



NEW ZEALAND

SELECTED ISSUES

May 2022

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NEW ZEALAND

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April 28, 2022

Approved By
**Asia and Pacific
Department**

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TRANSITORY OR PERSISTENT? THE RECENT SURGE IN NEW ZEALAND'S INFLATION¹

Like in many other advanced economies, New Zealand's inflation has accelerated recently, reaching 6.9 percent in 2022Q1, well above the Reserve Bank of New Zealand's inflation target range. Our empirical analysis finds that the recent surge in inflation is driven by both global and domestic factors, with global factors such as supply disruptions playing a larger role recently. At the same time, inflation for cyclically sensitive items increased recently, confirming the country's strong cyclical position and justifying continued monetary tightening. Going forward, inflation is expected to remain elevated in the near term and slow down toward the target range after that. That said, high uncertainty remains as commodity prices have been volatile, and inflation expectations can react to upward surprises to inflation. Monetary policy should adjust the pace of tightening in response to evolving conditions, and the central banks' clear communication is paramount to anchor inflation expectations.

A. Introduction

1. Like many other advanced economies, New Zealand has witnessed a surge in inflation.

As discussed in IMF (2021b, 2022), many advanced economies have faced a surge in inflation recently due to strong recovery in demand, persistent supply disruptions, supply chain bottlenecks, and rising commodity prices. Like other countries, New Zealand has witnessed a surge in inflation, with the CPI inflation reaching to 6.9 percent in 2022Q1, well above the Reserve Bank of New Zealand's (RBNZ's) 1-3 percent target range. Various metrics of underlying inflation have also increased significantly, and the RBNZ started tightening monetary policy from October 2021, after the discontinuation of the Large-Scale Asset Purchase program in July 2021.

2. This paper takes a comprehensive approach in analyzing New Zealand's inflation dynamics. The paper finds that both global and domestic factors are contributing to inflation dynamics, with global factors playing a larger role in the recent surge. Item level analysis suggests that, while the contribution of acyclical items to the surge in inflation is larger, inflation for cyclically sensitive items has also increased, in line with the economy's strong underlying cyclical position, warranting further tightening of monetary policy. The model-based forecast suggests that, while a slowdown in inflation is expected toward 2023, significant uncertainty persists. Moreover, the paper finds that, like other countries, New Zealand's inflation expectations, particularly shorter-term ones, tend to be influenced by temporary factors.

3. The rest of the paper is structured as follows. Section B summarizes New Zealand's inflation dynamics, with some cross-country comparison and a focus on housing-related inflation. Section C explores the role of domestic and global factors in determining New Zealand's inflation, using a structural empirical model. Section D takes a closer look at item-level inflation and analyzes

¹ Prepared by Yosuke Kido (APD). The chapter benefited from valuable comments from New Zealand Treasury; Reserve Bank of New Zealand; Ministry of Business, Innovation and Employment; and participants at a virtual seminar.

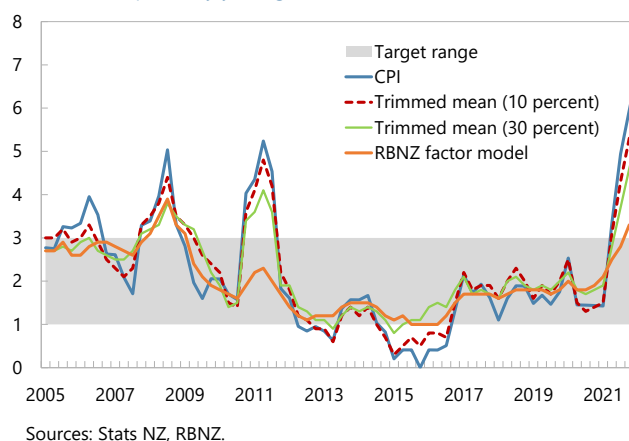
inflation for cyclically sensitive items and acyclical items. Section E explores the uncertainty around the inflation outlook and discusses inflation expectations and wage dynamics. Finally, Section F discusses policy considerations.

B. Recent Developments in New Zealand's Inflation: Above the Target Range

4. New Zealand's inflation reached well above the target range, with underlying measures also increasing. Headline inflation has reached 6.9 percent in 2022Q1, well above the RBNZ's target range. In addition to headline inflation, underlying inflation metrics, such as trimmed mean inflation, have risen rapidly, suggesting that the surge in inflation is broad-based.²

5. New Zealand's inflation is relatively high compared to other advanced economies. While a surge in inflation has been observed globally, New Zealand's inflation is higher than in many other advanced economies. New Zealand's strong cyclical position also stands out, and core inflation is among the highest in advanced economies.³

Various Metrics Point to the Surge in Inflation
(CPI Inflation, percent, y/y change)



Sources: Stats NZ, RBNZ.

6. At the same time, the recent surge in inflation has been stronger than what New Zealand's cyclical position would suggest. While New Zealand's tight labor market conditions and strong cyclical position have likely contributed to its elevated inflation, a standard Phillips curve model suggests that the recent surge in inflation is well above what slack predicts.⁴ It is likely that, in addition to domestic demand factors, domestic supply and global factors have also been playing a role. On the external front, tradable component inflation increased recently to 8.5 percent, accelerating at a faster pace than non-tradable component inflation, which typically reflects domestic slack and supply conditions, suggesting that global factors such as commodity prices and supply chain disruptions are playing a pivotal role.

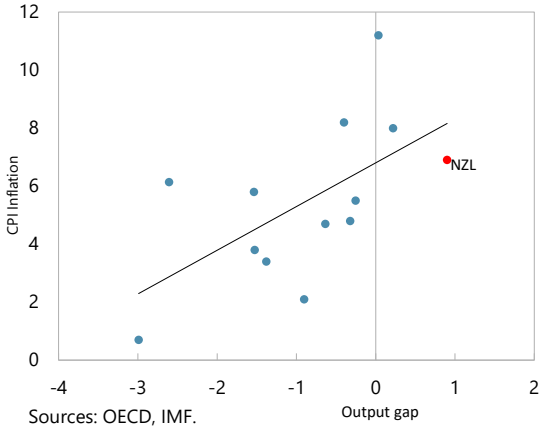
² The increase in inflation in 2011 was driven by an increase in the Goods and Services Tax in October 2010.

³ Some countries face inflation higher than New Zealand despite their weaker cyclical positions. That is likely because these countries have experienced more severe supply shocks that lead to higher inflation.

⁴ Inflation is also much higher than what the output gap suggests.

Inflation in NZL Is Relatively High in AEs, With Cyclical Positions Strengthening

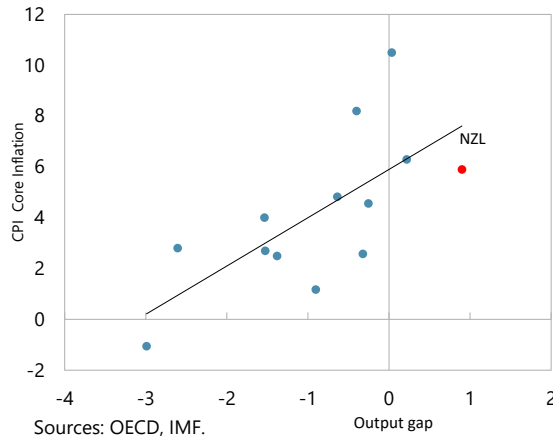
(Y: CPI inflation in 2022Q1, X: output gap in 2021, percent, AEs)



Sources: OECD, IMF.

Core Inflation Is Elevated

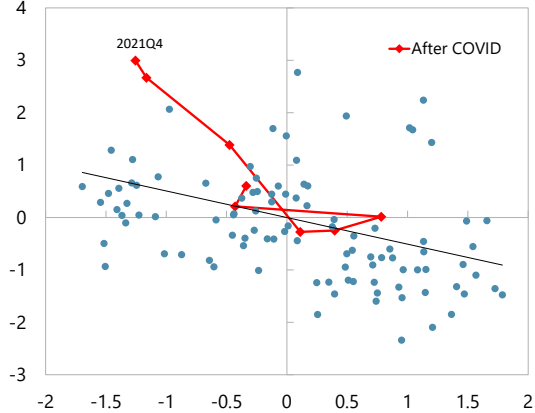
(Y: CPI core inflation in 2022Q1, X: output gap in 2021, percent, AEs)



Sources: OECD, IMF.

Inflation Reached Above What Slack Suggests

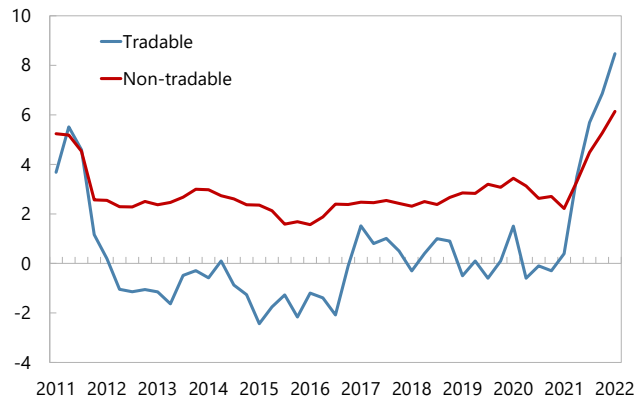
(Phillips curve, Y: Inflation minus inflation expectation, X: unemployment gap)



Source: IMF staff estimates.

Both Tradable and Non-Tradable Inflation Increased

(Inflation, y/y change, percent)



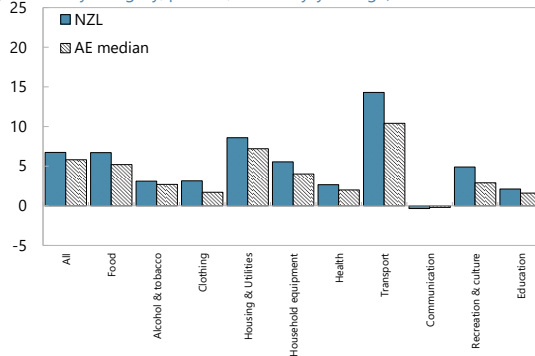
Source: Stats NZ.

7. By item, transport and housing showed higher inflation than other advanced economies.

While other advanced economies have also faced relatively high inflation in transport and housing, New Zealand shows even higher inflation in these items. In New Zealand, the sharp increase in transport inflation is driven by fuel prices, and inflation for international air transport has also been high amid strict border restrictions.⁵ As for housing-related inflation, New Zealand's high inflation has been largely driven by home ownership costs, reflecting the surge in

Inflation in Most Categories Exceeds Peers

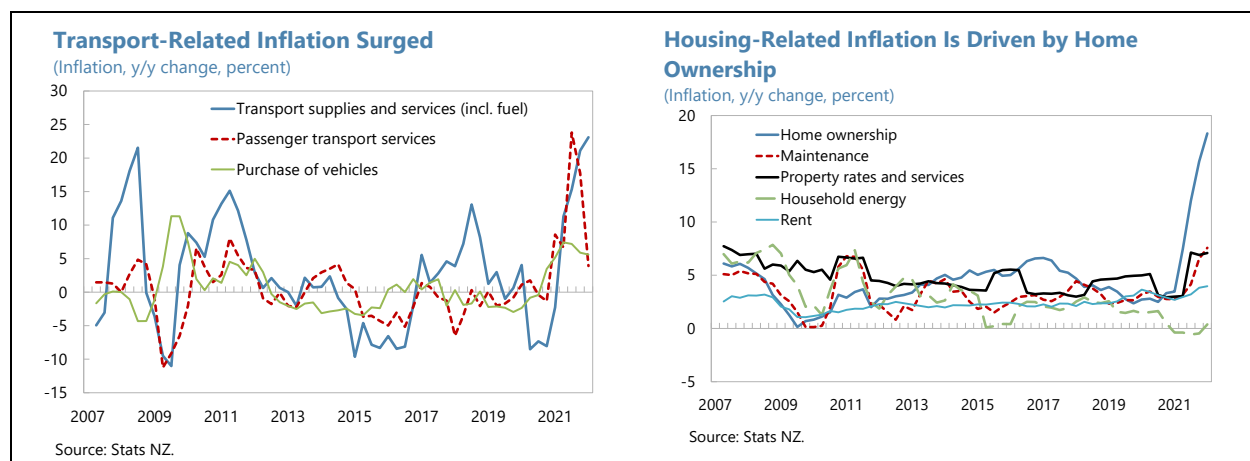
(Inflation by category, percent, 2022Q1 y/y change)



Sources: Stats NZ, OECD.

⁵ It should be noted that passenger costs show high variation among items. While international air transport recorded 36.7 percent y/y inflation in 2022Q1, rail passenger transport inflation remained at 0.0 percent.

housing prices after the pandemic (Box 1).⁶ Some other items, such as recreation equipment and household equipment, also showed higher inflation, potentially reflecting high shipping costs. Overall, item-level inflation highlights multiple factors affecting New Zealand's recent inflation dynamics.



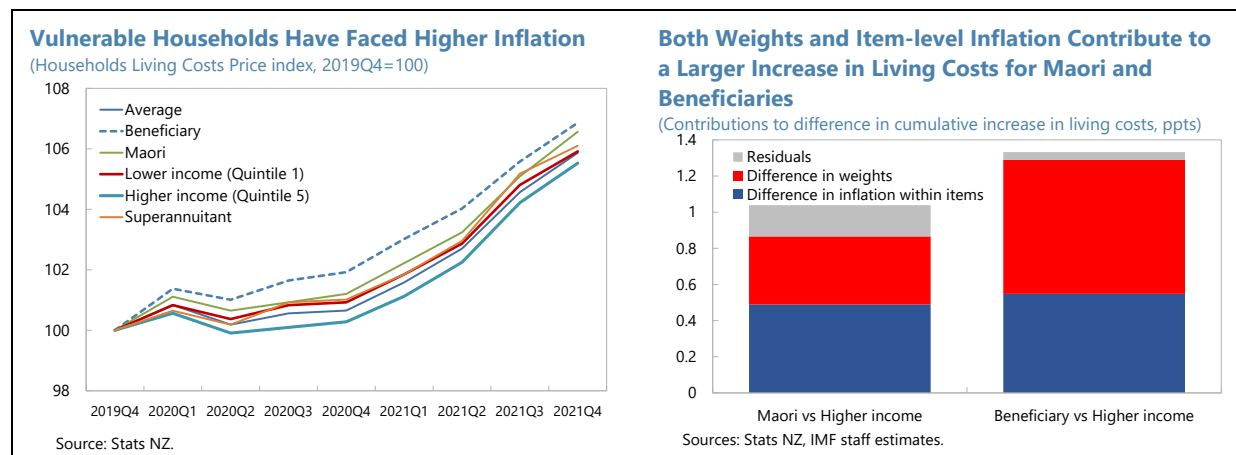
8. Vulnerable households have tended to face a larger increase in living costs after the pandemic. The recent surge in inflation has distributional implications. The living cost indices suggest that relatively vulnerable households, including Maori people, beneficiaries, and lower income households have faced a larger cumulative increase in living costs after the pandemic.⁷ A decomposition of the drivers of living costs shows that the larger increase in living costs for Maori households and beneficiaries compared to higher-income households has been driven both by the difference in living cost weights and the difference in inflation within items.⁸ A larger increase in living costs for vulnerable groups suggests that relief measures, if needed, should be targeted to these groups.⁹ In this regard, the temporary reduction of fuel excise duty and road user charges, which also benefit richer households, should be replaced by transfer measures targeted to vulnerable households that face a larger increase in living costs if continued support is needed after the announced period.

⁶ See Chapter 2 of the Selected Issues Papers for discussion about the housing market in New Zealand.

⁷ Beneficiaries are defined as households where the highest-income recipient receives a benefit payment, such as Job Seeker Support, Sole Parent Support, or Supported Living Payment.

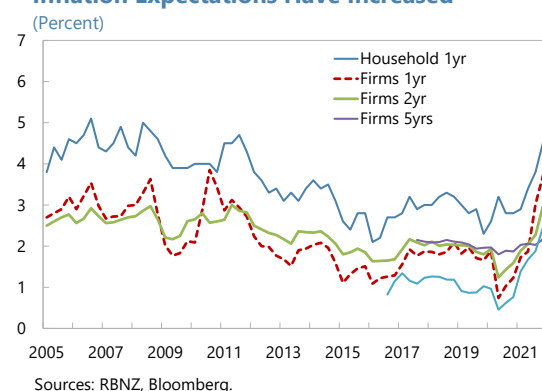
⁸ The decomposition is derived from the equation $\Pi - \Pi' \approx \sum_i w_i (\Pi_i - \Pi'_i) + \sum_i (w_i - w'_i) \Pi'_i$, where the left hand side of the equation stands for the difference in living cost inflation between two groups, and the first term of the right hand side shows the contribution from the difference in inflation within items (weighted average of the difference in item-level inflation) and the second term shows the contribution from the difference in weights.

⁹ In this context, the Pacific Employment Action Plan, laying out active labor market policies targeted to relatively vulnerable Pacific people, will be helpful.



9. Inflation expectations have increased, particularly in the near term. The survey conducted by the RBNZ suggests that short-term inflation expectations by firms and households have increased, after a gradual decline in recent years before the pandemic. For long-term inflation expectations, firms' 5-year inflation expectations have risen but remain anchored around the midpoint of the inflation target range. The 10-year breakeven inflation implied by the inflation-indexed bonds remains within the target range, although it has reached above its midpoint.

Inflation Expectations Have Increased



C. Disentangling the Drivers of the Surge in Inflation: A Sign and Zero Restriction Approach

10. In this section, we disentangle the drivers behind the recent surge in inflation using a semi-structural model. Specifically, we employ a small open economy structural vector autoregression model that incorporates both domestic and global factors.¹⁰ The model incorporates six variables, including domestic GDP growth, domestic inflation, the RBNZ official cash rate and nominal effective exchange rate, as well as global GDP and global inflation. By including global variables, the model aims to capture the open economy nature of New Zealand. We use data from 2003Q1-2022Q1 and employ Bayesian techniques to estimate parameters.

