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NEW ZEALAND

SELECTED ISSUES

August 2023

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SELECTED ISSUES

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Approved By
Asia and Pacific Department

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ADDRESSING CLIMATE CHANGE—UPDATES AND EMERGING CHALLENGES[1]

Greenhouse gas (GHG) emissions and economic activity continued to decouple in New Zealand in 2021: gross GHG emissions remained below 2019 levels. However, net emissions rose as the GHGs captured by land use, land use change and forestry declined. Nevertheless, projections suggest the gap between New Zealand's emissions targets and the projected path have narrowed significantly though more needs to be done if the Nationally Determined Contribution (NDC) for 2030 is to be met. Three critical policy initiatives were introduced in 2022: the first Emissions Reduction Plan (ERP) and associated emissions budgets were adopted; the National Adaptation Plan (NAP) was published; and the government proposed its framework for pricing agriculture emissions, which account for around 62 percent of net emissions and are the missing piece in the emissions pricing framework. However, policies intended to address the cost-of-living crisis such as cuts to fuel taxes and duties could have an adverse impact on the feasibility of New Zealand's emissions targets if prolonged. The heightened policy uncertainty was reflected in carbon prices: after peaking in November 2022, the price in the secondary market declined sharply and the June 2023 average price was around 40 percent below the peak level. The March 2023 Emissions Trading Scheme (ETS) auction failed to clear, resulting in no new units being released. This is a cause for concern: If falling prices are not arrested, the envisaged emissions reductions may be out of reach. Further, as proceeds from the ETS auctions are intended to be used to support climate investments, shortfalls could put these at risk. A robust and rising price floor is needed to ensure the government's targets can be met, and the ETS may need to be adjusted to ensure settings are consistent with emissions budgets. Mechanisms to fund public investments and crowd in private investments in mitigation and adaptation, and support risk sharing, are being developed. These include a further boost to the Climate Emergency Response Fund, an increase in the capital of New Zealand Green Investment Finance, and the issuance of green bonds to finance climate projects.

A. Updates and Developments

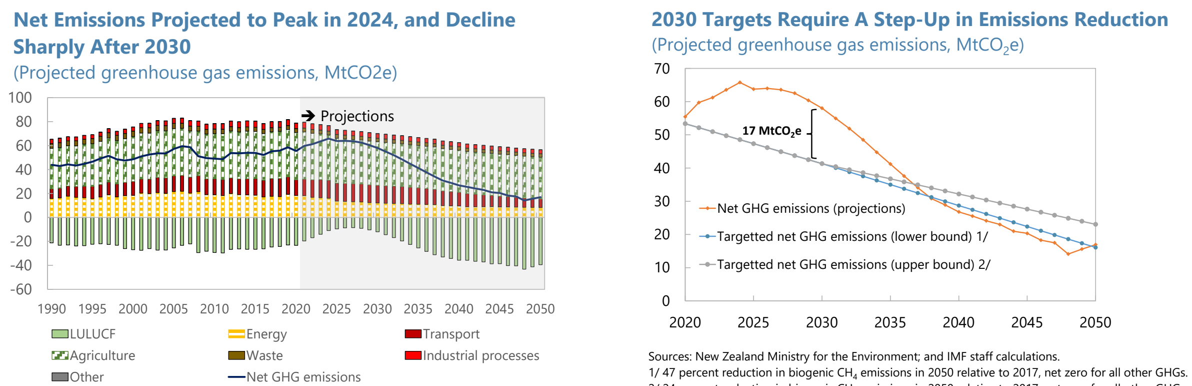
1. **Gross greenhouse gas (GHG) emissions in 2021 remained below 2019 levels.** Contrary to earlier expectations, gross GHG emissions declined even as the economic recovery gained momentum: emissions were estimated to be about 76.8 million metric tons of CO_2-equivalent ($MtCO_2e$),[2] about 4 percent below the 2019 level. Indeed, emissions were 0.7 percent lower than 2020, when the economy and energy use was impacted by the lockdowns. Net emissions were about 0.6 percent lower than in 2019 and 3.1 percent higher than in 2020, as the carbon captured by

[1] Prepared by Narayanan Raman (APD). This chapter updates and extends the chapter on *Addressing Climate Change in New Zealand* in the Selected Issues Paper (IMF Country Report 22/139) published alongside the 2022 Article IV staff report for New Zealand. The chapter benefited from comments received from Ian Parry (FAD), Charlotte Gardes-Landolfini and William Oman (both MCM) and the New Zealand authorities during the Article IV staff visit between June 1-15, 2023.

[2] Based on reporting for the Intergovernmental Panel on Climate Change's 4th Assessment Report 100-year time horizon global warming potentials for non-carbon dioxide gases. The fifth Assessment Report uses different—somewhat higher—estimates but the broad pattern is as described in this paper.

land use, land use change and forestry (LULUCF) declined. Similar to the trajectory described in staff's 2022 analysis, net emissions are projected to rise until around 2030 before stabilizing. As forests planted in recent years mature, absorption from LULUCF are expected to increase, causing net emissions to decline rapidly. Emissions in other sectors are projected to decline based on policies put in place to improve efficiency, including the Emissions Trading Scheme (ETS), and intensifying the use of zero-carbon energy sources. The government's baseline incorporates policies already in place, including the impact of investment in forestry that is planned and already undertaken. In contrast, a business as usual (BAU)[3] scenario contained in the Fund's Climate Policy Assessment Tool (CPAT), which largely reflects the outlook for population and economic growth, suggests New Zealand's emissions will continue to rise into the medium term and beyond.

Figure 1. New Zealand: Historical and Projected Greenhouse Gas Emissions and Targets



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

Sources: New Zealand Ministry for the Environment; and IMF staff calculations.
1/ 47 percent reduction in biogenic CH_4 emissions in 2050 relative to 2017, net zero for all other GHGs.
2/ 24 percent reduction in biogenic CH_4 emissions in 2050 relative to 2017, net zero for all other GHGs.

2. The gap between New Zealand's Nationally Determined Contribution (NDC) and its emissions path show an improvement based on revised data and updated projections to 2050, but it remains significant through 2030. As noted in the 2022 staff report, New Zealand's NDC was strengthened at COP26 in Glasgow to a 50 percent reduction of net GHG emissions relative to 2005 gross emissions (or around 30 $MtCO_2e$) by 2030. Separately, under domestic legislation, New Zealand aims to achieve net zero for all GHG emissions except biogenic methane by 2050, and reduce biogenic methane emissions by 10 percent by 2030, and by 24-47 percent by 2050, both relative to the 2017 level. Updated data and projections suggest that New Zealand is on track to meet its 2050 commitments, almost matching the ambitious scenario for biogenic methane abatement. Similarly, the gap relative to the NDC in 2030 has narrowed from 24 $MtCO_2e$ estimated in 2022 to 17 $MtCO_2e$. While welcome, the projections confirm that more abatement is needed to meet the 2030 NDC.

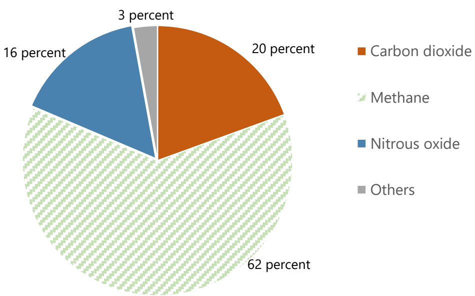
3. The broad pattern of emissions has not changed, with methane from agriculture still the most significant GHG emitted in New Zealand. Energy and transport are the next most significant sources of emissions. In particular, while electricity generation is largely zero carbon due

[3] The BAU scenario links projected emissions to GDP growth projections, assumptions about income elasticities of demand and price responsiveness of fuel use in different sectors, assumptions about the rate of technological improvement in relation to energy efficiency in different sectors, and future international energy prices (see Black, et. al, 2022). In contrast, the authorities' baseline incorporates active policy measures but not yet incorporate policies proposed in the Emissions Reduction Plan.

to the reliance on hydropower,[4] overall energy use remains dependent on fossil fuels, particularly in the transportation sector.

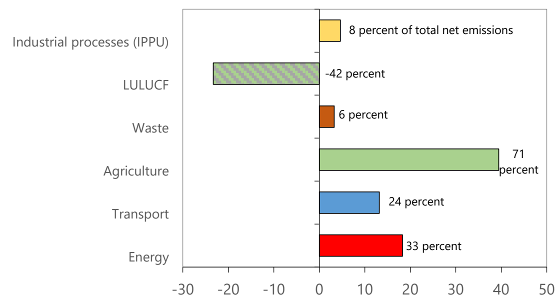
Figure 2. New Zealand: Profile of Greenhouse Gas Emissions

Methane Accounts For the Bulk of New Zealand's Net GHG Emissions
(Net emissions in 2020, $MtCO_2e$)



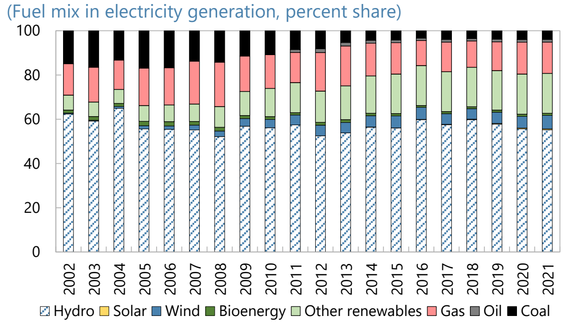
Source: New Zealand Ministry for the Environment.

Largely Due to Agriculture Emissions
(Net emissions in 2020, $MtCO_2e$)



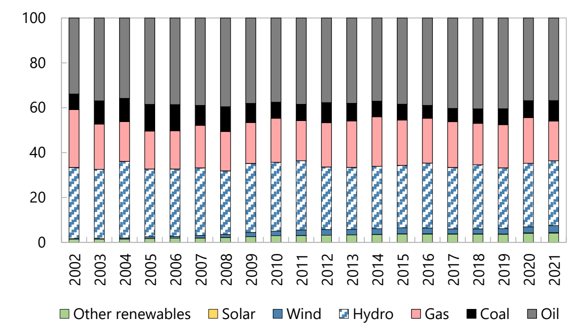
Source: New Zealand Ministry for the Environment.

Rising Share of Renewables Bolstered Already High Zero-Carbon Sources in Electricity Generation Mix
(Fuel mix in electricity generation, percent share)



Source: Our World in Data.

But Overall Energy Mix Still Dependent on Fossil Fuels
(Energy consumed by source, percent share)



Source: Our World in Data.

4. **The emissions price peaked in November 2022 but declined rapidly since.** Prices in the secondary market peaked at NZ$88.50 per NZ unit (equivalent to 1 metric ton of CO_2e, or tCO_2e) in mid-November 2022 as the introduction of the first emissions budget in 2021 for 2022-25 provided clarity on the government's targets. The liberalization of emissions prices in 2021 provided a clear signal to spur mitigation efforts, including through increased investment in forestry. However, prices began to retreat, falling to NZ$76 per unit by end-December. The clearing price in the official auctions also declined to NZ$79 in December. Prices continued to fall in 2023: by end-May, the market price stood at NZ$55 per unit, close to the lowest level in over 18 months recorded in March.

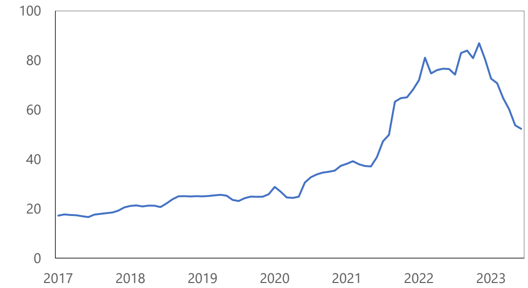
5. **The weakness in prices also impacted the March 2023 ETS auction, which did not clear.** As a result, no units were added to the market for the first time since the auction mechanism was introduced in 2021, and unsold units were rolled over into the June auction. The June auction also

[4] The reliance on hydropower presents its own challenges as energy supply will become increasingly vulnerable to droughts, which would likely then see New Zealand be forced to rely on fossil fuels as a backup unless renewables are scaled up significantly (see IEA, 2023).

did not clear. As a result, unsold units for both auctions rolled over again into September. In the event the September and December auctions also fail to clear, the unsold units will expire. Commentators raised concerns that the failure of the auctions reflected both uncertainty about the government's climate policies and an over-provision of units for auction. In addition, the independent Climate Change Commission raised concerns regarding a possible overhand of allocated NZUs, which further impacted prices. The authorities noted that auction mechanism is currently functioning as designed, ensuring that credits are not sold at too low a price, which would be damaging to the integrity of the framework in the long run. Nevertheless, the government launched a review of the ETS in June aimed at ensuring it continues to drivegross emission reductions and a transition to a low carbon economy. The review presented four options for public comment: decrease the number of units offered at auction, increase demand for units by allowing the government and foreign investors to purchase them, introduce restrictions or conditions on removal activities, and bar emitters from purchasing units directly from foresters to pay for emissions. The public comment period is scheduled to end in early August and final proposals for reforms to the ETS are expected soon after. After the announcement of the review, the price in the secondary market fell further to NZ$41, its lowest level since June 2021.

Figure 3. New Zealand: Secondary Market Emissions Price

After Peaking in November 2022, Emissions Price Declined
(Monthly average price, NZ$ per NZ unit)

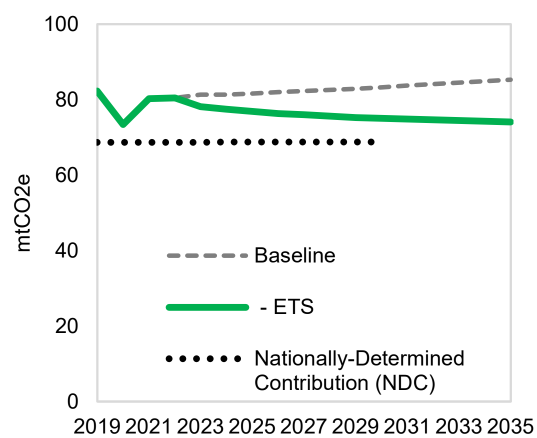


Source: www.carbonnews.co.nz

B. Mitigating Emissions

6. The Emissions Reduction Plan (ERP),[5] released in June 2022, sets out the authorities' targets and strategies to curtail emissions through 2050. The government set out the emissions budgets up to 2035, with the first budget covering 2022-25, with the subsequent period split into 2 5-year periods (2026-30 and 2031-35). Emissions are set to decline in each successive emissions budget period, with total emissions under the first budget period restricted to 290 MTCO_2e, a reduction of around 11.5

Figure 4. New Zealand: Significant Real Increase in the Emissions Price Can Largely Close the Gap to Commitments



Source: IMF Climate Policy Assessment Tool.

[5] GoNZ (2022a)

$MtCO_2e$ relative to the 2017-21 period,[6] declining to 240 $MTCO_2e$ by the third budget. Prior to the start of each new 5-yearly budget, the government will release a new ERP and set out the commitment for the upcoming budget period.

7. **The ETS remains a centerpiece of the ERP.** Using an average price of NZ$75 per NZ unit, the ETS is envisaged to contribute around a third of the emissions reduction envisaged in the first emissions budget period. The other cross-sectoral and sectoral initiatives are expected to deliver the remaining two-thirds. The biggest overall contribution to the emissions reduction would come from energy and industry, the ETS, transport, and, in some scenarios, agriculture.

8. **A more ambitious price scenario could close the gap between New Zealand's targets and projected emissions even more quickly.** As in 2022, staff have used the IMF's Climate Policy Assessment Tool (CPAT) to consider the impact of an increase in the real price of emissions from the level in 2023 to US$100 (NZ$165.40) by 2030. The revised assessment, which takes into account updated data and projections provided to the UN in 2022, suggests around two-thirds of the gap between New Zealand's projected emissions and its NDC for 2030 could be closed by the higher price scenario examined. It should be noted, this scenario is an ambitious one as it calls for the real emissions price to more than double in 7 years, which would be politically difficult to deliver. But the analysis confirms that a price-centered approach can deliver substantial gains.

