.*

## A. Introduction

**1. Like other advanced economies, Australia is witnessing high inflation that has become broad-based, though wage pressures in Australia appear contained so far**. Headline and core measures of inflation have accelerated and are well above the target range, with a large share of the CPI basket experiencing price gains of over 3 percent per year. Energy inflation in Australia remains significantly below that of other OECD countries, though core inflation, which excludes volatile energy and food components, shows Australian inflation well within the range of other OECD economies. That said, despite a tight labor market, wage pressures appear subdued so far.

**2. This paper analyzes inflation dynamics in Australia, with a special focus on wages**.

- *Inflation:* The paper finds inflation dynamics in Australia are similar to what is seen in most advanced economies in recent quarters, with inflation primarily driven by cyclically sensitive components. While external shocks following the Russian invasion of Ukraine and supply and shipping bottlenecks stemming from COVID-19 played a significant role in the initial spike in inflation, a positive output gap amid a historically tight domestic labor market is likely to play an increasingly important role going forward.

- *Wages:* Wage pressures are likely to pick up. Cross-country comparisons suggest that wages in Australia are less sensitive to labor market tightness than in other countries, potentially due to labor market institutions (collective bargaining and length of contracts). Nevertheless, labor market tightness is an important driver of wage growth, and tight labor market conditions are likely to feed into higher wages in the future. Static Phillips curve models predict higher wage growth than currently observed, indicating that continued labor market tightness could add upward pressure to wage dynamics in the period ahead. Evidence from business surveys also point to emerging pressures on labor costs. On the other hand, reopening of borders may mitigate some of the wage pressures.

- *Policy:* Monetary policy needs to continue tightening to rebalance demand and supply, with the pace and extent of tightening depending on the evolution of inflation, inflation expectations,

[1] Prepared by Pragyan Deb and Siddharth Kothari (both APD), with contributions from Yosuke Kido (BoJ). The chapter benefited from valuable comments from the Reserve Bank of Australia and the Commonwealth Treasury of Australia.

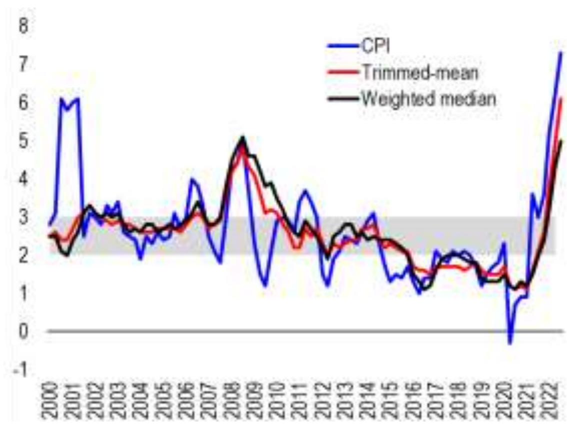
and wage growth. The RBA will need to be especially vigilant to inflation expectations and wage developments given upside risks.

**3. The rest of the paper is structured as follows.** Section B takes a deeper look at inflation developments in Australia in an international context, including the role of cyclical components. Section C focuses on wage dynamics, comparing recent wage growth to model predictions, explores evidence from sectoral Phillips curves, and uses cross-country data to analyze the role of labor market institutions in shaping the unemployment-wage nexus across countries. Section D concludes.

## B. Inflation Developments

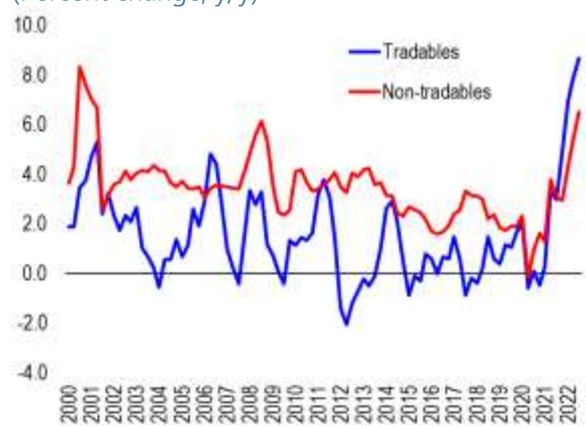
**4. Inflation in Australia has accelerated and become broad-based.** Headline inflation reached 7.3 percent in the third quarter of 2022. Measures of underlying inflation, including trimmed mean and weighted median inflation, have also accelerated and are now well-above the RBA's target range of 2 to 3 percent. While there is a significant external component to inflation, with tradable inflation increasing to 8.7 percent, non-tradable inflation has also accelerated in recent quarters, reaching 6.5 percent in 2022Q3. Overall, inflation pressures appear broad-based, with about 90 percent of the CPI basket experiencing price gains of over 3 percent per year, and also reflect strong domestic demand and rising input prices, although wage pressures remain subdued (see below).[2]

**Inflation Has Increased in Australia**
(CPI inflation, percent change, y/y)




Source: Haver Analytics.

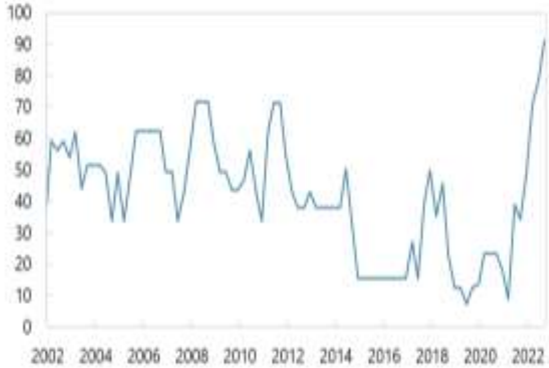
**Tradable Inflation Has Risen Sharply, Though Non-tradable Inflation Has Also Increased.**
(Percent change, y/y)




Source: Haver Analytics.

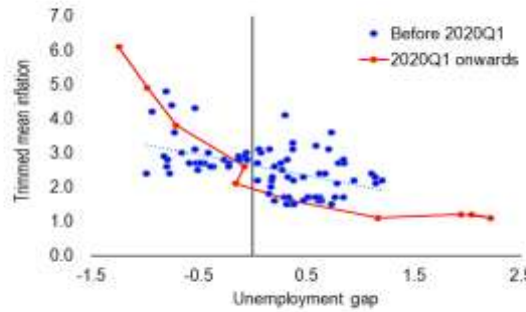
[2] Business Indicators data suggest an increase in non-wage non-profit shares of total sales, and PMI indices show significant input price pressures in Australia. National accounts data however suggests that wage and profit shares have not shifted significantly in recent quarters through 2022Q2.

**Inflation Has Also Become Broad-based**
(CPI items rising by more than 3 percent, sum of weights)




Sources: Reserve Bank of Australia; Haver Analytics; and IMF staff calculations.
Note: Chart is calculated based on year-on-year growth rates of non-seasonally adjusted data for the 11 CPI groups.

**High Inflation Partly Reflects Tightness in the Domestic Economy**
(Trimmed mean inflation, y/y vs. unemployment gap)




Sources: Haver Analytics; and IMF staff calculations.

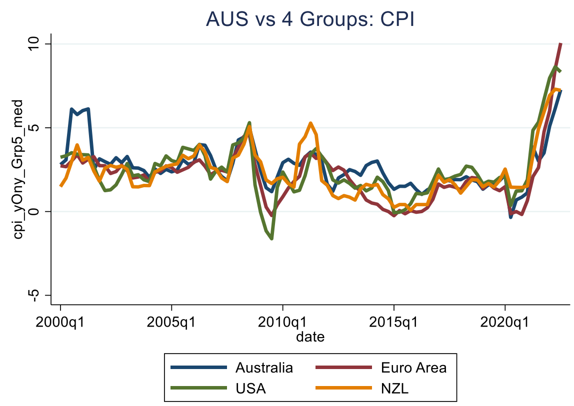
5. **Australia's inflation developments are similar to those in other advanced economies, though with lower energy inflation.** Inflation has increased in most advanced economies in recent quarters, with headline inflation in Australia being on the lower end of the spectrum compared to other OECD countries. The spike in global energy prices following the Russian invasion of Ukraine has resulted in a steep rise in energy inflation around the world, especially in Europe. Energy inflation in Australia has also increased to close to 15 percent, though remains significantly lower than in other OECD countries. A comparable measure of core inflation across countries, which excludes volatile energy and food components, shows Australian inflation at close to the OECD median.[3]

### Cyclical Versus Non-Cyclical Inflation

6. **Overall inflation can be broken down into cyclical and non-cyclical inflation to better understand the dynamics.** Following Stock and Watson (2019), we can estimate the cyclically sensitive component of inflation based on the association between inflation and economic slack. While there are different measures for economic slack, for this exercise, we measure slack by using the unemployment gap—the difference between the observed unemployment rate and trend unemployment (see Lian and Freitag, 2022).[4] Correlations are calculated for a panel of 30 advanced economies for which breakdown of CPI components are available for the 12 one-digit COICOP

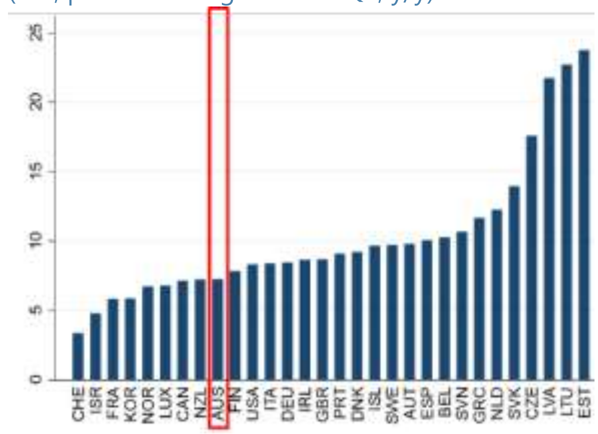
[3] In Australia, owner-occupied housing is a key driver of non-food non-energy inflation and the methodology used to measure owner-occupied housing inflation in Australia is different relative to other countries such as Canada, euro area, New Zealand, the United Kingdom, and the United States. If owner- occupied housing is excluded, core inflation in Australia is also at the lower end of the spectrum.
[4] Trend unemployment is measured using an HP filter with a smoothing parameter of 14400. Results are robust to alternate specifications, including a smoothing parameter of 1600.

**Headline Inflation Has Increased in Most Advanced Economies**
(Headline CPI inflation, percent change, y/y)



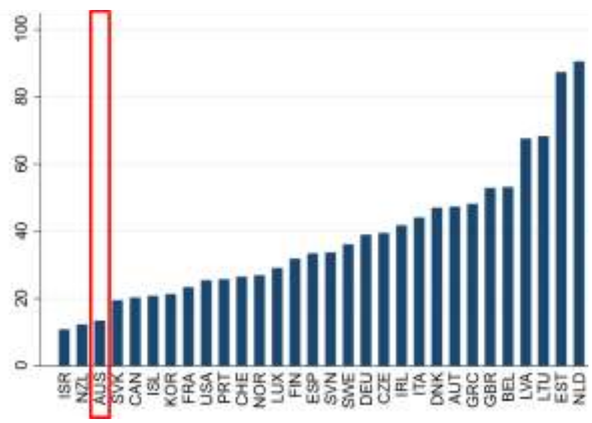

Sources: OECD; and IMF staff calculations.

**The Rise in Australian Inflation is on the Lower End of OECD Peers**
(CPI, percent change in 2022Q3, y/y)



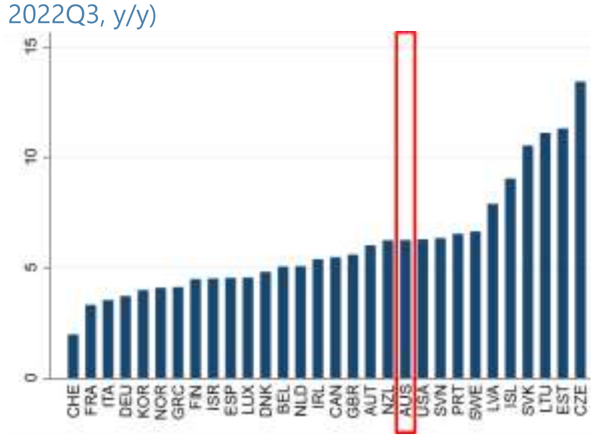
Sources: OECD; and IMF staff calculations.

**Though Still High, Energy Inflation in Australia Is Lower than in Other OECD Countries**
(CPI energy, percent change in 2022Q3, y/y)



Sources: OECD; and IMF staff calculations.

**Non-Food Non-Energy Inflation in Australia Is on Par with the OECD Average**
(CPI non-food non-energy, percent change in 2022Q3, y/y)



Sources: OECD; and IMF staff calculations.

components, over the period 2000Q1 to 2022Q2.[5] While a more detailed breakdown of inflation is available for Australia, using the 12-digit COICOP allows us to compare across countries and also estimate the sensitivity of sectors in a panel setting, avoiding potential endogeneity concerns. But this comes at a cost of having relatively broad and heterogenous components. We find that cyclical sensitivity varies significantly across CPI components and overall, the classification we obtain is similar to that from earlier studies. For the most cyclical components, the correlation between their inflation and unemployment gap is negative for our sample of advanced economies, allowing us to break down overall inflation between cyclical and non-cyclical components. For headline CPI

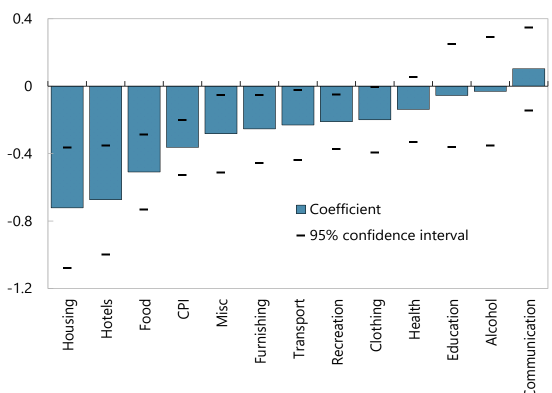
[5] Countries in our sample are Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Estonia, France, Germany, Finland, Greece, Iceland, Ireland, Israel, Italy, Japan, Korea, Latvia, Lithuania, Luxembourg, Netherlands, Norway, New Zealand, Spain, Portugal, Slovenia, Spain, Sweden, Switzerland, the United Kingdom and the United States.

components, housing, transportation, furnishing, hotels and restaurants, food and miscellaneous items are classified as cyclical components. We also construct an alternate measure which excludes food and energy (from transportation and housing) to arrive at a "core" measure of the cyclical component.