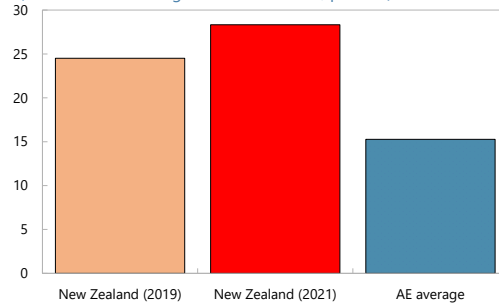
¹⁰ See Annex I for technical details. In addition, Annex II discusses the impact of fiscal shocks on inflation, although there is significant uncertainty around the fiscal policy impact given difficulties in analyzing COVID-related fiscal support.

Box 1. Housing-Related Inflation in New Zealand

The housing component accounts for a large part of New Zealand’s Consumer Price Index. The share of housing and household utilities component in New Zealand’s CPI basket stands at 28.3 percent, which has been increased from 24.5 percent before the pandemic after the CPI review in 2020. This is much larger than in many other advanced economies, where housing and utilities account for about 15 percent of CPI basket weights on average. Two main items in the housing and household utilities component are rent and home ownership, which account for 10.3 and 9.1 percent of the CPI basket, respectively (Table B1.1).

Housing Accounts for a Large Part of CPI

(The share of housing and utilities in CPI, percent)



Sources: Stats NZ, OECD.

The housing component in the CPI tends to be less volatile than housing prices and lags actual house prices. Compared to the house price index, the home ownership item in the CPI was much less volatile in previous housing cycles.¹ In addition, it tends to lag the change in house prices, and the correlation between the home ownership costs and the house price index peaks at a two-quarter lag (the CPI lags two quarters). At the same time, the CPI rent component tends to move contemporaneously with rental property prices.

Housing-related inflation in the CPI will likely slow down with some lag. If house prices will continue to moderate as currently expected, inflation in housing-related CPI items will likely also slow down with some lag. However, previous patterns suggest that that the price variation in housing-related CPI items will likely be smaller than fluctuations of house prices.

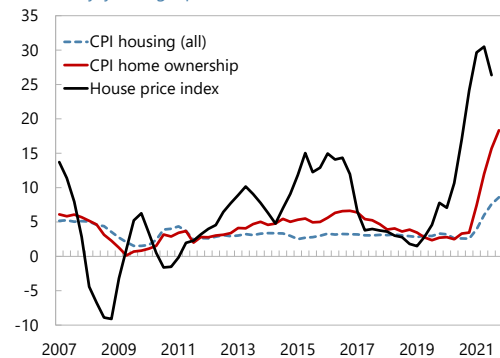
Housing-Related Items in CPI

	CPI weights (percent)
Home ownership	9.05
Rent	10.28
Property maintenance	2.28
Property rates and related services	3.24
Household energy	3.49
Housing total	28.33

Source: Stats NZ.

CPI Tends to Be Less Volatile Than House Prices

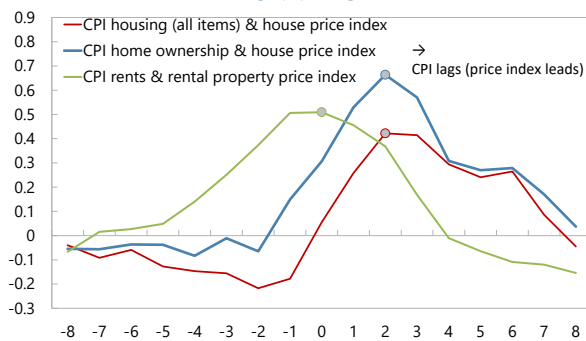
(Inflation, y/y change, percent)



Source: Stats NZ.

CPI Tends to Lag Actual Price Changes

(Correlation with lead and lag, q/q change)



Source: IMF staff estimates.

Note: Markers indicates lead or lag that maximizes correlation.

1/ The home ownership component in the CPI is conceptually different from the house price index as it only covers new houses and does not include land prices.

11. We employ a theoretically motivated identification scheme. Our identification scheme is based on theoretically motivated sign and zero restrictions developed by Rubio-Ramirez and others (2010). This approach has some advantages over a Phillips curve as the relationship between

inflation and other economic variables can vary depending on the nature of shocks (e.g., Forbes and others, 2018). With this approach, we identify both domestic and global structural shocks (Table 1). The domestic supply shock is identified as a shock that drives output and inflation in opposite directions. This shock can reflect changes in domestic productivity, as well as supply disruptions and setbacks to labor supply associated with disruptions to migration flows. For domestic demand, the first domestic demand shock is a non-monetary demand shock, which reflects fiscal policy and other types of demand shocks and boosts both output and inflation, while also leading to a higher interest rate and exchange rate appreciation.¹¹ The second domestic demand shock is a monetary policy shock, which reduces the interest rate, while also leading to higher output, inflation, and exchange rate depreciation. As New Zealand is a small open economy, the three domestic shocks are restricted in that they do not affect global output and global inflation.¹² As for global shocks, the global supply shock captures a global productivity shock and supply disruptions and drives global output and inflation in opposite directions, while the global demand shock drives global output and inflation in same direction. The two global shocks have no restriction on domestic variables and can affect domestic output and inflation.

Table 1. New Zealand: Identification of Structural Shocks

	Domestic Supply	Domestic Demand (non-MP)	Domestic Demand (Mon. Policy)	Global Supply	Global Demand
NZ GDP	+	+	-		
NZ Inflation	-	+	-		
NZ interest rate		+	+		
NZD NEER		+	+		
Global GDP	0	0	0	+	+
Global Inflation	0	0	0	-	+

Source: IMF staff estimates.

Notes: The table shows sign and zero restrictions employed to identify structural shocks. In the table, a + (-) sign indicates that the impulse response of the variable in question to the shock is restricted to be positive (negative), and 0 indicates no response of the variable to the shock. Restrictions are applied in first two quarters.

12. On average over the sample period, domestic factors tend to play a larger role in inflation dynamics. We use forecast error variance decomposition to analyze which factors are more important, on average, in determining inflation variation.¹³ The analysis suggests that domestic

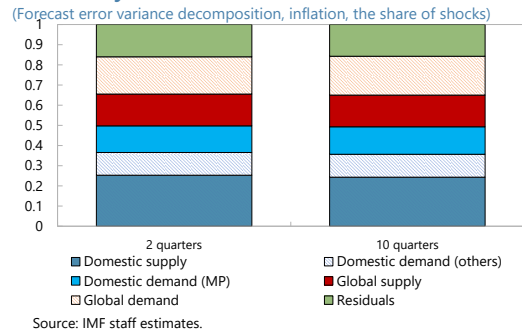
¹¹ Domestic monetary policy shock can also capture the impact from housing prices. The reduction of interest rate can boost housing prices and the housing component in CPI directly.

¹² This model does not include the global interest rate, which is included in Forbes et al, (2020), as it is difficult to measure the global neutral interest rate. Global monetary policy shocks discussed in Forbes et al (2020) are reflected in global demand shocks in our identification.

¹³ Related to this, using a small open economy Factor Augmented Vector Autoregression (FAVAR) model with the sample period of 1987Q4-2018Q1, Kamber and Wong (2020) find that foreign shocks account for more than 50 percent of variation of inflation gap in New Zealand, while domestic factors play a dominant role in determining trend inflation.

shocks play a larger role in determining inflation dynamics in both the short and medium term. In particular, the domestic supply shock accounts for the largest part of inflation dynamics, explaining about one quarter of the variation. In addition, the two domestic demand shocks (monetary policy-related and otherwise) together contribute by a similar amount. On global factors, on average, the contribution of the global demand shock is larger than the global supply shock.¹⁴

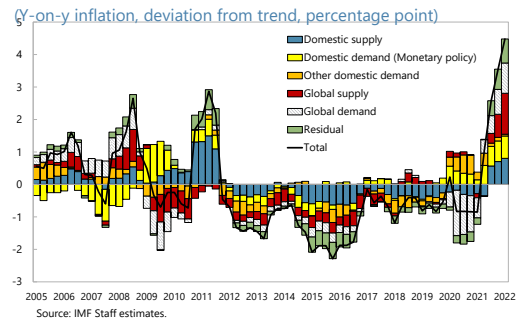
Domestic Factors Play a Somewhat Larger Role in Inflation Dynamics



13. Global factors have been playing a larger role during the recent surge in inflation.

Based on identified shocks, we conduct a historical decomposition of inflation dynamics, which summarizes drivers of inflation. It finds that the recent, large increase in inflation reflects the combination of global and domestic inflationary pressures, with global factors playing a larger role. On global factors, a rapid recovery in global demand and persistent supply disruptions have contributed to the recent increase. In addition, domestic supply disruptions due to the resurgence of the pandemic and prolonged border restrictions have added inflationary pressure, while domestic demand fueled by accommodative monetary policy has also played a role.

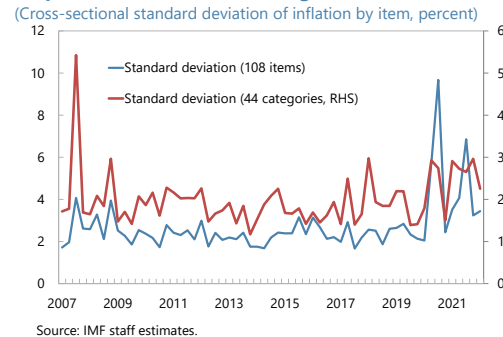
Both Global and Domestic Factors are Affecting Inflation



D. What Do One Hundred Items Say About Slack? Cyclically Sensitive Inflation.

14. The dispersion of inflation has increased significantly after the pandemic. At the aggregate level, inflation has become more volatile. At the same time, the variation of inflation at the item level has also increased significantly. Specifically, the cross-sectional standard deviation of inflation has increased, when measured at the most granular breakdown of 108 items. Similarly, cross-sectional variation among 44 larger categories has also increased.

Dispersion of Inflation Among Items Has Increased



15. Item-level inflation can shed light on underlying inflation dynamics and economic conditions. Recent literature looks at granular item-level inflation to gauge the cyclical position of the economy given technical challenges in measuring slack (e.g., Stock and Watson, 2020, Sharpio,

¹⁴ About 15 percent of variation is explained by residuals. The contribution of the domestic shocks will be about 60 percent of total variation if the contribution of residuals is excluded.

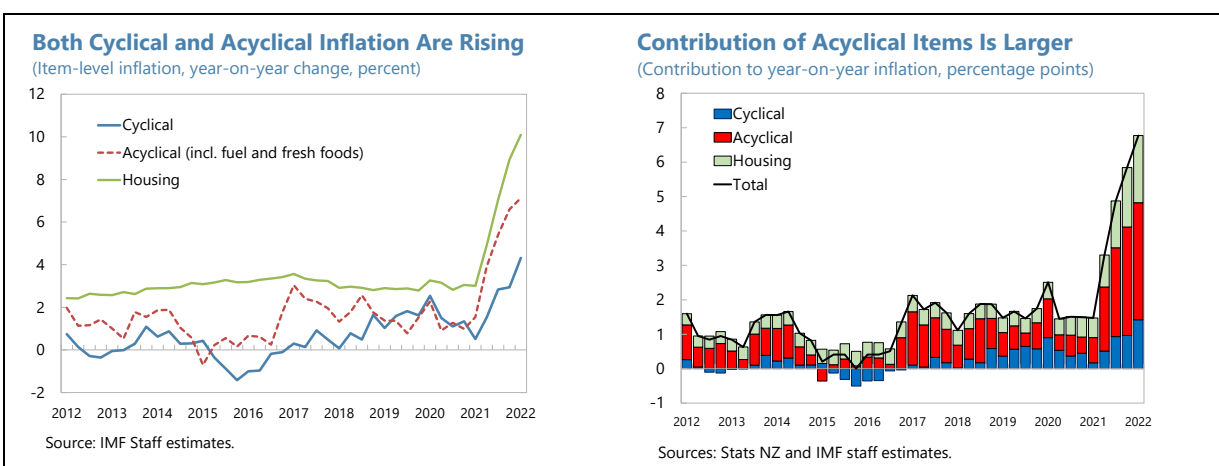
2018). The analysis exploits the fact that inflation for some categories of goods and services is more responsive to the business cycle than others.

16. To analyze slack in the economy, we measure cyclically sensitive inflation utilizing granular data. Following Sharpio (2018, 2020), Zaman (2019) and Bank of Japan (2021), we estimate a Phillips curve at item-level inflation to gauge cyclical and acyclical inflation. Specifically, we estimate the following regression using the most granular item-level inflation data (108 series):

$$\pi_{i,t} = \alpha_i \pi_{i,t-1} + (1 - \alpha_i) \pi_t^e + \beta_i (u_t - u_t^*) + \varepsilon_{i,t},$$

where $\pi_{i,t}$ denotes inflation for item i at time t , π_t^e denotes inflation expectations, and $u_t - u_t^*$ are deviations of the actual unemployment rate from the NAIUR (unemployment gap) estimated by the approach discussed in Bannister and others (2020).¹⁵ β_i captures sensitivity of item-level inflation to slack. A category is then labeled as either cyclical or acyclical based on the sign of parameter β_i : if the item shows a negative and statistically significant relationship with the unemployment gap, the item is labeled as cyclical, otherwise it is labeled acyclical.¹⁶ Given difficulties in measuring slack during the pandemic, we estimate parameters based on pre-COVID data (2008Q1-2019Q4). That way, we can analyze the cyclical position based on the relationship between item-level inflation and slack before the pandemic.

17. At the item level, both acyclical and cyclically sensitive items have been contributing to high inflation. Under the benchmark specification, 53 items out of 108 items are classified as cyclically sensitive items based on item-level regression, and other items are classified as acyclical. The breakdown suggests that housing and acyclical items have been the chief factors contributing to high inflation. At the same time, cyclically sensitive items also rose above the RBNZ target range, suggesting the tightening in labor market conditions and strong economic recovery.



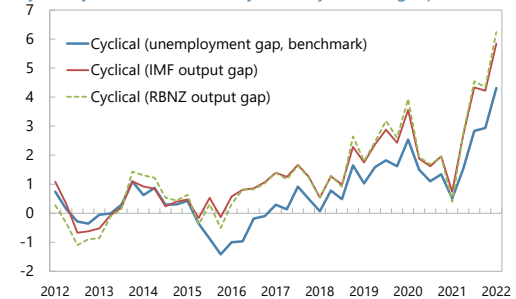
¹⁵ For inflation expectations, we use 2-year inflation expectations by firms.

¹⁶ We use a 10 percent significance level as a threshold. We do not include housing, fresh food and fuel in this exercise as they have different characteristics.

18. Cyclically sensitive inflation also surges with alternative specifications. Given potential mismeasurement of NAIRU and the unemployment gap, we also consider alternative measurements for slack in estimating Phillips curve relationships at the item level, namely measurements of the output gap estimated by RBNZ and IMF (following Bannister and others, 2020). Even with these alternative measurements of slack, estimated cyclically sensitive inflation increased sharply in recent quarters, confirming the economy’s strong cyclical position.

Cyclical Inflation Increased for Different Specifications

(Cyclically sensitive inflation, year-on-year change, percent)



Source: IMF Staff estimates.

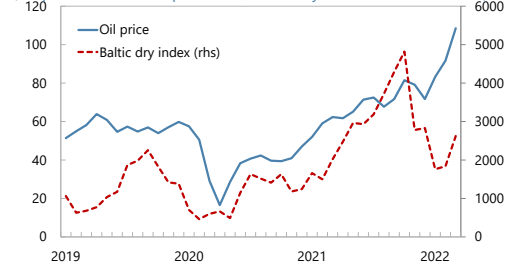
19. The results provide implications for policy formulation. Both benchmark and alternative measurements of cyclically sensitive inflation increased recently, pointing to the economy’s strong cyclical position. This suggests that the withdrawal of fiscal and monetary stimulus is appropriate and is required to avoid potential overheating of the economy.

E. Uncertainty Ahead

20. The outlook for inflation is highly uncertain and depends crucially on domestic and global factors. On the global front, as discussed in previous sections, global factors such as supply disruptions and pent-up demand have played an important role, and commodity prices have been elevated, mainly due to the war in Ukraine.¹⁷ On the domestic front, tight labor market conditions and further increases in inflation expectations would lead to wage inflation, fueling inflationary pressures (Box 2).

Commodity Price and Shipping Costs Have Been Volatile

(Oil price: WTI dollars per barrel; Baltic Dry Index: Jan 1985=1000)



Sources: Haver, FRED.

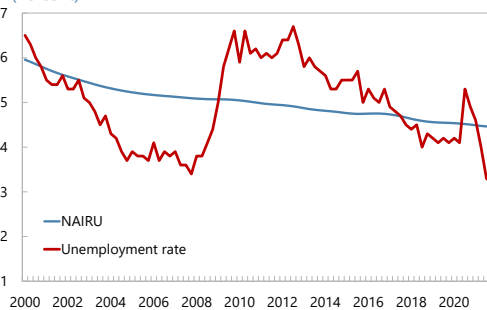
Model-based Projection

21. A model-based forecast helps to quantify the degree of uncertainty around future inflation.

We employ a time-varying parameter vector autoregression model with stochastic volatility (TVP-VAR with SV) following Del Negro and Primiceri (2015), which includes the unemployment rate, inflation, the policy interest rate, and the change in oil

Labor Market Conditions Have Tightened

(Percent)

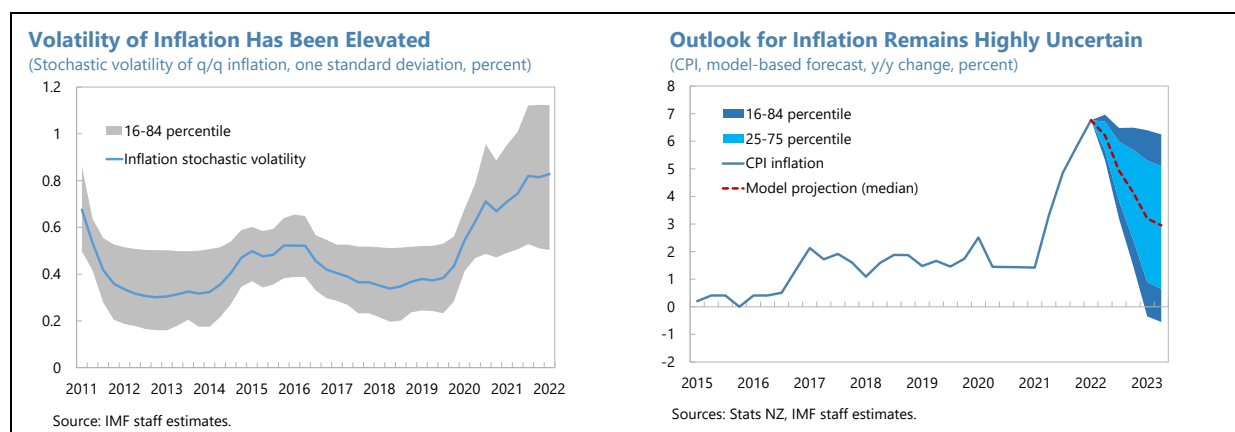


Sources: Stats NZ, IMF staff estimates.