9. **Hence, the ERP highlights the need to strengthen the ETS framework.** Specifically, the ERP proposes 5 focus areas:

- *The ETS settings:* Ensuring the unit limit and price controls settings are consistent with the emissions budgets and the NDC.
- *Adjust the ETS to drive a balance between net and gross emissions reductions:* Ensuring the ETS can support a balanced approach to emissions reduction.
- *Market governance of the ETS:* Developing an adequate and robust governance and regulatory framework for the ETS to ensure that it protects market participants and ensures price signals are reliable and can be used to plan investments.
- *The risk of emissions leakage:* Addressing emissions leakages, both domestic through the overallocation of units to the industrial sector, which may put emissions targets out of reach, and externally by ensuring there is a level playing field between domestic and external emissions.
- *The voluntary market framework:* Identifying measures to support a voluntary carbon market, including developing a market policy framework, which could complement the ETS.

10. **However, the price and unit supply decisions for 2023 published by the authorities are more modest than the recommendations of the independent Climate Change Commission (CCC, 2022).** In July 2022, the CCC recommended a sharp increase in the reserve and cost

[6] Note that the first emissions budget only covers 4 years while the second and third envelopes are over 5 years each. Therefore, it is more useful to look at average annual emissions, which are expected to decline from around 75 $MtCO_2e$ in 2017-21, to 72 $MtCO_2e$ in 2022-26, before accelerating to 61 $MtCO_2e$ for the second budget period and 48 $MtCO_2e$ for the third.

containment reserve trigger prices of NZ units to NZ$60 (from NZ$30 in 2022) and NZ$171-214 respectively (NZ$70 in 2022). The Commission also recommended that a total of 16.3 million units be made available for sale (2022: 26.3 million NZUs, including the cost containment reserve). In December, the government announced that it would instead set a reserve price of NZ$33.06, a cost containment reserve trigger price of NZ$80.64 and make 17.9 million units available for the auction. The setting of the trigger price in particular was a concern when the announcement was made as it was already below secondary market prices at the time. Following this, both the December auction and secondary prices started to decline, first converging to the new settings and falling rapidly thereafter. It is unclear why there has been such high volatility observed but if prices continue to decline, there may be a market expectation that the higher-than-expected availability of units and the low reserve prices in the ETS are inconsistent with emissions reductions targets.

11. A related issue that remains is the need to ensure the ETS drives gross emissions reductions rather than being biased toward afforestation to contribute to net zero. Modelling by the CCC suggests that given the focus on abatement of net emissions, afforestation becomes a less costly option, allowing emitters—particularly in the industry and energy, and transport sectors—to continue to emit while investing in offsets. However, when these sectors reach net zero, which is expected to happen by the late-2030s on current trends, a national gap against the path to the 2050 targets could remain. In this context, it is not clear if the ETS provides sufficient motive for investment in further mitigation when key sectors are already at net zero. This will be compounded by the fact that emitters currently outside the ETS (e.g., agriculture) and those that benefit from industrial allocations of units[7] will may not face the pressure to do more under current policies. Finally, the CCC estimates there is a surplus of 144 million units issued and banked that needs to be addressed by restricting the supply of new units by some other means. These surplus units act as an overhang on the market and could work to depress prices, thereby weakening the ETS. In response to these concerns, the government has announced in March 2023 that it will undertake a review of the ETS with a view to ensuring better market functioning and greater emphasis on gross reductions of GHG emissions. The review is also intended to manage the amount of "exotic forestry", that is forestry driven by planting of non-native plant and tree species, going forward. The review is scheduled to put forward its first recommendations for public consultation in the second quarter of 2023. Proposals to strengthen the incentives in the ETS to support gross emissions reductions and manage the amount of exotic (non-native) forest planting are expected to be rolled out by end-2024.

12. The first proposals for pricing agriculture emissions were released in October and a revised proposal was published in December 2022.[8] The government had set 2025 to be the start date for pricing agriculture emissions to guide consultations with representatives of the agriculture sector and the Federation of Māori Authorities as part of the He Waka Eke Noa—Primary Sector Climate Action Partnership. The focus of the work was to look at options to tackle the two main

[7] Certain sectors that meet the criteria of having emissions that cannot be quickly reduced due to the nature of their activities and processes are allocated free units outside the ETS auction mechanism (but within the emission budget) to ensure they can continue to operate. The ERP envisages this envelope will also be reduced over time but gradually in recognition of the limited scope to address emissions in these sectors.

[8] GoNZ (2022c).

GHGs emitted by agriculture, biogenic methane and nitrous oxide. In October 2022, the first proposals were released but these engendered an adverse reaction and a further reworking of the plans. A second proposal was released in December, which addressed concerns raised by the industry. Key highlights of the proposals:

- The price will be based on a farm level, split gas levy, that is to price the two gases separately, with the levy imposed at the individual farm level. An interim, processor-level levy would be proposed only as a transitional step if the farm-level pricing system could not be operationalized by 2025.
- Emissions would be assessed indirectly through more easily reportable metrics such as herd sizes, with adjustments applied for the use of emissions mitigating measures such as use of feedstock to limit emissions and use of integrated farming techniques to improve carbon capture on the farm.
- The levies will apply to farms that meet a pre-determined emissions threshold (approximately 200 tCO_2e per year).
- The initial levies will be set at a low level and a path will be set for 5 years, with a review after 3 years. The price of nitrous oxide will be capped so that the sector would not face a higher price than if it had entered the ETS at that point.
- Payments will be available for those that undertake sequestration and compensation would transition to ETS prices. A sequestration strategy would be formulated to set out how to account for and reward sequestration efforts.
- Revenues from the levy would be redistributed to farmers through incentive and sequestration payments, and a dedicated fund for Māori farmers.

However, a specific starting price has not been announced for both biogenic methane and nitrous oxide. Formal proposals are expected to be introduced later in 2023.

13. If implemented, New Zealand will become the first country to introduce a direct price on agriculture emissions. New Zealand's experience could serve as an important reference to other jurisdictions. Indeed, in most countries with large agriculture sectors, governments have largely implemented policies to encourage offsets rather than tackle farm-level emissions directly. But the common approaches to offsets have fallen short due to difficulties related to monitoring and verifying whether offsets are achieving the intended goals. The introduction of agriculture emissions prices would also strengthen signals for other forms of abatement, particularly LULUCF as there is considerable overlap in land used for forestry and farming.[9]

14. The proposals for pricing agriculture emissions are a useful first step but effectiveness will depend on how quickly prices rise and to what level. At this stage, it is difficult to assess the impact of the proposed pricing mechanism given the lack of a starting price and, in the case of methane, the envisaged path to market determined prices implied by the ETS. Work done by IMF staff[10] suggests globally methane needs to reach a uniform price of US$70 per tCO_2e to be

[9] Kerr and Sweet (2008).

[10] Parry, Black, Minnett, Mylonas and Vernon (2022).

consistent with holding global temperature rises to under 2˚C. Agriculture emissions prices need not rise to this level in New Zealand as the authorities have not committed to net zero in the sector, but there will need to be an increase to be consistent with their NDC: preliminary estimates using the CPAT suggest assuming the ETS price returns to its peak in real terms by 2030, a real methane price of US$5 per tCO_2e would get New Zealand to its NDC for 2030, though for further improvement to its 2050 targets, higher prices would be needed. It is not clear that the authorities envisage such an ambitious target in their plans, particularly after 2030 when higher prices will be needed. Second, the proposal to recycle the levies are consistent with staff advice to consider a feebate mechanism discussed in 2022. The proposed use of proceeds from the levy should be directed at supporting farmers in adopting technologies and practices that reduce emissions (use of feedstock that can limit emissions, adopting integrated farming techniques that allow farms to capture emissions). That said, the price setting for the incentive and sequestration payments are critical to ensure the scheme is fiscally sustainable. In particular, a reimbursement scheme that converges to ETS prices quicker than the levy would lead to a mismatch where outflows from the scheme quickly outpace revenues, leading to concerns over fiscal sustainability of the scheme because the proceeds from the levies will not be able to sustain payouts. Thus, it is critical that any scheme be designed carefully to avoid putting unfunded contingent liabilities on the budget.

15. To complement the ETS, the government has set up a Climate Emergency Response Fund (CERF), to provide dedicated public funding to initiatives that support the transition to a low-emissions and climate-resilient economy. The CERF was established in the Budget Policy Statement for Budget 2022 with an initial down payment of NZ$4.5 billion, which represented the projected cash proceeds from the ETS auctions between 2022/23-2025/26. To date, the government has made regular adjustments to the size of the CERF at each *Economic and Fiscal Update,* taking into account the four-year rolling forecast of ETS cash proceeds. In Budget 2022, the government allocated NZ$2.9 billion to facilitate multiyear planning to implement the first ERP, with NZ$1.5 billion made available immediately to make a start on critical projects. At the time of Budget 2022, the largest allocations were to fund decarbonization of process heat and improving energy efficiency in businesses, a scrap-and-replace scheme to help New Zealanders purchase zero-emissions vehicles (ZEVs), supporting mode shifting to encourage the use of public transit, walking and cycling and support for the development and uptake of high impact agriculture mitigation technologies. Since Budget 2022, a number of policy changes have been announced that could have implications for mitigation (see next section). Since its initial set up, the government has topped up the CERF by a net total of NZ$2.1 billion and has allocated NZ$5.7 billion in gross climate-related spending. The government also confirmed that these commitments will continue to be supported in the event of a shortfall in ETS auction proceeds.

16. The ERP also outlines cross-sectoral policies covering planning and infrastructure; research, science, innovation and technology; equitable transition measures; and the circular economy and bioeconomy.

- The goal in reforming the *planning and infrastructure* processes are to improve the resource management system, support emissions reduction through the use of appropriate policies and guidelines, strengthen financing for needed investments, and promote innovations.

- *Research, science, innovation and technology* will be encouraged to generate new options to reduce or capture emissions, and to encourage their adoption.
- *Equitable transition measures* are aimed at ensuring the process of reducing emissions is compatible with economic growth and improved living standards, including encouraging the development of new sectors and support for making needed investments in existing sectors.
- The *circular economy and bioeconomy* cover activities aimed at strengthening resource management and address other environmental concerns (e.g., biodiversity), recognizing efforts to promote a holistic approach has climate payoffs.

17. Sector-specific measures to address the unique challenges of segments of the economy are also discussed in the ERP. The ERP looks at the specific challenges to reducing emissions in the transport, energy and industry, building and construction, agriculture, forestry, waste, and a specific section on dealing with fluorinated gases. Sectoral plans are based on identified sectors:

- In *transport,* the key strategies are aimed at promoting mode-sharing and speeding up the adoption of electrification of transport.
- For *energy and industry,* policies are to be directed toward investing in renewables, supporting electrification of the economy and upgrading energy efficiency.
- In *building and construction,* the focus will be on lowering the embodied emissions from building activities, improving energy efficiency, including through amendments to the Building Code, and shifting energy use from fossil fuels.
- The *agriculture sector* is critically important, given its role as the largest source of emissions in New Zealand. In addition to pricing agriculture emissions, policies aim to accelerate the development and adoption of mitigation technologies and support producers to invest in the necessary changes. The ERP also discusses efforts to transition to lower-emissions land uses and systems.
- *Forestry* has served as GHG sink in New Zealand. The challenge going forward is how to ensure the sector can sustainably play this role while taking other considerations (preservation of biodiversity, equity concerns) into account.
- *Waste* contributes to 4 percent of New Zealand's total emissions. Policies here will focus on reducing organic waste, diverting organic waste away from landfills and increasing emissions capture. There will also be proposals to strengthen the governance of the waste management licensing framework to encourage better practices.
- *Fluorinated gases* are gases with high global warming potential and thus a small amount can have large climate-related effects. Policies will look at encouraging alternatives while using regulation to eliminate the use of the most potent gases.

The sector-specific policies are expected to result in a total emissions reduction of 6.2-13.3 $MtCO_2e$ over the period of the first emissions budget on top of the impact of the ETS discussed earlier.

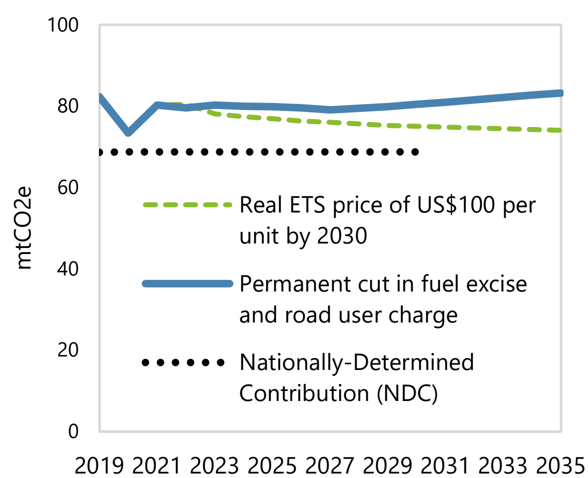
C. Shifts in Announced Policies and Implications

18. Starting in 2022, there has been a reprioritization of policies to address the cost-of-living crisis, which could have implications on the emissions path if maintained. As a result of sharply higher prices, particularly for fuel, the government introduced a raft of changes to previously announced spending allocations. First, the 36 percent cuts in the fuel excise and road user charges announced in March 2022 have been extended, though this is now expected to expire in July 2023. Second, the government wound down the scrap-and-replace scheme to focus on addressing immediate concerns for households. Third, the government extended the 50 percent discount for the use of public transport to June 2023, which will be replaced by a more targeted scheme that prioritizes lower-income New Zealanders (community services cardholders) and residents with limited mobility (Total Mobility users) on July 1. Finally, the biofuel mandate, which was expected to come into effect in April, was scrapped due to concerns it would raise fuel prices in the near term.

19. Staff's assessment[11] suggests that the impact of these deviations from previously announced policies should be limited. The scrap-and-replace scheme would have likely subsidized households that would have purchased a ZEV in any case and merely enabled them to bring this forward. As a result, the adoption of ZEVs is likely to be somewhat slower without this benefit but over the longer term, it can be expected to rise. Subsidies for the use of public transit could reduce emissions at the margin, but these benefit young people, who are already heavy users of public transport, which likely limits their impact. Similarly, the negative impact of cuts in the fuel excise and road user charge is also likely to be limited given their expiry from July 2023.

20. Had they been allowed to become permanent, the cuts in fuel excises and road user charges could have a significant impact on emissions. In a scenario where the cuts in the fuel excise on petrol (gasoline) and the road user charge announced in March 2023 are made permanent, the emissions by 2033 would wipe out the improvements from a sustained increase in the ETS price, resulting in almost no emissions reductions. Specifically, staff estimate that making the tax cuts permanent will result in about a 6.7 percent increase in gross emissions relative to the ETS baseline.[12] Assessments conducted in other countries also

Figure 5. New Zealand: Permanent Cut in Fuel Excise and Road User Charge Would Largely Wipe Out Benefits from a Higher Emissions Price



Source: IMF Climate Policy Assessment Tool.

[11] The assessment here only looks at the impact on the trajectory of GHG emissions. A fuller discussion of the fiscal cost and impact of the announced policies is contained in the main Article IV staff report.

[12] These estimates are based on assumptions from the demand response to the lower user price for petrol and the rate of technological change in energy efficiency. A higher pace of adoption of energy efficient technologies such as ZEVs for instance, could reduce the marginal impact of lower prices.

show that cuts to fuel taxes can leave emissions significantly higher than in a scenario where taxes were maintained.[13]

D. Adapting to Climate Change

21. The climate adaptation framework in New Zealand is centered on a 6-year cycle, starting with a risk assessment, preparation and adoption of a National Adaptation Plan (NAP), and biannual reviews. The first National Climate Change Risk Assessment (NCCRA) was prepared by the government in 2020 and identified 43 critical risks and assessed them by urgency. The Assessment then discussed the 10 most significant risks over 5 domains—natural, human, economy, built environment and governance—that need to be addressed. Future NCCRAs will be undertaken by the CCC, with the next one slated to be completed in 2026. This will then feed into the second NAP, which will be prepared by the government by 2028. The CCC will also prepare biennial progress reports on how effective the government's actions have been in addressing risks. The reviews are also a chance to reassess the appropriateness of targets and policies in the NAP, and whether changes are warranted.