**7. Our analysis suggests that in Australia, like in other advanced economies, current inflationary pressures are driven by cyclically sensitive components.** This does not necessarily mean that inflation in Australia is driven primarily by domestic factors—for example, while furnishing and housing are cyclically sensitive, their prices may still be driven by higher global prices of inputs and supply and shipping bottlenecks. Also, the analysis does not take into account one-off factors such as severe weather and flooding that affected food prices in Australia. However, the increase in cyclical inflation globally does suggest a role for the synchronized pickup in demand after the pandemic, particularly in the advanced economies, in the presence of continuing supply disruptions, including labor. This has resulted in a tight labor market globally and hence an increase in the cyclically sensitive inflation component, i.e., the component correlated with unemployment gap. Although these results do not necessarily imply that inflation is primarily driven by domestic factors, the fact that cyclical components that are historically sensitive to economic slack are driving inflation suggests a role for domestic demand management policies. These results are robust to differences in CPI weights across countries and continue to hold if weight differences are controlled for by using Australia CPI weights when comparing across countries. In addition, stripping out volatile components such as food and energy from the analysis does not change the overall result.[6]

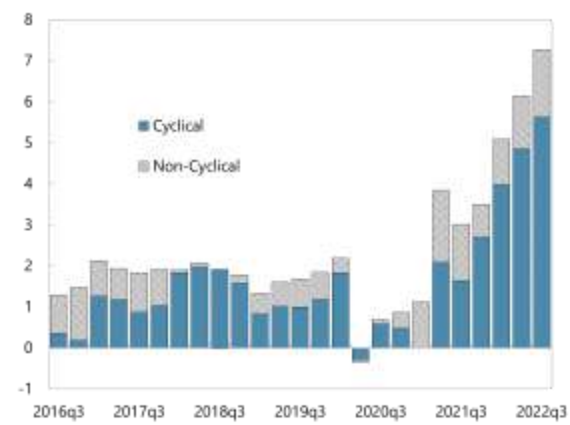
**Some Inflation Components Are More Sensitive to Cyclical Conditions**

(Sensitivity to unemployment gap)




**Cyclical Components Are Currently Driving Headline CPI in Australia**

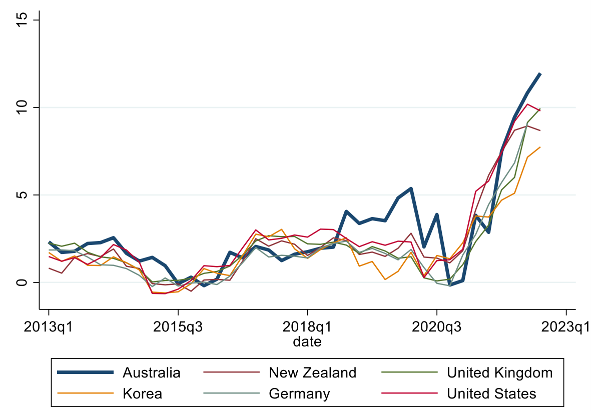
(Headline CPI, percent, y/y)




Sources: OECD; and IMF staff calculations.

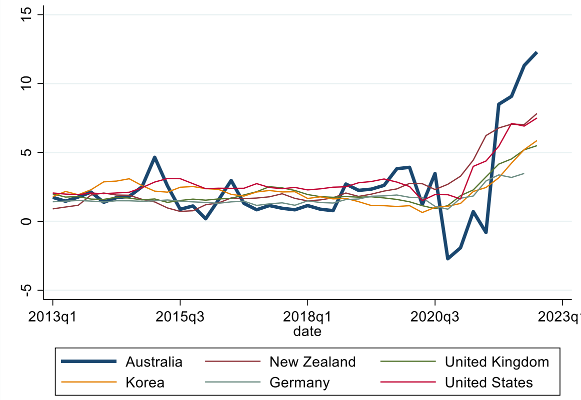
[6] Energy component is removed from the transportation and housing sectors. Food is omitted from the analysis.

**Cyclical Components Are also the Main Driver of Inflation in Other Advanced Economies**
(Cyclical headline CPI, percent, y/y)




Sources: OECD; and IMF staff calculations.

**Results Are Robust to Excluding Energy and Food**
(Cyclical component, percent, y/y)

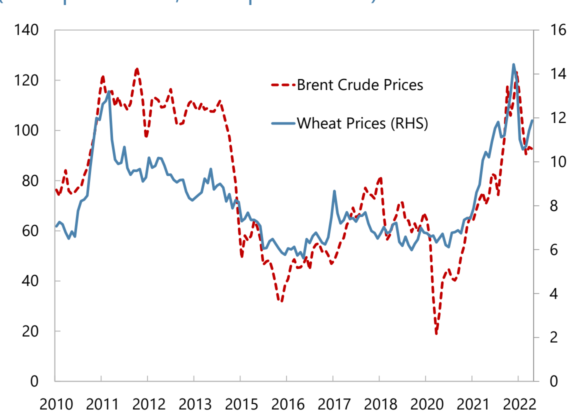



Sources: OECD; and IMF staff calculations.
Note: Differences in non-food non-energy inflation between Australia and other countries in part reflect differences in methodology for measuring owner-occupied housing inflation across countries.

## Changing Importance of External and Domestic Factors

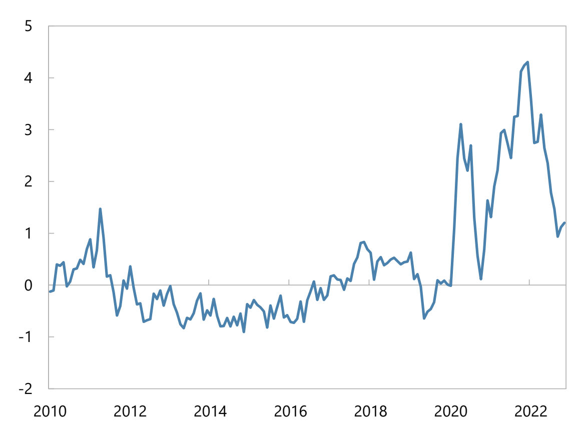
8. **The initial inflation spike in Australia was driven by surging international food and energy prices, along with supply chain and shipping disruptions.** But pressures from food and commodity prices are easing, and there are signs that capacity is beginning to catch up with the strong demand for goods. Supplier delivery times have returned to levels last observed 18 months ago, and global shipping costs have started to ease, albeit from high levels. Aggregate demand is expected to moderate as central banks across the globe tighten policy, but the risks of further supply disruptions cannot be ruled out given uncertainty surrounding China's economy.

**Global Energy and Food Prices Have Come Off their Peaks**
(USD per Barrel; USD per Bushel)




Source: Haver Analytics.

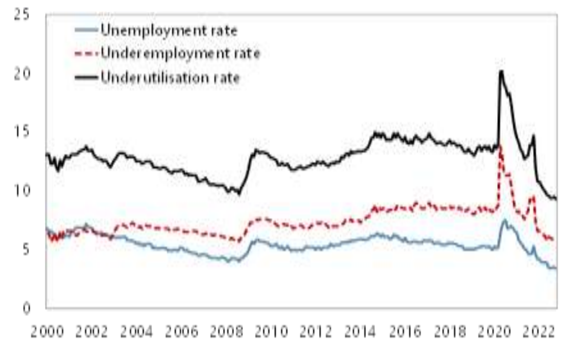
**Supply Chain Pressure Have Eased**
(Global Supply Chain Pressure Index)




Source: New York Fed.

**9. Wages are likely to play an increasing role in determining the persistence of inflation in Australia.** While the initial spike in inflation was driven by external factors, domestic demand is likely playing an increasing role. Labor markets in Australia are at historically tight levels, with the employment-to-population ratio and participation rate at record highs. Job vacancies are at very high levels, and underemployment and underutilization have come down as hiring workers has become increasingly challenging. How quickly and persistently these tight labor market conditions feed into wages, and in turn prices, will play a dominant role in determining the future path and persistence of inflation.

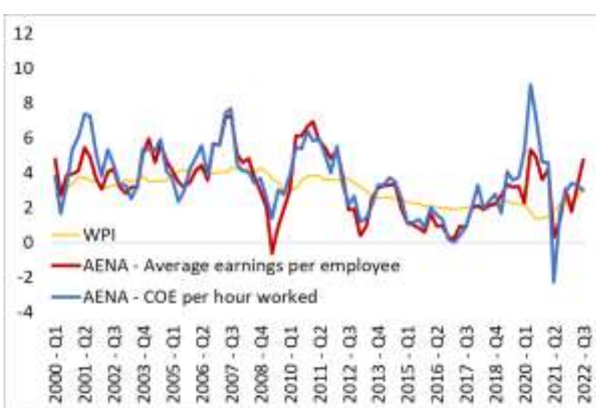
Labor Market Indicators
(Percent, seasonally adjusted)




## C. Wage Dynamics

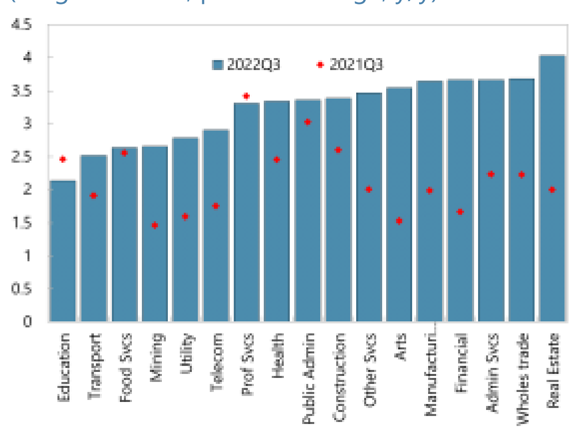
**10. Wage pressures appear to be subdued so far.** Wage inflation in Australia, as measured by the year-on-year change in the Wage Price Index (WPI), declined to a low of 1.4 percent during the COVID crisis. Wage inflation has increased to 3.1 percent in 2022Q3, with private sector wages picking up to 3.4 percent. Other metrics of wage inflation based on national accounts data have also seen an uptick but remain moderate by historical standards. Sectoral wage data also shows wage growth remains contained so far, even in sectors such as construction and manufacturing, where business surveys tend to show labor costs and labor shortages as major areas of concern for companies. While wages growth in most sectors is higher than a year ago, overall increases appear contained, though it is possible that they may increase in the future as wages catch up with labor shortages.

**Wage Inflation in Australia Remains Moderate**
(Wage inflation, percent change, y/y)




Sources: OECD; and Haver Analytics.

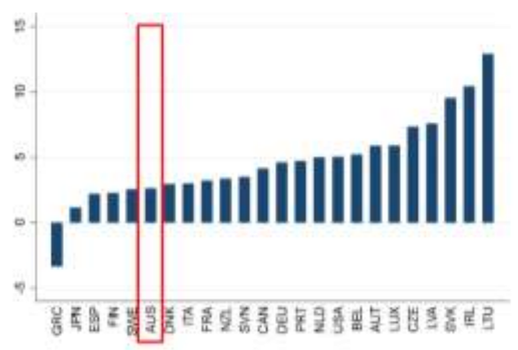
**Wage Pressures in Sectors Facing Worker Shortages Remain Moderate**
(Wage inflation, percent change, y/y)




Source: Haver Analytics.

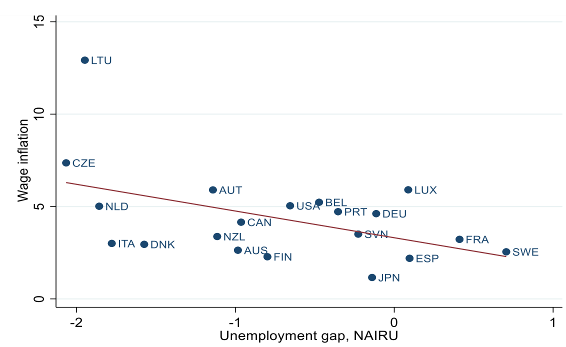
**11. Wage inflation in Australia has remained low in international comparison.** To assess wage pressures in Australia in an international context, and to analyze the drivers of wage inflation, we assemble data on wage inflation for a group of 24 advanced economies. As harmonized wage price indices are not available for all countries, we use various national sources, including the Wage Price Index in Australia, Labor Cost Indices for Europe and New Zealand, and other national sources where available.[7] Most advanced economies have higher wage growth than Australia, with median wage inflation in peers at about 4 percent as of 2022Q2. Wage growth is generally higher in countries with tight labor markets, indicating an important role for domestic labor market conditions in explaining wage dynamics.

**Wage Inflation in Australia Remains Low by International Standards**
(Wage inflation, percent change in 2022Q2, y/y)




Source: Haver Analytics.

**Countries with Tighter Labor Markets Tend to Have Higher Wage Inflation**
(WPI y/y percent change vs. unemployment gap)



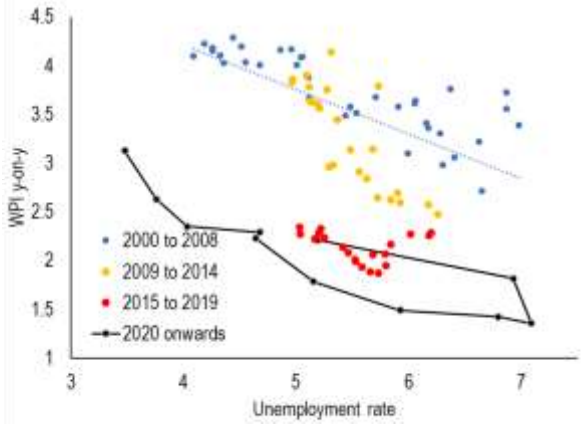

Sources: Haver Analytics; and IMF staff calculations.