¹⁷ Shipping costs have been volatile since 2021. Related to this, a recent study shows that shipping costs can have a persistent impact on inflation, peaking with a lag of up to one year, although effects tend to be somewhat smaller for countries with inflation targets such as New Zealand (Furceri and others, 2022).

prices.¹⁸ This approach allows for structural changes such as a change in the NAIRU and the neutral interest rate, as well as changes in volatility. With this model, volatility in inflation and uncertainty in the outlook for inflation can be analyzed.

22. The model-based forecast points to elevated uncertainty, calling for careful calibration of monetary policy. Stochastic volatility estimated from the TVP-VAR with SV model suggests that volatility for inflation has increased after the pandemic. With estimated time-varying parameters and volatility, we generate a model-based forecast, which forecasts the unemployment rate, inflation, the policy rate and the oil price together, based on an estimated time-varying lag structure and stochastic volatilities of shocks. The model-based forecast suggests that, in a central case, inflation will remain elevated in the short term but decline toward the inflation target range after that. However, it also suggests that there is significant uncertainty around the projection, which calls for flexible policy responses. Should inflation surprise on the up- or downside, there could be scope to adjust the pace of tightening accordingly. In addition, clear communication will be paramount to anchor inflation expectations amid high uncertainty.



Inflation Expectations

23. To analyze how inflation expectations would behave in response to temporary shocks, we conduct empirical analysis utilizing RBNZ survey data. Previous studies find that exogenous shocks can have an impact on inflation expectations in other advanced economies (e.g. Leduc and others, 2007; Ueda, 2010; IMF, 2021). In this section, we use 1-year and 2-year firms' inflation expectations and analyze how inflation expectations can respond to a temporary shock.¹⁹ Specifically, we assess that the impact of an increase in oil prices, given the recent sizeable contribution of oil prices to New Zealand's inflation and elevated volatility of oil prices. Considering the importance of the monetary anchor for inflation expectations, we restrict our sample to the

¹⁸ For detail, see Annex III for technical discussion. It should be noted that this model projection does not consider the impact of the temporary reduction of fuel excise duty and road user charges on inflation.

¹⁹ The RBNZ survey also provides 5-year and 10-year inflation expectations by firms, but we do not analyze them here as the sample size is small.

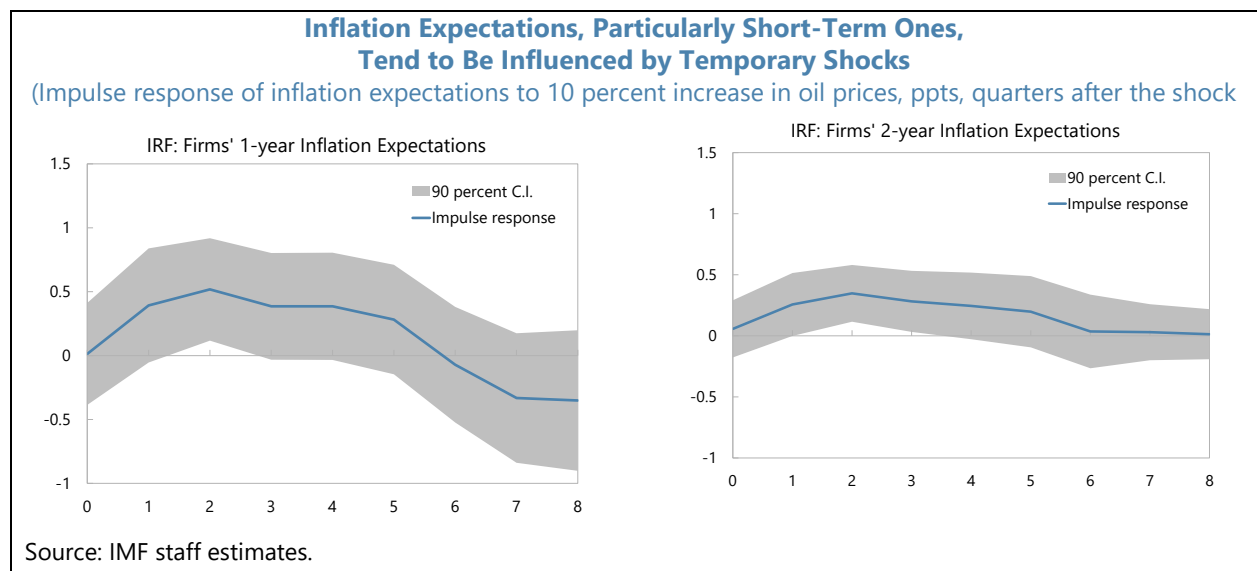
period after the inflation targeting regime was introduced in New Zealand. First, we identify structural shocks affecting oil prices, following Killian (2009, 2018).²⁰ Based on these identified shocks, we analyze the possible impact of oil price shocks on firms' inflation expectations, with a simple specification similar to Killian (2009):

$$\pi_t^{e,i} = c + \sum_j \beta_j Shock_{t-j} + \varepsilon_{t,i}$$

where $\pi_t^{e,i}$ denotes i -year ahead firms' inflation expectations and $Shock_{t-j}$ denotes identified oil price shocks based on Killian (2009). For the oil price shock, we use exogenous oil-specific demand shocks, which capture the shift in precautionary demand for oil, leading to higher oil prices. We use a sample from 1995Q1 to 2020Q1 and Newey-West heteroskedasticity and autocorrelation consistent standard errors in the estimation.²¹

24. The results suggest that inflation expectations can be influenced by temporary shocks.

In particular, firms' inflation expectations can be influenced by oil price shocks, and effects are stronger for shorter-term expectations. For 1-year inflation expectations, a 10 percent increase in



real oil prices can boost inflation expectations by about 0.5 percentage point at peak in the second quarter after the shock, and effects can last about four quarters. For 2-year inflation expectations, the impact is somewhat weaker, with a 0.3 percentage point increase in the second quarter after the shock, but the impact is similarly persistent. As discussed in Box 2, the increase in inflation

²⁰ See Annex IV for detail. Here, we look at structural shocks rather than oil price changes as an anticipated change in oil prices may not have an impact on inflation expectations. In addition, we aim to quantify oil specific demand shocks orthogonal to general demand shocks.

²¹ Endpoint of the sample is constrained by availability of Kilian's global activity index. Results are broadly similar for the sample from 2003Q1-2020Q1, the period after the lower bound of the target range was increased.

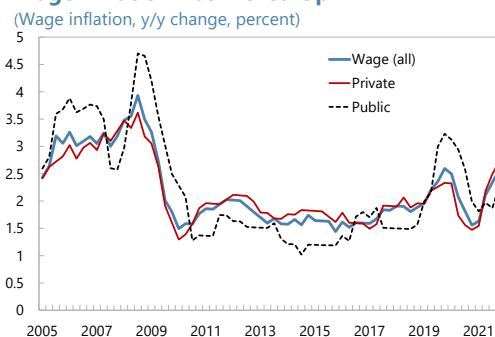
Box 2. Wage Inflation in New Zealand

Wage inflation has picked up recently, driven by private sector wage growth. Wage growth had slowed during the pandemic, as some services severely affected by the pandemic, including the hospitality sector, reported muted wage growth. Recently, however, wage inflation has picked up in these sectors and some other private sectors, with overall wage inflation reaching 2.6 percent in 2021Q4.

New Zealand’s wage development can be explained by a standard model that incorporates slack and inflation expectations. A standard wage Phillips curve model, which incorporates slack (the actual unemployment rate less Non-Accelerating Rate of Unemployment), lagged wage growth, and inflation expectations, explains New Zealand’s wage dynamics relatively well. This suggests that the recent pick up in wage inflation can be attributed to a tightening of labor market conditions, as well as the rise in inflation expectations. A potential further increase in inflation expectations amid global and domestic supply disruptions would fuel wage inflation, thereby feeding back to actual inflation.

Wages remain responsive to labor market conditions. In many advanced economies, a flattening of the wage Phillips curve has been observed (e.g. Gali and Gambetti, 2019). By contrast, the relationship between wage inflation and slack remains relatively stable in New Zealand. Labor market conditions are already tight, with the unemployment rate reaching 3.2 percent, well below the estimated NAIRU of 4.5 percent. A further tightening of labor market conditions will likely lead to higher wage inflation, adding inflationary pressure.

Wage Inflation Has Picked Up



Source: Stats NZ.

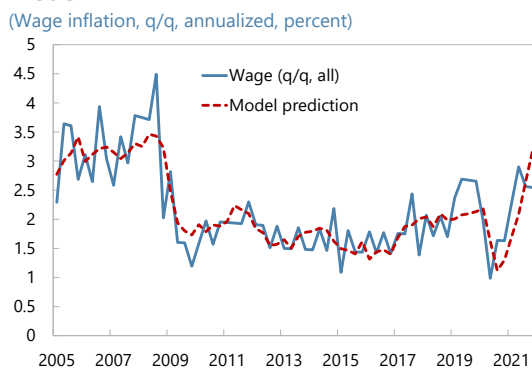
Determinants of Wage Inflation

	(1) All	(2) Private
Lagged wage growth	0.313*** (0.112)	0.244*** (0.13)
Inflation expectations	0.687*** (0.112)	0.756*** (0.13)
Unemployment gap	-0.312*** (0.066)	-0.281*** (0.07)
Constant	-0.082 (0.051)	-0.106* (0.056)
Adj R squared	0.624	0.517
Sample	2001Q1-21Q4	2001Q1-21Q4

Source: IMF staff estimates.

Notes: For inflation expectations, we use 2-year inflation expectations by firms. *** and * denote significance at 1 and 10 percent levels, respectively.

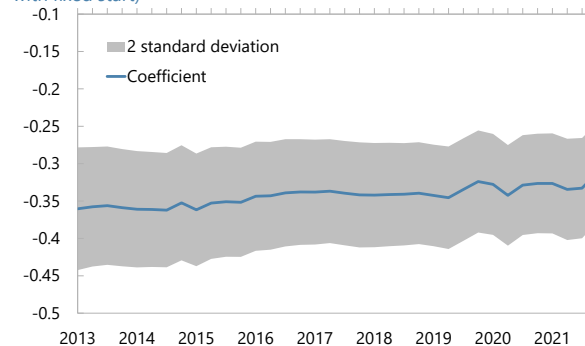
Wage Dynamics Is Explained by a Standard Model



Sources: Stats NZ, IMF staff estimates.

Wage Remains Responsive to Slack

(Sensitivity of wage inflation to unemployment gap, rolling regression with fixed start)



Source: IMF staff estimates.

expectations may have a feedback effect on inflation through wage growth, in addition to firms' forward-looking price setting behaviors. This suggests that the potential impact of upside inflation surprises on inflation expectations should be monitored carefully and underscores the importance of the central banks' clear communication to anchor inflation expectations.

F. Summary and Policy Discussion

25. This paper takes a comprehensive approach in analyzing New Zealand's inflation dynamics. New Zealand's inflation has increased sharply in recent quarters to a level well above what the amount of slack in the economy would suggest. New Zealand's inflation is now relatively high among advanced economies, with some items such as housing and transport recording higher inflation than other countries. The paper finds that both global and domestic factors are contributing to inflation dynamics, with global factors playing a larger role in the recent surge. At the same time, granular item-level analysis suggests that inflation for both cyclically sensitive items and acyclical items have increased, underscoring the economy's strong underlying cyclical position.

26. Uncertainty around the expected inflation trajectory remains high. As seen in the recent volatility in commodity prices and as illustrated by the model-based projection, uncertainty around the inflation outlook is high. The trajectory of inflation depends crucially on some global factors, including supply bottlenecks and commodity prices, and more prolonged supply disruptions or further increases in commodity prices would lead to persistently high inflation. On the domestic front, tight labor market conditions and increased inflation expectations may fuel inflationary pressures further through wages. The paper also finds that an upward surprise in inflation can lead to higher inflation expectations, particularly for the shorter-term expectations.

27. Monetary policy should be calibrated carefully amid high uncertainty, anchoring inflation expectations. While many of the factors causing the recent surge in inflation are beyond the RBNZ's control, with cyclically sensitive inflation picking up, a further tightening of monetary policy to curb inflationary pressure is appropriate. Given elevated uncertainty around the trajectory of inflation, the pace of monetary policy tightening should be calibrated carefully depending on the evolution of factors affecting inflation. Moreover, the central bank's clear communication will be paramount to anchor inflation expectations amid high uncertainty.

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Annex I. Structural Vector Autoregression with Sign and Zero Restrictions

1. In this annex, we discuss approaches to estimate a structural vector autoregression with sign and zero restrictions used in Section C. Our approach is based on Rubio-Ramirez and others (2010) and Forbes and others (2018, 2020). We start with a reduced-form Vector Autoregression model given below:

$$Y_t = c + \beta_1 Y_{t-1} + \beta_2 Y_{t-2} + \varepsilon_t,$$

where Y_t is a vector of the endogenous variables with 6 columns (the number of endogenous variables), c is a 6-vector of constant terms, β_i is a 6×6 matrix for time-invariant parameters for the lagged endogenous variables, ε_t is a 6-vector of reduced-form residuals. In the model, Y_t includes New Zealand's real GDP growth, quarterly headline CPI inflation, the nominal Official Cash Rate as a deviation from New Zealand's nominal neutral interest rate (Richardson and Williams, 2015), the change in the nominal effective exchange rate, global GDP growth (proxied by G20 GDP growth rate), and quarterly global inflation (proxied by OECD inflation).¹ As ε_t is a vector of reduced-form correlated residuals, we impose theoretical motivated sign and zero restrictions discussed in Table 1 to extract structural uncorrelated shocks.² We use quarterly data from 2003Q1-2022Q1.

2. We use a Bayesian method called Gibbs sampling to approximate the distributions of estimated parameters. For priors, we apply a modified version of Minnesota prior employed by Forbes and others (2018). For Gibbs sampling, we discard first 10,000 draws and save the final 1,000 final draws. In doing so, we obtain a covariance matrix that satisfies the sign and zero restrictions based on an algorithm by Rubio-Ramirez and others (2010).³

3. Forecast error variance decomposition and historical decomposition reported in Section C are based on estimated parameters. Historical decomposition is the average of 1,000 historical decompositions obtained from the saved draws and presented as year-on-year change.

¹ For OCR, we use the deviation from the neutral interest rate as the neutral interest rate has a declining trend. Similarly, Forbes and others (2018) use detrended interest rate for their analysis. The results are broadly similar if OCR is used for the estimation.

² It should be noted that, in the restrictions discussed in Table 1, the impact of the increase in GST in October 2010 is likely identified as negative supply shocks as it led to higher prices and will.

³ See Appendix A of Forbes and others (2018) for detail.

Annex II. The Impact of Fiscal Shocks on Inflation

1. In this annex, we extend the benchmark model discussed in Annex I to analyze the impact of fiscal policy on the recent surge in inflation.¹ In New Zealand, fiscal policy has played an active role in cushioning the impact of COVID-19 on economic activities. Fiscal measures implemented after the pandemic include large scale wage subsidies and income relief schemes, as well as infrastructure and housing-related investment. In the benchmark model, the overall impact of fiscal policy is reflected in non-monetary demand shocks, which do not have a major impact on inflation in recent quarters. To analyze the impact of fiscal policy explicitly, we add a fiscal variable (fiscal deficit-to-GDP) in the benchmark model and add a restriction related to fiscal shocks (Table A.II.1).² The first specification imposes a sign restriction only on fiscal deficit, while the second specification imposes restrictions also on GDP and inflation, precluding negative fiscal multiplier.

Table A.II.1. Extension to the Benchmark Model: Fiscal Shocks

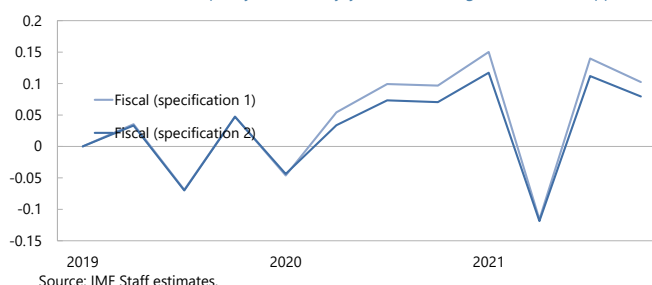
	NZ GDP	NZ inflation	NZ interest rate	NZ NEER	Fiscal deficit/GDP	Global GDP	Global inflation
Fiscal shock --specification 1					+	0	0
Fiscal shock --specification 2	+	+	+	+	+	0	0

Source: IMF staff estimates.