Risk Domains	Most Significant Risks Identified in the NCCRA	
Natural	Risks to coastal ecosystems due to sea level rise and more frequent extreme weather events.	Risks to indigenous ecosystems and species due spread of invasive species as a result of climate change.
Human	Displacement of individuals due to climate change and extreme weather events impacting social cohesion and community wellbeing.	Risk of exacerbating existing inequalities or creating new ones due to climate change.
Economy	Risks associated with lost productivity, lower activity and fiscal burden of disaster relief.	Risks to the financial system due to extreme weather events and ongoing changes to the climate.
Built environment	Risks to potable water supply due to changes in rainfall, temperature, drought, extreme weather events and sea level rise.	Risks to buildings from extreme weather events, including flooding and fire risks.
Governance	Risk of maladaptation as existing planning processes are ill-suited for a changing climate.	Risks that climate change impacts across all dimensions will be exacerbated by current institutional arrangements not suited for a world with a changing climate that calls for an emphasis on adaptation.

Adapted from GoNZ (2022b).

[13] For instance, Carbon Brief (2023) looked at the question of what would happen to emissions if fuel duties in the United Kingdom were allowed to rise faster than inflation as planned ("fuel duty escalator") based on policies in place prior to 2010 instead of the actual outcome being frozen from 2010-21 and cut by 5p 2022. They estimated that carbon emissions from the transport sector in the UK were about 24 percent higher and overall emissions were 7 percent higher than a baseline with the pre-2010 policy left intact.

22. The first NAP,[14] covering the period 2022-28, is intended to embed planning for climate resilience to address key risks. The NAP sets out three goals: reduce vulnerability to impacts of climate change; enhance adaptive capacity and consider climate change in decisions at all levels; and strengthen resilience to climate change. These objectives are to be achieved through actions in 8 areas as follows:

Areas for Actions	Key Issues Identified	Focus of Actions
Enabling better risk-informed decisions	Give New Zealanders the resources and capacity to assess exposure to and vulnerability from climate change	Strengthen availability of data, tools and methodologies needed to make the assessments
Driving climate-resilient development in the right locations	Ensure decision-making frameworks for planning and infrastructure investments both ensure climate-resilient development and account for possible risks	Improve integration of data, assessments and other tools into the planning and development process; ensure development of climate resilient public housing
Adaptation options, including managed retreat	Establish the range of adaptation options and how to choose between them	Identify the main options—*avoid* development that is not climate resilient, *protect* people and assets already in place, invest to *accommodate* climate change where possible, and *retreat* if change is unavoidable and costs are too high.
Natural environment	Strengthen the natural environment as a way of reducing climate-induced pressures, which also maintains biodiversity	Develop strategies to restore native ecosystems and avoid spread of invasive species
Homes, buildings and places	Ensure decisions on where to locate homes and the built environment, and how they are built, takes climate risks into account	Ensure the planning framework integrates climate resilience going forward
Infrastructure	Ensure critical infrastructure will be climate resilient	Ensure new infrastructure incorporates climate considerations in its design and build while reviewing the capacity of existing infrastructure to deal with climate change
Communities	Support all communities in adapting to climate change, with a focus on those most vulnerable to its effects	Develop strategies, guidance and tools to ensure the economic, cultural and social wellbeing in each community
Economic and financial system	Ensure the financial system is capable of recognizing the risks and opportunities due to climate change and are able to act on those	Improve accounting and disclosure standards to enable better risk assessments and possible pricing of risks

Adapted from GoNZ (2022b).

[14] GoNZ (2022b).

23. Measures to build capacity to implement the NAP are underway. The Plan sets out 3 categories of actions in each of these areas: *critical*, which are actions that need to begin immediately due to their urgency and criticality in setting the stage for subsequent measures; *supporting*, or actions that are either less urgent or dependent on critical actions being completed; and *proposed* actions, where more work is needed before implementation can begin. The list is expansive: 111 actions—39 critical, 50 supportive and 22 proposed—are to be implemented over the 6 years of the Plan period. In addition, the NAP proposes to set up a coordination framework within the government to support its implementation.

24. The NAP's focus is skewed towards filling information gaps and building institutional frameworks. In part, this reflects the multiple levels of decision-making in a number of arenas, particularly related to planning and development, where local governments and regions and the private sector are the main actors. The central government's role, therefore, is seen as primarily focused on providing the long-term planning and developing the tools needed to strengthen decision-making at those levels. However, there are areas where the central government will play a more direct role such as infrastructure planning and development, and provision of healthcare and social services, where greater clarity will be needed. For instance, the NAP does not yet set out a framework for assessing the climate readiness of critical infrastructure, which should be a priority. Further, with rebuilding after Cyclone Gabrielle and the January floods in Auckland about to start, it is critical to advance work on assessing how planning processes should work for a time when extreme climate-driven weather events become more frequent. Finally, there is a need to link these actions to the Budget framework to ensure there is progress.

25. Accounting for the cost of climate change remains work in progress but is critical to motivate investments in climate adaptation and mitigation. In 2022, staff recommended that the authorities develop a clear sense of the cost of doing nothing to motivate the needed investment in adaptation. While challenging, a first effort has been prepared and published. Partial estimates of extreme weather events suggest the costs incurred to date are significant but manageable: for instance, the costs associated with droughts and flooding events between 2007-17, including income foregone, are estimated at NZ$840 million[15] (0.4 percent of average annual GDP over that period), of which NZ$720 million is estimated to have come from droughts alone. The damage and rebuilding costs associated with the extreme weather events in early 2023, which climate change may have contributed to, have been put at NZ$9-14.5 billion (2.2-3.6 percent of GDP). Going forward, the authorities estimate[16] that increasing frequency of droughts would lead to GDP in 2061 to be 0.5 percent lower than a counterfactual based on historical precedent. A scenario with more frequent storms and flooding was expected to lower GDP by 0.7 percent relative to the counterfactual. More frequent storm and drought events would leave net Crown debt around 3.8 percent of GDP higher. These estimates look at purely domestic effects: there are likely to be spillovers from climate change on global economic conditions. For instance, the International Panel on Climate Change estimates that a 1.5-2 ˚C increase in average global temperatures by 2100 would

[15] GoNZ (2022b).

[16] GoNZ (2023).

lower global GDP by 0.3-0.5 percent. Even higher temperature increases will likely raise costs more than proportionately, given the non-linearities in this process. As a small open economy highly dependent on trade, New Zealand is likely to also experience additional impacts through this channel. Further work to refine these estimates would be useful to build the needed political consensus to address climate change.

26. In the financial system, the emphasis has focused on strengthening disclosure standards. Under the provisions of the Financial Sector (Climate-related Disclosures and Other Matters) Amendment Act 2021, around 200 large financial firms are now required to provide disclosures on climate-related risks and opportunities as part of their normal financial reporting practices, in accordance with guidelines published by the External Reporting Board. In addition, the RBNZ has started incorporating the impact of climate change in its financial supervision framework, looking at climate disaster scenarios as part of its latest annual stress testing exercise.[17] Similarly, the government at all levels as well as the private sector will be asked to provide disclosures on natural hazards

E. Financing Climate Action: Going Beyond the CERF

27. The universe of financing tools to support climate-related investment in New Zealand is still evolving. On the public sector side, other than the CERF, the government has announced the issuance of green bonds, that is public debt issued to finance public investment in suitable green projects. The bonds, which diversify the government's financing mix, are aimed at channeling funding to identified climate priorities and could benefit from tapping an investor base looking to finance climate activities, as well as more traditional buyers. The first issuance of the bonds took place in November 2022, when NZ$3 billion in securities maturing in 2034 were placed. To support private investment, the government set up a green investment bank, New Zealand Green Investment Finance (NZGIF) in 2019, and increased its capital by NZ$300 million under Budget 2023, bringing it to NZ$700 million. To-date NZGIF has invested over NZ$160 million by lending to or, taking equity stakes in, projects focusing on renewables, energy efficiency, transport and agriculture. NZ Super, the superannuation fund set up to prepare for future retirement costs, has also announced that it would look to allocate NZ$100 million to suitable climate-related investments. Given the importance of the Fund in the New Zealand context as an investor, this can drive significant changes in financial markets.

28. However, the total financing from these identified sources is dwarfed by the scale of investment needs. Estimates for the total cost of achieving New Zealand's emissions targets are inherently difficult to make given the large uncertainties around emissions, costs and rate of technological change but the sums involved tend to be large. In 2021, the CCC estimated that between 2021-2030, there would need to be an additional NZ$10.3 billion increase in investment in 5 sectors (road transport, electricity generation, increasing energy efficiency in buildings, food processing and native afforestation) to achieve the emissions targets in the Commission's 2021

[17] Reserve Bank of New Zealand (2022).

advice. Another estimate[18] of the investment needed to support rapid, scaled up electrification and to switch to zero-carbon sources of energy concluded that by 2030, there would need to be a real investment of NZ$42 billion, a large proportion of which would be to replace and upgrade existing transmission infrastructure. These would go into expanding utility scale renewable generation, addressing intermittency and support additional pressures from peak demand, upgrading the transmission network to cope with the unique challenges of scaling up the use of renewables, and expanding the distribution infrastructure to cope with the rapid electrification of transport and other activities. The investment needs in other sectors, as well as for adaptation and resilience, will only add to this total.

29. The ERP and NAP identify a number of actions to build on the initiatives listed to strengthen the financing framework. In addition to the CERF, issuance of green bonds and building on the success of NZGIF, the government's efforts are focused on strengthening the responsible investment framework in the public sector, particularly among Crown Agencies; supporting high-quality investment decisions; improving climate reporting and accounting; making it easier for individual savers to avoid investment in fossil fuels and other polluting industries; implementing the Carbon Neutral Government program; and using procurement rules to create demand for green investment products and services.

30. Consideration could be given to expanding the range and scope of instruments available to support climate projects in New Zealand. New Zealand already has an established price mechanism, which could generate the cash flows needed for financial instruments to be developed and priced. Policies to strengthen transparency, accounting and verification of green targets in the ERP would further support financial innovation. That said, New Zealand could look at innovations rolled out elsewhere: countries and other issuers have strengthened commercial bank lending to incorporate climate considerations, and used sustainability-linked bonds and loans, sustainability and social bonds, green asset-backed securities, and other financial investments[19] to make progress on climate and sustainability goals. In particular, sustainability-linked instruments—instruments that embed sustainability goals in their key performance indicators—could supplement the price mechanisms of the ETS, particularly for projects where climate-driven cash flows might not be applicable (e.g., adaptation projects). Regulatory efforts to enable better disclosures and data sharing, which New Zealand is already embarking on, could be a step in that direction. Other financial investments, particularly those that invest in innovations and climate start-ups, could also complement government investment in research and development, which can lead to positive externalities.

F. Offshore Abatement and International Cooperation

31. New Zealand has incorporated offshore abatement into its NDC. Both the government and the CCC note that meeting New Zealand's NDC with domestic abatement alone would require

[18] Boston Consulting Group (2022).

[19] Prasad, Loukoianova, Feng and Oman (2022).

efforts that are likely to be costly. The authorities have indicated that they are exploring a range of options for offshore mitigation, including partnering with countries in the Asia Pacific region. However, no decisions have yet been taken on these options at this stage.

32. The offshore abatement market remains underdeveloped, which has implications for its usefulness in the near term. The use of offshore abatement, including through financial support to increase offsets in LULUCF, could be useful in theory: to address climate change, global emissions need to come down and efforts should be directed to where the most gains can be realized to achieve the fastest progress. However, in the absence of robust and internationally accepted account and verifications standards, the CCC (2022) recommended that in the near-term, the emissions reductions from offshore mitigation should be set at zero.

33. New Zealand is ramping up climate financing to support climate actions in developing countries, with a focus on supporting abatement and adaptation activities in the region. Between 2022-25, New Zealand intends to invest NZ$1.3 billion in climate projects, of which at least 50 percent will go to the Pacific region. [20] Given the large adaptation needs among New Zealand's neighbors, and their small emissions footprints, the government has also committed to setting aside at least 50 percent of this to support adaptation projects. Mitigation efforts, on the other hand, will focus on projects in South and Southeast Asia, Africa and Latin America. Pacific Island Countries face considerable difficulties in accessing climate finance due to their lack of capacity in putting together a portfolio of bankable climate projects[21]—areas which New Zealand could help with, given its proven track record on these issues. In addition, New Zealand's capacity and expertise in accounting for and verifying emissions over the last two decades is another area that could be helpful to countries in the region.

G. Conclusions

34. New Zealand continues to make progress on reducing emissions, but there remains a gap between its 2030 NDC and projected emissions path. Staff's analysis shows that allowing emissions prices to rise further than currently projected would contribute to a more significant reduction in emissions. That said, the illustrative scenario examined with an ambitious price path still leaves a gap between projected emissions and targets. To fully rely on a price mechanism would entail even higher prices, which may be difficult to deliver politically.

35. The recent decline in emissions prices is a cause for concern if sustained. If falling prices are not arrested, the envisaged emissions reductions may be out of reach. Further, as proceeds from the ETS auctions are intended to be used to support climate investments, shortfalls could put these needed investments at risk. Therefore, it is critical to address the weaker sentiment on prices, and lay steps to ensure the emissions budgets are seen as credible, supported by fleshed out policies. In particular, recent policy changes that raise demand for fossil fuels should be allowed to expire as planned and, if needed, replaced by targeted support. In the current macroeconomic environment,

[20] Ministry of Foreign Affairs and Trade (2022).

[21] Fouad, Novta, Preston, Schneider and Weerathunga (2021).

making fuel tax cuts permanent likely only results in temporary relief from higher prices and spurs demand. Consideration should be given to tightening the planned supply of new NZ units into the ETS to both signal the government's commitments to its targets and address the overhang of previously issued and banked units.

36. The proposed framework for pricing agriculture emissions is welcome but key details remain to be worked out. As noted in 2022, pricing agriculture emissions is the key missing piece in the price-based framework in New Zealand. The proposed initial price is too low to effect the changes needed, but the proposal to allow prices to rise gradually is appropriate. That said, the recommendations only commit to bringing the price of one GHG—nitrous oxide—to parity with the ETS and leaves out the much larger piece, biogenic methane. There should also be the goal for pricing all forms of agriculture emissions to be consistent with New Zealand's NDC in this area, though flexibility in timing could be useful to garner the needed political consensus. The plan to recycle proceeds from the agriculture levies to support investment in emissions reductions at the farm level, and sequestration, is appropriate and further solidifies support for the scheme. At the end of the day, there are likely to be shifts in the profile of New Zealand's agriculture sector as a result of these changes but the adoption of emerging techniques related to more efficient land usage and application of feedstocks and other technologies will likely see the sector continue to grow.[22] However, the reimbursement level should be set at a level that is sustainable. A divergence caused by a more generous reimbursement policy relative to the level of the levy could render the scheme unsustainable, thus putting its long-term viability at risk.

37. The NAP is a useful step in identifying priorities but as rebuilding from natural disasters gets underway, fleshing out specific policies is urgent. The NAP is an expansive document that aims to link the risks identified in the NCCRA to sector-level actions. A next step would be to review where work can be advanced more rapidly than planned, given the need to have firmer reforms to planning and development frameworks before recovery works from the natural disasters in early 2023 begins. This would avoid rebuilding in a way that exacerbates risks. In this context, work to determine options and differentiate the treatment of different properties that have sustained damage is underway with a preliminary estimate of around 700 homes assessed as being unsafe to rebuild. The government, working with local councils, is examining options to buyout these properties. There is also a need to strengthen the cost assessments of actions under the purview of the central government such as the replacement of major infrastructure such as utilities and roads, and integrate the overall cost of the adaptation package into the Budget.

38. Setting up financing mechanisms to support investment in mitigation and adaptation can help spur private sector participation in greening New Zealand. The scale of financing needs to support the needed investment—both private and public—exceeds available resources. There is a need to add new instruments to crowd in private investment and support innovation. Sustainability and sustainability-linked instruments could be a useful complement to the price mechanism already in place, particularly to support investment where cash flows may not be readily apparent

[22] Moot and Davison (2021).

such as for adaptation. There could also be scope to identify barriers to the adoption of existing tools and instruments to ensure their effective use.

39. The underdeveloped status of offshore abatement markets suggests this is not yet an avenue that can deliver verifiable emissions reductions to achieve the NDC yet. A number of critical pillars to ensure this can be a viable pathway to lower emissions for the NDC such as robust data collection, modeling to assess to what extent investment delivered additional emissions reductions, verification of the measures put in place and monitoring, require further work by the international community. It will also be critical that accounting properly for the abatement is carried out carefully and in a transparent manner to avoid double- or otherwise over-counting emissions reductions.