## Wage-Unemployment Relation in Australia and Internationally

**12. The wage-unemployment relation varies across countries and within countries over time.** In Australia, aggregate wage inflation has been low since about 2015, with the relation between wage growth and unemployment, the wage Phillips curve, seemingly shifting downwards and becoming flatter. Wage growth in the post-COVID period seems significantly lower than what a historical Phillips curve would suggest, though more in line with a lower and flatter Phillips curve. By contrast, in the US and in New Zealand, wage growth in recent quarters seems consistent with longer-term Philips curves.

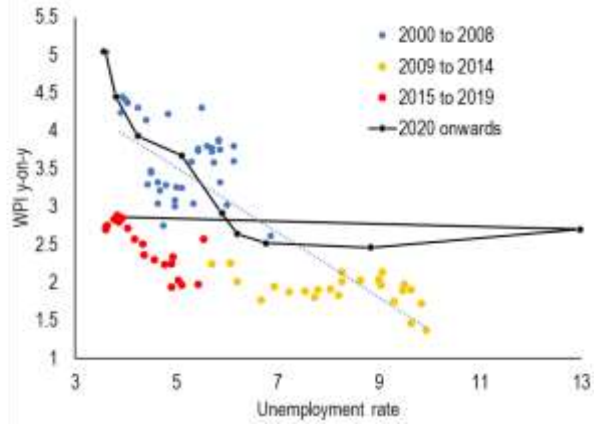
[7] In particular, we use Labor Cost Indexes covering industry, construction and services for all European countries, the Employment Cost Index for all civilians for the US, compensation per hour worked for Canada, and the Labor Cost Index covering public and private sector for New Zealand. For Japan, we compute hourly wages by dividing contractual earnings by total hours worked.

**In Australia, the Wage Phillips Curve Remains Low and Flat**
(Australia, Wage Phillips Curve)



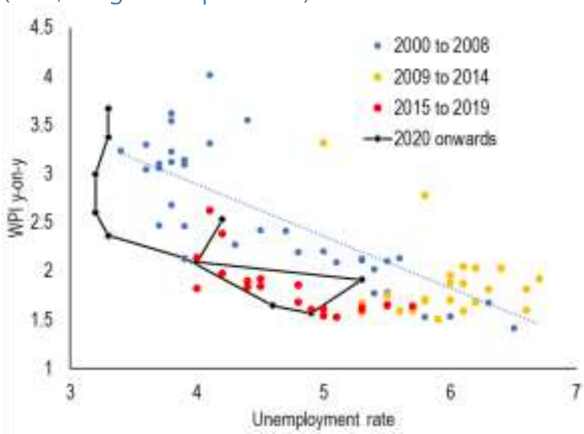

Sources: Haver Analytics; and IMF staff calculations.

**In the US, Wage Growth Is Now Above Levels Implied by Historical Trends**
(USA, Wage Phillips Curve)




Sources: Haver Analytics; and IMF staff calculations.

**New Zealand Also Has Higher Wage Growth Than Historical Trends**
(NZL, Wage Phillips Curve)



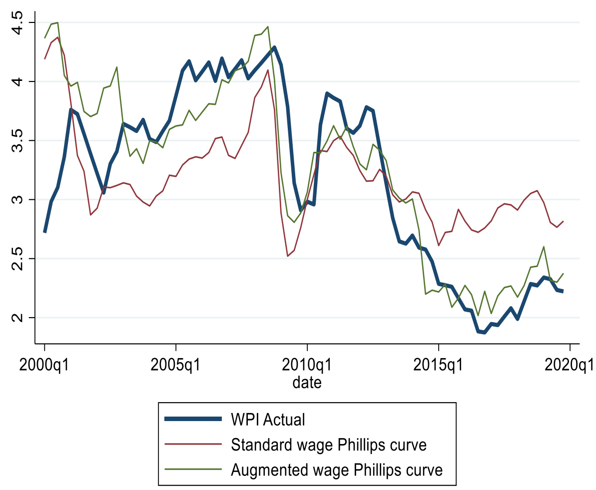

Sources: Haver Analytics; and IMF staff calculations.

13. **Australia's pre-pandemic low wage growth can be empirically explained by an augmented wage Phillips curve, though recent wage growth is low compared to model estimates.** A standard wage Phillips curve relationship, which incorporates unemployment gap and one-year ahead inflation expectations, suggest that wage growth in Australia has been lower than what the historical empirical relationship suggests.[8] However, such an estimate does not take into account persistent underemployment in Australia before the pandemic, where underemployment is defined as part-time employees who want to work more hours but are not able to. In addition, the standard Phillips curve relationship does not control for the secular decline in labor productivity

[8] We calculate unemployment gap by estimating trend unemployment using an HP filter with a smoothing parameter of 14400. Results are robust to alternate specifications, including a smoothing parameter of 1600. Results are robust to alternative measures of labor market slack, such as the unemployment gap calculated relative to the NAIRU.

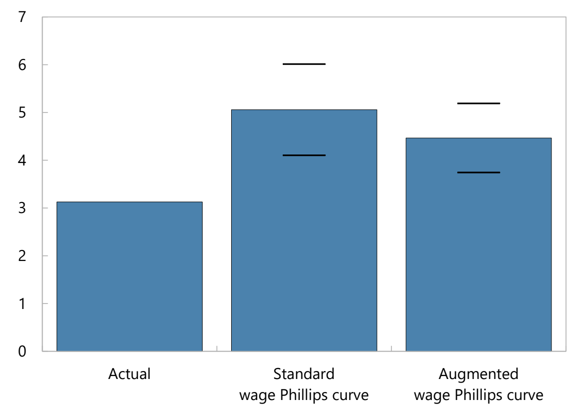
since the mining boom of the early 2010s and shocks to the terms of trade.[9] Controlling for these factors in an augmented wage Phillips curve relationship with additional control variables results in a much better fit with the observed dynamics of the WPI before the pandemic (see Annex for regression tables; see also IMF, 2020).[10] This analysis aims to establish the long-run relationship between economic slack and wage dynamics, as opposed to short-term forecasting, and implies that recent wage growth in Australia is below what economic indicators would imply. This suggests upside risks to wage inflation in the period ahead if the labor market remains tight.[11]

**Augmented Wage Phillips Curve Can Explain Low Pre-pandemic Wage Growth in Australia**
(Percent, y/y)




Sources: Haver Analytics; and IMF staff calculations.

**Latest Wage Growth Is Well Below Predictions Based on Phillips Curves**
(WPI growth, y/y, percent, 2022Q3)




Note: Black lines show 95 percent confidence intervals around the predicted values.
Sources: Haver Analytics; and IMF staff calculations.

**Role of Labor Market Tightness in Determining Wage Dynamics: Australia compared to Peers and Evidence from Australian Sectoral Data**

**14. Given the tightness of labor markets, we further explore the wage-unemployment relation in an international context.** We estimate wage Phillips curves using quarterly data for 23 countries from the period 2000 to 2019:[12]

$$\pi_{i,t}^{w} = \alpha_i + \alpha_t + \beta_1 u_{i,t}^{gap} + \beta_2 \pi_{i,t}^{e} + \beta_3 g_{i,t}^{LP} + \varepsilon_{t,i}^{h} \qquad (1)$$

[9] The downward shift in the wage Phillips curve in Australia can also reflect other structural factors not captured by the augmented Phillips curve, such as impact of globalization or changes in the relative bargaining power of labor. Bishop and Chan (2019) found that lower trade union density in Australia is not responsible for lower wage growth.
[10] Results are similar when a national account (AENA) based measure of wages, such as compensation per employees is used. However, given higher volatility of the AENA measure, the fit is less tight, especially for the augmented model (see Annex)
[11] Models using lagged wages as explanatory variables generally provide a better fit. But these models suggest very high persistence in wages, which in turn drives the results. While useful for forecasting, such persistence makes it harder to link wage dynamics to labor market slack (unemployment gap or underemployment). Hence the specification in this analysis does not include lagged wages.
[12] We exclude Greece from our sample when estimating the Phillips curves as the wage formation process in Greece was likely severely affected by the crisis in the country for a large part of our sample period.

where $\pi^{w}_{i,t}$ is the y-on-y percent change in wages in country '$i$' at time '$t$'; $u^{gap}_{i,t}$ is the.unemployment gap, computed as the deviation between the unemployment rate and an Hodrick-Prescott (HP) trend; $\pi^{e}_{i,t}$ is 1-year ahead inflation expectations from the consensus forecasts; and $g^{LP}_{i,t}$ is trend labor productivity growth.[13] All regressions include country and time fixed effects to control for unobservable time-invariant country characteristics and global shocks respectively and standard errors are clustered at the country level. We also consider dynamic versions of the equation, which includes 4 lags of the dependent variable.

**Table 1. Australia: Wage Phillips Curve – Australia Compared to Peers**

| VARIABLES | (1) Baseline Full Sample | (2) Baseline Australia | (3) With lags Full Sample | (4) With lags Australia |
|---|---|---|---|---|
| Unemployment gap | -0.944*** | -0.554*** | -0.272** | -0.160*** |
| | (0.284) | (0.207) | (0.0973) | (0.0505) |
| Expected inflation | 1.244*** | 0.309 | 0.282*** | 0.0448 |
| | (0.270) | (0.191) | (0.0956) | (0.0649) |
| Trend labor productivty growth | 0.890** | 0.602 | 0.324* | 0.0472 |
| | (0.375) | (0.374) | (0.158) | (0.119) |
| Lag 1, dependent variable | | | 0.694*** | 1.207*** |
| | | | (0.0813) | (0.0940) |
| Lag 2, dependent variable | | | 0.185*** | -0.261 |
| | | | (0.0397) | (0.159) |
| Lag 3, dependent variable | | | 0.0986** | -0.122 |
| | | | (0.0367) | (0.184) |
| Lag 4, dependent variable | | | -0.337*** | 0.105 |
| | | | (0.0254) | (0.102) |
| Constant | -0.505 | 1.602*** | 0.119 | 0.0336 |
| | (0.807) | (0.597) | (0.252) | (0.1000) |
| Observations | 1,660 | 80 | 1,604 | 80 |
| R-squared | 0.703 | 0.300 | 0.885 | 0.959 |

Source: IMF staff estimates.
Notes: Data at the country-quarter level. Reports results for estimates of equation 1. Dependent variable in each regression is growth rate of wages. Columns 1 is for the full sample of 23 countries while column 2 is for Australia only. Columns 3 and 4 repeat column 1 and 2 respectively but include lag values of the dependent variable. Standard errors are clustered at the country level for columns 1 and 3. *, **, and *** indicate significance at the 10, 5 and 1 percent level respectively.

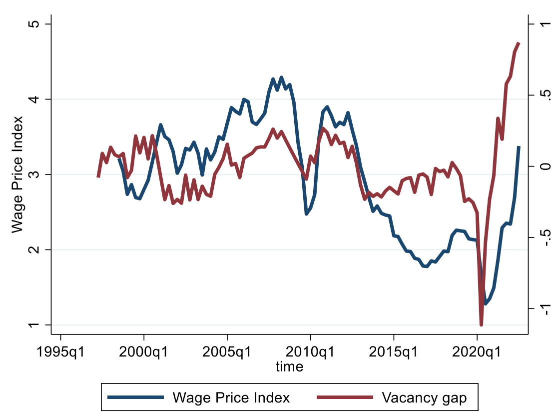
15. **Labor market tightness plays an important role in explaining wage dynamics, though Australian wages are somewhat less sensitive to unemployment compared to peers.** Table 1 reports results for the baseline estimates of the wage Phillips curve. As predicted by theory, higher unemployment relative to trend is associated with lower wage growth, while higher inflation expectations are associated with higher wage growth. Lower trend productivity growth is also associated with lower wage growth (column 1). Column 2 repeats the same specification but only for Australia. Unemployment gap remains negative and significant, though the coefficient is smaller

[13] For trend unemployment, to ensure cross-country comparability, in the baseline we use HP filtered unemployment rate with a smoothing parameter of 14400. As a robustness we also consider $u^{gap}_{i,t}$ measured as a deviation from NAIRU from the WEO Database. Trend labor productivity is also computed using an HP filter.

than for the cross-country panel, suggesting that Australian wages are less sensitive to labor market tightness than the average among advanced economies. Similarly, the smaller coefficient on inflation expectations suggests a much smaller reaction in Australian wages to inflation expectations than in the overall sample. These results are robust to including lags of the dependent variable as additional controls (column 3 and 4), using q-on-q growth rates of wages as the dependent variable, and using NAIRU instead of a HP trend to compute unemployment gap (Annex Table 2)

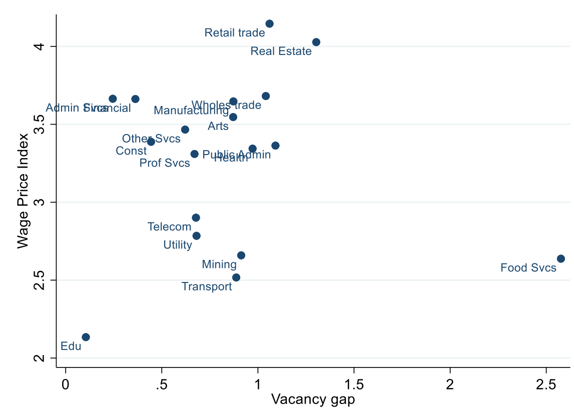
**16. Sectoral data for Australia also suggests a significant relationship between wage growth and labor market tightness.** We proxy unemployment at the sector level using advertised job vacancies in a particular sector, normalized by employment in that sector. We then calculate a measure of the vacancy gap using an HP filter on the vacancy rate by sector. At the aggregate level of all industries, we observe a positive correlation between wage growth and the vacancy rate, except in the aftermath of the last mining boom. Using the latest available data (2022Q3), we again find that sectors with a higher vacancy gap tend to have higher wage growth.