Notes: The table shows sign and zero restrictions employed to identify fiscal shocks, which are added to the benchmark restrictions discussed in Table 1. In the table, a + (-) sign indicates that the impulse response of the variable in question to the shock is restricted to be positive (negative), and 0 indicates no response of the variable to the shock. Restrictions are applied in first two quarters. In both specifications, fiscal deficit-to-GDP is restricted to have negative (surplus) impact on non-monetary demand shocks.

2. For both specifications, we find that fiscal policy contributed to an increase in inflation in 2020, when large-scale relief measures such as wage subsidies were deployed, and again in the second half of 2021, when wage subsidies were reactivated. Overall, the impact of fiscal policy measures is estimated to be relatively small compared to the other shocks driving the recent surge in inflation. That said, there is significant uncertainty around the model estimate as the model may not adequately consider the counterfactual without large-scale COVID-related fiscal relief measures and, consequently, with a much deeper recession and higher unemployment.³

The Impact of Fiscal Policy Is Estimated to Be Relatively Small
(The contribution of fiscal policy shocks on y/y inflation, change from 2019Q1, ppts)



¹ In this annex, we study the impact of fiscal policy up to 2021Q4 given data availability.

² For the fiscal variable, we include quarterly fiscal deficit-to-GDP, which is derived from seasonally adjusted quarterly operating balance, public investment and GDP.

³ It should be noted that the specifications employed in this section do not consider the difference of fiscal policy measures and state dependent effects of fiscal policy (see Riches, 2022 for discussion in New Zealand's context).

Annex III. Model-based Inflation Projection

1. In this annex, we discuss the approaches to generate a model-based projection based on time-varying parameter vector autoregression with stochastic volatility used in Section E. We follow an approach developed by Del Negro and Primiceri (2015), which is a revised version of Primiceri (2005). The model can be expressed as follows:

$$\begin{aligned} Y_t &= X_t' B_t + A_t^{-1} \Sigma_t \varepsilon_t, \\ X_t &= I_n \otimes [1, Y_t'], \\ B_t &= B_{t-1} + v_t, \\ \alpha_t &= \alpha_{t-1} + \zeta_t, \\ \log \sigma_t &= \log \sigma_{t-1} + \eta_t, \end{aligned}$$

where Y_t is a vector of the endogenous variables with n columns (the number of endogenous variables, 4 in this case), X_t comprises of constant term and lagged endogenous variable, formally expressed as the second equation, B_t is a matrix for time-varying parameters for the lagged endogenous variables and the constant terms, which follows a random walk process. ε_t is a n -vector of reduced-form residuals. A_t is a lower triangular matrix with ones on the main diagonal, and their non-diagonal free elements are stacked in the vector α_t . Σ_t is a diagonal matrix with positive elements $\sigma_t = \text{diag}(\Sigma_t)$. ε_t follows n -variate standard normal distribution, and v_t , ζ_t , and η_t are mutually independent Gaussian random vectors. In our model, Y_t includes the unemployment rate, quarterly inflation, the Official Cash Rate, and the change in oil prices. We use quarterly data from 2000Q1-2022Q1.

2. To estimate parameters, we use a Bayesian method following Primiceri (2005) and Del Negro and Primiceri (2015).¹ For priors, we use modified version of Primiceri (2005) discussed in Krueger (2015). For Gibbs sampling, we discard first 5,000 draws and derive a distribution of parameters with 10,000 samples.

3. In Section D, we show the estimated distribution of stochastic volatility for the interest rate (corresponding component in Σ_t) and the forecast density of inflation (presented as year-on-year change) based on the estimated distribution of parameters. For forecasting, the model forecasts the unemployment rate, inflation, the Official Cash Rate, and the change in oil price jointly.

¹ We use R package [bvarsv](#) discussed in Krueger (2015).

Annex IV. Impulse Response of Inflation Expectations to Temporary Shocks

1. In this annex, we discuss an approach to estimate the impulse responses of inflation expectations to the increase in oil prices discussed in Section E. In the first step, we identify structural shocks driving real oil prices based on the approach proposed by Kilian (2009). We use identified shocks instead of the actual change in oil prices as we want to isolate unexpected changes in oil prices, which in theory should not impact inflation expectations. In addition, the structural identification allows us to distinguish a shock specific to oil prices from other shocks such as demand shocks.

2. For the first step, we set up a simple vector autoregression model discussed in Kilian (2009):

$$Y_t = c + \beta_1 Y_{t-1} + \dots + \beta_{24} Y_{t-24} + \varepsilon_t,$$

where Y_t is a vector of the endogenous variables with 3 columns (the number of endogenous variables), c is a vector of constant terms, β_i is a vector of parameters for lagged endogenous variables at lag i , and ε_t is a vector of correlated residuals. Y_t includes the change in global oil production obtained from the US Energy Information Administration, Kilian's global activity index, and real oil prices¹. The model is on a monthly frequency with 24-month lags, and we include the sample from February 1986-April 2020. ε_t is a reduced form shock, and we impose a widely used Cholesky decomposition following Killian (2009) to obtain structural shocks:

$$\varepsilon_t = \begin{bmatrix} \varepsilon_t^{prod} \\ \varepsilon_t^{ea} \\ \varepsilon_t^{oil} \end{bmatrix} = \begin{bmatrix} a_{1,1} & 0 & 0 \\ a_{1,2} & a_{2,2} & 0 \\ a_{1,3} & a_{2,3} & a_{3,3} \end{bmatrix} \begin{bmatrix} e_t^{oil\ supply} \\ e_t^{aggregate\ demand} \\ e_t^{oil-specific\ demand} \end{bmatrix}$$

where $e_t^{oil\ supply}$, $e_t^{aggregate\ demand}$, and $e_t^{oil-specific\ demand}$ are structural shocks identified with Cholesky decomposition. For this exercise, we use oil-specific demand shocks ($e_t^{oil-specific\ demand}$), which capture precautionary demand for accumulating oil reserves and boost oil prices while they do not have contemporaneous impacts on oil supply and economic activities.²

3. As a next step, we calculate the impact of oil-specific demand shocks on firms' inflation expectations based on identified shocks:

$$\pi_t^{e,i} = c + \sum_j \beta_j Shock_{t-j} + \varepsilon_{t,i},$$

where $\pi_t^{e,i}$ denotes i -year ahead firms' inflation expectations and $Shock_{t-j}$ denotes structural shocks (in our case, oil-specific demand shocks $e_t^{oil-specific\ demand}$ discussed above, converted to quarterly frequency). We use a sample from 1995Q1 to 2020Q1 and Newey-West heteroskedasticity and autocorrelation consistent standard errors in the estimation.³ Section E reports the results.

¹ For the global activity index and real oil prices are in logarithm and detrended by linear trend regressions. The global activity index reflects the modification discussed in Kilian (2018).

² We also analyze the impulse responses to oil supply shocks, and results are broadly similar.

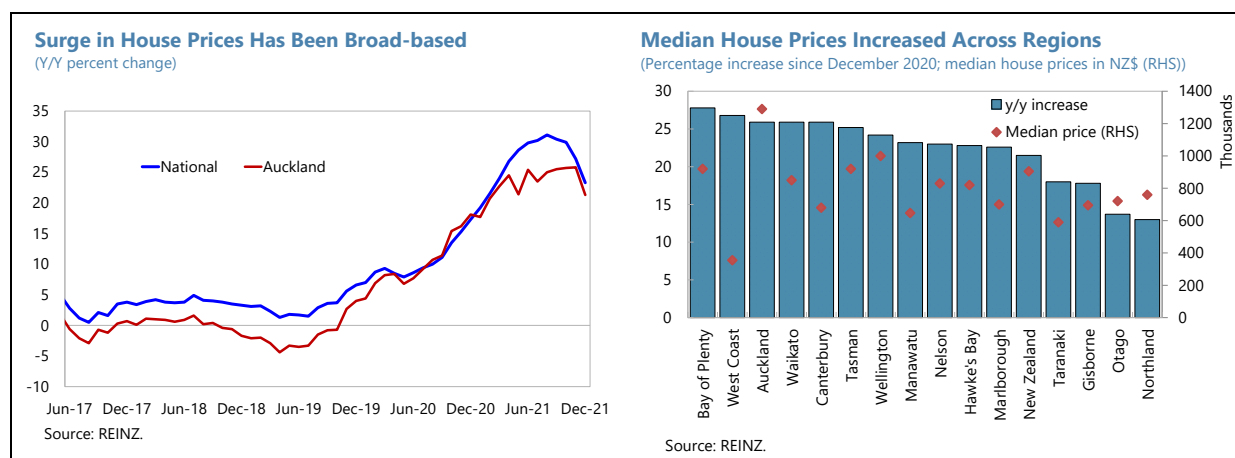
³ Results are broadly similar for the sample from 2003Q1-2020Q1, the period after the lower bound of the target range was increased.

ADDRESSING THE HOUSING CYCLE¹

Despite the COVID-19 pandemic, housing prices have surged in New Zealand in 2020 and much of 2021, more so than in other countries, raising affordability concerns. This was driven by demand-side factors such as record low mortgage rates, easy credit availability, COVID-related pent-up demand, and lagged effect of population growth interacting with inelastic supply. The housing market is now turning given that many of these factors are reversing, in part due to recent policy actions, but the extent of moderation remains uncertain. Rising mortgage rates are set to further dent affordability and make borrowers vulnerable to mortgage repricing risks, but financial stability risks from the housing market would likely be manageable as banks are well capitalized. Policy should focus on increasing supply and ensuring affordability, including through the provision of public social housing. Macroprudential policy should be adjusted commensurate with the evolution of the housing cycle and financial stability risks, while the planned expansion of the macroprudential toolkit may prove useful for future use.

A. Introduction

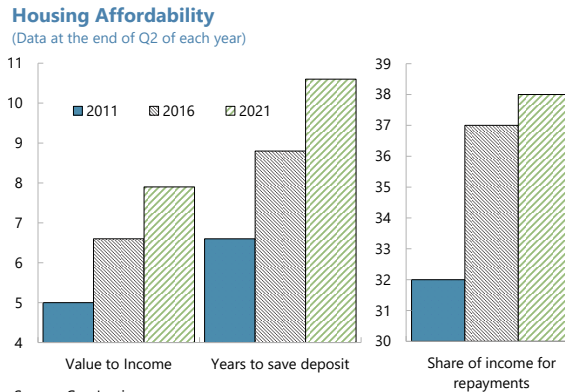
1. Despite the COVID-19 pandemic, house prices continued to surge in New Zealand in 2020 and much of 2021. Despite the recent slowdown amid policy tightening, house values were up by around 24 percent y/y in December 2021, down from the peak of 31 percent y/y in August 2021. The increases were broad-based, with prices in Auckland up by 21 percent, and outside Auckland by 25 percent (y/y, December 2021). Relative to December 2020, median house prices increased in all regions, despite persistent differences in levels.



2. Record house price growth led to rapidly declining affordability. Median prices for residential property across New Zealand increased from NZ\$745,000 in December 2020 to NZ\$905,000 in December 2021. Auckland's median residential property price increased even faster

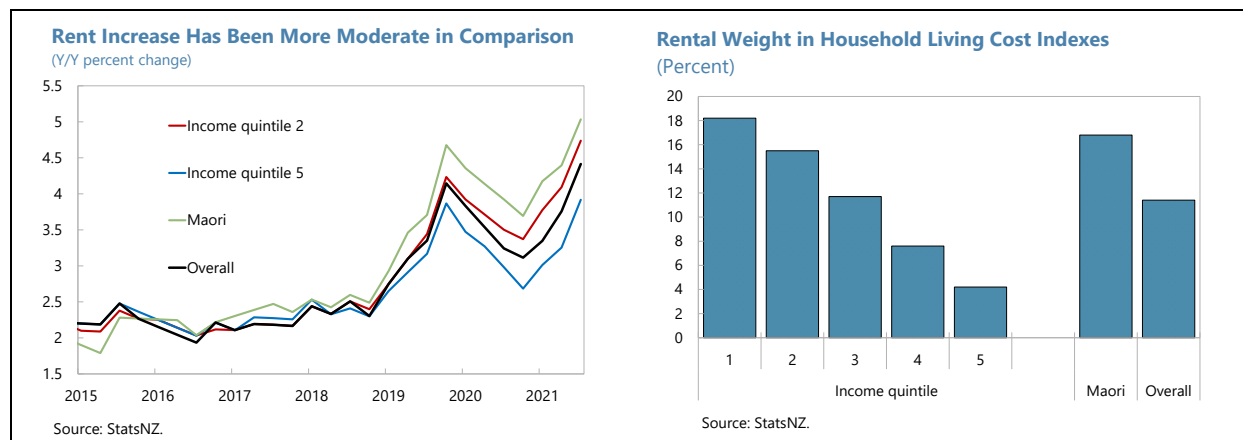
¹ Prepared by Pragyan Deb (APD). This chapter benefitted from valuable comments and suggestions from the New Zealand Treasury, Ministry of Business, Innovation and Employment (MBIE), Ministry for the Environment (MfE), Ministry of Housing and Urban Development (HUD), Kāinga Ora, and Reserve Bank of New Zealand (RBNZ), including at a virtual seminar.

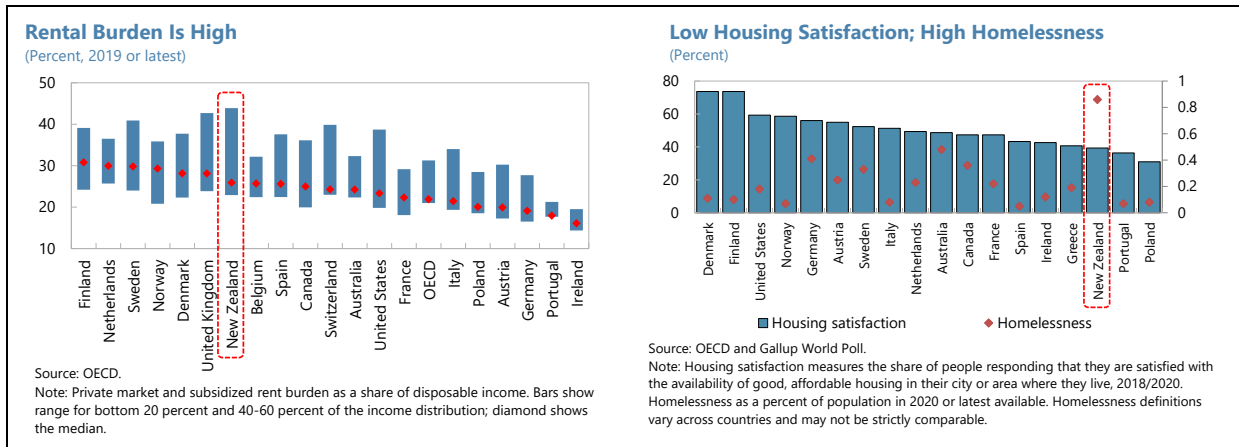
from NZ\$1,025,000 in December 2020 to NZ\$1,290,000 in December 2021. The CoreLogic Housing Affordability Report shows that as of Q2 2021, the average property is valued at 7.9 times the average annual household income, a record high in the series' 18-year history, and well above the long-term average of 5.8 times. The figure is up sharply from the 7.4 times recorded in 2021 Q1 and 6.6 times a year earlier in 2020Q2. Required down payments as a share of income have increased rapidly, making it harder for first-time buyers to enter the market, and, despite historically low interest rates (until recently), average mortgage payments as a proportion of household income have increased.



3. Rents have increased less and rent as a share of income has remained stable, but the rental burden is high. Rental property price increases have been more modest in comparison, increasing around 5 percent (flow measure) and 3.5 percent (stock measure) in 2021. However, data on the price of actual rentals for housing available from the household living costs price indexes show that the increases have been somewhat higher for lower income quintiles, which also have a higher weight of rents in their overall cost price indices, suggesting an increasing burden for poorer households. The same holds true for Māori communities, which have seen higher increases in rental prices. To put this in context, comparing with other OECD economies, the rental burden in New Zealand is relatively high, particularly for the bottom 20 percent of the income distribution. In addition, survey data suggests that housing satisfaction in New Zealand is relatively low compared with the rest of the OECD, while homelessness is high.

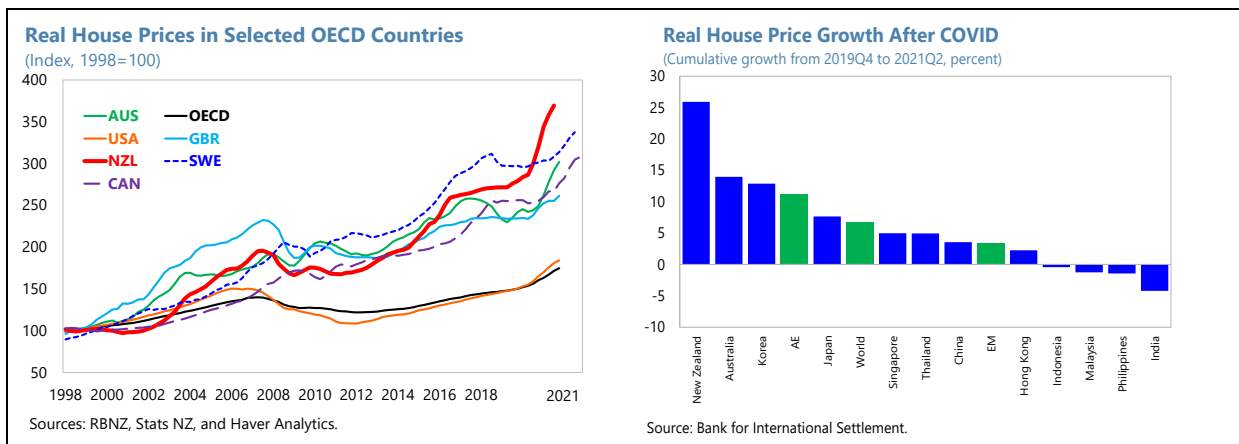
4. The rest of the paper is organized as follows. Section B discusses New Zealand’s housing sector developments in an international context, comparing it with other OECD economies and comparators in Asia. Section C discusses the drivers behind the surge in house prices and the likely outlook given that many of these factors are already reversing or are expected to in the near future. Section D discusses the macroeconomic and financial spillovers from the housing market. Section E discusses policy priorities.