40. New Zealand is well placed to support climate action in developing countries, particularly in the region. The significant increase in climate finance, with a focus on supporting countries in the region, is important and helpful as many Pacific Island Countries face constraints in accessing climate financing. In particular, these countries face difficulties in identifying and packaging a pipeline of bankable climate projects, areas New Zealand where has a proven track record. New Zealand also has significant expertise in compiling and reporting data on climate issues, and could support similar efforts in the region. These efforts would complement the direct support for climate projects already planned.

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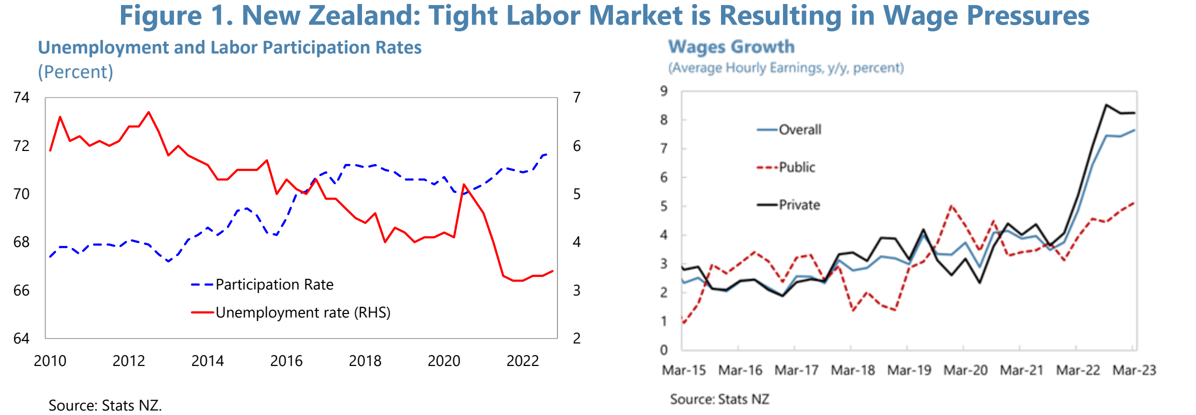
WAGE FORMATION AND THE EFFECT OF MINIMUM WAGES IN NEW ZEALAND[1]

Labor markets in New Zealand face conjunctural and structural challenges. Historically low unemployment rate since the pandemic have fed into wage growth, pushing up non-tradeables inflation and making already high inflation stickier. This paper explores the labor market dynamics in New Zealand and compares it with peer economies. Structural wage characteristics are also discussed, in light of more recent developments relating to the Fair Pay Agreements Act. It finds a robust wage-unemployment relationship, which explains the role played by tightness of the labor in setting the pace for higher wages in recent months. The absence of collective bargaining mechanisms may have added to wage pressures at this juncture. A long period of increases to the minimum wage has outpaced median wages and has resulted in high minimum wages compared to peer economies. The paper finds that the increases in the minimum wage feed into the overall wage distribution and create significant spillovers to wage outcomes even beyond where the minimum wage binds, especially for men.

A. Introduction

1. **Significant labor market constraints and high wage growth are feeding into inflation, which is increasingly driven by non-tradeables.** Labor markets conditions in New Zealand are historically tight, with record high labor force participation and historically low levels of unemployment and underemployment rates. Job vacancies are at very high levels and underemployment and underutilization have also gone down as hiring workers has become increasingly challenging. This has put upward pressure on wages, with expectations of wage growth, particularly in the short term, also spiking. These dynamics are increasingly feeding into inflation.

Figure 1. New Zealand: Tight Labor Market is Resulting in Wage Pressures

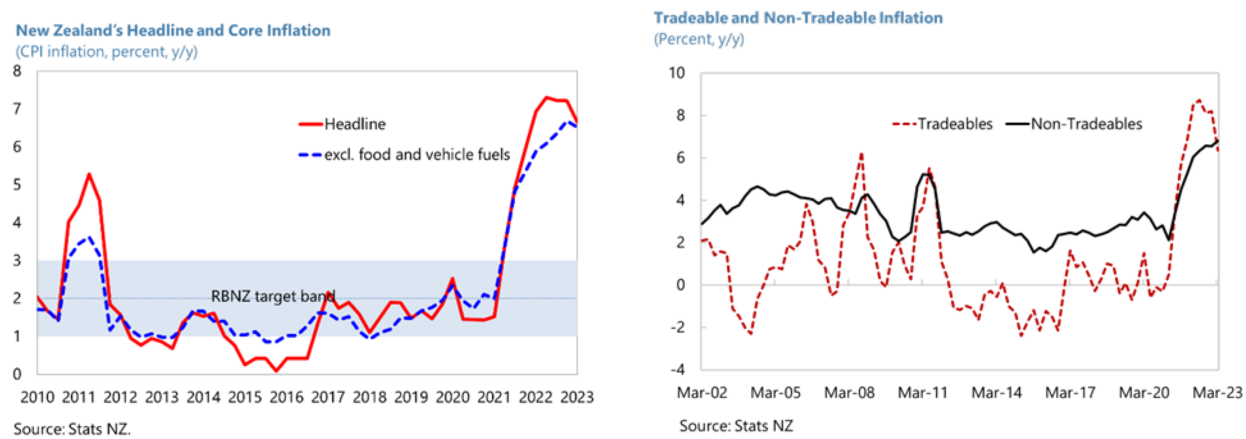


2. **High inflation has persisted since the second half of 2021 and is increasingly driven by non-tradeables.** Like in most advanced economies, inflation is now cooling but remains high at 6.7 percent y/y in 2023Q1. When inflation first started picking up in the second half of 2021, it was

[1] Prepared by Pragyan Deb, Nour Tawk (both APD). The chapter benefited from valuable support from Abdullah Alnasser. We thank the New Zealand authorities for their valuable comments and suggestions.

mostly driven by a spike in international food and energy prices and supply chain and shipping disruptions. But pressures from food and commodity prices are easing, and although the supply-chain disruptions are expected to persist for some time, there are signs that capacity is beginning to catch up with strong demand for goods. This is reflected in the decline in tradeable inflation. However, non-tradeable inflation has taken its place, keeping overall inflation high and sticky.

Figure 2. New Zealand: Non-Tradeables Have Kept Headline Inflation Persistent Despite Easing Pressures on Tradeables



3. This paper analyzes the labor market dynamics in New Zealand, comparing with peers, and discusses structural characteristics unique to New Zealand that have shaped the recent wage formation.

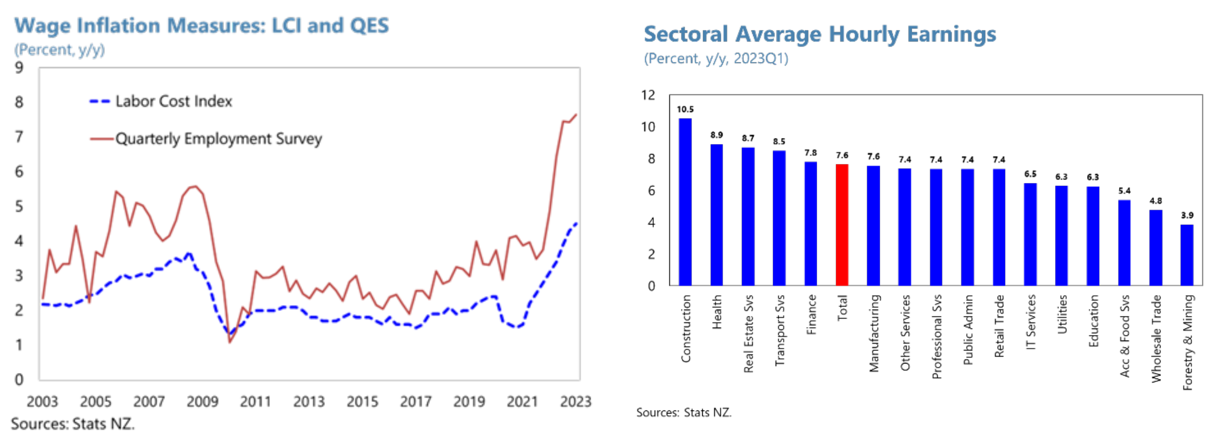
- It finds a robust wage-unemployment relationship in New Zealand, which explains the role played by tightness of the labor in setting the pace for higher wages and in turn greater inflationary pressures, particularly amongst non-tradeables.
- Using a cross-country panel, it finds that greater share of collective bargaining and longer contract length is associated with wages being less sensitive to unemployment and inflation expectations. Given collective bargaining is more prevalent in Australia, this might explain higher wage pressures in New Zealand relative to Australia at the current juncture, despite similarly tight labor markets in both countries..
- Using an industry-level database for hourly wages, it finds that minimum wages (which have risen rapidly over the past decade) have a positive pass-through to overall wages, and could push the entire distribution of wages to the right (higher). In addition, increases in the minimum wage can reduce overall inequality for low earners, but do not address inequality between genders and ethnic groups.

4. The rest of the paper is structured as follows. Section B explores the wage dynamics in New Zealand over the recent period, putting it in an international context, and compares and contrasts the wage Phillips curve relationship with its peer economies. Section C focuses on the role of collective and enterprise bargaining systems and finds that such systems might have contributed to wage moderation in the recent period in Australia and can in part explain the lower wage pressures vis-à-vis New Zealand. With the passage of the Fair Pay Agreements Act, this section also draws lessons for the future in New Zealand. Section D explores the effect of the minimum wage in New Zealand - which has increased rapidly in recent years and sits above the OECD average - on the overall wage distribution, as well as its effect in reducing inequality regarding wage disparities across genders and ethnic groups. Section E concludes.

B. Wage Growth Dynamics in New Zealand

5. Wage pressures are significant. Wage inflation in New Zealand, as measured by the year-on-year (y/y) change in the Labor Cost Index (LCI), declined to a low of 1.6 percent during the pandemic. However, it has increased steadily since then, to 4.3 percent in 2023Q1, a level considerably higher than the Reserve Bank of New Zealand's (RBNZ) of 1–3 inflation target. While the LCI is arguably the best measure of underlying pressures as it measures changes in salary and wage rates for a fixed quantity and quality of labor, other metrics of wage inflation based on quarterly employment survey (QES) suggest even greater pressures. Average hourly earnings based on the QES suggests that wages increased 7.6 percent in 2023Q1, with sectors such as services and construction showing particularly rapid wage growth.

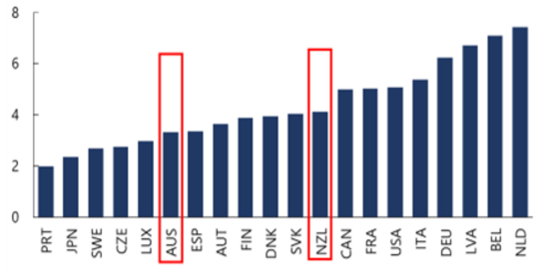
Figure 3. New Zealand: Wage Growth Has Picked Up, Particularly In Services and Construction



6. New Zealand's wage inflation in 2022 was on par with other advanced economies, but higher than in Australia. To assess wage pressures in New Zealand in an international context, and to analyze the drivers of wage inflation, we assemble data on wage inflation for a group of 24 advanced economies. As harmonized wage price indices are not available for all countries, we use various national sources, including the Wage Price Index in Australia, the Labor Cost Index in New Zealand, Labor Cost Indices for Europe, and other national sources where available. New Zealand appears in the middle of the pack, with the median wage inflation in peers at about 4 percent. Wage growth at the end of 2022 was generally higher in countries with tight labor markets, indicating an important role for domestic labor market conditions in explaining wage dynamics. But while both Australia and New Zealand had similar unemployment gaps at the end of 2022, wage pressures were higher in New Zealand.

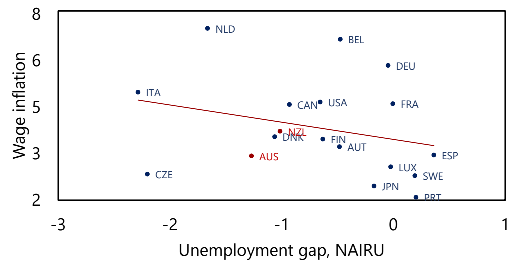
Figure 4. New Zealand: Wage Growth Remains Moderate by International Standards

Wage Inflation New Zealand Compared to OECD
(Wage inflation, y/y, percent, 2022Q4)



Source: Haver Analytics.

Unemployment Gaps and Wage Inflation
(WPI y/y percent vs. unemployment gap, 2022Q4)



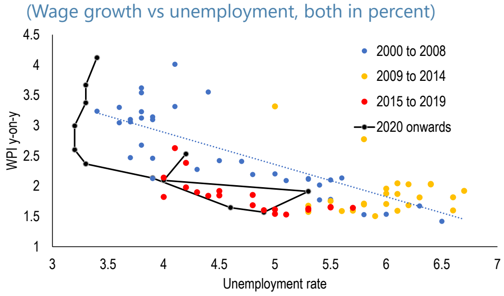
Sources: Haver Analytics; and IMF staff calculations.

Wage-Unemployment Relation in New Zealand and Internationally

7. The wage-unemployment relation varies across countries and within countries over time. In New Zealand, aggregate wage inflation has been low since about 2014, with the relation between wage growth and unemployment, the wage Phillips curve, seemingly shifting downwards and becoming flatter. Wage growth in the post-COVID period is higher than what a historical wage Phillips curve would suggest, which is similar to the trend seen in the US. But it is in contrast to Australia, where wages remain low relative to the historical relationship. We formally analyze wage dynamics in New Zealand and globally using estimated wage Phillips curves.

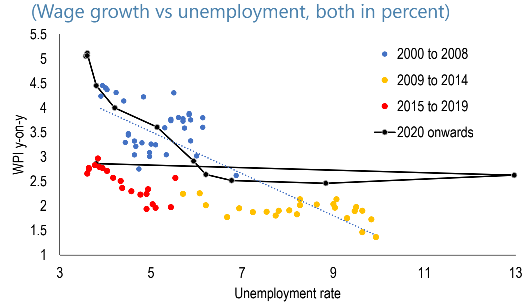
Figure 5. New Zealand: The Post-Pandemic Wage Inflation Is Higher Than Implied by Phillips Curves

Phillips Curve in New Zealand
(Wage growth vs unemployment, both in percent)



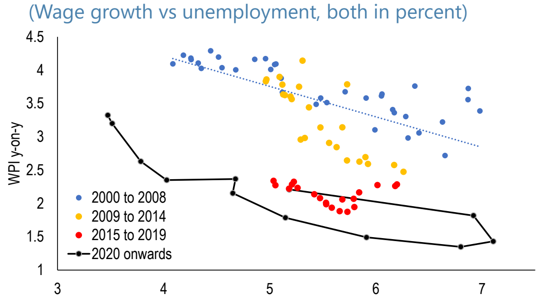
Sources: Haver Analytics; and IMF staff calculations.

Phillips Curve in the U.S.
(Wage growth vs unemployment, both in percent)



Sources: Haver Analytics; and IMF staff calculations.

Phillips Curve in Australia
(Wage growth vs unemployment, both in percent)



Sources: Haver Analytics; and IMF staff calculations.

8. **Regression based estimates of the wage Phillips curve confirms inverse relationship between the level of unemployment and the rate of change in wages.** We estimate wage Phillips curves using quarterly data:

$$\pi_t^w = \alpha + \beta_1 u_t^{gap} + \beta_2 \pi_t^e + \beta_3 g_t^{LP} + \mathcal{E}_{t,i}^h \qquad (1)$$

where π_t^w is the y-on-y percent change in wages measured using changes in the labor cost index; u_t^{gap} is the unemployment gap, computed as the deviation between the unemployment rate and either a Hodrick-Prescott (HP) trend or the NAIRU estimates form the IMFs World Economic Outlook database; π_t^e is 1-year ahead inflation expectations from the consensus forecasts; and $g_{i,t}^{LP}$ is trend labor productivity growth.[2] Since the goal behind this analysis is to shed light on the overall wage-employment relationship in New Zealand, in our baseline specification, we restrict our sample to 2000 to 2019. This helps avoid the noise introduced by the COVID-19 pandemic in economic data. However, our results continue to hold if we include the COVID-period in our analysis (see below). Table 1 reports the regression coefficients which have the expected signs and are statistically significant. A decline in the unemployment gap—which is a measure of the tightness in the labor market—is associated with higher wage growth. In addition, higher expected inflation is associated with higher wage growth and while higher trend labor productivity is also associated with higher wages, this relationship is less strong. The results hold with both the HP filter and NAIRU based gaps.