**Wage Growth and Vacancies Are Correlated at the Aggregate Level**
(Percent)




Sources: Haver Analytics.

**Sectors with Higher Vacancy Rates Are Exhibiting Higher Wage Growth**
(Percent, 2022Q3)




Sources: Haver Analytics; and IMF staff calculations.

**17. Formal analysis using a sectoral Phillips curve confirms the role of labor market tightness in explaining wage growth.** Empirical estimates of a wage Phillips curve relationship using industry level data, using a panel setting, confirms that a higher vacancy gap is associated with faster wage growth. For our baseline specification (Table 2, columns 1-4), we restrict the sample to the pre-COVID period (2000Q1 to 2019Q4) to avoid contaminating the regressions with pandemic related noise. In the simplest specification (column 1) we find that higher vacancy rates are associated with higher wage growth. This result continues to hold when we add 1-year ahead inflation expectations (column 2, instead of time fixed effects), labor productivity growth (column 3, though labor productivity is not statistically significant), and lagged wage growth (column 4). The results also hold if we include data from the pandemic years (column 5 and 6). Results in columns 1-6 are based on private sector wage growth, which is likely to be more sensitive to labor market conditions. However, we get similar, but weaker, results when we use total wages (which includes the public sector) in columns 7 and 8. Finally, the results are robust to using q/q growth in wages instead of y/y growth.

**Table 2. Australia: Wage Phillips Curve – Sector Level Analysis**

| VARIABLES | Private WPI | Private WPI | Private WPI | Private WPI | Private WPI | Private WPI | Total WPI | Total WPI | Q-on-Q | Q-on-Q |
|---|---|---|---|---|---|---|---|---|---|---|
| Vacancy gap | 0.195* | 0.381** | 0.168** | 0.0783** | 0.159* | 0.0809** | 0.180 | 0.0907* | 0.0874** | 0.0926*** |
| | (0.101) | (0.177) | (0.0697) | (0.0356) | (0.0852) | (0.0319) | (0.108) | (0.0493) | (0.0307) | (0.0299) |
| Inf Exp, 1 year ahead | | 0.00571*** | | | | | | | | |
| | | (0.000828) | | | | | | | | |
| Trend labor productivity growth | | | -0.112 | | | | | | | |
| | | | (0.0738) | | | | | | | |
| Lag 1, dependent variable | | | | 0.765*** | | 0.751*** | | 0.632*** | | -0.177*** |
| | | | | (0.0359) | | (0.0414) | | (0.0705) | | (0.0331) |
| Lag 2, dependent variable | | | | -0.0199 | | -0.0104 | | 0.000205 | | -0.171*** |
| | | | | (0.0310) | | (0.0306) | | (0.0289) | | (0.0397) |
| Lag 3, dependent variable | | | | 0.0674** | | 0.0650** | | 0.00775 | | -0.114*** |
| | | | | (0.0240) | | (0.0229) | | (0.0275) | | (0.0358) |
| Lag 4, dependent variable | | | | -0.143*** | | -0.152*** | | -0.0125 | | 0.427*** |
| | | | | (0.0431) | | (0.0409) | | (0.0348) | | (0.0575) |
| Constant | 0.0303*** | 0.0154*** | 0.0319*** | 0.01000*** | 0.0288*** | 0.0100*** | 0.0306*** | 0.0116*** | 0.00757*** | 0.00782*** |
| | (1.88e-05) | (0.00216) | (0.00111) | (0.00167) | (2.42e-07) | (0.00164) | (2.00e-05) | (0.00193) | (5.71e-06) | (0.000895) |
| Observations | 1,323 | 1,323 | 1,323 | 1,323 | 1,593 | 1,533 | 1,323 | 1,323 | 1,323 | 1,323 |
| R-squared | 0.703 | 0.278 | 0.713 | 0.869 | 0.719 | 0.877 | 0.722 | 0.841 | 0.416 | 0.589 |

Source: IMF staff estimates.

Notes: Data at the sector-quarter level. Dependent variable in each regression is y/y growth rate of wages, except columns 9 and 10 where q/q rates are used for robustness. Columns 1 to 4 use data for private sector wages and restricts the sample to the per-COVID period (2000Q1 to 2019Q4). Columns 5 and 6 report results for the full sample until 2022Q2 (including COVID period). Columns 7 and 8 use total WPI (private and public sector). All regressions include country and time fixed effects, except column 2 which excludes time fixed effect and instead uses 1-year ahead inflation expectations for the Australian economy (does not vary by sectors). Standard errors are clustered at the country level. *, **, and *** indicate significance at the 10, 5 and 1 percent level respectively.

## Role of Labor Market Institutions in Shaping the Unemployment-Wage Relation: Lessons from Cross-Country Analysis

18. **Labor market institutions can have varying effects on the cyclical response of wages to economic conditions.** The literature on how labor market institutions impact the responsiveness of wages to shocks remains inconclusive. The "corporatism" view of Bruno and Sachs (1985) and Calmfors and Drifill (1988) suggests that higher collective bargaining coverage could moderate wage demands in response to domestic and external shocks, as unions internalize the macroeconomic implications of higher wage increases, especially in response to a supply shock. A more recent literature argues that with higher bargaining power, workers are more likely to negotiate larger wage increases in tight labor market conditions, with the recent decline in union density and collective bargaining cited as one of the reasons for a flattening Phillips curve (BIS 2022, Lombardi and other 2020, and Ratner and Sim 2022, Suthaharan and Bleakley 2022). The theoretical literature is clearer on the impact of contract lengths on wage responsiveness: in countries where employment contracts are set for longer periods of time, wages are more sticky, reacting less to domestic and external conditions.

19. **To assess the role of labor market institutions in wage dynamics, we modify the standard Phillips curve to allow for heterogeneity based on labor market institutions.** In

particular, we introduce interaction terms to the standard Phillips curve described in equation 1, estimating:

$$\pi^{w}_{i,t} = \alpha_i + \alpha_t + \beta^1 u^{gap}_{i,t} + \boldsymbol{\gamma}(\boldsymbol{X_i} * \boldsymbol{u^{gap}_{i,t}}) + \beta^2 \pi^{e}_{i,t} + \beta^3 g^{LP}_{i,t} + \mathcal{E}^{h}_{t,i} \qquad (2)$$

where $X_i$ is a variable which captures labor market institutions in country $i$. We consider 3 labor market characteristics from OECD: (i) average share of workers under collective bargaining agreements, (ii) average length of collective bargaining agreements; and (iii) trade union density.[14]

**Table 3. Australia: Wage Phillips Curve – Unemployment Interacted with Labor Market Institutions**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| | Lags of dependent variable included | | | | Lags of dependent variable not included | | | |
| VARIABLES | Collective bargaining | Length of agreement | Trade union density | All together | Collective bargaining | Length of agreement | Trade union density | All together |
| Unemployment gap | -0.515*** | -0.715*** | -0.364** | -0.720*** | -1.608*** | -2.030*** | -1.274*** | -2.027*** |
| | (0.160) | (0.227) | (0.140) | (0.232) | (0.328) | (0.395) | (0.388) | (0.394) |
| Coll Bargaining*U gap | 0.00485** | | | 0.00156 | 0.0155*** | | | 0.00657 |
| | (0.00177) | | | (0.00191) | (0.00436) | | | (0.00552) |
| Avg length of contract*U gap | | 0.0189*** | | 0.0148* | | 0.0535*** | | 0.0349* |
| | | (0.00641) | | (0.00785) | | (0.0135) | | (0.0189) |
| Trade union density*U gap | | | 0.00522 | 0.00108 | | | 0.0205* | 0.00516 |
| | | | (0.00311) | (0.00254) | | | (0.0102) | (0.00815) |
| Expected inflation | 0.292*** | 0.322*** | 0.286*** | 0.323*** | 1.110*** | 1.135*** | 1.206*** | 1.112*** |
| | (0.0849) | (0.0860) | (0.0932) | (0.0850) | (0.201) | (0.189) | (0.248) | (0.188) |
| Trend labor productivty growth | 0.324* | 0.321* | 0.325* | 0.324* | 0.804** | 0.754** | 0.867** | 0.757** |
| | (0.160) | (0.161) | (0.160) | (0.164) | (0.322) | (0.316) | (0.370) | (0.316) |
| Lag 1, dependent variable | 0.672*** | 0.655*** | 0.688*** | 0.653*** | | | | |
| | (0.0780) | (0.0788) | (0.0799) | (0.0789) | | | | |
| Lag 2, dependent variable | 0.177*** | 0.172*** | 0.183*** | 0.171*** | | | | |
| | (0.0395) | (0.0382) | (0.0403) | (0.0385) | | | | |
| Lag 3, dependent variable | 0.0947** | 0.0936** | 0.0974** | 0.0930** | | | | |
| | (0.0365) | (0.0357) | (0.0366) | (0.0356) | | | | |
| Lag 4, dependent variable | -0.342*** | -0.343*** | -0.338*** | -0.344*** | | | | |
| | (0.0272) | (0.0277) | (0.0260) | (0.0284) | | | | |
| Constant | 0.225 | 0.276 | 0.143 | 0.283 | -0.112 | 0.00298 | -0.387 | 0.0407 |
| | (0.241) | (0.247) | (0.250) | (0.250) | (0.594) | (0.546) | (0.741) | (0.543) |
| Observations | 1,604 | 1,444 | 1,604 | 1,444 | 1,660 | 1,500 | 1,660 | 1,500 |
| R-squared | 0.887 | 0.889 | 0.885 | 0.889 | 0.729 | 0.744 | 0.710 | 0.747 |

Source: IMF staff estimates.
Notes: Data at the country-quarter level. Reports results for estimates of equation 2. Dependent variable in each regression is year-on-year wage growth. Columns 1-4 include lag dependent variables as controls, while columns 5-8 do not. Column 1 and 5 interact collective bargaining share with unemployment gap, columns 2 and 6 interact average length of collective agreements with the unemployment gap, columns 3 and 7 interact trade union density with unemployment gap, while columns 4 and 8 include all three interactions in the same regression. All regressions include country and time fixed effects. Standard errors are clustered at the country level. *, **, and *** indicate significance at the 10, 5 and 1 percent level respectively.

20. **Among the different labor market characteristics, longer contract length is most robustly associated with wages being less sensitive to unemployment and inflation expectations.** Table 3 reports results for equation 2, where the unemployment gap is interacted with various measures of labor market institutions. The coefficient on the interaction term of

[14] Australia and the United States get dropped from the sample when considering regressions with average length of collective bargaining contracts, as OECD does not have data on average contract lengths for these countries due to comparability issues.

collective bargaining with the unemployment gap is positive, which combined with the negative coefficient on unemployment gap itself, indicates that wages are less sensitive to movements in unemployment in countries with higher levels of collective bargaining. The same is true for length of contracts (column 2), with countries with longer contracts generally having less sensitive wages, while results for trade union density (column 3) are somewhat weaker. As the various measures of labor market institutions are correlated, in column 4 we include all three interactions together in the same regression. Consistent with theory, we find that length of contract is most robustly associated with wages being less sensitive to unemployment.[15] Quantitatively, about a 9-month longer average contract length reduces the sensitivity of wages to unemployment by half. Table 4 also reports results for equation 2, but interacting the institutional variables with inflation expectations. The results again point to length of contracts being most robustly associated with less sensitivity of wages to inflation developments. Therefore, length of contracts is likely the most salient feature of labor market institutions which matter for the cyclical response of wages to economic conditions.[16]

**Table 4. Australia: Wage Phillips Curve – Inflation Expectations Interacted with Labor Market Institutions**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| | Lags of dependent variable included | | | | Lags of dependent variable not included | | | |
| VARIABLES | Collective bargaining | Length of agreement | Trade union density | All together | Collective bargaining | Length of agreement | Trade union density | All together |
| Unemployment gap | -0.286*** | -0.312*** | -0.272** | -0.319*** | -0.955*** | -1.009*** | -0.941*** | -1.007*** |
| | (0.0976) | (0.107) | (0.0979) | (0.108) | (0.260) | (0.270) | (0.278) | (0.259) |
| Expected inflation | 0.408** | 0.599*** | 0.301** | 0.565** | 1.759*** | 2.149*** | 1.529*** | 2.122*** |
| | (0.159) | (0.207) | (0.123) | (0.200) | (0.376) | (0.493) | (0.400) | (0.464) |
| Coll Bargaining*Inf exp | -0.00345 | | | -0.00327* | -0.0156** | | | -0.0145** |
| | (0.00224) | | | (0.00182) | (0.00632) | | | (0.00512) |
| Avg length of contract*Inf exp | | -0.0195** | | -0.0182** | | -0.0632** | | -0.0436** |
| | | (0.00886) | | (0.00805) | | (0.0228) | | (0.0178) |
| Trade union density*inf exp | | | -0.00107 | 0.00736* | | | -0.0165 | 0.0132 |
| | | | (0.00245) | (0.00378) | | | (0.0117) | (0.00859) |
| Lab prod growth | 0.316* | 0.263 | 0.320* | 0.288* | 0.819** | 0.610* | 0.821** | 0.690** |
| | (0.152) | (0.157) | (0.161) | (0.150) | (0.323) | (0.347) | (0.375) | (0.318) |
| Lag 1, dependent variable | 0.687*** | 0.678*** | 0.694*** | 0.676*** | | | | |
| | (0.0823) | (0.0817) | (0.0812) | (0.0828) | | | | |
| Lag 2, dependent variable | 0.181*** | 0.179*** | 0.185*** | 0.178*** | | | | |
| | (0.0389) | (0.0397) | (0.0397) | (0.0392) | | | | |
| Lag 3, dependent variable | 0.0961** | 0.0956** | 0.0983** | 0.0951** | | | | |
| | (0.0369) | (0.0356) | (0.0368) | (0.0358) | | | | |
| Lag 4, dependent variable | -0.335*** | -0.338*** | -0.337*** | -0.338*** | | | | |
| | (0.0255) | (0.0255) | (0.0254) | (0.0257) | | | | |
| Constant | 0.270 | 0.506* | 0.141 | 0.461* | 0.190 | 0.861 | -0.161 | 0.824 |
| | (0.242) | (0.265) | (0.248) | (0.261) | (0.598) | (0.609) | (0.678) | (0.606) |
| Observations | 1,604 | 1,444 | 1,604 | 1,444 | 1,660 | 1,500 | 1,660 | 1,500 |
| R-squared | 0.885 | 0.887 | 0.885 | 0.887 | 0.713 | 0.722 | 0.705 | 0.727 |

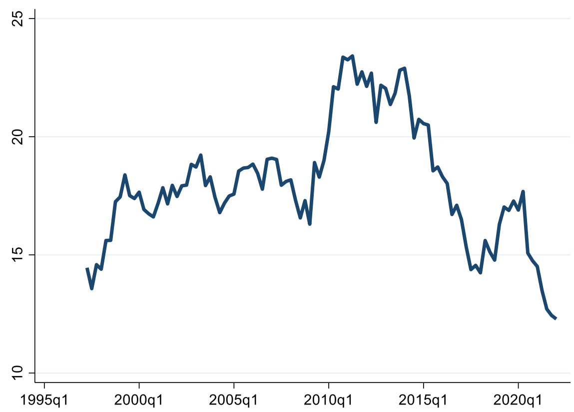
Source: IMF staff estimates.