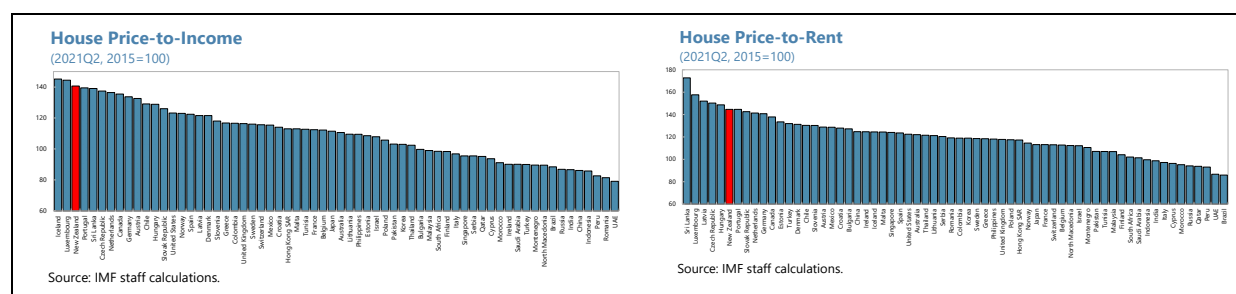


B. New Zealand House Prices in an International Context

5. Price increases in New Zealand have been higher than in other advanced economies, particularly in the post-COVID-19 period. House prices in New Zealand were already increasing faster than in its peers before COVID-19, and the pandemic accelerated this trend. Since 1998, prices in New Zealand have increased by over 250 percent, almost four times the average increase across OECD countries (around 70 percent). And this trend has continued during the COVID-19 period— from 2019Q4 to 2021Q2, house prices in New Zealand increased by close to 26 percent, compared with around 11 percent in other advanced economies and less than 7 percent globally (Bank of International Settlements Property Price Statistics Database).



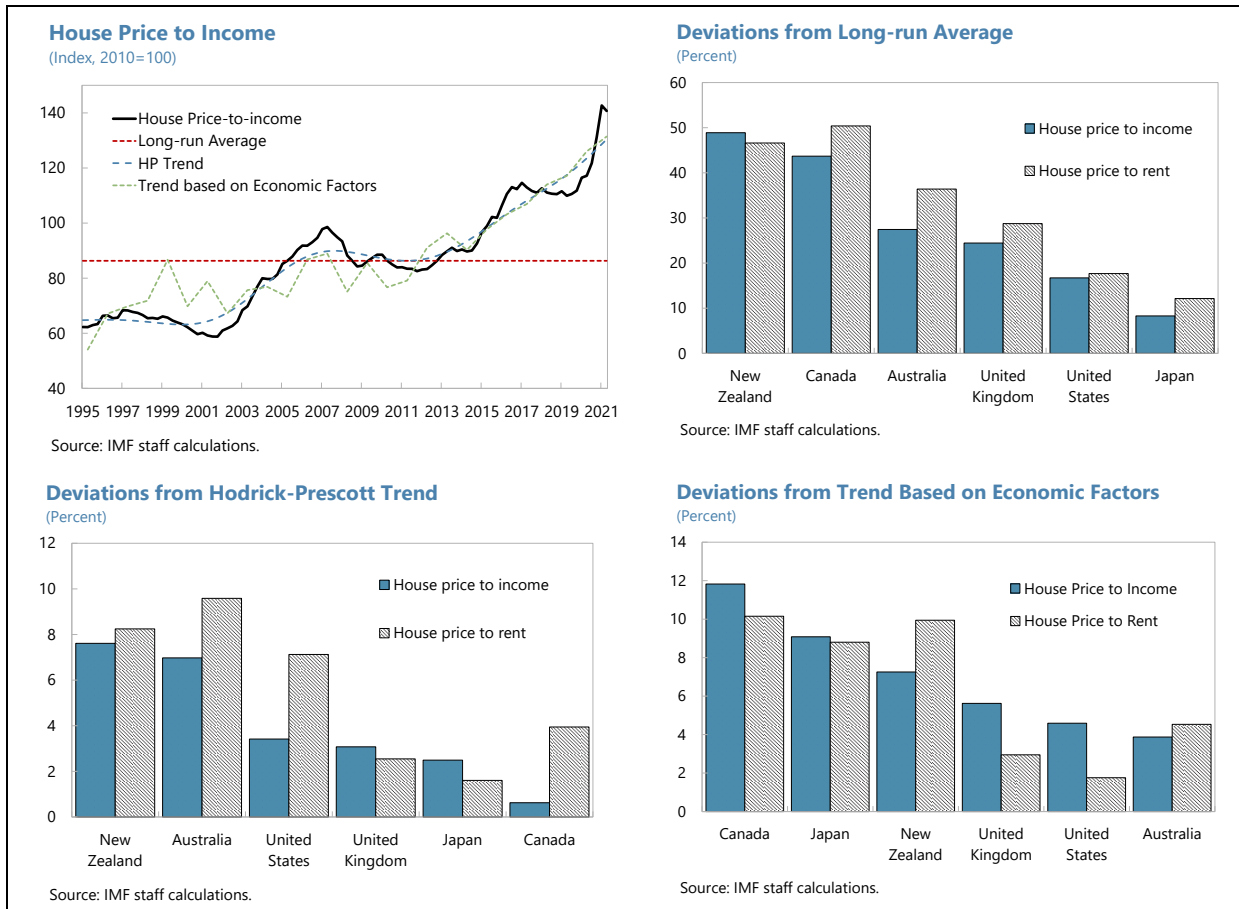
6. A similar trend is observed for affordability metrics, with New Zealand impacted more strongly than most other OECD countries. Comparing across countries is challenging given vastly different starting points and heterogeneity in quality of housing. However, we can focus on changes in these metrics to assess whether affordability has improved or deteriorated over time. New Zealand ranks highest in the Asia-Pacific region and is near the top among OECD countries in terms of increases in house-price-to-income and house-price-to-rent ratios since 2015.



7. Prices appear misaligned when compared with underlying trends. Deviations of affordability indicators from long-term country-specific trends can provide an indication of misalignment. However, the choice of the underlying trend is not clear a-priori (see European Central Bank, 2011; Philipponnet and Turrini, 2017). While ratios such as house price to income and house price to rents are in theory bounded and should revert to their long term average, they may deviate for long periods of time. However, for most countries, data is only available since the 1990s which may not be sufficient to capture the entire cycle and identify the true average value. In addition, there might be structural changes. To address these concerns, we capture the trend in housing variables using three methods:

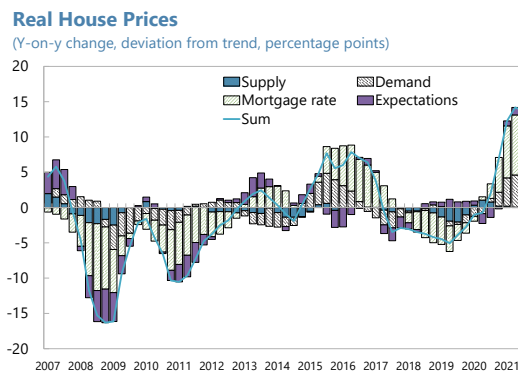
- A long run average computed over the entire sample period. This method implicitly assumes that house price to income and house price to rents follow a mean-reverting pattern and any deviation from this mean represents misalignment.
- A Hodrick-Prescott (HP) filter to remove the cyclical component. The HP filter gives more weight to more recent observations and hence better take into account recent trends. Hence it is likely to result in lower measured values for misalignment.
- A regression based long-term trend that controls for fundamental economic factors driving demand and supply. This method captures misalignment that cannot be explained by usual factors such as financial conditions (interest rates), supply of housing (lagged dwelling investment), lagged population growth and economic conditions (GDP growth).

New Zealand appears misaligned on all these measures, with the highest misalignment among comparator countries in the house-price-to-income ratio and significant misalignment also in the house-price-to-rent ratio. Regression-based estimates show smaller misalignment after controlling for low interest rates and the lagged effect of population growth, the two factors that have the highest explanatory power in the New Zealand context.

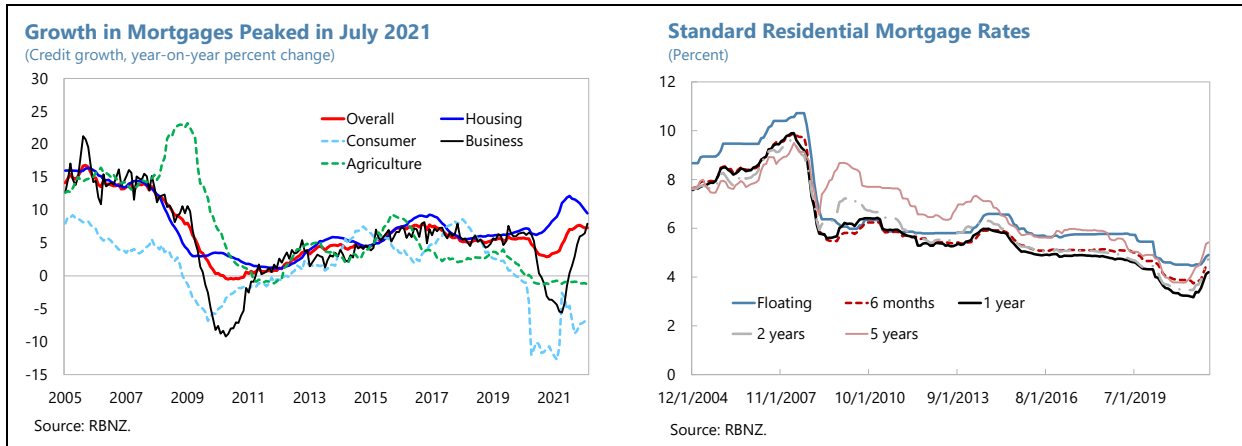


C. Drivers of Housing Price Dynamics and Outlook

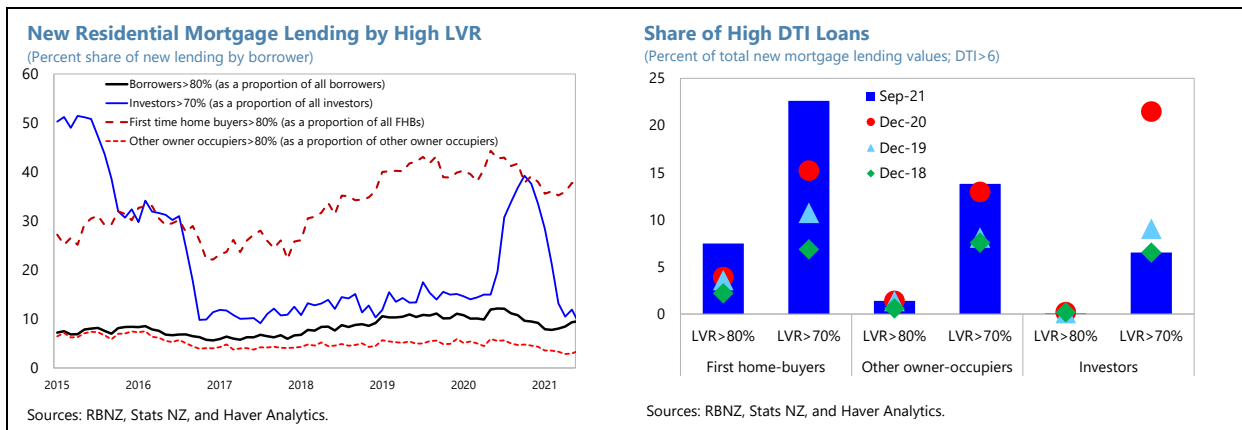
8. Both demand and supply factors play a role in explaining the surge in house prices through 2021 and the resultant misalignment relative to trend. Demand was driven by record low mortgage rates, easy credit availability, COVID-related pent-up demand, and lagged effect of population growth. By contrast, supply remained inelastic in the short term, with recent reforms aimed at freeing up land supply, improving planning and zoning, and fostering infrastructure investments to enable fast-track housing developments and lower construction costs expected to yield results only over the medium to long term. This imbalance resulted in a surge in prices. Empirical estimates, based on a VAR model with theoretically motivated sign restrictions, confirms that low mortgage rates and high demand help explain the surge in residential property prices (see Annex I).



9. Historically low mortgage rates, particularly long-term rates, increased demand. While interest rates had been trending down gradually pre-COVID, accommodative policies to mitigate the COVID-19 shock pushed down interest rates further and resulted in a change in banks' lending portfolio away from businesses towards mortgage lending. Popular mortgage rates, particularly the 2-year mortgage, which accounts for almost half of mortgages in New Zealand, reached its historic low of under 3.5 percent at the beginning of 2021 and remained in that region for much of the year, until the Reserve Bank of New Zealand (RBNZ) started tightening policy rates in the last quarter of 2021 in response to rising inflation.



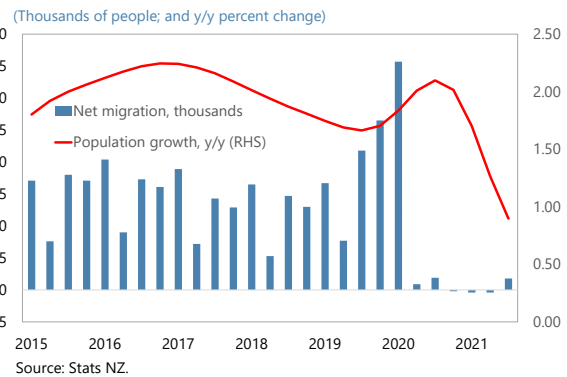
10. Macroprudential measures to alleviate the impact of the pandemic eased housing credit attainability, including for investment, further increasing demand. The temporary removal of loan-to-value (LTV) restrictions during the pandemic resulted in an increase in high LTV and high debt-to-income (DTI) lending. A large contributor to overall demand was investor appetite, driven in part by easy attainability of high LTV mortgages for investors. Until recent policy action, including macroprudential tightening and tax policy changes, a rapid increase in high-LTV investor loans fueled demand. This was particularly the case because mortgage interest payments as a share of rents were also low, resulting in lucrative opportunities for investors. However, this increase in investor demand might have helped check the increase in rental prices to some extent.



11. Housing demand was also supported by the lagged effect of population growth and COVID-19-related pent-up demand.

The years before the COVID-19 pandemic witnessed high and sustained levels of net migration, which peaked in the months before the pandemic. This resulted in an increase in total population and an associated increase in demand for housing. In addition, the COVID-19 pandemic and associated restrictions and changes in work practices resulted in a desire to “upsize” homes. Some of this may have lasting effects as people change work habits after the pandemic—reduce number of days they work from the office for example. Lockdown savings added to the pressures. A reflection of these factors, along with animal spirits, can be seen from survey data, which indicates that the “fear of missing out” in the housing market peaked at the end of 2020 and early part of 2021.

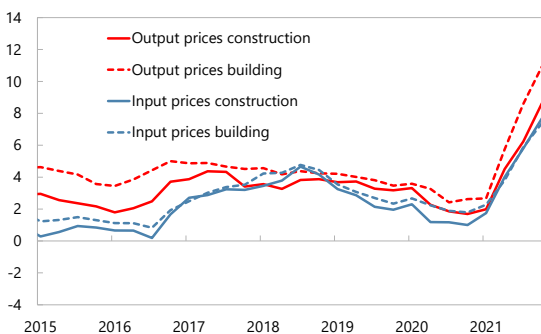
Migration and Population Growth



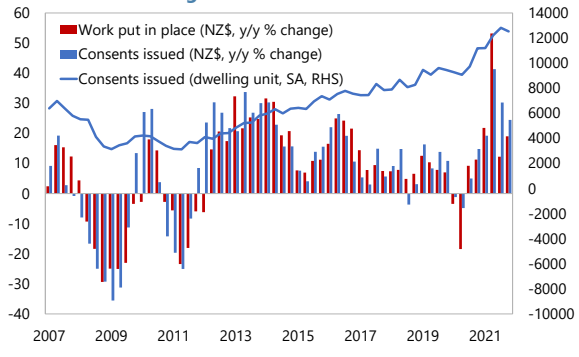
12. By contrast, supply remained low until recently. While demand was surging, pandemic restrictions made it harder to build homes, reflected by a steep increase in both input and output prices of buildings, and more broadly construction. This intersected with chronic underinvestment in housing—between 2013 and 2018, while New Zealand’s population increased by over 10 percent, the stock of occupied dwellings only increased by 6.7 percent—a result of restrictive land zoning, lack of public infrastructure for new developments, slow consenting processes, and capacity constraints in the building sector. The decline of the residential construction sector after the global financial crisis (GFC) played an important role in this respect, and it took consent numbers a long time to recover post-GFC. The increase in demand in the face of inelastic supply resulted in a spike in prices, which was further aggravated by an accompanying rise in rents, in turn pushing up investor demand. Encouragingly, consents and work put in place have increased significantly in recent quarters, which should help ease supply constraints going forward.

Producer Prices: Construction and Building

(Percent change, y/y)



Residential Buildings



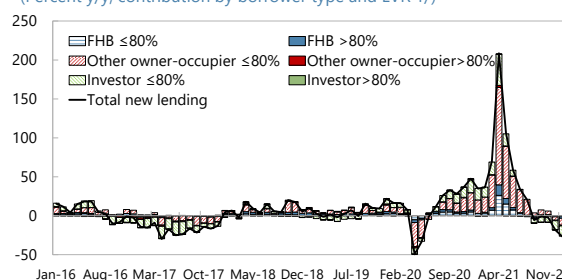
13. The housing market is expected to correct. Many of the factors that contributed to the surge in prices through 2021 are expected to reverse, and there are signs that prices may have peaked, with recent data pointing to a decline in sales volumes and mortgage lending.