Table 1. New Zealand: Wage Phillips Curve

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Gap using HP Filter			Gap using NAIRU		
Unemployment gap	-0.626***	-0.571***	-0.561***	-0.473***	-0.421***	-0.415***
	(0.0953)	(0.0901)	(0.0838)	(0.0523)	(0.0483)	(0.0512)
Expected inflation		0.386***	0.290***		0.306***	0.285***
		(0.0826)	(0.0989)		(0.0759)	(0.0956)
Trend labor productivity growt			0.408*			0.0973
			(0.215)			(0.200)
Constant	2.130***	1.271***	1.095***	2.160***	1.477***	1.431***
	(0.0555)	(0.175)	(0.156)	(0.0495)	(0.158)	(0.152)
Observations	80	80	80	80	80	80
R-squared	0.371	0.528	0.550	0.507	0.601	0.603

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Source: IMF staff estimates.

Notes: Data at quarterly frequency. Reports results for estimates of equation 1. Dependent variable in each regression is growth rate of wages. Columns 1 to 3 calculated unemployment gap by estimating trend unemployment using an HP filter with a smoothing parameter of 14400. Columns 4 to 6 uses IMF estimates of the NAIRU to calculate unemployment gap. Robust standard errors with *, **, and *** indicating significance at the 10, 5 and 1 percent level respectively.

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

9. An extended wage Phillips curve confirms the important role played by migration and export prices in New Zealand. Table 2 extends equation (1) by exploring the role of additional variables. Given the important role played by migration in the New Zealand labor market, we introduced lagged migration in the Phillips curve relationship. We find that lagged migration (4 quarters) has a statistically significant impact on wages, lowering growth. The effect is highest between 4 and 8 quarters, with insignificant results outside this window. Similarly, higher export prices are also associated with higher wage growth after around 4-quarters. Both variables remain statistically significant when put in together in the extended wage Phillips curve (specifications 3 and 6 in Table 2). Results are similar with HP filter and NAIRU based unemployment gap. Unlike in Australia (see IMF, 2023), inclusion of underemployment and underutilization rates in the case of New Zealand does not have a large impact (the coefficients are not significant).

Table 2. New Zealand: Extended Wage Phillips Curve

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Gap using HP Filter			Gap using NAIRU		
Unemployment gap	-0.615***	-0.575***	-0.603***	-0.481***	-0.424***	-0.466
	(0.0688)	(0.0722)	(0.0616)	(0.0437)	(0.0454)	(0.04
Expected inflation	0.124	0.326***	0.187**	0.0944	0.321***	0.14
	(0.0949)	(0.0906)	(0.0863)	(0.0870)	(0.0860)	(0.08
Trend labor productivity growth	0.834***	0.317	0.800***	0.344*	0.000364	0.33
	(0.206)	(0.211)	(0.202)	(0.185)	(0.198)	(0.19
Lagged net migration	-0.623***		-0.375**	-0.968***		-0.754
	(0.177)		(0.150)	(0.160)		(0.14
Lagged export prices		1.100***	1.240***		1.096***	0.954
		(0.390)	(0.394)		(0.357)	(0.36
Constant	1.273***	1.075***	1.090***	1.901***	1.418***	1.731*
	(0.189)	(0.154)	(0.161)	(0.173)	(0.152)	(0.15
Observations	72	80	72	72	80	72
R-squared	0.697	0.583	0.732	0.742	0.635	0.76

Source: IMF staff estimates.
Notes: Data at quarterly frequency. Reports results for estimates of equation 1, with additional controls. Dependent variable in each regression is growth rate of wages. Columns 1 to 3 calculated unemployment gap by estimating trend unemployment using an HP filter with a smoothing parameter of 14400. Columns 4 to 6 uses IMF estimates of the NAIRU to calculate unemployment gap. Robust standard errors with *, **, and *** indicating significance at the 10, 5 and 1 percent level respectively.

10. The results reported above are robust to alternate specifications. Since the primary focus in this exercise is to identify economic drivers of wage growth, our baseline specification does not include lagged wage growth, which are more important for a forecasting exercise. Annex table 1 replicates the results by adding 4 lags of the dependent variable. Our results continue to hold and are statistically significant, but the magnitudes are smaller since most of the dynamics are now explained by lagged values, given persistence in the wage growth series. Given the noise introduced by the COVID-19 pandemic in economic data, our baseline is estimated using data that predates the pandemic. However, Annex Table 2 reports results that includes the pandemic period (until 2023Q1) and our results continue to hold.[3] While we use data from New Zealand's labor cost index as our

[3] The results for New Zealand do not change significantly but this is not the case when we move to the cross-country panel later. This is likely because of the more limited impact of the pandemic in New Zealand. But for consistency, we exclude the COVID-19 period from our baseline specification even for New Zealand.

baseline which helps with comparability with other countries when we move the panel setting, all the results presented above continue to hold when wage growth is measured based on data from the Quarterly Employment Survey (see Annex Table 3). Annex Table 4 reports results using q-o-q growth in wages (as opposed to y-o-y wage growth used in the baseline).

Role of Labor Market Tightness in Determining Wage Dynamics: New Zealand Compared to Peers

11. Given the tightness of labor markets, we further explore the wage-unemployment relation in an international context. We estimate wage Phillips curves described in equation 1 using quarterly data for 23 countries in a panel setting, from the period 2000 to 2019:[4]

$$\pi_{i,t}^{w} = \alpha_i + \alpha_t + \beta_1 u_{\mathrm{i},t}^{gap} + \beta_2 \pi_{\mathrm{i},t}^{e} + \beta_3 g_{i,t}^{LP} + \varepsilon_{t,i}^{h} \qquad (2)$$

where $\pi_{i,t}^{w}$ is the y-on-y percent change in wages in country 'i' at time 't'; $u_{\mathrm{i},t}^{gap}$ is the unemployment gap, computed as the deviation between the unemployment rate and an Hodrick-Prescott (HP) trend; $\pi_{\mathrm{i},t}^{e}$ is 1-year ahead inflation expectations from the consensus forecasts; and $g_{i,t}^{LP}$ is trend labor productivity growth.[5] All regressions include country and time fixed effects to control for unobservable time-invariant country characteristics and global shocks respectively and standard errors are clustered at the country level. We also consider dynamic versions of the equation, which includes 4 lags of the dependent variable.

12. Labor market tightness plays an important role in explaining wage dynamics, though New Zealand wages are somewhat less sensitive to unemployment compared to peers. Table 3 reports results for the baseline estimates of the wage Phillips curve. As suggested by theory, higher unemployment relative to trend is associated with lower wage growth, while higher inflation expectations are associated with higher wage growth. Lower trend productivity growth is also associated with lower wage growth (column 1). Columns 2 and 3 repeat the same specification but only for New Zealand and Australia respectively. The unemployment gap remains negative and statistically significant, though the coefficient is smaller than for the cross-country panel, suggesting that New Zealand and Australian wages are less sensitive to labor market tightness than the average among advanced economies. Similarly, the smaller coefficient on inflation expectations suggests a much smaller reaction in New Zealand wages to inflation expectations than in the overall sample. These results are robust to including lags of the dependent variable as additional controls (column 4 to 6), using q-on-q growth rates of wages as the dependent variable, and using NAIRU instead of a HP trend to compute unemployment gap.

[4] We exclude Greece from our sample when estimating the Phillips curves as the wage formation process in Greece was likely severely affected by the crisis in the country for a large part of our sample period.

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

Table 3. New Zealand: Wage Phillips Curve - Compared to Peers

VARIABLES	(1) Baseline Full Panel	(2) Baseline New Zealand	(3) Baseline Australia	(4) With lags Full Panel	(5) With lags New Zealand	(6) With lags Australia
Unemployment gap	-0.944***	-0.561***	-0.632***	-0.268**	-0.164***	-0.169***
	(0.283)	(0.0838)	(0.207)	(0.0954)	(0.0394)	(0.0528)
Expected inflation	1.241***	0.290***	0.252	0.278***	0.133***	0.0384
	(0.271)	(0.0989)	(0.191)	(0.0952)	(0.0285)	(0.0660)
Trend labor productivity growth	0.890**	0.408*	0.662*	0.321*	-0.0687	0.0536
	(0.374)	(0.215)	(0.371)	(0.157)	(0.0709)	(0.120)
Lag 1, dependent variable				0.701***	0.639***	1.206***
				(0.0804)	(0.116)	(0.0936)
Lag 2, dependent variable				0.183***	0.411***	-0.259
				(0.0401)	(0.131)	(0.159)
Lag 3, dependent variable				0.0957**	-0.0412	-0.121
				(0.0382)	(0.157)	(0.184)
Lag 4, dependent variable				-0.335***	-0.208*	0.101
				(0.0272)	(0.112)	(0.102)
Constant	-0.504	1.095***	1.674***	0.118	0.198**	0.0505
	(0.806)	(0.156)	(0.597)	(0.250)	(0.0814)	(0.101)
Observations	1,660	80	80	1,604	80	80
R-squared	0.704	0.550	0.311	0.887	0.951	0.959

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

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

C. Role of Labor Market Arrangements: Collective Bargaining

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

Lessons from Cross-Country Analysis

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

particular, we introduce interaction terms to the standard Phillips curve described in equation 2, estimating:

$$\pi_{i,t}^{w} = \alpha_i + \alpha_t + \beta^1 u_{i,t}^{gap} + \boldsymbol{\gamma}(\boldsymbol{X_i} * \boldsymbol{u_{i,t}^{gap}}) + \beta^2 \pi_{i,t}^{e} + \beta^3 g_{i,t}^{LP} + \varepsilon_{t,i}^{h} \qquad (3)$$

where X_i is a variable which captures labor market institutions in country i. We consider 3 labor market characteristics from OECD: (i) average share of workers under collective bargaining agreements, (ii) average length of collective bargaining agreements; and (iii) trade union density.[6]

Table 4. Panel: Wage Phillips Curve - Unemployment Interacted with Labor Market Characteristics

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

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

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

15. Greater share of collective bargaining and longer contract length is associated with wages being less sensitive to unemployment and inflation expectations. Table 4 reports results for equation 2, where the unemployment gap is interacted with various measures of labor market

[6] Australia and the United States get dropped from the sample when considering regressions with average length of collective bargaining contracts, as OECD does not have data on average contract lengths for these countries. However, this data is available from national sources, and including Australian data in the sample does not change the results.

arrangements. The coefficient of the unemployment gap estimate remains significant. In addition. the coefficient on the interaction term of collective bargaining with the unemployment gap is positive, which, combined with the negative coefficient on unemployment gap itself, indicates that wages are less sensitive to changes in unemployment in countries with higher levels of collective bargaining. The same is true for length of contracts (column 2), where countries with longer contracts generally having less sensitive wages, while results for trade union density (column 3) are somewhat weaker. As the various measures of labor market arrangements are correlated, in column 4 we include all three interactions together in the same regression. Consistent with theory, we find that length of contract is most robustly associated with wages being less sensitive to unemployment. Table 5 also reports results for equation 2 but interacting the institutional variables with inflation expectations. The results again point to greater collective bargaining and longer contracts associated with less sensitivity of wages to inflation developments.[7]

Table 5. Panel: Wage Phillips Curve - Inflation Expectations Interacted with Labor Market Institutions

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

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

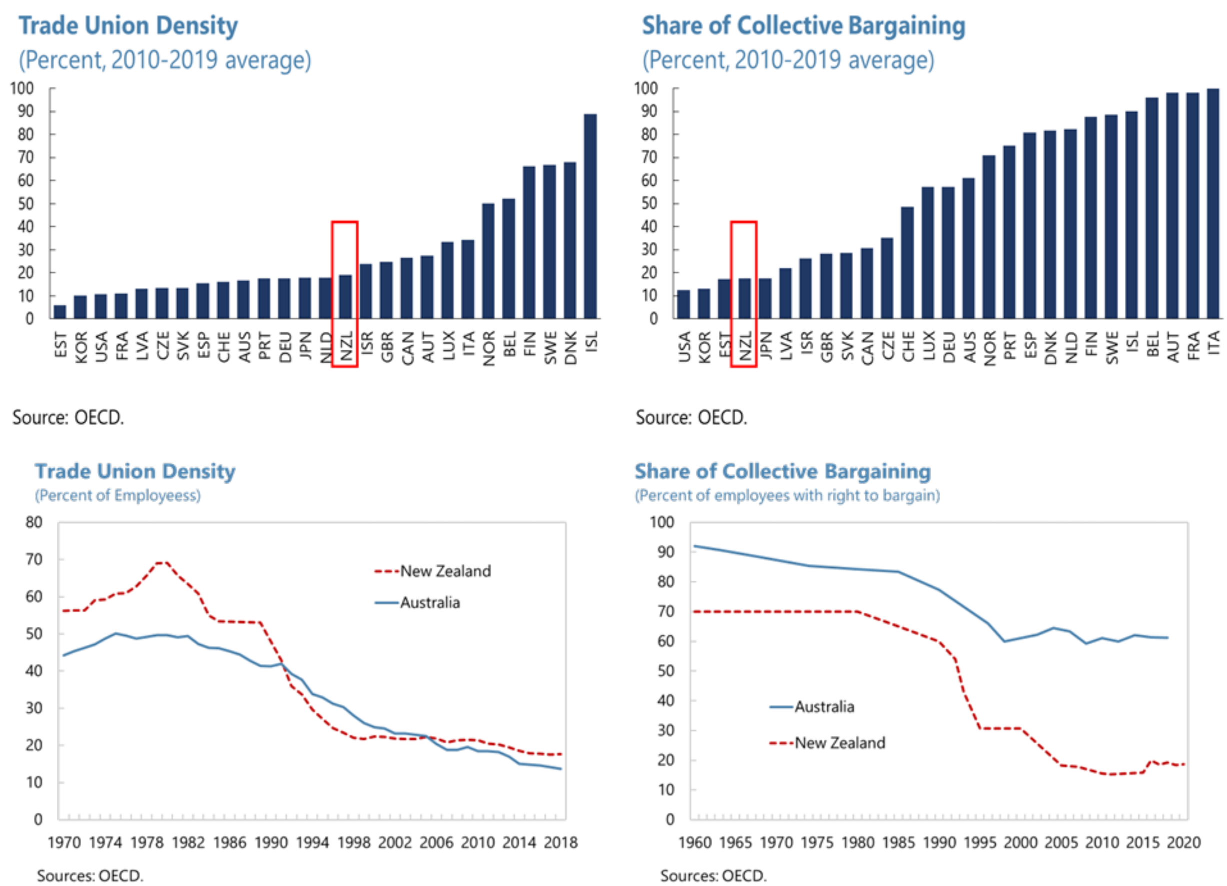
Source: IMF staff estimates.
Notes: Data at the country-quarter level. Reports results for estimates of equation 2. Dependent variable in each regression is year-on-year wage growth. Columns 1-4 include lag dependent variables as controls, while columns 5-8 do not. Columns 1 and 5 interact collective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

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

Implications for New Zealand

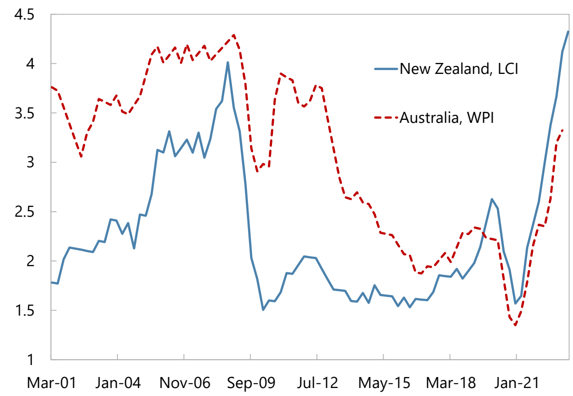
16. Trade union density and the share of collective bargaining are low in New Zealand. Like in most other OECD economies, trade union participation in New Zealand has declined over time and currently stands at less than 20 percent. However, New Zealand stands out in terms of the share of collective bargaining, which is particularly low, especially when compared with Australia. While overall trade union density shows a similar trend in both Australia and New Zealand, the share of collective bargaining in New Zealand stood at 18.6 percent in 2020 as opposed to above 60 percent in Australia. This is in contrast to the situation before the 1980s when the share of collective bargaining was close to 70 percent. Legal changes in the late 1980s and early 1990s led to a dramatic decline in the share of collective bargaining, resulting in a decentralized labor system more akin to the United States, with weaker unions and primarily worksite-based bargaining.