Notes: Data at the country-quarter level. Reports results for estimates of equation 2. Dependent variable in each regression is year-on-year wage growth. Columns 1-4 include lag dependent variables as controls, while columns 5-8 do not. Columns 1 and 5 interact collective bargaining share with expected inflation, columns 2 and 6 interact average length of agreements with expected inflation, columns 3 and 7 interact trade union density with expected inflation, while columns 4 and 8 include all three interactions in the same regression. All regressions include country and time fixed effects. Standard errors are clustered at the country level. *, **, and *** indicate significance at the 10, 5 and 1 percent level respectively.

[15] As an extension, we also considered adding an interaction of the lagged dependent variable with length of contract. The interaction terms were insignificant.

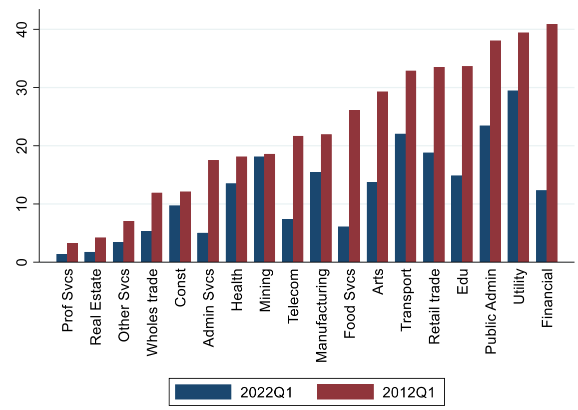
[16] Other structural characteristics can also impact sensitivity of wages to economic conditions. IMF (2022) finds that economies with more stringent employment protection laws and greater market power in product markets (as proxied by the average price markup in the economy) have wages that are more sensitive to changes in unemployment and inflation expectations.

**Coverage under Federal Wage Agreements Has Declined but Remains Significant**
(Share of employed under federal wage agreement, percent)



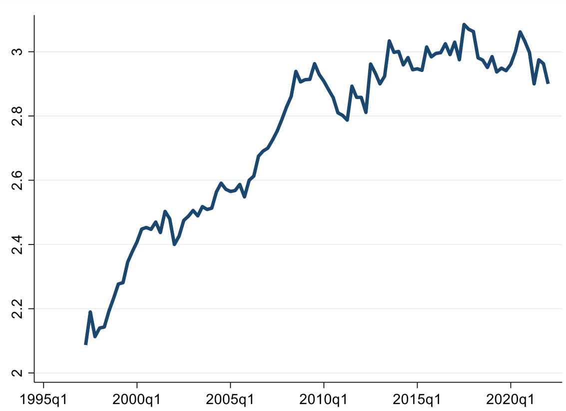

Sources: Haver Analytics and IMF staff calculations.

**Federally Registered Wage Agreement Shares Differ Significantly across Sectors**
(Share of employed under federal wage agreement, percent)



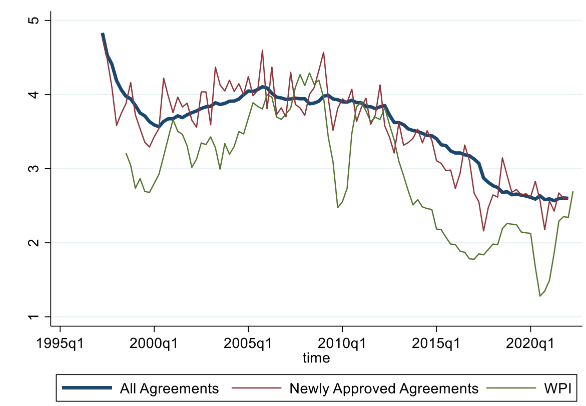

Sources: Haver Analytics and IMF staff calculations.

**The Duration of Agreements Has Remained High Since the 2010s**
(Wage agreement duration, years)




Sources: Haver Analytics and IMF staff calculations.

**Wage Increases Under Federal Agreements Have Fallen but Stabilized in Recent Years**
(Percent, y/y)




Sources: Haver Analytics and IMF staff calculations.

**21. Prevalence of enterprise wage agreements in Australia with long contract lengths may have moderated the increase in wage growth.** As of 2022Q2, about 1.74 million employees (13 percent of employees) were covered under current federally registered enterprise agreements,[17] with over 35 percent of employees (as of May 2021) covered when considering both federal and state registered enterprise agreements. This figure does not include awards, which accounted for 23 percent of employees in 2021. Therefore, while lower than in the past, collective wage agreements continue to cover a substantial portion of the workforce, with significant heterogeneity across sectors. This, coupled with the fact that the average duration of wage agreements has

[17] The data excludes expired agreements that have not yet been replaced.

increased to around 3 years in 2022, in part explains why wages in Australia have remained contained.[18] By design, wage increases under agreements with long durations are slow moving, and this avoided a sharper drop in wages during the pandemic, while in the current conjuncture, it has also resulted in a slower upward response of wages to labor market tightness. This is also borne out by wage increases granted in newly approved enterprise bargaining agreements, which have also remained subdued.

## D. Conclusion and Policy Discussion

**22. Inflation in Australia has risen and has become broad-based, with core inflation within the range of other advanced economies.** This is despite lower pressure from energy in Australia compared with other advanced economies. Cyclical inflation in Australia has also increased in line with what has been observed in other economies. The initial spike in inflation was more external, driven by a spike in international food and energy prices due to the war in Ukraine and supply chain and shipping disruptions, but these pressures are now easing. Commodity prices have come off their highs earlier in the year, and supply-side indicators such as global shipping costs, supplier delivery times and inventory-to-sales ratios are all easing, although second-round effects via higher utility prices (given the increase in wholesale costs) are expected to continue to exert pressures. But increasingly over time, these non-labor-cost external pressures are being replaced by domestic factors given an output gap that is expected to remain positive over the next couple of years and historically tight labor market with unemployment rates near a 50-year low.

**23. Although wage growth has remain subdued, given robust evidence of the Phillips curve relationship in Australia, it is expected to pick up.** Institutional features such as the prevalence of wage agreements with long contract lengths may have helped keep wages in check. Recent developments, including the Fair Work Commission (FWC) decision to increase award and national minimum wages by 4.6 and 5.2 percent, respectively, are likely to impact wage growth through the indirect impact on wages growth in other pay-setting methods, even though the direct impact is small. Average wage growth in enterprise agreements is expected to lag other pay setting methods, reflecting the multiyear duration of the outstanding stock of enterprise agreements and the low wage cap policies still in place across most state government employers. However, if inflation expectations increase and wage agreements lock in high wage growth, this could add to the persistence of inflation in the

**Wages and Business Survey of Labor Costs**
(Quarter-on-quarter change; percent; seasonally adjusted)


Sources: ABS; National Australia Bank Business Survey; and IMF staff calculations.

[18] Harmonized data for average length of contracts for Australia is not available from OECD, making comparisons more difficult. Among OECD countries, while contract lengths are relatively short at 12 months in several countries, they extent to as long as 36 months in Denmark, Spain, Italy, and Sweden. In Australia, while the average length of enterprise agreements is long, awards are reset every year, suggesting heterogeneity in responses for different groups.

future. Survey evidence points to this risk, but the reopening of the border could, over time, help to alleviate labor shortages, easing pressures.

**24. Inflation is expected to remain above target through 2024, necessitating continued monetary policy tightening to rebalance demand and supply.** Broad-based inflationary pressures are expected to gradually decline, with inflation reaching the inflation target band by the end of 2024, subject to some uncertainty. While wages have been slow to pick up, partly due to institutional features, the RBA needs to remain vigilant and ensure that supply and demand rebalance quickly so that current, high inflation does not lead to dis-anchoring of inflation expectations and higher wage demands, making inflation even more persistent. The RBA should communicate its policy intentions clearly and stand ready to recalibrate its forward guidance in response to evolving economic circumstances.

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# Annex I. Additional Results

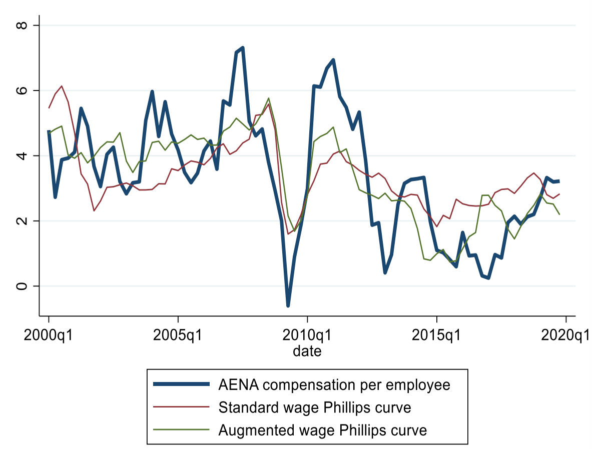
Annex Table 1 shows the regression tables for the baseline and augmented Phillips curves for both the WPI and different AENA measures of wage growth. The fit is less tight for the AENA measure, particularly for the augmented model, given higher volatility of the series. In addition, for the AENA augmented models, expected inflation enters with a wrong sign, even though it is statistically insignificant.

**Annex Table 1. Australia: Wage Phillips Curves**

| VARIABLES | (1) Standard | (2) Augmented | (3) AENA Average Earnings per Employee | (4) Augmented AENA Average Earnings per Employee | (5) AENA Non-Farm Average Earnings per Employee | (6) Augmented AENA Non-Farm Average Earnings per Employee |
|---|---|---|---|---|---|---|
| Unemployment gap | -0.418** | -0.238 | -1.510*** | -0.628 | -1.444*** | -0.609 |
| | (0.193) | (0.249) | (0.499) | (0.632) | (0.510) | (0.639) |
| Expected inflation | 0.560*** | 0.0587 | 1.009** | -0.538 | 1.020** | -0.565 |
| | (0.207) | (0.142) | (0.418) | (0.567) | (0.417) | (0.558) |
| Trend labor productivity growth | | 0.252 | | 0.749 | | 0.907 |
| | | (0.385) | | (1.064) | | (1.052) |
| Underemployment | | -0.681*** | | -1.058*** | | -1.014*** |
| | | (0.161) | | (0.353) | | (0.365) |
| Change in terms of trade | | 0.114 | | 5.941** | | 6.061** |
| | | (0.421) | | (2.304) | | (2.371) |
| Constant | 1.695*** | 7.800*** | 0.640 | 11.57*** | 0.604 | 11.17*** |
| | (0.542) | (1.665) | (1.080) | (3.311) | (1.073) | (3.418) |
| Observations | 80 | 76 | 80 | 80 | 80 | 80 |
| R-squared | 0.283 | 0.827 | 0.283 | 0.529 | 0.271 | 0.517 |

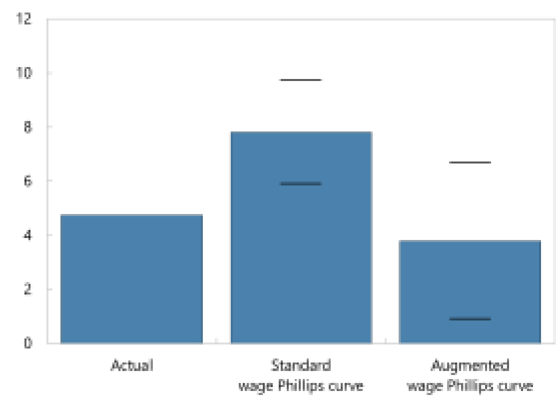
Source: IMF staff estimates.
Notes: Data at the quarterly frequency with robust standard errors.
*, **, and *** indicate significance at the 10, 5 and 1 percent level respectively.

**AENA Wage Measure Is More Volatile, but Phillips Curve Relationship Holds**
(Percent, y/y)




Sources: Haver Analytics and IMF staff calculations.

**Latest Wage Growth Is Again Below Standard Phillips Curve Prediction**
(WPI growth, y/y, percent, 2022Q3)




Note: Black lines show 95 percent confidence intervals around the predicted values.
Sources: Haver Analytics and IMF staff calculations.

Annex Table 2 below show robustness results for Equation 1. Columns 1 and 2 repeat the baseline specifications from Table 1, columns 3 and 4 use data on NAIRU from the World Economic Outlook Database to construct unemployment gap instead of an HP trend, while columns 5 and 6 use quarter-on-quarter growth rate of wages instead of year-on-year.