- *Efforts to rebalance demand away from investors while incentivizing building activity are bearing fruit.* Removal of property investors' tax deductibility of mortgage interest and the extension of the minimum holding period to exempt capital gains on investment properties from income tax have contributed to a decline in investor demand.² New loans to investors and highly leveraged buyers (LVR exceeding 80 percent) declined more rapidly by 47 percent and 25 percent y/y, respectively, in December 2021.

- *Rising mortgage rates and macroprudential policy actions are curbing lending.* Mortgage rates have started increasing as monetary stimulus is withdrawn, but they remain low. The RBNZ reintroduced loan-to-value ratio (LVR) limits on mortgages in March 2021 and tightened them in May and November. The amendments to the Credit Contracts and Consumer Finance Act (CCCFA) designed to protect borrowers and strengthen the consumer credit regulatory regime that came into force in December 2021 had the unintended effect of tightening credit conditions further. Given these developments, and the changes to tax policy, new mortgages declined by 19 percent y/y in December 2021, the fastest pace of decline since September 2017. They have continued to decline in 2022, with new lending declining by 27 percent in January and 25 percent in February. The RBNZ is consulting on the possible introduction of additional MPMs, such as DTI ceilings and instituting a floor on test interest rates to assess borrowers' ability to meet debt service obligations.

New Residential Mortgage Lending Declined Across All Borrower Types, Led by Investors

(Percent y/y, contribution by borrower type and LVR 1/)



Sources: RBNZ and IMF staff calculations.

1/ FHB: First-home buyer. LVR: Loan-to-value ratio.

- *Efforts are ongoing to improve housing supply.* A NZ\$3.8 billion allocation was made to the Housing Acceleration Fund to increase supply of houses and improve housing affordability. Recent amendments to the Resource Management Act (RMA) in October 2021 allow for higher density housing construction without requiring resource consent, making it easier to build new homes. Similar measures implemented on a more limited basis in Auckland, as part of the Auckland Unitary Plan, led to a significant increase in new housing units, primarily in the up-zoned areas (see Greenaway-McGrevy and Phillips, 2021). However, these measures will take time to bear fruit: a cost-benefit appraisal by the Treasury (see PWC and Sense, 2021) estimated about 75 thousand additional dwellings would be built in the next 5-8 years, which is close to 50

² Interest deductions are not allowed for existing properties acquired since end-March 2021, and deductions for existing residential property acquired before this date will be phased out by March 2025. New builds are exempted from this change for 20 years to incentivize building activity. The minimum holding period to exempt capital gains on investment properties from income tax ("bright-line test") was extended from 5 to 10 years.

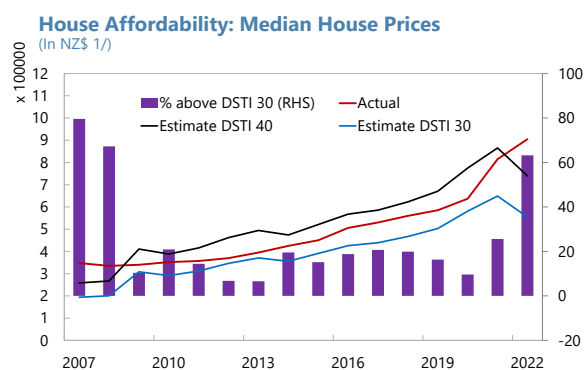
percent of new dwellings that became available over the last 5 years. More than 200 thousand additional dwellings are expected over 20 years, which represents a 10 percent increase over the stock of private dwellings at the end of 2021. The Government is also in the process of replacing the RMA to streamline approvals and further incentivize local authorities to approve new housing projects more readily to boost effective land supply.

D. Outlook and Macroeconomic Impact

14. A moderation of prices has set in, but there are macroeconomic risks in both directions. The timing and depth of the turnaround in the housing market remains uncertain, as house prices have proven difficult to predict (house price expectations pointed to a decline during the pandemic, which did not take place). House prices could quickly stabilize or decline sharply. A sudden and deep correction would likely have significant spillovers to the rest of the economy.

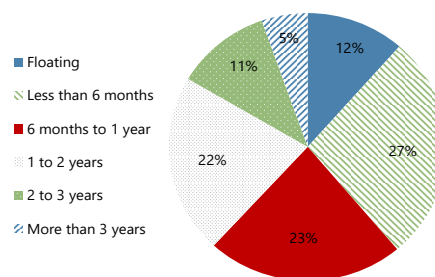
15. Rising mortgage rates are set to further dent housing affordability. We can measure affordability using a borrowing capacity approach based on the maximum size of a mortgage loan attainable by a household to finance a home purchase given its income, the prevailing mortgage rate, and leverage requirements.³ Until recently, low mortgage rates meant that median house prices in New Zealand were about 26 percent higher than house prices attainable under a 30-percent debt-service-to-income ratio (DSTI). But the rise in mortgage rates at the end of 2021 and its projected path in 2022 are set to increase this gap to over 60 percent by June 2022 if house prices remain at the December 2021 level. This raises serious affordability concerns.

16. Borrowers are vulnerable to rising interest rates. New Zealand's household debt, most of it housing-related, is high, having increased from 158 percent of disposable income at end-2019 to 169 percent in June 2021. As interest rates rise,



Source: IMF staff calculations.
1/ Year ended in June. 2022 are estimates based on prices in December 2021.

Repricing Profile of Owner Occupier Mortgages
(Percent, end-December 2021)



Sources: RBNZ and IMF staff calculations.

³ Attainable house prices are estimated by using average annual household disposable income by fiscal year end (end-June). Affordable housing cost is assumed to be in the conventional range of a debt service to household income ratio (DSTI) of 30 to 40 percent. The mortgage rate is the 1-year fixed average residential mortgage rate (monthly), applying to a principal and interest loan of 30-year maturity. The mortgage is to finance up to a loan-to-value ratio of 80 percent with a down payment of 20 percent. Actual house prices are the median value of dwellings in June of each year reported by StatsNZ. For 2022, estimates are based on December 2021 house prices and projected average household disposable income (increased by 3 percent y/y) and interest rates (based on rates at the end of December 2021 and assuming a cumulative 50bps hike in the policy rate until June, with a proportional impact on mortgages).

homeowners, particularly those who have taken out mortgages recently with high home values, will face higher interest payments relative to their incomes as their mortgages reprice. While there has been a trend towards taking out longer fixed-term mortgages, especially in 2021 when rates were at an all-time low, a vast majority of mortgages in New Zealand are at a floating rate or fixed for less than one year, with only 5 percent of owner occupier mortgages fixed for 3 or more years. Estimates suggest that during 2022, almost NZ\$215 billion worth of mortgages will have to be rolled over at sharply higher interest rates.

17. Higher interest payments will be a drag on private consumption and economic growth. Although stress tests by banks suggest that most borrowers are likely to be able to afford this increase in mortgage rates, limiting financial stability risks, interest payments as a share of disposable income are expected to increase significantly. Since their trough in June-2021, implicit interest rates on housing—calculated as the ratio of households’ interest payment on housing loans over total housing loans outstanding—increased from 3.2 percent to 4.2 percent at the end of December 2021, and are expected to increase (based on our baseline projection for policy rates) to 4.7 percent and 6.1 percent by June 2022 and 2023 respectively. Rising interest payments will likely constitute a drag on household private consumption and overall economic growth. The magnitude will depend on the elasticity of private consumption to disposable income, which can vary widely depending on the nature of the income shock (temporary vs permanent) and household characteristics (income distribution, savings etc.), but could range from 0.3 to 0.5 percent of GDP in 2022 and 0.6 to 1.3 percent of GDP in 2023.⁴ However, rising deposit rates could help offset some of this increase by increasing income from financial assets, though the distribution of assets and liabilities are likely to be skewed amongst households.

Table 1. New Zealand: Impact of Interest Rate Changes on Interest Servicing Burden

	Actual Jun-21	Alternative scenarios					
		Actual Dec 2021		Baseline June 2022		Baseline June 2023	
		(% change)		(% change)		(% change)	
Implicit Interest rate (percent)	3.2	4.2	1.0	4.7	1.5	6.1	2.9
Interest payments (NZ\$ bil)	10	13	33	15	49	19	92
(Percent of household disposable income)	4.9	6.5	1.6	7.2	2.4	9.3	4.5
Housing loan outstanding (NZ\$ bil)	318						
Household disposable income (NZ\$ bil)	207						

Sources: RBNZ and IMF staff estimates.

18. Downside risks to house prices have increased. Conditional on 2021Q4 economic conditions, real house prices in New Zealand could fall by 19 percent with a 5 percent likelihood. This estimate is based on the IMF’s House-price-at-risk (HaR) methodology, which quantifies downside risks to future house price growth using quantile regression methods. HaR links house price dynamics to fundamental factors such as macroeconomic conditions, demand and supply

⁴ This assumes that an estimated 68 percent of mortgages reset in 2022, increasing to 84 percent by 2023. The assumptions about elasticity of consumption to changes in disposable income ranges from [0.3 to 0.6] based on a survey of the empirical literature. See de Bondt, Gieseck, and Zekaite (2020).

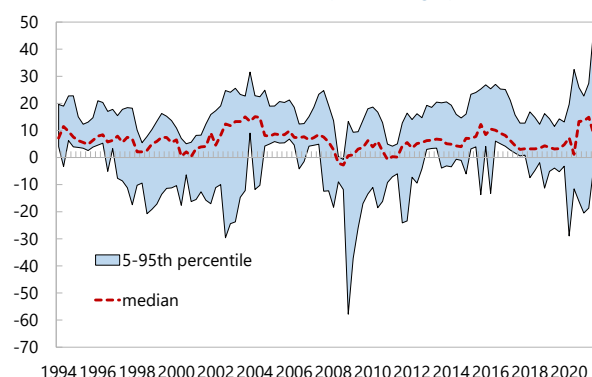
factors, financial conditions, and house price valuations.⁵ The model shows that downside risks increased sharply in 2020Q2 amid the strict lockdown and sizable economic slowdown, declined in the second half of 2020 with the economic rebound, and started widening again in the last quarter of 2021 as a result of tightening domestic financial conditions and increasing misalignment.

19. Financial stability risks from a downturn in the housing market are limited, but household balance sheets will be affected.

Despite banks' large exposure to mortgages, financial spillovers from a sharp correction in the housing market is likely to be limited as banks are well capitalized. Stress tests by the RBNZ show that banks would continue to meet minimum capital standards in the event of a 1-in-50 to 1-in-75 year shock, including a 39 percent decline in house prices. But housing and land represents a large part of household net wealth, and a sharp downturn in the sector will dampen demand via wealth effects. Using elasticities estimated by Case, Quigley and Shiller (2005) for an international panel of 14 advanced economies, a 10 percent decline in housing wealth (baseline projection) could decrease private consumption by 1 percent and GDP growth by 0.6 percent. A larger correction of house prices and associated 19 percent decline in housing wealth (5 percent likelihood from HaR) could decrease private consumption and GDP by 2 and 1.3 percent respectively.

Downside Risks Remain in the Housing Market

(House-Price-at-Risk in New Zealand, 4 quarter change, percent)

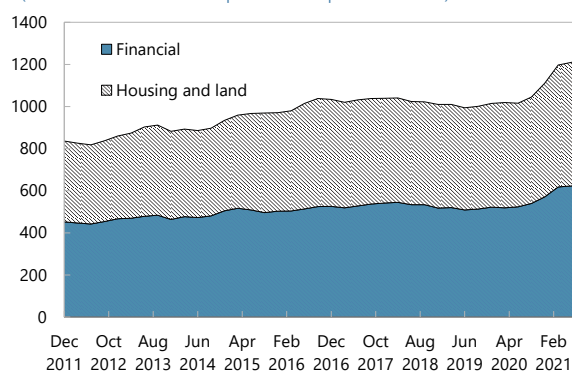


1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020

Source: IMF staff estimates.

Household Wealth

(Household net wealth as a percent of disposable income)



Sources: RBNZ and IMF Staff Calculations

E. Policy Options

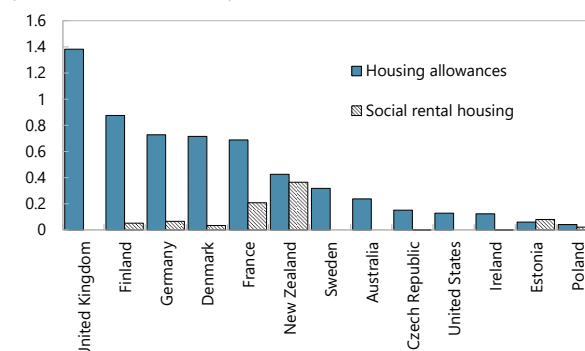
20. Tackling housing imbalances requires a comprehensive approach, and recent initiatives will help address these imbalances. Achieving long-term housing sustainability and affordability depends critically on freeing up land supply, improving planning and zoning, and fostering infrastructure investments to enable fast-track housing developments and lower construction costs. Recent amendments to the RMA and the easing of zoning restrictions to permit medium-density housing in all of the country's major cities represent a major departure from the systems in place from the 1980s that encouraged low-density detached single-family housing.

⁵ See April 2019 Global Financial Stability Report (Chapter 2) for methodology and discussion.

Together with the National Policy Statement on Urban Development and the Medium Density Residential Standard, these measures should boost housing construction. But there is a continued need for significant government spending on land, infrastructure, and housing, including financial incentives from the central government that enables and incentivizes local councils and iwi (Māori tribal organizations) to provide the basic infrastructure for new developments.

21. Increasing the stock of social housing also remains important. While increasing overall housing supply is critical, given high homelessness and rental burden particularly in the lower income quintiles, it is also necessary to take into account distributional issues. Even with a large correction in prices, low-income New Zealanders are unlikely to be able to enter the housing market in the near term. Housing costs for low-income New Zealanders have doubled as a proportion of their income since the 1980s, and homeownership rates have fallen while household debt has increased substantially. This highlights the need to increase the stock of social housing. The number of applicants waiting for public housing has nearly tripled between 2018 and 2021, with over 24,000 people (more than half of which Māori) on the public housing register as of September 2021. Therefore, although New Zealand already spends more than other OECD countries on supporting public rental housing, there is scope for improving overall public spending on housing for targeted interventions to support secure, affordable rentals for people on lower incomes, and for helping first home buyers.

Public Spending on Housing Allowances and Social Housing
(Percent of GDP, 2020 or latest)



Source: OECD.

22. A continued moderation of prices is widely expected, and macroprudential policy should be adjusted commensurate with the evolution of financial stability risks. Mitigating investors' demand for existing housing has helped moderate near-term price pressures. In addition, LVR restrictions have been effective in making lending for housing more cautious and should be maintained at current levels unless price increases or credit growth do not moderate to sustainable levels. Work underway to expand the MPM toolkit, including the ability to readily implement DTI ceilings when warranted, is welcome and can prove useful in addressing future financial stability risks as they arise. Additional capital-based tools, such as higher risk weights on mortgages, leverage limits, and additional capital buffers, can be considered if financial stability risks emerge. The empirical literature on the effectiveness of MPMs finds that capital-based tools are effective at protecting the financial system, although their impact at moderating credit to housing or affecting house prices is more limited. MPMs that directly affect the supply of loans, such as LTV and DTI ratios, are effective at both (see Ampudia et. al. 2021; Alam et al 2019; Igan and Kang 2011; Cerutti et. al 2015; Kuttner and Shim 2013; amongst others).

23. Macroeconomic policy support may be needed in case of a deep and rapid correction. Financial stability risks from a sharp downturn in the housing market are limited given high bank

capitalization, but pockets of vulnerability, particularly amongst recent borrowers, may exist. More broadly, there is likely to be a larger impact on consumption through wealth and sentiment effects. In a scenario of a marked housing correction, macroeconomic policy support may be needed to avoid second round effects and a pronounced downturn.

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Annex I. Structural Vector Autoregression with Sign Restrictions

1. The empirical estimates in Section C employ a structural vector autoregression with theoretically motivated sign restrictions based on a Bayesian approach similar to Rubio-Ramirez and others (2010). We start with a reduced-form Vector Autoregression model given below:

$$Y_t = c + \beta_1 Y_{t-1} + \dots + \beta_4 Y_{t-4} + \varepsilon_t,$$

where Y_t is a vector of four endogenous variables related to housing: i) real house price growth, ii) residential investment as a percent of GDP, iii) detrended mortgage rates, and iv) housing stock as a share of population. β_i is a 4×4 matrix for time-invariant parameters for the lagged endogenous variables, ε_t is a 4-vector of reduced-form residuals. We impose theoretical motivated sign restrictions to identify four structural shocks: housing supply shock, housing demand shock, mortgage rate shock, and expectations. The identification scheme follows a discussion by Towbin and Weber (2015) and Ben-David and others (2019). The sign restrictions are applied in the first two quarters after the shocks.

Table A.I.1. New Zealand: Sign Restrictions: Identification of Shocks				
	Housing Supply Shock	Housing Demand Shock	Mortgage Rate Shock	Expectation Shock
Real house prices	-	+	-	+
Residential Investment/GDP	+	+	-	+
Mortgage Rate (detrended)	n.a.	+	+	n.a.
Per-capita Housing Stock	+	-	n.a.	+

2. Using identified structural shocks, we compute historical decomposition of house price changes. The model is estimated using quarterly data from 2005Q1-2021Q3.

ADDRESSING CLIMATE CHANGE IN NEW ZEALAND¹

While New Zealand's greenhouse gas emissions (GHGs) have declined on a per capita basis, the level of emissions and carbon intensity of economic activity remain high relative to peer countries. The authorities have announced their intention to step up the pace of emissions reductions, and additional policy efforts will be needed to deliver on these new targets. Higher carbon prices through the Emissions Trading Scheme (ETS), together with other policies, will be needed to encourage stronger efforts to curb emissions. In addition, agricultural emissions, which are currently excluded from the ETS, should be priced going forward to encourage emissions reductions in New Zealand's largest source of GHGs. Proceeds from carbon pricing should be used to compensate groups adversely affected by higher emissions costs and for investment in green technology. On climate adaptation, New Zealand's ample fiscal space and implementation capacity provide scope to ensure investments in infrastructure and other physical capital are climate resilient.