Figure 6. New Zealand: Low Share of Collective Bargaining



17. These structural differences between New Zealand and Australia labor market might partly explain the difference in wage growth dynamics in recent months. As of 2023Q1, while wage price pressures have increased in both Australia and New Zealand, pressures are more contained in Australia with the WPI growing at around 3.6 percent vs 4.3 percent in the case of LCI in New Zealand (and 7.6 percent based on the Quarterly Employment Survey). Our empirical results suggest that a larger share of collective wage agreements and longer contracts are associated with lower sensitivity of wages to labor market tightness. Australia's greater prevalence of collective wage bargaining coupled with the fact that the average duration of wage agreements increased to around 3 years in 2022 might in part explain why wages in Australia have responded less to labor market condition relative to New Zealand since the pandemic. By design, wage increases under enterprise agreements are slow moving, and this could explain the higher wage growth before the pandemic and the slower upward response of wages to labor market tightness in the current conjuncture. This is also borne out by wage increases granted in approved enterprise bargaining agreements in Australia in 2022, which remained subdued. Going forward, with the passage of the Fair Pay Agreements Act in December 2022, which will set sectoral minimum terms and conditions, the role of sectoral bargaining in New Zealand is set to increase, which will likely contribute to less volatile wage growth.

Figure 7. Recent Wage Growth Has Been More Pronounced in New Zealand Than in Australia
(Percent, y/y)



Sources: Stats NZ; and ABS.

D. Structural Drivers of Wages: The Role of the Minimum Wage

18. New Zealand has three types of minimum wage which are reviewed and revised annually. Presently, employers in New Zealand are subject to three types of minimum hourly wages: *adult*, *starting-out*, and *training* depending on employees' specific circumstances.[8] Structural changes to the minimum wage have also taken place over the years: a *youth minimum wage* was instituted in 2001 and was abolished in 2008. The majority of employees are bound by the adult minimum wage, but some workers are subject to the sub-minimum rates such as those whose employment agreement requires a certain level of training towards a qualification, and workers under the age of 20 entering employment for the first six months (starting-out). The minimum wage is reviewed and revised every year under the Minimum Wage Act of 1983. Following the annual review, the minimum wage has increased on a yearly basis for each type of minimum pay. As of April 1, 2023, the minimum wage (before tax) is NZ$22.70/hour for adults, and NZ$ 18.16/hour for employees in the starting-out and training categories (typically the sub-minimum minimum wages are 80 percent of the adult minimum wage).

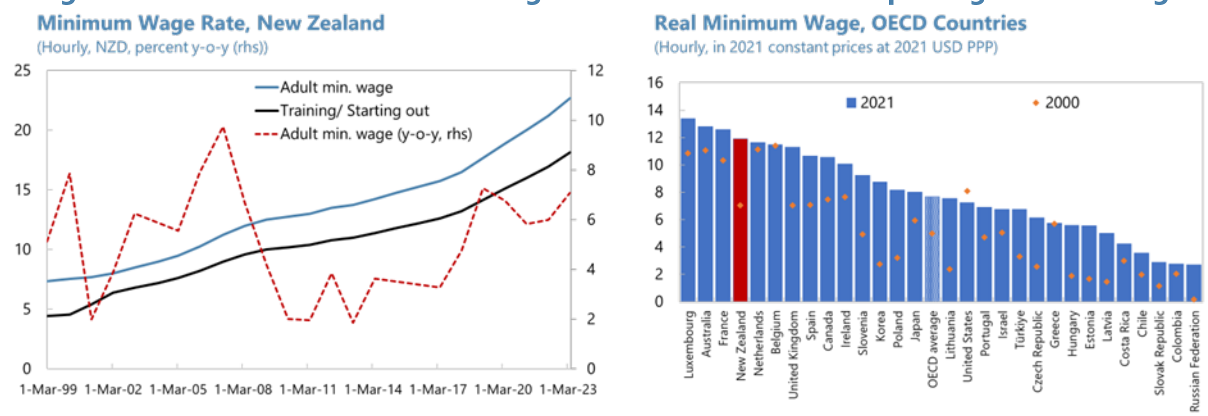
19. The minimum wage in New Zealand has been rising for decades and is high compared to most OECD peers. Following a strong growth progression in the early 2000s, minimum wage increases moderated between 2010 and 2017, and averaged between 2 to 3 percent, somewhat higher than inflation. Growth picked up again over the past few years and outpaced inflation,

[8] For more information see Employment New Zealand.

averaging around 6.6 percent yearly from 2019 through 2023. Historically, the real minimum wage in New Zealand has been elevated compared to the OECD average: in 2000, it was about 40 percent higher than the OECD average. This trend has accelerated over time, with the real minimum wage is currently 55 percent higher than the OECD average. In real terms, the minimum wage grew by about 70 percent since 2000, while in comparison, the OECD average increased by 54 percent.

20. The analysis presented here examines the impact of minimum wage increases on the rest of wages, including those well above the minimum. There is significant scope in understanding the impact of minimum wage increases on the broader labor market, including unemployment and employment, labor productivity, participation, and other related metrics as featured in significant bodies of research (see Mare and Hyslop, 2021). In this exercise, we look into the effect of the statutory minimum wage increases on the formation of other wages, including those around the median of wage distribution, and between cohorts by gender, job industry, and ethnic groups.

Figure 8. New Zealand: Minimum Wage Has Risen Over Time Surpassing OECD Average



Sources: Employment New Zealand; and IMF staff calculations. Sources: OECD.

21. Regressions on the impact of the minimum wage on average wages confirms a pass-through from the minimum wage to average wages. We estimate the relationship between the hourly real (adult) minimum wage and average and median wages for overall, male and female workers using the following specification:

$$\ln\,(Wage)_{i,t} = \beta \ln\,(Min.Wage)_t + \sigma_i + \sigma_{i1} * \text{time} + \gamma_t^{\sigma} + \varepsilon_{i,t} \quad (4)$$

where $\ln\,(Wage)_{i,t}$ is the log of the real hourly wage (either average or median) of industry i at year t, $\ln\,(Min.Wage)_t$ is the log of the real minimum wage at year t. Time-invariant effects are represented by σ_i, while industry-time trends are represented by $\sigma_{i1} * \text{time}$, and time fixed effects are also included (γ_t^{σ}). The results in Table 6 suggest a positive pass-through from minimum wages to average and median hourly real wages: a one percent increase in minimum wages would lift the hourly real wage by 0.5 percentage point, with effects stronger for women compared to men. Similarly, at the median percentile, the impact of a one percent minimum wage increase is higher for women (0.74 ppt vs 0.5 ppt for men).

Table 6. New Zealand: Relationship Between Log Average, Log Median Wages, and Log Minimum Wages

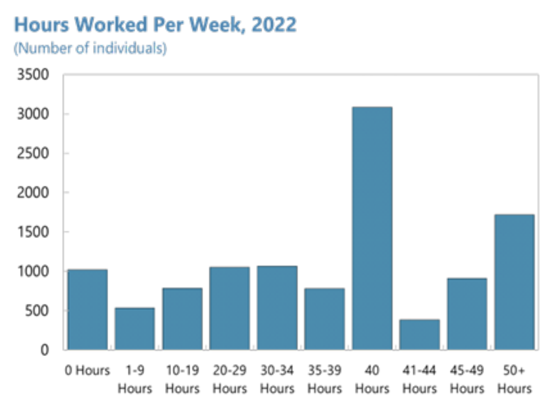
VARIABLES	(1) Hourly Wage Total	(2) Hourly Wage Male	(3) Hourly Wage Female	(4) Median Wage Total	(5) Median Wage Female	(6) Median Wage Male
Minimum wage (log)	0.522***	0.783***	0.411**	0.629***	0.742***	0.508***
	(0.166)	(0.182)	(0.189)	(0.130)	(0.145)	(0.155)
Constant	1.919***	1.099**	2.297***	1.458***	1.081**	1.856***
	(0.475)	(0.522)	(0.541)	(0.373)	(0.416)	(0.445)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry X time trends	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.508	0.554	0.402	0.649	0.671	0.550
Number of industries	18	18	18	18	18	18
No. of observations	252	240	252	252	240	252

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

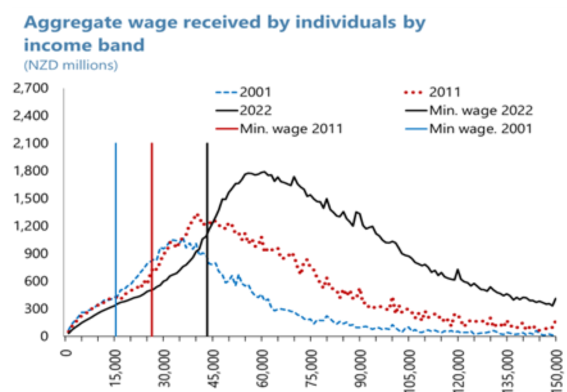
Source: IMF staff estimates.
Notes: Data at the industry-year level. Reports results for estimates on the following equation $\ln{(Wage)_{i,t}} = \beta \ln{(Min.Wage)_t} + \sigma_i + \sigma_{i1} * \text{time} + \gamma_t^{\sigma} + \varepsilon_{i,t}$. Where $Wage_{i,t}$ represents the log of the hourly average or median wage for industry *i* at time *t* for either women, men, or the total average, and $Min.Wage_t$ represents the log minimum wage. All regressions include industry and time fixed effects. Standard errors are clustered at the industry level. *, **, and *** indicate significance at the 10, 5 and 1 percent level respectively.

22. **Increases in the minimum wage have become more binding over time across a wider range of wage percentiles.** The large increases of the minimum wage in the last 20 years have significantly closed the gap with the median wage in New Zealand and have changed the shape of the wage distribution. Making the assumption that a minimum wage earner would work an average of 40 hours a week, and 52 weeks a year (i.e., the most frequent workload among wage earners in 2022)—the income bracket of a minimum wage earner has also shifted over time: in 2001 the minimum wage was binding at the 10th percentile of the wage distribution, but it currently binds at the 30th percentile of the distribution of overall wages. In other words, the income of a full-time minimum wage earner has gotten progressively higher in the wage distribution. Furthermore, based on the academic literature on the potential effects of minimum wages (see next paragraph), this implies that an increase in the minimum wage would likely affect not only workers earning at the 30th percentile of the wage distribution but also those earning below it and around it (Lee, 1999; Autor, Manning and Smith, 2016).

Figure 9. New Zealand: If Average of 40 Hours is Worked Per Week in 2022, the Minimum Wage Affects the Wage Distribution Around the 30th Percentile



Sources: Stats NZ.



Sources: Inland Revenue New Zealand, Employment New Zealand, and IMF staff estimates.

23. The literature[9] on the impact of minimum wage increases to overall wages suggests a pass-through to the wage distribution, even at wages above the minimum wage. Studies have shown that spillover effects can occur for workers earning wages below or around the percentile where the minimum wage is typically binding. For instance, when firms employ workers who earn the minimum wage, their wages will be increased according to the minimum wage hike, causing the wage distribution density to spike around the minimum wage. Another effect pertains to spillovers: increases in the wage bill of minimum wage earners may push firms to substitute minimum wage workers for more skilled workers (Neumark and Wascher (2006), Gramlich (1976)). The increase in demand for higher-skilled labor could subsequently raise their wages. Spillovers to the lower end of the distribution could also occur: for instance, if minimum wage earners are at the 10th wage earning percentile, workers at the 5th percentile may be affected, depending on which factors come into play. An increase in the minimum wage has been found to reduce inequality at the lower tail of the distribution (DiNardo, Fortin, and Lemieux, 1996; Lee, 1999), by increasing the wages of lower tail earners. Autor, Manning, and Smith (2016) demonstrate that spillovers from the minimum wage could also extend to wage percentiles that sit above the minimum wage, implying spillovers to both tails of the distribution. They interpret these spillovers as a true wage effect for workers who are initially earning above the minimum, which can inadvertently increase the inequality between low- and high-wage earners.

24. Given the recent increases in the minimum wage, we explore its potential effects on other percentiles of the wage distribution. In the absence of detailed data for wages percentiles at a granular level, we focus on the effect of the hourly real minimum wage on average hourly real wage earnings, exploring data variation at the industry level (covering 17 industries), as well as across genders and ethnicities. We follow Autor, Manning, and Smith (2016) and use annual data from 2009 to 2022:

$$W_{i,t}\,(average) - W_{i,t}\,(median) = \beta_1\big[\,W_{min,t} - W_{i,t}\,(median)\big] + \beta_2\big[\,W_{min,t} - W_{i,t}\,(median)\big]^2 + \sigma_{i0} + \sigma_{i1} * \text{time} + \gamma_t^{\sigma} + \varepsilon_i^{\sigma} \qquad (5)$$

where $W_{i,t}\,(average)$ represents the log hourly real[10] average (mean)[11] wage, $W_{i,t}\,(median)$ is the log hourly median wage (i.e., 50th percentile) in industry *i* at time *t*; σ_{i0} represents time invariant effects, industry-specific trends are represented by σ_{i1}, and time effects are represented by γ_t^{σ}. $W_{min,t}$ is the log minimum real wage for that year. We follow Lee (1999) and Autor, Manning and Smith (2016) by defining the *bindingness of the minimum wage* as the log difference between the minimum wage and the median (Lee refers to this as the *effective minimum wage*). In this formulation, a more binding minimum wage is one that is closer to the median, resulting in a higher (less negative) effective minimum wage. The quadratic term captures the idea that a change in the minimum wage is likely to have more impact on the wage distribution where it is more binding. As a

[9] This refers to the overseas literature, which is predominantly based on US studies or UK-based studies.

[10] Hourly average, median, and minimum wages are adjusted to real terms using CPI inflation.

[11] Given that the wage distribution has a right tail, the median falls below the mean.

robustness check, we also include lags of the dependent variable (or lag of the real hourly average wage) as a control to mitigate reverse causality (Annex tables 5-12), while time fixed-effects control for unobservable effects which may be changing over time.

25. Results suggest that the minimum wage in New Zealand is binding beyond the 50th percentile. Table 7 reports the relationship between the effective minimum wage and the part of the real wage distribution above the 50th percentile, and finds that the effective minimum wage has an effect for hourly average wages of both men and women.[12] The results suggest a significant effect of an increase in the minimum wage on the upper part of the wage distribution.[13] Surprisingly, the results show that the effect of minimum wages are larger for men than for women, implying that an increase in the minimum wage is not reducing income inequality between genders. Lack of data at lower percentiles prevent empirical testing of the effect of minimum wage increases on the left tail of the wage distribution (i.e., below the median), but evidence from US studies (Lee, 1999; and Autor, Manning and Smith, 2016) suggests a typical strong role of minimum wage increases on the inequality of lower wage earners, irrespective of where the minimum wage binds. Overall, the results imply that the minimum wage has a spillover effect beyond the percentile of the distribution where it is binding (as we would expect the minimum wage to bind at the 30th percentile in 2022), potentially leading to higher wages at the higher end of the distribution. Robustness checks (annex tables 5-6) show that results remain robust even when controlling for overall wages.

Table 7. New Zealand: Relationship Between Log(average) - Log(median) and Log (min. wage) - Log (median)

VARIABLES	(1) Hourly Wage	(2) Hourly Wage Female	(3) Hourly Wage Male	(4) Hourly Wage	(5) Hourly Wage Female	(6) Hourly Wage Male
Log (min. wage) - log(median)	0.587***	0.564***	0.822***	0.364***	0.408***	0.332***
	(0.214)	(0.215)	(0.208)	(0.088)	(0.104)	(0.087)
Log (min. wage) - log(median), sq	0.388**	0.233	0.446***	0.111	-0.277*	0.058
	(0.176)	(0.230)	(0.155)	(0.094)	(0.162)	(0.087)
Levels/first-differenced	Level	Level	Level	FD	FD	FD
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry X time trends	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.357***	0.305***	0.483***	-0.015	0.047	0.019
	(0.067)	(0.059)	(0.074)	(0.046)	(0.057)	(0.055)
R-squared	0.154	0.221	0.194	0.161	0.271	0.185
Number of industries	18	18	18	18	17	18
No. of observations	252	240	252	234	221	234

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: IMF staff estimates.
Notes: Data at the industry-year level. Reports results for estimates of equation 5. Dependent variable in each regression is log(average)-log(median) of real hourly wages. All regressions include industry and time fixed effects. Standard errors are clustered at the industry level. *, **, and *** indicate significance at the 10, 5 and 1 percent level respectively.