**Annex Table 2. Australia: Robustness for Wage Phillips Curve - Australia Compared to Peers**

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | Baseline | Baseline | NAIRU ugap | NAIRU ugap | Q-on-Q | Q-on-Q |
| VARIABLES | Full Sample | Australia | Full Sample | Australia | Full Sample | Australia |
| Unemployment gap | -0.272** | -0.160*** | -0.312** | -0.170*** | -0.194** | -0.0976** |
| | (0.0973) | (0.0505) | (0.115) | (0.0340) | (0.0719) | (0.0482) |
| Expected inflation | 0.282*** | 0.0448 | 0.142 | 0.0674 | 0.129* | 0.0434 |
| | (0.0956) | (0.0649) | (0.0954) | (0.0564) | (0.0709) | (0.0448) |
| Trend labor productivty growth | 0.324* | 0.0472 | 0.643*** | -0.0845 | 0.221** | 0.0369 |
| | (0.158) | (0.119) | (0.200) | (0.0937) | (0.0991) | (0.0836) |
| Lag 1, dependent variable | 0.694*** | 1.207*** | 0.586*** | 1.137*** | -0.167 | 0.360*** |
| | (0.0813) | (0.0940) | (0.0806) | (0.0929) | (0.103) | (0.129) |
| Lag 2, dependent variable | 0.185*** | -0.261 | 0.198*** | -0.235 | 0.0980 | 0.0826 |
| | (0.0397) | (0.159) | (0.0357) | (0.159) | (0.0635) | (0.156) |
| Lag 3, dependent variable | 0.0986** | -0.122 | 0.117*** | -0.111 | 0.0298 | 0.184* |
| | (0.0367) | (0.184) | (0.0350) | (0.179) | (0.0673) | (0.101) |
| Lag 4, dependent variable | -0.337*** | 0.105 | -0.340*** | 0.0874 | 0.158 | 0.125 |
| | (0.0254) | (0.102) | (0.0406) | (0.103) | (0.142) | (0.149) |
| Constant | 0.119 | 0.0336 | 0.319 | 0.324*** | 0.114 | 0.0261 |
| | (0.252) | (0.1000) | (0.188) | (0.120) | (0.173) | (0.0727) |
| Observations | 1,604 | 80 | 1,388 | 80 | 1,646 | 80 |
| R-squared | 0.885 | 0.959 | 0.819 | 0.963 | 0.353 | 0.688 |

Source: IMF staff estimates.

Notes: Data at the country-quarter level. Reports results for estimates of equation 1. Dependent variable in each regression is growth rate of wages. Columns 1 and 2 repeat the baseline from Table 1 in the main text, with column 1 being for the full sample of 23 countries while column 2 is for Australia only. Columns 3 and 4 repeat column 1 and 2 respectively but use NAIRU from the World Economic Outlook Database to construct unemployment gap instead of an HP trend, while columns 5 and 6 use quarter-on-quarter growth rate of wages instead of year-on-year. Standard errors are clustered at the country level for columns 1 and 3. *, **, and *** indicate significance at the 10, 5 and 1 percent level respectively.

# CLIMATE MITIGATION POLICIES IN AUSTRALIA[1]

*Australia has significantly raised its climate change mitigation ambition, upgrading its 2030 NDC under the Paris agreement and codifying the NDC, as well as the net zero by 2050 target, into law. Achieving its abatement goals will require significant policy effort. A broad-based carbon price is the most efficient and effective way to achieve emission reductions. However, if implementing a high enough economy-wide carbon price to meet the NDC is politically challenging, strong sectoral policies and regulations can play a key role in meeting emission goals.*

## A. Introduction

1. **Australia, like the rest of the world, faces significant challenges from climate change**. Rising temperatures and more frequent natural disasters, such as the recent bush fires and floods in Australia, are likely to impose significant human and economic costs (IPCC, 2022). Limiting the damage from climate change and attaining the Paris Agreement's temperature goals will require significant global effort, with estimates suggesting that greenhouse gas (GHG) emissions will need to be cut by 25 to 50 percent below 2019 levels by 2030 (Black and others, 2022). Australia will need to play its part, and in this context, Australia's upgraded mitigation targets are welcome.

2. **Achieving Australia's mitigation targets will require strong policy action.** Using the IMF and World Bank's Climate Policy Assessment Tool (CPAT), this paper assesses the impact of first-best mitigation policy on Australian emissions and economic activity. The paper finds that a broad carbon tax of US$75 can deliver significant abatement across sectors, reducing emissions in 2030 by about 16 percent relative to a business-as-usual scenario. The economic impact of a carbon tax is expected to be limited: the impact on GDP will depend crucially on how revenues are used, while the net welfare effect of carbon taxes, after considering other benefits (lower congestion, climate benefits etc.), will likely be positive. In the absence of an economy-wide carbon price, strong sectoral policies will be needed to achieve abatement goals.

3. **The rest of the paper is structured as follows.** Section B provides an overview of recent emission trends in Australia. Section C compares Australia's NDC to its own long-term target and to the NDC of other G20 countries. Section D discusses the impact of a carbon tax on emissions and economic activity. Section E to H discuss other sector policies, and Section I concludes.

## B. Recent Trends in Green House Gas (GHG) Emissions

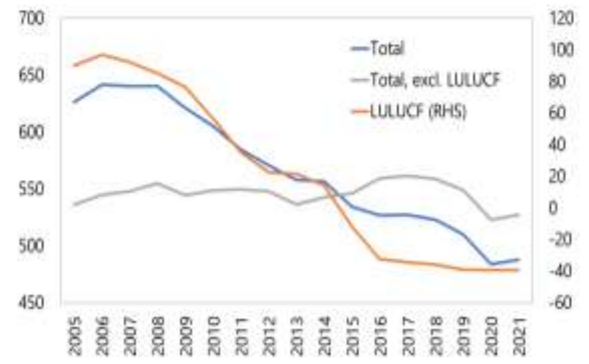
4. **Total GHG emissions have declined in Australia, though with significant heterogeneity across sectors.** Estimated emissions in 2021 were 489 MtCO2e, about 24 percent lower than peak emissions recorded in 2006. The LULUCF sector has seen a significant decline in emissions from 90 MtCO2e in 2005 to -39 MtCO2e in 2021, with total non-LULUCF emissions broadly unchanged over

[1] Prepared by Siddharth Kothari (APD) and Karlygash Zhunussova (FAD). The chapter benefited from valuable comments from the Commonwealth Treasury of Australia; the Department of Climate Change, Energy, the Environment and Water (DCCEEW); and participants at a seminar at the Treasury.

the same period.[2] Within non-LULUCF emissions, a decline in electricity, waste and agricultural emissions was offset by an increase in emissions in transport and other sectors. As of 2021, 33 percent of emissions come from the electricity sector, 21 percent from stationary energy, 19 percent from transport, and about 16 percent from agriculture.

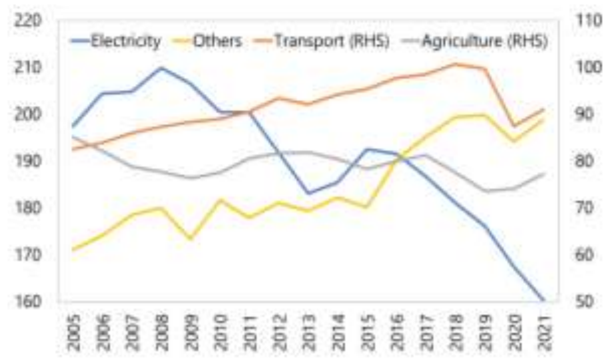
**5. Emissions intensity in Australia has declined but remains one of the highest among advanced economies.** Australia was the 15th largest GHG emitter in 2019, accounting for about 1.2 percent of global emissions. Emissions intensity in per-capita and per-GDP terms remains one of the highest in the OECD, though per-capita emissions have fallen by more than the OECD average.

**Emissions Have Declined, Driven by Lower LULUCF Emissions**
(MtCO2e)



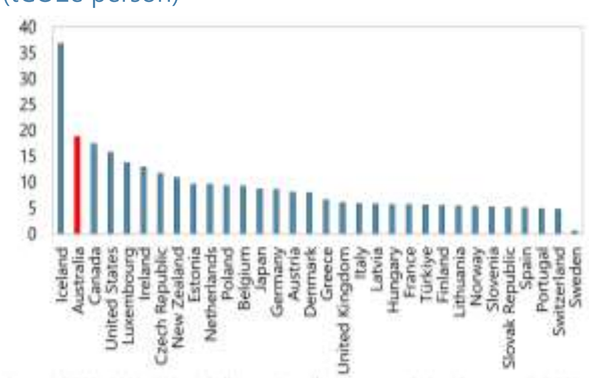

Source: DCCEEW.
Note: LULUCF refers to land use, land use change, and forestry.

**Lower Electricity and Agricultural Emissions Have Been Offset by Increases Elsewhere**
(MtCO2e)



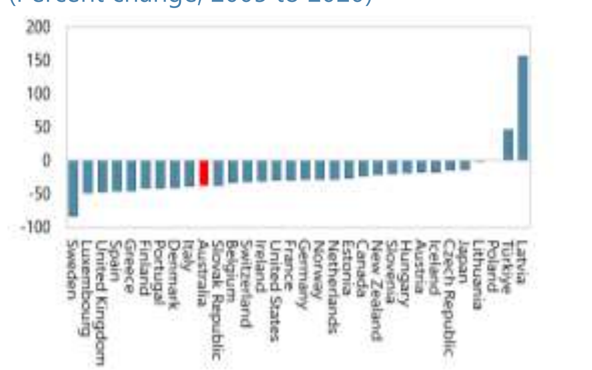

Source: DCCEEW.

**Per-Capita Emissions Remain Among the Highest in the OECD**
(tCO2e person)




Source: OECD.

**Per-Capita Emissions Have Declined More than the OECD Average**
(Percent change, 2005 to 2020)




Source: OECD.

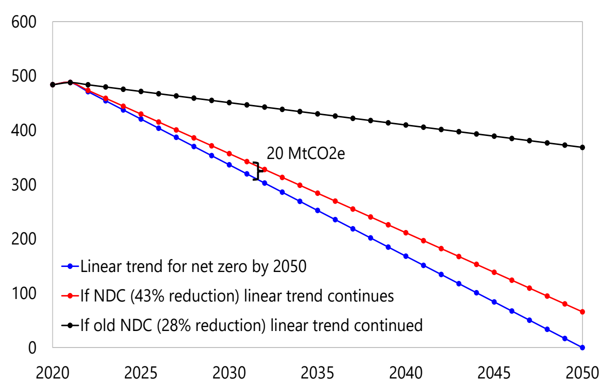
[2] As an Annex I Party of the UNFCCC, Australia submits detailed annual National Inventory reports to the UNFCCC, where domestic or territorial emissions are included i.e. emissions from the use of exported fossil fuel are not part of the national inventory. LULUCF emissions include all anthropogenic fires. Non-anthropogenic natural disturbances (including bushfires) and the subsequent recovery are modelled to average out over time. Australia also submits detailed supplementary data on LULUCF emissions under Article 7.1 of the Kyoto Protocol which shows that the decline in LULUCF emissions has been driven by lower deforestation emissions, as well as lower net emissions from forest, crop, and grazing land management.

## C. Australia's Emissions Target Under the Paris Agreement

6. **Australia has upgraded its NDC under the Paris Agreement and created a framework for accountability to meet mitigation targets.** In June 2022, Australia submitted a more ambitious 2030 mitigation target to the UNFCC, committing to a 43 percent reduction in emissions from 2005 levels (compared to the earlier target of a 26-28 percent reduction). In addition, the *Climate Change Act 2022* was recently passed, which codifies the 2030 target as well as the 2050 net zero goal into law. The Act also creates a framework for accountability and future action to meet these targets by (i) requiring an annual ministerial statement to Parliament outlining progress towards the target, and (ii) empowering the Climate Change Authority, an independent statutory agency, to advise the Minister on the climate change statement and future emission targets. The first ministerial statement to Parliament was delivered in December 2022.

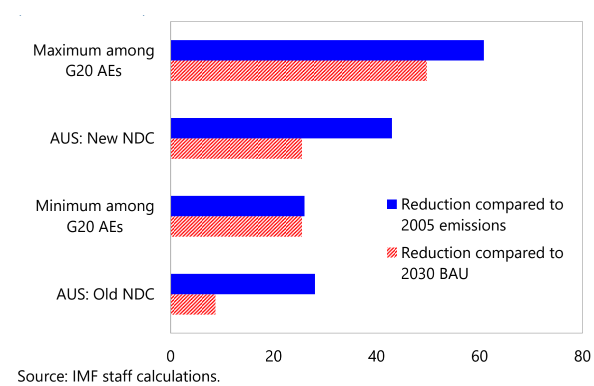
7. **The new NDC is broadly in line with the goal to reach net zero by 2050 and within the range of ambition of other G-20 advanced economies (AEs).** Australia's short-term emissions target are now well aligned with the longer-term goal to achieve net zero by 2050. A linear path to net zero by 2050 would imply emissions of 337 MtCOe in 2030, only about 20 MtCO2e lower than the new NDC. By contrast, the old NDC was about 114 MtCO2e higher than the emissions implied by a linear path to net zero. Comparing the ambition of NDCs across countries is challenging due to differences in base years and emissions coverage. However, two metrics—the percent reduction in emissions between 2005 and 2030 and the percent reduction in emissions in 2030 compared to business-as-usual (BAU) projections—suggest that while the old NDC required Australia to reduce emissions by significantly less compared to peers, the new NDC is within the range of commitments by other G20 AEs. In particular, the targeted emissions reduction compared to 2030 BAU is towards the lower end of G20 AEs, while the decline in total emissions compared to 2005 implied by the NDC is broadly in line with the AE average.

**Australia's Path to Net-zero Compared to NDCs**
(MtCO2e)




Source: IMF staff calculations.