A. Background and Recent Developments

1. New Zealand's greenhouse gas (GHG) emissions have declined on a per capita basis.

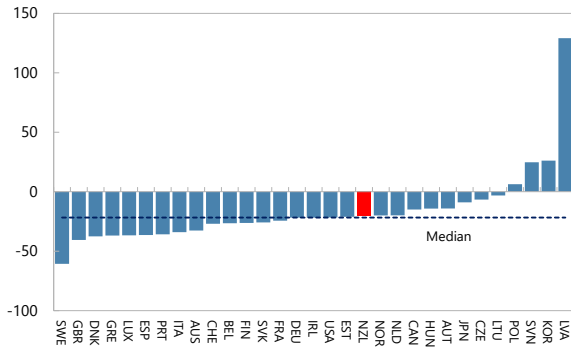
Total GHG emissions in New Zealand remained largely constant, declining by 0.2 percent, between 2005 and 2019. However, they fell by 20.3 percent on a per capita basis, about the same as the median decline seen in OECD countries. That said, the level of per capita emissions is higher than in peers, as are GHG emissions per unit of GDP. Land Use, Land Use Change and Forestry (LULUCF) in New Zealand functions as a carbon sink rather than a contributor to net emissions, absorbing emissions from other sectors. As such, CO₂ only accounts for around 21 percent of net emissions as forestry absorbed 23.6 million metric tons of CO₂ in 2018. By contrast, methane, especially biogenic methane generated by agricultural activities, forms the bulk of net emissions. Different from most OECD countries, New Zealand relies primarily on zero carbon sources—mainly hydroelectricity and, increasingly, other renewables—rather than fossil fuels for electricity generation. The share of renewables has risen since 2005, as the use of coal in particular has declined.

2. CO₂ emissions declined significantly in 2020, largely reflecting the impact of the COVID-19 pandemic, but this is not expected to be sustained. While official data on emissions of all GHGs is not yet available, data compiled by the [Global Carbon Database](#) suggests New Zealand's CO₂ emissions declined by 10.8 percent y/y in 2020 as economic activity and mobility were impacted by the pandemic and related lockdowns. As these measures were relaxed, it is expected that emissions have bounced back. Emissions of other GHGs, especially biogenic methane, are not expected to have been impacted by the pandemic.

¹ Prepared by Narayanan Raman (APD). This chapter benefitted from valuable comments and suggestions from Nicoletta Batini (IEO) and participants from the New Zealand Treasury, Ministry for the Environment, Climate Change Commission and Reserve Bank of New Zealand at a virtual seminar during the 2022 Article IV consultation mission.

Per Capita Emissions Declined in Line with OECD Median

(Percent change in total emissions between 2005 and 2019)

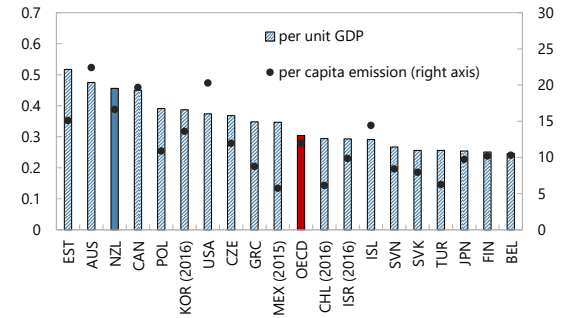


Source: OECD.

Emissions Intensity Is Higher than Peers

KgCO₂ equivalent per USD

MTCO₂ equivalent per person

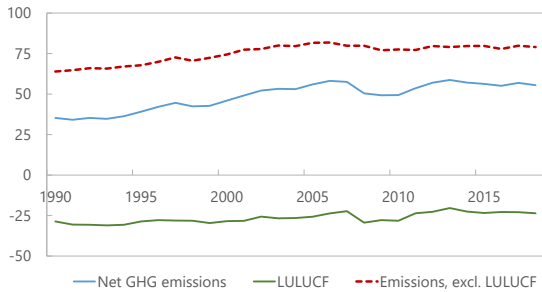


Data are for 2018, unless otherwise indicated.

Source: OECD.

Forests Are a Carbon Sink, Partly Absorbing CO₂ Generated in Other Sectors

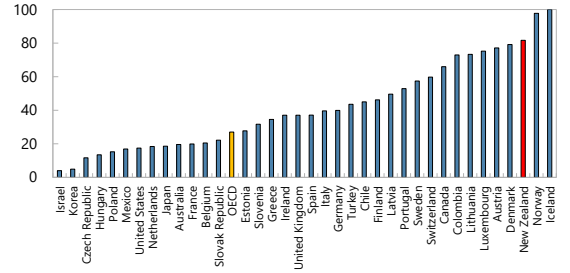
(Greenhouse gas emissions, MtCO₂e)



Sources: New Zealand Ministry for the Environment, and IMF staff calculations.

Share of Zero-Carbon Fuels in Electricity Generation Among the Highest in the OECD

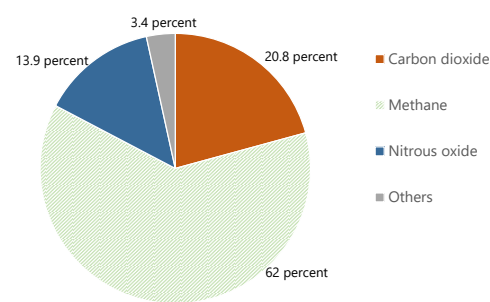
(Renewables and zero-carbon fuels share in electricity generation, percent)



Source: OECD.

Methane Accounts For the Bulk of New Zealand's Net GHG Emissions

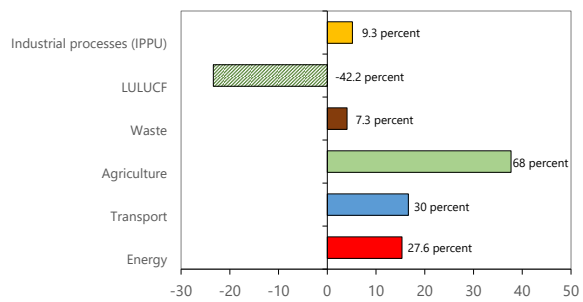
(Net emissions in 2018, MtCO₂e)



Source: New Zealand Ministry for the Environment.

Agriculture Is The Largest Contributor, Particularly Through Emissions of Biogenic Methane

(Net emissions in 2018, MtCO₂e)



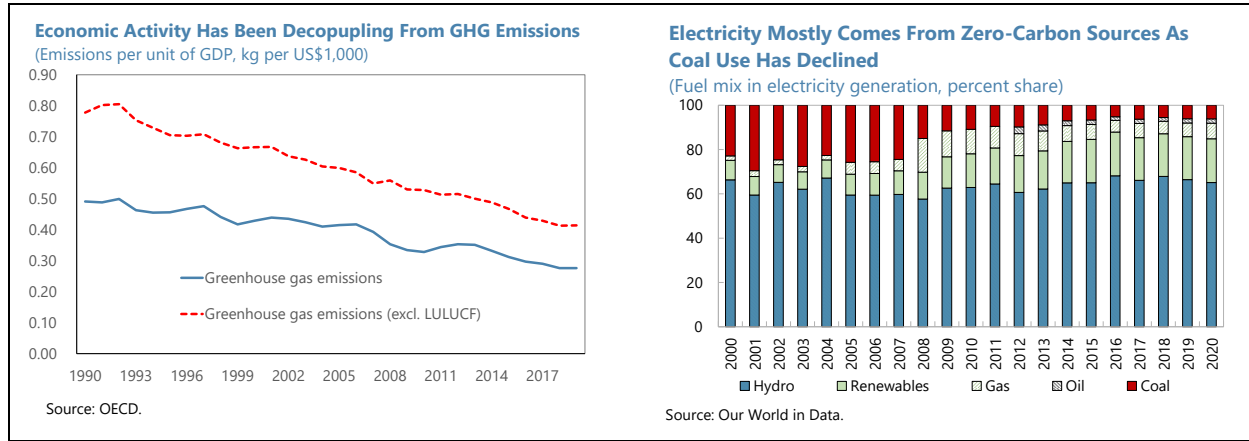
Source: New Zealand Ministry for the Environment.

B. Outlook

3. Over the medium term, per capita emissions are projected to continue declining.

Economic activity and emissions have been decoupling for over three decades now: in 2019, each unit of GDP produced only 56 percent of the GHG emissions it generated in 1990. New Zealand has also made progress in decarbonizing the energy sector, particularly by reducing the use of coal. Ongoing efforts to replace its remaining coal-powered boilers in the commercial and industrial sectors would significantly reduce emissions as well as particulate air pollution. Going forward, the

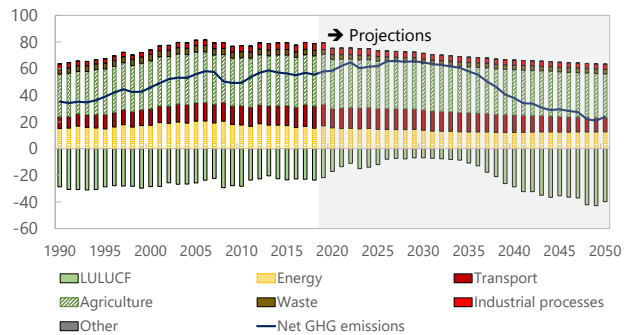
authorities project lower emissions in transport, building and construction, the residential sector and, over the longer term, agriculture.



4. Population and economic growth will push overall emissions higher in the near term though over the long term, they are expected to decline. In 2020, the authorities published a set

of long-term projections for GHG emissions that incorporate factors that could reduce emissions (e.g., a continuing decoupling of economic activity from CO₂ emissions, the impact of higher carbon prices from the emissions trading scheme (ETS), investment in and adoption of lower carbon technologies and contributions from afforestation² and improvements in agriculture), and factors that might raise them (e.g., economic and population growth). Based on modeling trends for these factors, the authorities project a net reduction in emissions by 2050.

Net Emissions Are Projected to Decline, Driven by CO₂ Absorption From Increased Forest Cover
(Projected greenhouse gas emissions, MtCO₂e)



Sources: New Zealand Ministry for the Environment, IMF staff calculations.

However, the profile is heavily backloaded, with net emissions rising through 2025, stabilizing between 2025 to 2035 before they decline thereafter as the investments in increasing forest cover start to pay off. Lower emissions from energy, transport and agriculture are also expected to make a contribution in the longer term.

5. New Zealand committed to a more ambitious timetable to reduce emissions at COP26.³ The domestic legislative framework under the Zero Carbon Act specifies that New Zealand will achieve net zero for GHG emissions (excluding biogenic methane, or methane generated from agricultural activities) by 2050 and reduce biogenic methane emissions by 10 percent by 2030 and

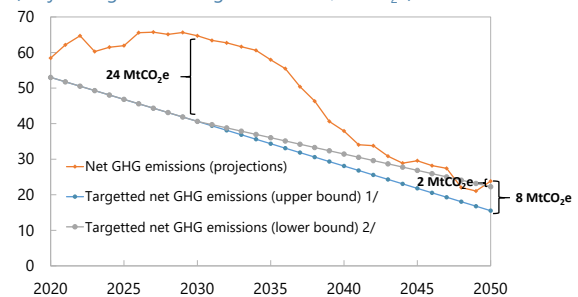
² Specifically, absorption through forestry is projected to decline between 2025 and 2035 as planting forests initially emits more carbon than it absorbs though this is reversed as forests mature.

³ New Zealand is not a major emitter—accounting for under 0.1 percent of annual global GHG emissions—but the commitment to the multilateral process is an important signal to the global community.

24-47 percent by 2050, relative to the 2017 level. Separately, under the Paris Agreement, New Zealand committed to reducing its net GHG emissions (excluding biogenic methane) by 30 percent below its gross 2005 levels by 2030. At the COP26 summit in Glasgow, the commitment for 2030 (Nationally Defined Contribution, or NDC) was strengthened to a 50 percent reduction of net GHG emissions relative to 2005 gross emissions. This would represent around a 27 percent decrease in net emissions of all GHGs between 2018 and 2030. The authorities have not specified how these new targets will be delivered and are exploring the use of international mitigation (offshore offsets) in addition to their domestic efforts. Details on policy measures aimed at progress towards the 2030 targets are expected to be included in a forthcoming Emissions Reduction Plan (ERP), which will inform proposed emissions budgets through to 2035.⁴

6. Based on the authorities' projections, New Zealand would not meet its new emissions targets for 2030 without significant additional policy effort. Both New Zealand's targets and the projected path for emissions are backloaded, reflecting the fact that large changes in emissions in the near term will be difficult to deliver, given the technology that is likely to be available in the envisaged timeframe. Over the longer horizon, however, the impact of the ongoing investment in afforestation, together with greater use of technologies, can more cost effectively deliver improvements. That said, there is a substantial gap between the new commitments and earlier projections of around 24 million metric tons of CO₂-equivalent (MtCO₂e) in 2030, and between 2-8 MtCO₂e in 2050, assuming the targets will be met solely through domestic abatement efforts (see footnote 4). Further, the projected emissions path would leave a very small window to meet the 2050 targets, which raises questions regarding its vulnerability to adverse shocks. Finally, it should be noted that even under the more ambitious mitigation scenario, New Zealand is not aiming for net zero for total GHG emissions in 2050.

2030 Targets Require A Step-Up in Emissions Reduction
(Projected greenhouse gas emissions, MtCO₂e)



Sources: New Zealand Ministry for the Environment, IMF staff calculations.
1/ 24 percent reduction in biogenic CH₄ emissions in 2050 relative to 2017, net zero for all other GHGs.
2/ 47 percent reduction in biogenic CH₄ emissions in 2050 relative to 2017, net zero for all other GHGs.

7. A LULUCF-centered emissions reduction strategy has limits. While agreeing that afforestation will be an integral part of any plan to achieve New Zealand's targets, the independent Climate Change Commission (CCC) has voiced concerns about an over-dependence on this approach. First, there is a concern that this will delay the transition to a low- or zero-carbon economy in other sectors if afforestation turns out to be cost-effective relative to other mitigation efforts, thereby limiting the increase in the overall price of carbon. Second, there will be an ongoing need to keep planting trees beyond 2050 to keep offsetting ongoing gross emissions if the latter are

⁴ As the details on possible international mitigation efforts are not yet available, staff's assessment is based exclusively on domestic mitigation and hence represents an upper bound of the level of domestic reductions that need to be achieved. The authorities consider it highly unlikely that the NDCs could be met solely through domestic abatement efforts and aim to bridge the gap between the emissions budgets and the NDCs through offshore mitigation.

not brought under control, which raises questions on intergenerational equity, particularly when future generations are also burdened with the cost of adaptation. Third, adverse events such as droughts or fires could damage forest cover and retard progress, particularly since afforestation is envisaged to only begin materially reducing net emissions after 2035. In addition, afforestation needs to be sensitively implemented to ensure biodiversity is maintained while respecting other social goals, particularly related to the welfare of affected groups.

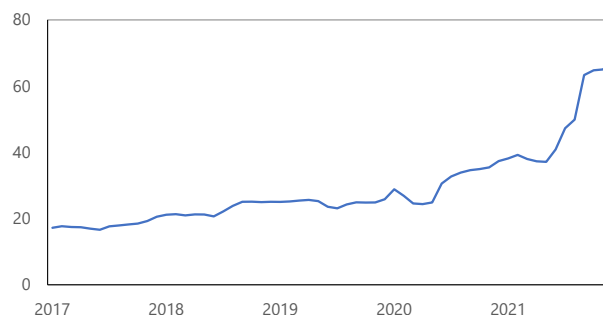
C. Policies to Support GHG Mitigation

8. A number of policies already in place are aimed at accelerating the reduction in emissions.

- The [ETS, which was introduced in 2008](#), has elements of a cap-and-trade system, where the government sells “units” (equivalent to 1 metric ton of CO₂ equivalent or tCO₂e each), with the availability of units set out in 5-year emissions budgets that are progressively tightened (Box). To encourage stronger price signals, the authorities removed the price cap that had previously been implemented in the market’s early stages. As a result, the clearing price in the market nearly doubled from NZ\$36 in March 2021 to NZ\$70 in March 2022, which is in line with the shadow price proposed for conducting Benefit-Cost Analyses (BCAs) on public projects (see below). The main limitation of the ETS is the exclusion of about 55 percent of projected emissions, mainly from agriculture, from the scheme, though this is currently under review. The ETS is seen by market participants and other stakeholders as a transparent and effective method to drive change, and there is strong consensus that it should be the foundation of New Zealand’s efforts to meet its targets.
- In October 2021, New Zealand passed legislation requiring large financial firms as well as firms that issue debt or equity on the stock exchange to publish [climate risk disclosures](#). The goals of the new law, which will come into effect fully by 2023, are to:

 - ensure that the effects of climate change are routinely considered in business, investment, lending and insurance underwriting decisions;
 - help climate reporting entities better demonstrate responsibility and foresight in their consideration of climate issues; and
 - lead to more efficient allocation of capital, and help smooth the transition to a more sustainable, low emissions economy.

Carbon Prices Have Increased, Particularly After the Market Was Liberalized in 2021
(Monthly mean price, NZ\$ per NZ unit)



Source: www.carbonnews.co.nz.

- In the **financial sector**, the RBNZ has [announced](#) that climate considerations will impact some aspects of its work, mainly related to raising external awareness on the risks and implications of climate change, contributing to regulatory policy discussion such as climate-related disclosures, and building its internal capacity and awareness. The RBNZ also leads the Council of Financial Regulators' (CoFR) Climate Change Community of Practice, and is a member of [Central Banks and Supervisors for Greening the Financial System \(NGFS\)](#) and the [Sustainable Insurance Forum](#).