26. Industries and occupations where average wages are close in value to the minimum wage are also likely to be affected by increases in the minimum wage. Data suggests that those working in the services-focused industries and community services, such as retail sales employees,

[12] The pass-through of the minimum wage may be overestimated, given that estimations using OLS can at times lead to an upward bias.

[13] These results are robust when adding lags of the dependent variable, and lags of the hourly real average wage.

laborers, or community workers, earn closest to the minimum wage, with the difference between their median hourly wages and hourly minimum wage ranging between NZ$2-5. Similarly, workers in retail trade and accommodation or agriculture and transport earn closer to the minimum wage. In addition, disparities in wages are evident among ethnicities: generally, workers of European descent earn close or higher than the total average, while Māori or Pacific Peoples generally earn less than the total average, both in high paying and low paying jobs.

27. Pay disparities are also evident across genders, with women earning consistently less than men, and closer to the minimum wage in more industries than men. Data reveals that female workers in New Zealand earn less than their male peers in almost all industries: on average, women earn about NZ$ 8.6 per hour more than the minimum wage across industries, compared to NZ$ 11.9 per hour for men, or in other words, what amounts to 88 cents in wages for women per each dollar that men earn.[14] Women in the services, agriculture, transport and manufacturing industries earn relatively closer to the minimum wage, but disparities are also visible within female workers across ethnicities: Pacific peoples Māori, and Asian women on average earn less compared to their European peers.

Figure 10. New Zealand: Minimum Wage is More Binding for Lower-Wage Industries Like Services and Agriculture, and for Women of Māori or Pacific Ethnicity

Sources: Stats NZ; and IMF staff calculations.

[14] The wage gap is calculated for the average hourly earnings for men and women respectively, across all industries.

28. Results on differential impacts of the minimum wage regarding ethnicity suggest varying magnitudes of spillovers to different ethnic groups. Using equation (5) as a baseline adapted to each ethnic group, the results suggest that an increase in the minimum wage has a more significant impact on Māori workers compared to those of European, Pacific, or Asian ethnicity (Table 8).[15] However, the results are inconclusive regarding the effects of the minimum wage on female workers of different ethnicity (Table 9): at a first glance, the results suggest higher spillover effects towards Asian female workers, who appear at an initial stage to earn higher wages compared to women in other ethnic groups, across most industries, but the effects are not statistically significant for women of Māori ethnicity. Similarly, results in Table 10 show a higher pass-through for European men (who earn highest wages compared to other ethnicities) than for other ethnicities, suggesting that an increase in the minimum wage is not particularly effective in reducing within-ethnicity inequality. Annex tables 5-12 corroborate similar magnitude effects.

Table 8. New Zealand: Relationship Between Log (average) – Log (median) and Log (min. wage) - Log (median), by Ethnicity

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Maori	European	Pacific Peoples	Asian	Maori	European	Pacific Peoples	Asian
Log (min. wage) - log(median)	0.350**	0.333	0.202	0.106	0.409***	0.272***	0.357***	0.307***
	(0.158)	(0.238)	(0.152)	(0.153)	(0.066)	(0.094)	(0.080)	(0.070)
Log (min. wage) - log(median), sq	-0.052	0.206	-0.206	-0.176	0.200**	0.075	-0.143	-0.010
	(0.151)	(0.194)	(0.177)	(0.147)	(0.078)	(0.105)	(0.137)	(0.093)
Levels/first-differenced	Level	Level	Level	Level	FD	FD	FD	FD
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry X time trends	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.248***	0.293***	0.237***	0.227***	-0.032	-0.016	-0.005	0.052
	(0.059)	(0.078)	(0.050)	(0.050)	(0.056)	(0.056)	(0.068)	(0.055)
R-squared	0.332	0.105	0.349	0.223	0.279	0.118	0.378	0.235
Number of industries	18	18	17	17	18	18	17	17
Number of observations	242	252	219	232	216	234	198	213

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: IMF staff estimates.
Notes: Data at the industry-year level. Reports results for estimates of equation 5. Dependent variable in each regression is log(average)-log(median) of real hourly wages Māori, European, Pacific and Asian workers, respectively. All regressions include industry and time fixed effects. Standard errors are clustered at the industry level. *, **, and *** indicate significance at the 10, 5 and 1 percent level respectively.

[15] A low R-squared suggests the possibility of some unexplained variation.

Table 9. New Zealand: Relationship Between Log (average) – Log (median) and Log (min. wage) - Log (median), by Ethnicity, Women

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Maori	European	Pacific Peoples	Asian	Maori	European	Pacific Peoples	Asian
Log (min. wage) - log(median)	0.039	0.030	0.159	0.422**	0.176**	0.227***	0.488***	0.672***
	(0.197)	(0.195)	(0.182)	(0.208)	(0.082)	(0.080)	(0.105)	(0.094)
Log (min. wage) - log(median), sq	-0.180	-0.360**	-0.372	0.048	-0.154	-0.451***	-0.073	0.102
	(0.241)	(0.179)	(0.242)	(0.212)	(0.151)	(0.107)	(0.187)	(0.146)
Levels/first-differenced	Level	Level	Level	Level	FD	FD	FD	FD
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry X time trends	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.141**	0.205***	0.220***	0.240***	0.145**	0.119**	-0.039	0.074
	(0.065)	(0.063)	(0.059)	(0.069)	(0.067)	(0.059)	(0.073)	(0.081)
R-squared	0.182	0.306	0.411	0.282	0.251	0.393	0.391	0.488
Number of industries	17	18	16	17	17	17	13	16
Number of observations	213	239	167	207	189	221	144	183

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: IMF staff estimates.
Notes: Data at the industry-year level. Reports results for estimates of equation 5. Dependent variable in each regression is log(average)-log(median) of real hourly wages Māori, European, Pacific and Asian female workers, respectively. All regressions include industry and time fixed effects. Standard errors are clustered at the industry level. *, **, and *** indicate significance at the 10, 5 and 1 percent level respectively.

Table 10. New Zealand: Relationship Between Log (average) – Log (median) and Log (min. wage) - Log (median), by Ethnicity, Men

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Maori	European	Pacific Peoples	Asian	Maori	European	Pacific Peoples	Asian
Log (min. wage) - log(median)	0.040	0.478**	-0.139	0.307**	0.210**	0.398***	-0.299**	0.416***
	(0.162)	(0.207)	(0.158)	(0.149)	(0.083)	(0.084)	(0.145)	(0.074)
Log (min. wage) - log(median), sq	-0.277*	0.138	-0.439***	-0.108	-0.152	-0.014	0.239***	-0.023
	(0.145)	(0.135)	(0.161)	(0.120)	(0.101)	(0.069)	(0.084)	(0.079)
Levels/first-differenced	Level	Level	Level	Level	FD	FD	FD	FD
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry X time trends	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.195***	0.423***	0.171***	0.314***	0.011	0.019	-0.018	0.086
	(0.071)	(0.083)	(0.059)	(0.060)	(0.090)	(0.063)	(0.077)	(0.072)
R-squared	0.324	0.171	0.249	0.355	0.269	0.230	0.323	0.357
Number of industries	18	18	17	17	18	18	17	17
Number of observations	228	252	199	224	204	234	175	206

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: IMF staff estimates.

Notes: Data at the industry-year level. Reports results for estimates of equation 5. Dependent variable in each regression is log(average)-log(median) of real hourly wages Māori, European, Pacific and Asian male workers, respectively. All regressions include industry and time fixed effects. Standard errors are clustered at the industry level. *, **, and *** indicate significance at the 10, 5 and 1 percent level respectively.

E. Key Takeaways

29. The wage-unemployment relationship in New Zealand is significant, with tightness of the labor market feeding into wages and eventually prices. The results suggest that tighter labor market conditions lead to higher wage growth, and this result is robust to various specifications and controls. This paper also finds a significant role for migration and export prices, which are currently adding to wage pressures. A cross country comparison of the relationship with other advanced economies suggests that while the relationship is robust, labor market conditions on average have a smaller effect on wages in New Zealand.

30. Collective bargaining and longer contract length are associated with wages being less sensitive to unemployment. Cross country analysis finds that longer contracts and greater share of collective bargaining dampens the wage-employment relationship. This might explain higher wage pressures in New Zealand relative to Australia in the current juncture—collective bargaining is less prevalent in New Zealand and current wage pressures are more acute. Going forward, as the Fair Pay Agreements come into effect and sets collectively bargained minimum terms and conditions at the sectoral level, it could result in a weakening of the wage-employment relationship in New Zealand and lead to a less volatile, but stickier wage growth.

31. Minimum wages are an effective tool in lifting wages for low-wage earners, but they may feed into overall wage pressures and do not address inequality between ethnicities. Using an industry-level database for hourly wages, the results suggest that an increase in the minimum wage can lead to an increase in the total and hourly wages. However, the results also suggest spillover effects to higher percentiles of the distribution where the minimum wage is not binding. This indicates that, while the minimum wage is likely to result in an increase in wages at the lower end of the distribution (and where the minimum wage is binding), it can potentially lead to greater inequality between low-wage and high-wage earners, as it also increases wages of the latter. In addition, while the results show that increases in the minimum wage can reduce inequality for low-wage earners and between male and female workers, they do not find concrete evidence of reducing inequities embedded across ethnicities.

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Annex I. Additional Robustness Results

Annex Table 1 shows the regression tables for the wage Phillips curve including lags of the dependent variable.

Annex Table 1. New Zealand: Adding Lags

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
Unemployment gap	-0.133***	-0.163***	-0.164***	-0.171***	-0.159***	-0.167***
	(0.0418)	(0.0390)	(0.0394)	(0.0496)	(0.0391)	(0.0497)
Expected inflation		0.118***	0.133***	0.131***	0.129***	0.126***
		(0.0264)	(0.0285)	(0.0303)	(0.0287)	(0.0300)
Trend labor productivity growth			-0.0687	-0.0234	-0.0640	-0.0360
			(0.0709)	(0.101)	(0.0723)	(0.0981)
Lagged net migration				-0.00942		-0.0283
				(0.0813)		(0.0829)
Lagged export prices					-0.0989	-0.146
					(0.159)	(0.180)
Lag 1, dependent variable	0.822***	0.645***	0.639***	0.647***	0.637***	0.639***
	(0.119)	(0.117)	(0.116)	(0.126)	(0.117)	(0.128)
Lag 2, dependent variable	0.350**	0.405***	0.411***	0.403***	0.424***	0.425***
	(0.158)	(0.133)	(0.131)	(0.134)	(0.134)	(0.141)
Lag 3, dependent variable	-0.172	-0.0467	-0.0412	-0.107	-0.0353	-0.0968
	(0.178)	(0.159)	(0.157)	(0.180)	(0.159)	(0.183)
Lag 4, dependent variable	-0.142	-0.209*	-0.208*	-0.160	-0.219*	-0.174
	(0.130)	(0.113)	(0.112)	(0.125)	(0.114)	(0.127)
Constant	0.307***	0.180**	0.198**	0.208*	0.194**	0.213*
	(0.0929)	(0.0819)	(0.0814)	(0.108)	(0.0815)	(0.108)
Observations	80	80	80	72	80	72
R-squared	0.939	0.951	0.951	0.953	0.951	0.953

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Source: IMF staff estimates.

Notes: Data at quarterly frequency. Reports results for estimates of equation 1 augmented with lags of dependent variable. Unemployment gap calculated by estimating trend unemployment using an HP filter with a smoothing parameter of 14400. Robust standard errors with *, **, and *** indicating significance at the 10, 5 and 1 percent level respectively.

Annex Table 2 shows the regression results for New Zealand for an extended sample, that includes the COVID-19 period (until 2023Q1).

Annex Table 2. New Zealand: Extended Sample Including COVID-19 Period

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
Unemployment gap	-0.632***	-0.527***	-0.528***	-0.543***	-0.542***	-0.538***
	(0.0823)	(0.0845)	(0.0817)	(0.0790)	(0.0725)	(0.0705)
Expected inflation		0.379***	0.282***	0.150	0.318***	0.218**
		(0.0612)	(0.102)	(0.104)	(0.0937)	(0.0931)
Trend labor productivity growt			0.298	0.704***	0.210	0.676***
			(0.216)	(0.207)	(0.213)	(0.206)
Lagged net migration				-0.357*		-0.114
				(0.208)		(0.177)
Lagged export prices					1.094***	1.388***
					(0.392)	(0.392)
Constant	2.191***	1.312***	1.242***	1.312***	1.221***	1.108***
	(0.0564)	(0.133)	(0.165)	(0.200)	(0.161)	(0.166)
Observations	92	91	84	76	84	76
R-squared	0.331	0.563	0.521	0.638	0.553	0.681

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Source: IMF staff estimates.

Notes: Data at quarterly frequency. Reports results for estimates of equation 1 augmented with lags of dependent variable. Unemployment gap calculated by estimating trend unemployment using an HP filter with a smoothing parameter of 14400. Robust standard errors with *, **, and *** indicating significance at the 10, 5 and 1 percent level respectively.

Annex Table 3 shows the regression results for New Zealand using growth in average hourly earnings using data from the Quarterly Employment Survey (as opposed to the LCI used in the baseline).

Annex Table 3. New Zealand: Growth in Average Hourly Earnings Using QES Data

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
Unemployment gap	-0.948***	-0.871***	-0.860***	-0.953***	-0.896***	-0.928***
	(0.169)	(0.172)	(0.170)	(0.166)	(0.138)	(0.147)
Expected inflation		0.533***	0.427**	0.166	0.517***	0.295**
		(0.134)	(0.173)	(0.170)	(0.145)	(0.133)
Trend labor productivity growt			0.450	0.953**	0.225	0.883**
			(0.383)	(0.405)	(0.356)	(0.386)
Lagged net migration				-1.163***		-0.651**
				(0.347)		(0.312)
Lagged export prices					2.723***	2.557***
					(0.712)	(0.769)
Constant	3.133***	1.947***	1.752***	2.207***	1.703***	1.830***
	(0.0969)	(0.286)	(0.252)	(0.344)	(0.226)	(0.299)
Observations	80	80	80	72	80	72
R-squared	0.316	0.427	0.437	0.542	0.512	0.598

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Source: IMF staff estimates.

Notes: Data at quarterly frequency. Reports results for estimates of equation 1 augmented with lags of dependent variable. Unemployment gap calculated by estimating trend unemployment using an HP filter with a smoothing parameter of 14400. Robust standard errors with *, **, and *** indicating significance at the 10, 5 and 1 percent level respectively.

Annex Table 4 shows the regression results using quarter-on-quarter growth in wages (instead of year-on-year growth in the LCI used in the baseline).

Annex Table 4. New Zealand: Using q-o-q Wage Growth

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
Unemployment gap	-0.195***	-0.178***	-0.178***	-0.184***	-0.180***	-0.182***
	(0.0309)	(0.0266)	(0.0269)	(0.0263)	(0.0254)	(0.0256)
Expected inflation		0.117***	0.116***	0.0921***	0.123***	0.103***
		(0.0269)	(0.0334)	(0.0326)	(0.0345)	(0.0342)
Trend labor productivity growth			0.00618	0.0759	-0.0108	0.0701
			(0.0670)	(0.0754)	(0.0715)	(0.0770)
Lagged net migration				-0.0904		-0.0478
				(0.0674)		(0.0666)
Lagged export prices					0.205*	0.212
					(0.119)	(0.128)
Constant	0.531***	0.270***	0.267***	0.287***	0.264***	0.256***
	(0.0168)	(0.0565)	(0.0595)	(0.0674)	(0.0598)	(0.0636)
Observations	80	80	80	72	80	72
R-squared	0.375	0.526	0.526	0.572	0.538	0.583

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: IMF staff estimates.

Notes: Data at quarterly frequency. Reports results for estimates of equation 1 augmented with lags of dependent variable. Unemployment gap calculated by estimating trend unemployment using an HP filter with a smoothing parameter of 14400. Robust standard errors with *, **, and *** indicating significance at the 10, 5 and 1 percent level respectively.