**Comparing Australia's NDC to Other G20 AEs**
(Emissions reduction implied by NDC, percent)

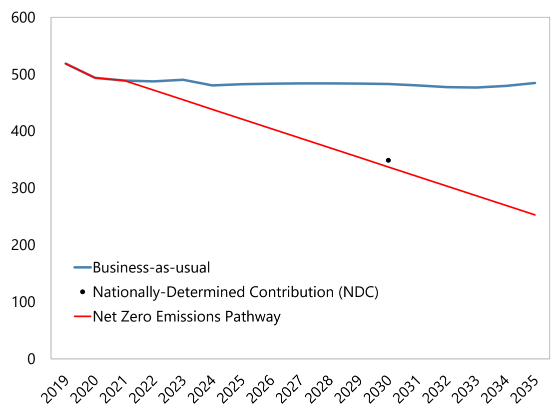



Source: IMF staff calculations.

## D. Policies to Reduce Emissions: The Role of a Carbon Price

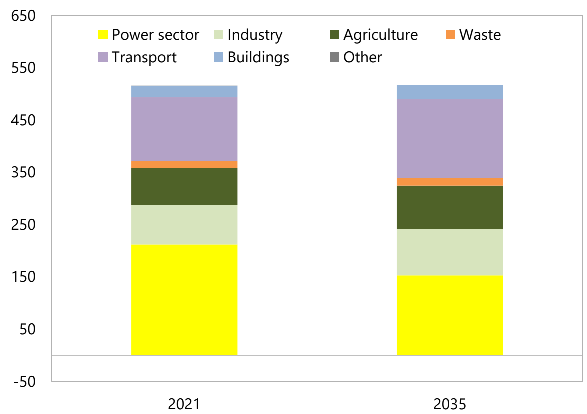
**8. Achieving Australia's emissions target will require significant policy effort.** Calculations using the IMF and the World Bank's Climate Policy Assessment Tool (CPAT) indicate that a business-as-usual (BAU) or baseline scenario, which assumes no new policies or tightening of existing policies, would see emissions in Australia stay flat between 2020 and 2030, with some reduction in power sector emissions offset by increases elsewhere, especially transport and industry.[3] Achieving the NDC will require reducing emissions by about 28 percent relative to BAU, thus requiring significant policy effort.

**In a Business-as-usual Scenario, Emissions Will Remain High.**
(MtCO2e)




Source: IMF-WB CPAT.

**Lower Power Sector Emissions Are Offset by Increases Elsewhere under BAU Scenario**
(MtCO2e)




Source: IMF-WB CPAT.

**9. A broad-based carbon price is considered to be first best policy in reducing emissions.** Having a clear price signal as a key feature of the policy framework has several advantages, including: (i) it can help achieve emissions reduction in a cost-effective manner by promoting across-the-board behavioral responses to reduce emissions, including by redirecting investment towards clean technologies; and (ii) if implemented through a carbon tax or an auction-based emissions trading system, a carbon price can raise significant revenues, generating resources to fund infrastructure investments needed for the energy transition, lower existing taxes, and mitigate the impact on those adversely impacted by the transition. And while a carbon price can generate some economic costs, it can also foster significant domestic environmental co-benefits (e.g. reductions in local air pollution and reduced transport congestion).

**10. A carbon price of US$75 can deliver significant emissions reduction across sectors, with limited economic costs.** An illustrative scenario is considered using the CPAT, where an economy-wide carbon tax of US$30 is introduced in 2023, with the tax rate increasing linearly to

[3] The BAU scenario projects out emissions based on GDP growth rates, a trend in energy intensity of GDP, and a trend in CO2 intensity of energy production. Part of the increase in BAU emissions is driven by the post-pandemic recovery in economic activity. Power sector emissions decrease in the BAU due to projected increase in renewables driven by a reduction in costs and technological improvements in the power sector.

US$75 by 2030, consistent with the international carbon price floor proposed in Parry, Black, and Roaf (2021) to meet the 2 degree Celsius temperature goal set in the Paris Agreement. The scenario assumes that no other policy measures are implemented.

- **Emissions reduction:** A broad-based carbon tax of US$75 is expected to reduce emissions by 16 percent relative to BAU. Given the broad nature of the tax, emissions will decline across all sectors, with the largest fall seen in power generation.

- **Economic impact:** A carbon tax can raise significant fiscal revenue of about 1 percent of GDP per year by 2030. There is significant uncertainty regarding the impact of carbon taxes on GDP with the sign and magnitude likely depending crucially on how the revenue is recycled.[4] Estimates suggest that using the revenue to fund public investment, which has a large multiplier, can raise average GDP growth through 2030 by about 0.1 percentage point per year. Instead, if revenues are used to reduce labor taxes or for transfers to households, then the net effect on GDP growth can be slightly negative at about -0.2 percentage point due to smaller multipliers. Relative to BAU in 2030, a carbon tax will also raise the price of coal and other fossil fuels significantly, while the price of electricity is expected to increase by about 11 percent.[5] Taking into account input-output linkages, the knock-on effect of higher fuel and electricity prices on prices charged by other sectors is likely to be small (less than 1 percent), especially for large sectors like services. However, some sectors which use fossil fuels intensively, such as aviation, may see price increases of up to 7 percent, with somewhat more moderate increases in energy-intensive trade-exposed sectors like steel and other metal products.

- **Other co-benefits and net welfare effects:** A carbon tax is expected to have other co-benefits, including reduced transport congestion and benefits from better air quality. Expressed as a percent of GDP, the average welfare benefits from these sources through 2030 are expected to be 0.2 percent, two-thirds of the direct economic efficiency cost of a carbon tax (about -0.3 percent). Adding domestic climate co-benefits raises the net welfare benefit of a carbon tax by about 0.6 percent of GDP in 2030.[6]

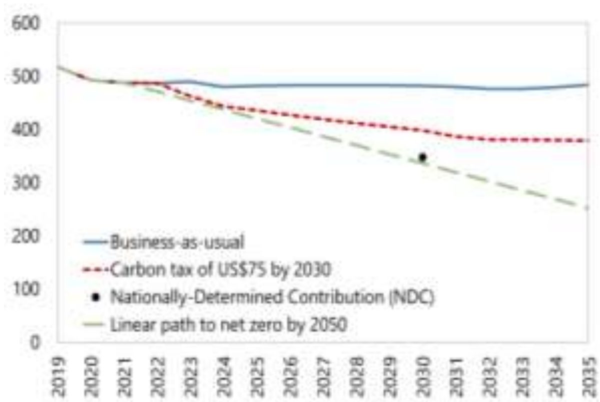
[4] Besides the form of revenue recycling, GDP effects are sensitive to assumptions about how mitigation policy affects the allocation of investment across sectors and time, the future availability of low-carbon technologies and the rate at which learning-by-doing lowers their costs, all of which are difficult to pin down accurately. National-level studies based on CGE models often point to increases in GDP from carbon pricing. Ex-post empirical studies that decompose the effects of climate policies on GDP find either zero or small positive impacts of reforms implemented in Europe and North America.

[5] Global (pre-tax) prices of crude oil, LNG, and coal are projected to fall by 30, 6, and 36 percent by 2030 respectively, implying that despite the introduction of a carbon price, energy prices will be lower in 2030 than the recent highs.

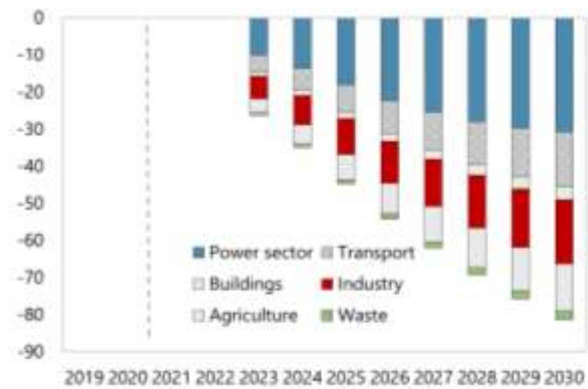
[6] Efficiency costs reflect the annualized costs of adopting cleaner but more expensive technologies and the costs to households and firms from reduced energy use. Domestic environmental co-benefits reflect reductions in local air pollution from less combustion of fossil fuels—total co-benefits are the emission reduction times the co-benefit per ton of $CO_2$ reduced. Assuming social cost of carbon at $75 per ton of $CO_2$.

## Figure 1. Impact of a Carbon Tax on Emissions and Economic Activity

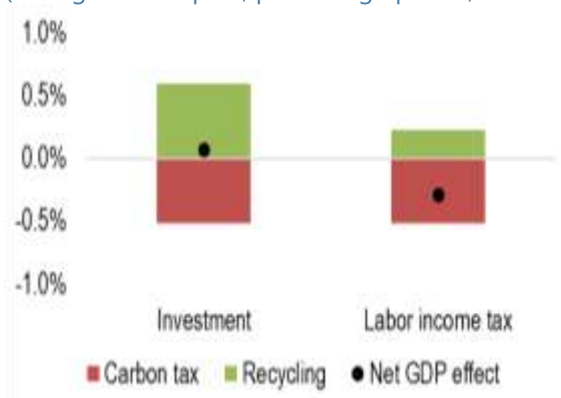
### US$75 Carbon Tax Can Reduce Emissions by About 15 Percent Relative to BAU by 2030
(MtCO2e)




### Emissions Fall Across All Sectors in a Carbon Tax Scenario
(Change in emissions, MtCO2e)



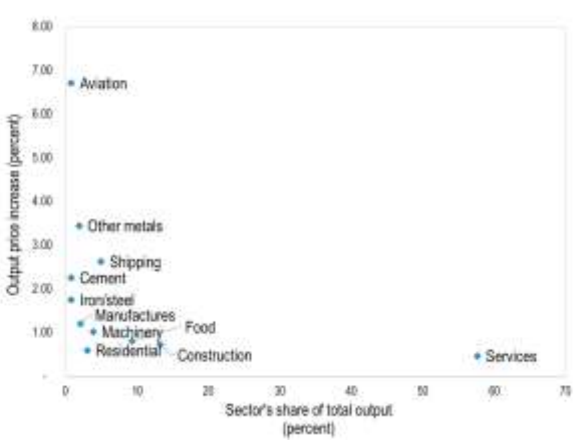

### Impact on GDP Will Depend on How Revenues Are Used
(GDP growth impact, percentage points, 2023-20)



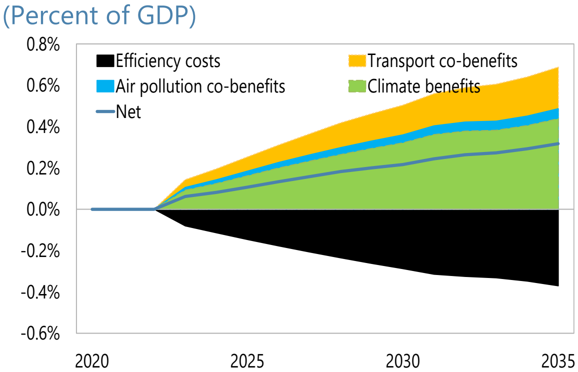

### Electricity and Fossil Fuel Prices Will Rise
(Energy price changes in 2030)

| Fuel | Unit | Baseline | Baseline + - Carbon tax | % change |
|---|---|---|---|---|
| Gasoline | US$ per liter | 0.96 | 1.14 | 19.3% |
| Diesel | US$ per liter | 1.04 | 1.25 | 20.6% |
| LPG | US$ per liter | 0.52 | 0.67 | 28.0% |
| Kerosene | US$ per liter | 0.51 | 0.71 | 39.5% |
| Oil | US$ per barrel | 53.11 | 88.32 | 66.3% |
| Coal | US$ per gigajoule (GJ) | 4.95 | 12.16 | 146.0% |
| Natural gas | US$ per gigajoule (GJ) | 29.54 | 33.78 | 14.4% |
| Electricity | US$ per kwh | 0.26 | 0.29 | 12.4% |

### Price Effects in Most Sectors Would Be Limited




### Net Welfare Effects of a Carbon Tax Would Be Positive
(Percent of GDP)




Note: Efficiency costs are pure mitigation costs, reflecting (1) the annualized costs of adopting cleaner but more expensive technologies, net of any savings in lifetime energy costs and avoided investment in emissions intensive technologies, and (2) the costs to households and firms from reduced energy use.

Source: IMF-WB CPAT.

**11. As global fossil fuel prices decline from their recent highs, countries may have an opportunity to gradually increase carbon prices without impacting energy prices relative to recent levels.** The recent price surge in coal and LNG prices has so far had little impact on emissions due to short-term supply constraints on renewables. In fact, the larger increase in the price of gas relative to coal in some jurisdictions has led to the perverse incentive to increase coal share in electricity generation. While fossil fuel prices are expected to decline in the medium-term, if higher prices were to persist it would encourage a faster switch to renewables by increasing the price differential between fossil fuels and renewable sources of energy. Gradually increasing the carbon price as global fossil fuel prices decline can help lock in better incentives to switch to renewables. Furthermore, a carbon price would impact more emissions-intensive coal more than LNG, correcting the perverse incentive to switch to coal seen in recent months.

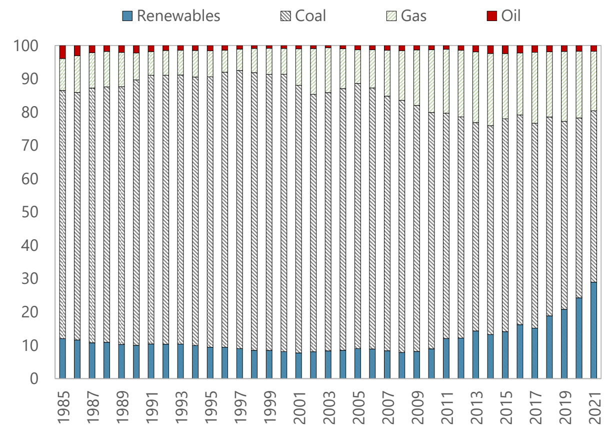
**12. A carbon price alone is unlikely to deliver enough emissions reduction to achieve Australia's NDC, highlighting the need for complementary sectoral policies.** The US$75 carbon price scenario delivers only about half the emissions reduction needed to meet Australia's NDC. A significantly higher carbon price, like US$140 as has been committed by Canada, would reduce emissions by 24 percent relative to BAU, still falling short of the NDC (which requires a 28 percent reduction). While model projections for very high carbon prices become more speculative given uncertainty around behavioral responses as well as the cost-effectiveness of new technologies at these high prices, the CPAT suggests that a carbon price of about US$180 will be needed by 2030 to meet the NDC.[7] If fossil fuel prices decline more than currently forecast, the carbon price required to meet the NDC will be even higher. As such high carbon prices will entail significantly higher energy costs and may not be politically feasible, strong sectoral policies may be needed to achieve Australia's emission targets. In particular, sectoral feebates can elicit broad behavioral responses to reduce emissions without impacting average prices, while stepped up public investment in green infrastructure can further catalyze private investment and speed up the transition.