Box 1. New Zealand's Emissions Trading Scheme

New Zealand set up its ETS in 2008, and in 2020, the first auctions were conducted. As currently constituted, the ETS works on auctioning permits on a subset of emissions, based on a whole-economy envelope for GHG emissions.

As a first step, the government sets out 5-year budgets for all GHG emissions, taking into account the economy's needs to sustain growth and investment. The overall envelope for the 2021-25 period was set at 354 MtCO₂e, and will be progressively reduced in the successive 5-year budgets to reach 242 MtCO₂e for the 2031-35 period. This overall limit is binding for the economy.

Of the total envelope for 2021-25, around 55 percent of projected emissions, largely from agriculture, are excluded from the ETS. Around 12 percent is reserved for a "free" allocation, that is allocation to industries where emissions intensity is high and unavoidable, or where a binding limit could prompt the offshoring of activities thereby leaving overall global emissions unchanged. The remainder is to be offered for auction under the ETS (around 25 percent) and held as a stockpile/buffer (around 8 percent), to be released if market clearing prices at auctions exceed a pre-determined trigger price.

Units, equivalent to 1 tCO₂e each, can also be generated by removal of carbon through forestry, thereby giving firms an avenue to offset their emissions. There is currently no limit to the number of units that can be generated through this mechanism.

Auctions are guided by two price triggers: a floor to ensure carbon is priced at a minimum level to ensure prices generated by the auction are economically meaningful, and a trigger price which, if reached, would prompt the authorities to release some of the stockpiled units. For 2022, the floor was raised from NZ\$20.40 per unit to NZ\$30, while the trigger price for the release of additional units was raised from NZ\$51 to NZ\$70.

The ETS allows secondary market trading: successful bidders or those who generate units through afforestation can then sell on their units to other participants in the market.

9. An Emissions Reduction Plan (ERP), to be ready in May 2022, will set out how New Zealand will deliver on its climate mitigation commitments. While details of the ERP are not ready, a public consultation document,⁵ which outlines policy options under consideration, was released in preparation for the ERP. Key proposals in the document include:

⁵ Ministry for the Environment, 2021, [Te hau mārohi ki anamata | Transitioning to a low-emissions and climate-resilient future: Have your say and shape the emissions reduction plan](#). Wellington: Ministry for the Environment

- Strengthening the ETS by improving market governance and reviewing the free industrial allocation (free allocation of units to specific sectors due to the nature of their activities or to ensure emitting activities are not offshored);
- Integrating emissions reduction into land-use planning and investments as part of the review of the planning framework, as well as the urban planning and funding framework;
- Encouraging research and development, including targeting an increase in funding by the public and private sectors to develop and implement green technologies from 1.35 percent currently to 2 percent of GDP;
- Developing options to encourage behavioral change and the development of a circular bioeconomy that reduces emissions;
- By 2035, reducing vehicle use by 20 percent, increasing zero-emissions vehicles to 30 percent of the light fleet, reducing emissions from freight transport by 25 percent, and reducing emissions intensity of transport fuel by 15 percent;
- In the energy and industrial sector, developing an energy strategy with a renewable energy target and plans to decarbonize the industrial sector, discouraging further industrial investment in GHG emitting technologies such as a ban on coal boilers, and updating energy efficiency guidelines;
- In agriculture, accelerating the development of mitigations through R&D; and
- In building and construction, replacing the use of fossil fuels in buildings, including setting a date to end the expansion of fossil gas pipelines into new builds, and explore potential mandatory regulations to improve energy efficiency in commercial and public buildings.

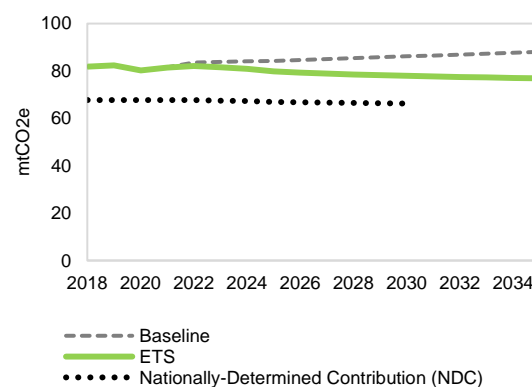
The document also outlines proposals for strengthening monitoring of the targets to ensure accountability for meeting them, and ensuring the changes are equitably implemented, particularly to consult with the Māori and indigenous communities.

10. The 2021/22 Budget identified addressing climate change as a key policy priority, which includes action on some of the proposals outlined above. The government allocated NZ\$300 million to accelerate investment in low-carbon technology through NZ Green Investment Finance Limited; and NZ\$67.4 million to implement the Carbon Neutral Government Programme, which includes NZ\$19.5 million for the State Sector Decarbonisation Fund and NZ\$41.8 million for leasing low-emissions vehicles. A further NZ\$19.7 million has been set aside to finance policy responses to the final advice from the CCC. There are also allocations to tackle on-farm emissions, both by encouraging integrated farm planning systems and financing of research and development. The government has also committed to channel future ETS revenues to achieve further emissions reductions, starting with the 2022/23 Budget, which is estimated to amount to NZ\$4.5 billion over a 4-year period. As noted above, the Budget also specifies a shadow price be used while preparing BCAs to prioritize public projects. Projects that are projected to emit carbon will now have those

emissions counted as a cost over the lifetime of the project while those that reduce carbon will have those reductions included in the estimated benefits. The government has proposed a shadow price equal to the cost of abatement, currently estimated to be around NZ\$61-122 per metric ton for emissions released in 2021, rising to NZ\$119-238 per ton by 2050. The government is developing tools for agencies to incorporate emissions assessments in BCAs. Finally, the government has committed to full carbon neutrality for the public sector by 2025, largely by replacing coal boilers and electrifying the government's car fleet.

11. A higher price on carbon will be important to spur investment to reduce emissions. Following the removal of the price cap, the recent near doubling of carbon prices reflects a good first signal of the need for higher carbon prices. That said, there is concern that market participants may focus too heavily on creating units through offsets, particularly in light of limits to this approach (e.g., limited room to expand forest cover), rather than strengthening their own mitigation efforts. The adoption of shadow carbon prices by the government in conducting BCAs of public projects will also tilt the balance toward low emission and carbon-negative projects. Progressively expanding the use of this approach, as the government intends, is critical and should be done as quickly as feasible.

More Than Doubling the Real Carbon Price Would Still Not Be Sufficient to Reach the 2030 Target



Source: Country authorities, estimates from the IMF's Carbon Price Assessment Tool

Note: Emissions excluding Land Use, Land Use Change and Forestry. The figure only considers the impact of higher prices on domestic emissions and does not consider offshore mitigation efforts.

12. In the long run, a carbon price-only strategy would call for a significant, and possibly difficult, increase in the price of emissions to deliver the needed reductions. Analysis using the Fund's Carbon Pricing Assessment Tool (CPAT) suggests that the projected increase in the ETS prices, while contributing to the reduction in emissions, would be insufficient to meet New Zealand's targets. Based on the model's parameters and assuming that the market rate for emissions roughly double from US\$45.88 (NZ\$68) currently to US\$100 in real terms by 2030, gross emissions would fall relative to a business-as-usual scenario but would still be around 13 MtCO₂e higher than that implied by New Zealand's targets. Modeling undertaken by the New Zealand Productivity Commission suggests prices would need to rise to around NZ\$150-250 per metric ton to achieve net zero emissions. Notwithstanding this, the results show that properly pricing GHG emissions would allow New Zealand to make significant progress in lowering emissions.

13. The authorities are working on options to address emissions from agriculture, which is a significant contributor to emissions. The focus on improving farming practices to reduce biogenic methane emissions is needed to deliver positive results. The authorities and the CCC

estimate that implementing best practices in animal husbandry already available today could reduce emissions in the sector by around 24 percent from current levels by 2050, which is the lower bound of New Zealand's NDCs, and newer technologies could deliver even larger improvements. That said, a technology-driven approach carries risks: it is not clear that feasible technologies and approaches can be developed in the timeframe needed to meet New Zealand's emissions targets.⁶ While there are some promising advancements in train (e.g., adjusting stocking rates (the intensity of resources devoted to animal husbandry) and feeds to increase yields while reducing herd sizes, developing new types of feeds to reduce emissions from cattle, developing vaccines against microbes that generate emissions, reducing the use of nitrogen-based synthetic fertilizers to reduce nitrous oxide emissions), there is uncertainty whether these can be scaled up to the required levels to make a significant dent in methane emissions.

14. Pricing agricultural emissions, either by expanding the ETS or developing an alternative, could be a useful vehicle to incentivize the necessary investment in agriculture.

Recognizing the limits of a technology-driven approach, the authorities are reviewing options to introduce a price-based mechanism for agriculture. The national emissions envelope already incorporates all GHG emissions, including from agriculture, and data on sectoral emissions is being collected. It would be feasible to integrate biogenic methane into the ETS. Work on addressing methane emissions should not be delayed given that it is up to 35 times more potent in trapping heat over a 100-year span than CO₂. Encouragingly, as biogenic methane is a short-lived GHG with an atmospheric lifespan of approximately 12 years, a decline in emissions would lead to a fall in the stock of atmospheric GHGs offsetting the impact of longer-lived gases. In setting prices for biogenic methane, as is being done with other GHGs, a transition to economically meaningful prices will need to take place relatively quickly to encourage a reduction in emissions from farming practices. That said, this needs to be balanced against the possibility that a high price could encourage offshoring of some agricultural activities from New Zealand, where the emissions intensity may be lower, thereby adversely impacting global emissions.

15. A price-based mechanism could be supported through targeted measures designed to reward producers who successfully reduce their emissions.

A feebate designed to be revenue neutral would provide a rebate for producers whose emissions are below average while charging a fee on those who have above average emissions. Feebates have the advantage of automatically adjusting to improvements in the sector and, in most countries, rely on existing administrative structures. Further, as feebates are calibrated to average emissions, they are fiscally neutral: the burden on the government will not rise even as overall emissions decline. In particular, New Zealand could implement a feebate scheme using herd sizes and other proxies to estimate emissions, supplemented by regular adjustments to reflect the increasing adoption of practices to reduce

⁶ The Intergovernmental Panel on Climate Change (IPCC) estimates only with medium confidence that improvements in agricultural practices could deliver global reductions in GHGs by 0.3-3.4 GtCO₂e per year by 2050. In contrast, shifting a larger part of the global population to a plant-based diet would deliver between 2-3 times more reduction with high confidence. (See IPCC, 2019, *Climate Change and Land: An IPCC Special Report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems.*)

emissions, especially as methane emissions are already being monitored.⁷ To further ensure smaller farms are not unduly disadvantaged, consideration could be given to giving direct support in the form of inputs and access to scientific advice. The authorities are actively considering a levy-and-rebate scheme along these lines as one option to price agricultural emissions.

16. In the near term, there is scope to accelerate decarbonization in the energy, residential and transport sectors to complement the price-based approach. The CCC suggests that targeted incentives and direct government action in improving the uptake of electric vehicles, improving the building stock to promote energy efficiency and further greening power generation could contribute the most to reducing emissions. Public investment is likely necessary on this front: the Commission estimates that it would take around NZ\$2 billion annually until 2030—primarily in transport and the electricity infrastructure—to achieve the needed improvements. This will need to be supplemented by private investment in renewables and energy efficiency, which would benefit from developing green finance instruments that could support the transition. Initiatives to encourage density in housing development would also help: denser housing, particularly building more multi-family dwellings that allow people to live closer to jobs and other amenities, would not only help with housing affordability but would also encourage walking, cycling and the use of public transport, thereby reducing the need to drive. However, achieving greater housing density will take time.

D. Policies to Support Adaptation to Climate Change

17. The economic costs imposed by climate change on New Zealand are significant and will likely rise going forward. The Treasury's [2021 Long-term Fiscal Statement](#) estimates that the impact of more frequent and larger and more frequent flood and drought events will reduce GDP by around 0.8 percent relative to trend by 2050 in the median estimate, but there could be losses of up to 1.7 percent in some scenarios. This translates into a fiscal cost, measured in the median increase in net public debt, of around 3.8 percentage points of GDP by 2050. Further, this estimate is likely to be conservative as it only looks at the impact of intense weather events and does not include other costs, which are likely to be significant. Finally, the range of estimates developed by the authorities is both wide and skewed toward more adverse outcomes, suggesting costs could be higher than the median, and adverse scenarios more likely than benign ones. That said, New Zealand is more able than most countries in the Asia Pacific to invest in climate resilient infrastructure, which can yield returns well in excess of their costs. Recent work surveyed by IMF staff suggests that the costs of investment in climate-resilient infrastructure in New Zealand are relatively limited (less than 1 percent of GDP annually) while fiscal space is relatively unconstrained.⁸

⁷ The proposed scheme would be broadly similar to one proposed by IMF staff to address CO₂ emissions in Denmark, alongside working toward a reduction in herd sizes. See Batini, N., I. Parry and P. Wingender, 2020, [Climate Mitigation Policy in Denmark: A Prototype for Other Countries](#), IMF Working Paper No. 20/235, November (Washington, DC: International Monetary Fund)

⁸ IMF Departmental Paper, 2021, [Fiscal Policies to Address Climate Change in Asia and the Pacific](#), Departmental Paper No. 21/07, March (Washington, DC: International Monetary Fund)

18. The first [National Climate Change Risk Assessment \(NCCRA\)](#), published in 2020, highlights key climate vulnerabilities in New Zealand. The report highlighted risks in 5 main areas, and flagged knowledge gaps that need to be addressed. In particular, the NCCRA flagged two major risks to the economy: the fiscal and economic costs associated with lost productivity, disaster relief expenditure and unfunded contingent liabilities; and risks to the financial system. There were also extreme or major risks related to the natural environment, the built environment (including infrastructure), human welfare and governance. A second NCCRA, to be prepared by the CCC, will be released in 2026.

19. The National Adaptation Plan (NAP) is expected to be released in August 2022. The NAP, which will be informed by the NCCRA, will outline the framework for addressing risks associated with, and adapting to changes driven by, climate change. Specific policy proposals are expected to be published in April 2022 as part of the public consultation process.

20. There is an urgent need to communicate the costs and benefits related to adapting to climate change. The discussion on climate change in New Zealand has focused on mitigating emissions, where significant work has been done and given the focus of global climate discussions on this issue. Further, the actual responsibility in ensuring adaptation takes place will disproportionately fall at the local level rather than by the central government, including by setting out rules, regulations and guidelines that promote resilience against climate events. While it is clear that preparing for climate impacts will carry costs, there is a risk that the discussion could become unbalanced if it does not also include the potential costs of not addressing risks. In this regard, the preparation of the National Adaptation Plan is welcome and should contribute to the discussions when it is ready in August 2022. Estimates of risks and costs on both sides need to part of the conversation as soon as practicable to facilitate a more balanced discussion.

E. Conclusions

21. Without additional measures, New Zealand is unlikely to meet its emissions target for 2030. After 2030, the window to the 2050 commitments will be small—not meeting the 2030 goals would imply a need for a subsequent, rapid decarbonization of the economy, which could be both disruptive and risky. The authorities intend to address this through new proposals in the upcoming ERP.

22. Properly pricing GHG emissions would incentivize emissions reduction. The increase in prices following the liberalization of ETS prices can ensure that emissions prices are economically meaningful to accelerate the take-up of low emissions technologies and invest in carbon abatement. That said, prices will need to rise significantly further to fully reflect the costs of emissions. The exclusion of agricultural emissions from the ETS is a major gap that needs to be addressed as soon as possible, given that it is the primary source of emissions in New Zealand. The authorities intend to outline possible approaches to pricing these emissions in the ERP. While the use of new technologies and techniques to address agricultural emissions is helpful, pricing biogenic methane would be an important spur to encourage the take-up of these advances. Given the larger gains from reducing methane emissions relative to addressing CO₂, due to its potency as a GHG and short

lifespan, additional measures, including developing and rolling out new technologies and implementing a feebate mechanism, should be considered. Adverse distributional consequences of higher emissions prices, in the agricultural sector and more generally, should be mitigated through social spending, including cash transfers.

23. An afforestation-centered mitigation strategy has its limits and carries risks.

Afforestation to absorb emissions is rightly an important part of New Zealand's mitigation strategy. However, an over-reliance on afforestation may unduly delay progress in reducing gross emissions, raises questions regarding inter-generational equity and leaves progress on lowering emissions open to risks from adverse events such as droughts and fires.

24. A price-based approach could be twinned with complementary policies to encourage addressing gross emissions and accelerate the transition to a low-carbon economy.

Investment in green technologies and infrastructure, such as encouraging the replacement of high emissions technology with newer more efficient alternatives, further phasing out the use of fossil fuels in transport and energy generation, and creating the necessary charging infrastructure to accelerate the take-up of electric vehicles can speed the transition. To take advantage of future developments in technology, scaling up R&D spending has the potential to yield high returns over the longer term. Other key investments should be to reduce the need for driving, either by investing in public transport or encouraging walking and cycling. In this context, New Zealand's emissions goals dovetail well with the government's strategy to encourage greater density in housing development, particularly in major urban centers, though this will likely take time to bear fruit. In the agricultural sector, consideration could be given to introducing a fiscally neutral feebate mechanism that would reward efficient producers while imposing fees on those who pollute more. Investment in international mitigation could in principle be a useful tool to more cost-effectively deliver on the needed global emissions reductions. However, its efficacy in practice is uncertain given the lack of consensus on accounting for these reductions amid open questions on avoiding double counting contributions from this source, and issues around verification. As such, care is needed in utilizing this tool.

25. New Zealand is well placed to invest in strengthening resilience in the face of climate change.

There is a need to strengthen infrastructure and revisit practices related to planning and development given the increased likelihood of more frequent and intense severe weather events due to climate change. This need not be entirely new spending: the authorities' planned public investment program should integrate climate resilience as an important consideration in project design and selection. A robust national dialogue to ensure discussions of the cost of preparing for climate change are measured against a cost of not addressing the risks of extreme weather events would be useful in building up the political consensus to fortify the economy against climate change.