Annex table 5 shows robustness results for equation 5. Columns 1-6 repeat the baseline specification, adding a lag of the dependent variable as a control to the regression.

Annex Table 5. New Zealand: Relationship Between Log (average) – Log median) and Log (min. wage) - Log (median)

VARIABLES	(1) Hourly Wage	(2) Hourly Wage Female	(3) Hourly Wage Male	(4) Hourly Wage	(5) Hourly Wage Female	(6) Hourly Wage Male
Log (min. wage) - log (median)	0.702***	0.736***	0.877***	0.145**	0.001	-0.098
	(0.217)	(0.248)	(0.204)	(0.066)	(0.087)	(0.065)
Log (min. wage) - log (median), sq	0.442**	0.359	0.466***	-0.014	-0.410***	-0.914***
	(0.178)	(0.276)	(0.152)	(0.068)	(0.123)	(0.072)
Lag Dependent variable	0.047	0.139*	0.077	-0.950***	-0.916***	0.085
	(0.070)	(0.073)	(0.066)	(0.072)	(0.080)	(0.067)
Levels/first-differenced	Level	Level	Level	FD	FD	FD
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry X time trends	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.394***	0.343***	0.522***	0.175***	0.203***	0.234***
	(0.068)	(0.062)	(0.073)	(0.036)	(0.045)	(0.044)
R-squared	0.170	0.236	0.228	0.562	0.583	0.562
Number of industries	18	17	18	18	17	18
Number of observations	234	221	234	234	221	234

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: IMF staff estimates.

Notes: Data at the industry-year level. Reports results for estimates of equation 3. Dependent variable in each regression is log(average)-log(median) of real hourly wages. All regressions include industry and time fixed effects, and industry-time trends, as well as the lag of the dependent variable as a control. Standard errors are clustered at the industry level. *, **, and *** indicate significance at the 10, 5 and 1 percent level respectively.

Annex table 6 shows robustness results for equation 5. Columns 1-6 repeat the baseline specification, adding a lag of real average hourly wages (log) as a control to the regression.

Annex Table 6. New Zealand: Relationship Between Log (average) – Log (median) and Log (min. wage) - Log (median)

VARIABLES	(1) Average hourly real wages, total	(2) Average hourly real wages, female	(3) Average hourly real wages, male	(4) Average hourly real wages, total	(5) Average hourly real wages, female	(6) Average hourly real wages, male
Log (min. wage) - log(median)	0.675***	0.631**	0.859***	0.941***	0.780***	0.894***
	(0.214)	(0.245)	(0.205)	(0.076)	(0.083)	(0.073)
Log (min. wage) - log(median), sq	0.412**	0.275	0.452***	0.623***	0.424***	0.481***
	(0.176)	(0.275)	(0.153)	(0.077)	(0.132)	(0.068)
Lag average wage (log)	0.062	0.027	0.015	-0.910***	-0.886***	-0.935***
	(0.056)	(0.069)	(0.056)	(0.067)	(0.072)	(0.067)
Levels/first-differenced	Level	Level	Level	FD	FD	FD
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry X time trends	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.192	0.252	0.482**	2.848***	2.740***	3.024***
	(0.194)	(0.216)	(0.205)	(0.215)	(0.224)	(0.219)
R-squared	0.173	0.221	0.223	0.572	0.605	0.598
Number of industries	18	17	18	18	17	18
Number of observations	234	221	234	234	221	234

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: IMF staff estimates.

Notes: Data at the industry-year level. Reports results for estimates of equation 3. Dependent variable in each regression is log(average)-log(median) of real hourly wages. All regressions include industry and time fixed effects, and industry-time trends, as well as the lag of real average hourly wages as a control. Standard errors are clustered at the industry level. *, **, and *** indicate significance at the 10, 5 and 1 percent level respectively.

Annex table 7 shows robustness results for equation 5, by ethnicity. Columns 1-8 repeat the baseline specification, adding a lag of the dependent variable as a control to the regression.

Annex Table 7. New Zealand: Relationship Between Log (average) – Log (median) and Log (min. wage) - Log (median), by Ethnicity

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Maori	European	Pacific Peoples	Asian	Maori	European	Pacific Peoples	Asian
Log (min. wage) - log(median)	0.431***	0.486**	0.149	0.177	0.144***	0.124*	0.026	0.025
	(0.148)	(0.239)	(0.162)	(0.171)	(0.053)	(0.069)	(0.058)	(0.059)
Log (min. wage) - log(median), sq	0.074	0.275	-0.231	-0.117	-0.195***	-0.012	-0.374***	-0.258***
	(0.143)	(0.193)	(0.197)	(0.166)	(0.066)	(0.075)	(0.093)	(0.074)
Lag of real average hourly wage (log)	0.117**	0.062	-0.093	0.105	-0.790***	-0.935***	-1.085***	-0.886***
	(0.059)	(0.069)	(0.071)	(0.072)	(0.064)	(0.070)	(0.077)	(0.080)
Levels/first-differenced	Level	Level	Level	Level	FD	FD	FD	FD
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry X time trends	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.246***	0.342***	0.246***	0.253***	0.127***	0.173***	0.217***	0.211***
	(0.052)	(0.078)	(0.053)	(0.057)	(0.043)	(0.042)	(0.048)	(0.044)
R-squared	0.406	0.129	0.342	0.216	0.618	0.549	0.727	0.559
Number of industries	18	18	17	17	18	18	17	17
Number of observations	216	234	198	213	216	234	198	213

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: IMF staff estimates.

Notes: Data at the industry-year level. Reports results for estimates of equation 5. Dependent variable in each regression is log(average)-log(median) of real hourly wages Māori, European, Pacific and Asian workers, respectively. All regressions include industry and time fixed effects, and the lag of the dependent variable. Standard errors are clustered at the industry level. *, **, and *** indicate significance at the 10, 5 and 1 percent level respectively.

Annex table 8 shows robustness results for equation 5, by ethnicity. Columns 1-8 repeat the baseline specification, adding a lag of the hourly real average wage as a control to the regression.

Annex Table 8. New Zealand: Relationship Between Log (average) – Log (median) and Log (min. wage) - Log (median), by Ethnicity

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Maori	European	Pacific Peoples	Asian	Maori	European	Pacific Peoples	Asian
Log (min. wage) - log(median)	0.440***	0.464*	0.181	0.171	0.862***	0.917***	0.884***	0.773***
	(0.147)	(0.236)	(0.163)	(0.173)	(0.062)	(0.084)	(0.071)	(0.072)
Log (min. wage) - log(median), sq	0.061	0.253	-0.194	-0.126	0.482***	0.606***	0.606***	0.430***
	(0.143)	(0.192)	(0.201)	(0.167)	(0.063)	(0.085)	(0.115)	(0.085)
Lag of real average hourly wage (log)	0.126**	0.077	-0.035	0.038	-0.797***	-0.883***	-0.989***	-0.774***
	(0.052)	(0.054)	(0.060)	(0.057)	(0.067)	(0.067)	(0.080)	(0.076)
Levels/first-differenced	Level	Level	Level	Level	FD	FD	FD	FD
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry X time trends	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-0.111	0.099	0.339*	0.153	2.314***	2.672***	2.877***	2.323***
	(0.166)	(0.188)	(0.189)	(0.175)	(0.203)	(0.206)	(0.239)	(0.228)
R-squared	0.412	0.134	0.336	0.208	0.603	0.544	0.686	0.524
Number of industries	18	18	17	17	18	18	17	17
Number of observations	216	234	198	213	216	234	198	213

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: IMF staff estimates.

Notes: Data at the industry-year level. Reports results for estimates of equation 5. Dependent variable in each regression is log(average)-log(median) of real hourly wages Māori, European, Pacific and Asian workers, respectively. All regressions include industry and time fixed effects, and the lag of the real hourly average wage. Standard errors are clustered at the industry level. *, **, and *** indicate significance at the 10, 5 and 1 percent level respectively.

Annex table 9 shows robustness results for equation 5, for women and by ethnicity. Columns 1-8 repeat the baseline specification, adding a lag of the dependent variable as a control to the regression.

Annex Table 9. New Zealand: Relationship Between Log (average) – Log (median) and Log (min. wage) - Log (median), by Ethnicity, Women

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Maori	European	Pacific Peoples	Asian	Maori	European	Pacific Peoples	Asian
Log (min. wage) - log(median)	0.074	0.137	0.081	0.660***	0.041	-0.152**	0.094	0.271***
	(0.203)	(0.206)	(0.202)	(0.241)	(0.064)	(0.067)	(0.086)	(0.084)
Log (min. wage) - log(median), sq	-0.136	-0.328*	-0.500*	0.154	-0.170	-0.571***	-0.491***	-0.255**
	(0.245)	(0.185)	(0.262)	(0.262)	(0.115)	(0.080)	(0.142)	(0.119)
Lag Dependent variable	0.135	0.157**	-0.011	0.008	-0.861***	-0.932***	-0.962***	-0.893***
	(0.084)	(0.069)	(0.087)	(0.084)	(0.084)	(0.076)	(0.097)	(0.093)
Levels/first-differenced	Level	Level	Level	Level	FD	FD	FD	FD
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry X time trends	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.254***	0.252***	0.214***	0.466***	0.232***	0.254***	0.180***	0.234***
	(0.061)	(0.066)	(0.065)	(0.070)	(0.052)	(0.045)	(0.057)	(0.065)
R-squared	0.214	0.327	0.366	0.348	0.567	0.670	0.685	0.691
Number of industries	17	17	13	16	17	17	13	16
Number of observations	189	221	144	183	189	221	144	183

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Source: IMF staff estimates.

Notes: Data at the industry-year level. Reports results for estimates of equation 5. Dependent variable in each regression is log(average)-log(median) of real hourly wages Māori, European, Pacific and Asian female workers, respectively. All regressions include industry and time fixed effects, and the lag of the dependent variable. Standard errors are clustered at the industry level. *, **, and *** indicate significance at the 10, 5 and 1 percent level respectively.

Annex table 10 shows robustness results for equation 5, for women and by ethnicity. Columns 1-8 repeat the baseline specification, adding a lag of the hourly real average wage as a control to the regression.

Annex Table 10. New Zealand: Relationship Between Log (average) – Log (median) and Log (min. wage) - Log (median), by Ethnicity, Women

VARIABLES	(1) Maori	(2) European	(3) Pacific Peoples	(4) Asian	(5) Maori	(6) European	(7) Pacific Peoples	(8) Asian
Log (min. wage) - log(median)	0.022	0.007	0.089	0.763***	0.690***	0.666***	0.874***	1.043***
	(0.199)	(0.211)	(0.201)	(0.235)	(0.085)	(0.071)	(0.095)	(0.082)
Log (min. wage) - log(median), sq	-0.176	-0.387**	-0.496*	0.248	0.542***	0.110	0.436***	0.536***
	(0.243)	(0.189)	(0.261)	(0.255)	(0.141)	(0.095)	(0.159)	(0.121)
Lag real average hourly wage (log)	0.077	-0.072	0.070	0.181**	-0.718***	-0.828***	-0.844***	-0.825***
	(0.057)	(0.062)	(0.083)	(0.076)	(0.077)	(0.072)	(0.103)	(0.084)
Levels/first-differenced	Level	Level	Level	Level	FD	FD	FD	FD
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry X time trends	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.025	0.449**	0.003	-0.079	2.180***	2.543***	2.444***	2.490***
	(0.177)	(0.189)	(0.255)	(0.239)	(0.224)	(0.215)	(0.310)	(0.255)
R-squared	0.210	0.312	0.370	0.373	0.533	0.654	0.629	0.696
Number of industries	17	17	13	16	17	17	13	16
Number of observations	189	221	144	183	189	221	144	183

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: IMF staff estimates.

Notes: Data at the industry-year level. Reports results for estimates of equation 5. Dependent variable in each regression is log(average)-log(median) of real hourly wages Māori, European, Pacific and Asian female workers, respectively. All regressions include industry and time fixed effects, and the lag of the hourly real average wage. Standard errors are clustered at the industry level. *, **, and *** indicate significance at the 10, 5 and 1 percent level respectively.

Annex table 11 shows robustness results for equation 5, for men and by ethnicity. Columns 1-8 repeat the baseline specification, adding a lag of the dependent variable as a control to the regression.

Annex Table 11. New Zealand: Relationship Between Log (average) – Log (median) and Log (min. wage) - Log (median), by Ethnicity, Men

VARIABLES	(1) Maori	(2) European	(3) Pacific Peoples	(4) Asian	(5) Maori	(6) European	(7) Pacific Peoples	(8) Asian
Log (min. wage) - log (median)	-0.22	0.57***	-0.07	0.28*	0.05	0.11*	-0.00	-0.01
	(0.197)	(0.200)	(0.191)	(0.163)	(0.061)	(0.061)	(0.058)	(0.065)
Log (min. wage) - log (median), sq	-0.52***	0.18	-0.47**	-0.12	-0.28***	-0.12**	-0.40***	-0.34***
	(0.178)	(0.130)	(0.219)	(0.129)	(0.073)	(0.048)	(0.096)	(0.064)
Lag Dependent variable	0.13	-0.05	-0.02	0.07	-0.91***	-1.02***	-1.02***	-0.94***
	(0.082)	(0.065)	(0.074)	(0.065)	(0.073)	(0.069)	(0.078)	(0.079)
Levels/first-differenced	Level	Level	Level	Level	FD	FD	FD	FD
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry X time trends	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.12	0.47***	0.17***	0.33***	0.16**	0.25***	0.18***	0.26***
	(0.078)	(0.081)	(0.060)	(0.068)	(0.065)	(0.045)	(0.053)	(0.055)
R-squared	0.339	0.218	0.301	0.362	0.630	0.642	0.709	0.658
Number of industries	18	18	17	17	18	18	17	17
Number of observations	204	234	175	206	204	234	175	206

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: IMF staff estimates.

Notes: Data at the industry-year level. Reports results for estimates of equation 5. Dependent variable in each regression is log(average)-log(median) of real hourly wages Māori, European, Pacific and Asian male workers, respectively. All regressions include industry and time fixed effects, and the lag of the dependent variable. Standard errors are clustered at the industry level. *, **, and *** indicate significance at the 10, 5 and 1 percent level respectively.

Annex table 12 shows robustness results for equation 5, for women and by ethnicity. Columns 1-8 repeat the baseline specification, adding a lag of the hourly real average wage as a control to the regression.

Annex Table 12. New Zealand: Relationship Between Log (average) – Log (median) and Log (min. wage) - Log (median), by Ethnicity, Men

VARIABLES	(1) Maori	(2) European	(3) Pacific Peoples	(4) Asian	(5) Maori	(6) European	(7) Pacific Peoples	(8) Asian
Log (min. wage) - log(median)	-0.13	0.58***	-0.08	0.28	0.92***	1.00***	0.87***	0.85***
	(0.175)	(0.200)	(0.193)	(0.169)	(0.100)	(0.070)	(0.084)	(0.068)
Log (min. wage) - log(median), sq	-0.44***	0.18	-0.48**	-0.13	0.47***	0.44***	0.52***	0.30***
	(0.159)	(0.131)	(0.219)	(0.133)	(0.104)	(0.056)	(0.129)	(0.067)
Lag of real average hourly wage (log)	0.10*	0.01	0.00	-0.00	-0.92***	-0.99***	-0.96***	-0.84***
	(0.059)	(0.055)	(0.058)	(0.062)	(0.096)	(0.067)	(0.088)	(0.075)
Levels/first-differenced	Level	Level	Level	Level	FD	FD	FD	FD
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry X time trends	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-0.15	0.43**	0.17	0.35*	2.69***	3.12***	2.76***	2.57***
	(0.200)	(0.199)	(0.189)	(0.185)	(0.289)	(0.215)	(0.260)	(0.230)
R-squared	0.342	0.216	0.300	0.358	0.537	0.642	0.646	0.635
Number of industries	18	18	17	17	18	18	17	17
Number of observations	204	234	175	206	204	234	175	206

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: IMF staff estimates.

Notes: Data at the industry-year level. Reports results for estimates of equation 5. Dependent variable in each regression is log(average)-log(median) of real hourly wages Māori, European, Pacific and Asian male workers, respectively. All regressions include industry and time fixed effects, and the lag of the hourly real average wage. Standard errors are clustered at the industry level. *, **, and *** indicate significance at the 10, 5 and 1 percent level respectively.