## E. Power Sector

**13. Despite recent progress, renewables remain a smaller share of electricity generation than in OECD peers.** While electricity sector emissions have declined in recent years, the sector remains the biggest emitter of GHGs. Progress has been made in improving the fuel mix in electricity generation, with the share of coal declining from over 80 percent of generation in 2000 to about 51 percent in 2021, though it remains high compared to OECD peers. The share of renewable sources has increased from 9 percent to about 29 percent over the same period, exceeding the Commonwealth Renewable Energy Target set for 2020 (33,000 GWh). Australia has made particularly quick progress in deployment of solar technology, including small- and mid-scale solar installation, where capacity more than doubled between 2018 and 2020. However, the share of renewables in electricity generation remains below the OECD average.

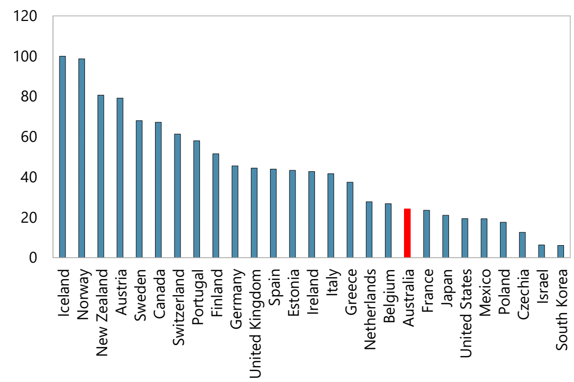
[7] With higher income and price elasticities assumptions (since the elasticity of emissions to carbon taxes may be higher than price elasticities estimated from temporary changes in energy prices), the price needed to achieve the NDC decreases to $110 per ton of $CO_2$.

**Share of Renewables in Electricity Generation Has Increased**
(Fuel mix in electricity sector, share)




Source: Our World in Data.

**Share of Renewables in Electricity Generation Remains Low Compared to OECD Peers**
(Percent, 2020)




Source: Our World in Data.

**14. Most Australian states and territories have strong renewable energy targets, and the Commonwealth government recently committed to increasing the national share of renewables in Australia's electricity grids to 82 percent by 2030.** Most state and territory governments have strong legislated or aspirational targets for renewables capacity, with various policy tools being deployed to achieve these targets including special renewable zones (e.g. NSW). Under the "Rewiring the Nation" plan, the Commonwealth government is expected to invest $20 billion towards modernizing the electricity grid, which is expected to unlock a further $55 billion in private co-financing. The baseline scenario in Australia's Emissions Projections 2022, recently released by the government, projects a significant decline in electricity sector emissions from 172 MtCOe in 2020 to 79 MtCO2e in 2030, driven by strong uptake of renewables. An "additional measures" scenario, which takes into account additional policies under Rewiring the Nation and a national renewable electricity target of 82 percent by 2030, projects emissions from the electricity sector falling to 62 MtCO2e by 2030.

**Summary Table of Renewable Energy Targets**

| State/Territory | Renewable Energy Target | Status |
|---|---|---|
| National | 82% renewable electricity target by 2030 | Confirmed in policy document |
| NSW | 12 GW of new capacity by 2030 under the electricity infrastructure investment safeguard | Legislated in 2020 |
| VIC | Renewable energy target of 65% by 2030 and 95% by 2035 | To be legislated |
| QLD | Renewable energy target of 70% by 2032 and 80% by 2035 | To be legislated |
| SA | More than 50% reduction in net emissions from 2005 levels by 2030; 100% net renewable energy generation by 2030 | Non-legislated. Announced and confirmed in policy document |
| WA | No target | |
| TAS | 100% by 2022, 200% of current needs by 2040 | Target maintained since 2015 |
| ACT | 100% by 2020 | Legislated for 2020 onwards. Target achieved in 2019. |
| NT | 50% by 2030 | Non-legislated. Announced during 2016 election campaign, confirmed in policy document. |

**15. Complementing existing policy plans in the power sector with a price signal in the form of a feebate can help reduce emissions in a cost-effective manner with minimal impact on average electricity prices.** Under a feebate, electricity generators would be subject to a fee or a rebate depending on a carbon price and the generator's average emissions intensity compared to a pivot point.

$$
\begin{aligned}
\textit{Fees of generator} \\
&= \mathrm{CO_2}\ \textit{price} \\
&* (CO_2 \textit{ emissions per kWh of generator} - \textit{pivot point } CO_2 \textit{ emissions per KWh}) \\
&* \textit{electricity generation}
\end{aligned}
$$

If the pivot point is set based on recent industry average emission rates, the feebate will be broadly revenue neutral and will have a limited effect on average electricity prices. At the same time, by putting a price on marginal changes in emissions, the feebate incentivizes generators to exploit any behavioral response that lowers their emissions. Such a feebate can complement existing initiatives by providing a broad incentive to substitute away from fossil fuels and encourage investment in renewables, though design features of the feebate will need to be considered carefully to avoid undue volatility in the wholesale electricity markets.

**16. Proactively addressing capacity constraints in the construction sector will be essential to ensure that the investment needed in the electricity grid can occur at the required pace.** A 2022 Market Capacity Report published by Infrastructure Australia highlighted the low confidence of the construction industry to deliver on the announced infrastructure project pipeline. Significant infrastructure spending will be required to prepare the grid for the intermittency of renewables and to minimize the risk of disruptions in the electricity market of the type seen in recent months. As such, actively working towards addressing capacity constraints in the sector by reprioritizing investments and collaborating with industry should be a priority.

## F. Industrial Emissions and the Safeguard Mechanism

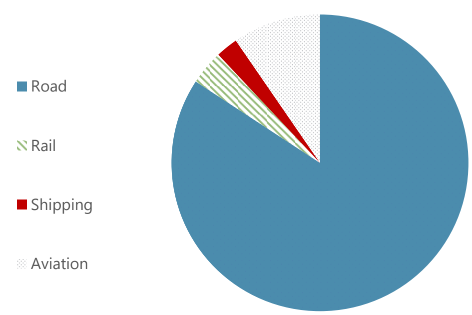
**17. Industrial emissions, especially for large emitters covered by the Safeguard Mechanism, have been increasing.** The Safeguard Mechanism covers all facilities with annual emissions above 100,000 tonnes CO2e, including the largest emitters in mining, manufacturing, oil and gas, transport and waste disposal. The mechanism places a limit on GHG emissions intensity for each covered entity called a baseline, with any facility emitting above the baseline required to surrender Australian Carbon Credit Units (ACCUs) to meet its commitment under the mechanism. However, the baselines set under the scheme have largely been non-binding to date, resulting in covered emissions increasing from about 131 MtCO2e in 2016-17 to about 137 MtCO2e in 2020-21.

**18. The government has launched a consultation to transform the Safeguard Mechanism into a binding baseline-and-credit system**. The consultation will help guide the key design elements of the reformed Safeguard Mechanism, such as details on how the baseline will be set (e.g. absolute baselines vs. baselines on emissions intensity), the path of emissions reduction for covered entities, setting of baselines for new entrants, as well as details on how a crediting and trading scheme will work, including the issuance of Safeguard Mechanism Credits for those emitting below baseline. The consultation will also consider whether tailored treatment is needed for energy-intensive, trade-exposed (EITE) businesses.[8] The authorities plan to implement the reforms to the mechanism by mid-2023.

**19. If well implemented, the planned reforms to the Safeguard Mechanism can introduce a clear market signal and help drive down industrial emissions in an efficient manner.** While final decline rates have not been set, the consultation paper expects indicative decline rates between 3.5 and 6 percent each year through 2030. Australia's Emissions Projections 2022, recently released by the government, considers an "additional measures" scenario, where covered facilities contribute a proportional share to achieving Australia's 2030 target, equivalent to abatement of 46 MtCO2e. In addition to the price signal generated by the baseline-and-credit scheme, the authorities envisage subsidized investments (through the National Reconstruction Fund and the Clean Energy Finance Corporation) to be a key driver of industrial decarbonization, and will also allow for the use of offsets. While CPAT does not model the Safeguard Mechanism facilities explicitly, its detailed sectoral breakdown can be used for a back-of-the-envelope calculation to estimate a carbon price that would be consistent with delivering a given amount of emission reductions.[9] Assuming that about half of the 46 MtCO2e abatement is achieved directly through the price signal (with the remaining abatement achieved through other regulation, offsets, and subsidized investments), model results suggest that a carbon price of about US$70 per ton would deliver the required abatement. To the extent the elasticity of emissions to a carbon price is higher than assumed, the carbon price associated with delivering these abatement goals will be lower.

## G. Transport Sector

**Transport Emissions**
(Share of total emisisons; 2021)




**20. Transport sector emissions remain high.** Total transport emissions increased from 83 to 100 MtCO2e between 2005 and 2019, though have declined to 91 MtCO2e in 2021, in part due to pandemic-related disruptions to travel. Road transport is the largest contributor to emissions, accounting for about 85 percent of total transport sector emissions.

**21. The government is scaling up policy action to reduce transport emissions.** Import tariffs on non-luxury electric cars were removed, and the government exempted eligible electric vehicles (EVs) from fringe benefits tax. The government has committed to a $500 million "Driving the Nation Fund," which will support the installation of a

[8] The free allocation of emissions up to baseline partially protects the competitiveness of EITE sectors, but at higher levels of abatement the costs of switching to cleaner technologies can be significant, potentially harming competitiveness of EITI firms relative to countries with less stringent mitigation policies. However, the benefit of any special treatment for EITI sectors should be weighed against the additional costs imposed on other sectors if they need to bear a larger share of the abatement burden. On the other hand, Australian exports also face risks from carbon border adjustments implemented by other jurisdictions. While the European Union's Carbon Border Adjustment Mechanism is the most advanced, it is likely to have a limited impact on Australia exports as currently designed. However, an expansion of CBAs to other jurisdictions and with wider coverage could have significant effects on Australian exports if Australian mitigation effort is lower than trading partners.

[9] A rough mapping is done to align sectors covered by the Safeguards Mechanism. Sectors included are industry (including mining), aviation, rail, waste, food and forestry and services.

national network of electric vehicle charging stations, hydrogen refueling highway infrastructure and other measures to support an accelerated and coordinated uptake of low emissions vehicles. The government is also in the process of developing a National Electric Vehicles Strategy, including consideration of vehicle fuel efficiency standards.

**22. Adding price signals to the transport sector can help reduce emissions efficiently.** Road transportation is especially difficult to decarbonize through carbon pricing alone due to the relatively modest impact carbon prices have on retail fuel prices and public resistance to higher fuel prices. Applying fuel efficiency standards to vehicles can help incentivize the take-up of EVs. Alternatively, feebate arrangements that subsidizes low emission vehicles and taxes higher emission vehicles (e.g., integrated into the vehicle registration tax system) can help promote the full range of behavioral responses to decarbonize the vehicle fleet, while avoiding a fiscal cost to the government and not raising average car prices. Feebate systems have been effective in boosting EV uptake in several countries, notably the Netherlands and New Zealand.

## H. Other Sectors

**23. Continued policy effort can help reduce agricultural emissions and ensure that LULUCF sector continues to act as a carbon sink.** Emissions from agriculture have declined from about 85 MtCO2e in 2005 to 78 MtCO2e in 2021, while LULUCF emissions have been negative since 2016. Key policy tools that have helped to reduce emissions in the land and agriculture sectors are the tightening of regulation of land clearing by state governments, Emissions Reduction Fund/Climate Solutions Fund (ERF/CSF), a voluntary scheme under which participants can undertake eligible projects to cut emissions or sequester carbon and earn Australian Carbon Credit Units (ACCUs). Continued efforts to strengthen the scheme, including its governance framework, can help deliver agricultural abatement in the future. In this context, the Government has appointed an independent panel of experts to review the integrity of Australian Carbon Credit Units (ACCUs).

## I. Conclusion

**24. Achieving Australia's enhanced climate goals will require a comprehensive mitigation strategy.** Australia's new NDC, as well as the recently passed Climate Change Bill that creates a framework for accountability to meet mitigation targets, are welcome developments. Achieving these goals will require strong policy effort. Implementing a broad-based carbon price is the first best policy for reducing emissions and has several advantages, including: (i) it can achieve emissions reduction in a cost-effective manner by promoting across-the-board behavioral responses to reduce emissions; (ii) if implemented through a carbon tax or an auction-based emissions trading system, a carbon price can raise significant revenues, generating resources to fund public investment and mitigate the impact on workers and regions adversely impacted by the transition; and (iii) it can minimize risks to Australian exports from carbon border adjustments. If broad-based carbon pricing is not feasible or cannot be implemented with a carbon price high enough to incentivize in full the necessary emissions reduction, strong sectoral and regulatory policies will be needed. These can include feebates at the sectoral level (power, transport, land use), potentially providing broad mitigation incentives with limited impact on average prices, and regulatory policies such as vehicle emissions standards. A step up in public investment in the electric grid and charging infrastructure can also help speed up the transition and catalyze private investment. Extensive consultation with stakeholders and the public through the transition can help build support for the needed policy actions to achieve mitigation goals.

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