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What Drives Rents in New Zealand? National and Regional Analysis

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Executive Summary

This paper aims to provide an initial framework to improve our understanding of the factors that impact housing rentals in New Zealand. This framework is useful for several reasons. Firstly, rents provide a better signal of the balance of supply and demand for dwellings than house prices do. This is because rents do not reflect expectations for future gains as house prices do. Secondly, providing a better understanding of rent drivers can lead to better government policy as renters typically pay a larger proportion of their incomes on housing costs than owner occupiers and so are more vulnerable to large movements in housing costs. Thirdly, forecasting rents can also improve the accuracy of house price forecasts, as they are one of the factors that influence house prices. Finally, the framework helps us to test theories of how land and housing markets operate.

We find that, over the past 20 years, nominal wage inflation and the relative supply and demand of dwellings are the two key drivers of rent inflation at both the national and regional level, through impacting tenants' ability and willingness to pay, and the availability of rental properties respectively. When the effect of other factors is excluded, a 1 percent increase in nominal wages leads directly to a 1 percent increase in new tenancy rents. A 1 percent increase in people per dwelling,[1] leads to a 1.5 percent increase in rents at the national level. These results also hold using Stats NZ's estimate of rental inflation for all tenancies, albeit with lower magnitudes, as rents for existing tenancies are typically less volatile than new ones.

We also find that rent inflation at the national level is affected by mortgage rates (increasing mortgage rates increase rents) and the unemployment rate (increasing unemployment decreases rents). However, their contributions are smaller and less significant than wages and the physical supply and demand of dwellings. The small effect of mortgage rates on rents is consistent with previous analysis done by the Housing Technical Working Group on the impact of land supply restrictions. When land supply is highly constrained, we would expect financial factors, such as interest rates, to have a greater impact on house prices than rents.

Expanding the research to consider regional differences, we find the identified key drivers of rental: growth in wages or household income, and physical supply and demand, still explain changes in rents at a regional council level. However, if we allow the model to assume these factors have different sized impacts in different regions it improves the model's predictive ability, suggesting a variety of region-specific factors affect how much these drivers impact on rent inflation. These differences may include local planning restrictions, infrastructure levels, and capacity of the local construction industry to respond to changes in demand.

[1] People per dwelling is used as an indicator of the relative supply and demand of dwellings. We assume an increase in people per dwellings suggests demand is growing more quickly than supply.

Key Findings

1. Understanding the key drivers of rents is important to monitor and assess the balance of supply and demand in the housing market, improve the accuracy of house price forecasts, and identify potential hot spots at the regional level.

2. Wage inflation and relative supply and demand of dwellings (measured by people per dwelling) are the two key drivers of rent inflation for new tenancies at the national level.

3. Mortgage interest rates positively affect rents but relatively little, and the relationship is not robust across model specifications. This is consistent with previous analysis done by the Housing Technical Working Group on the impact of land supply restrictions.

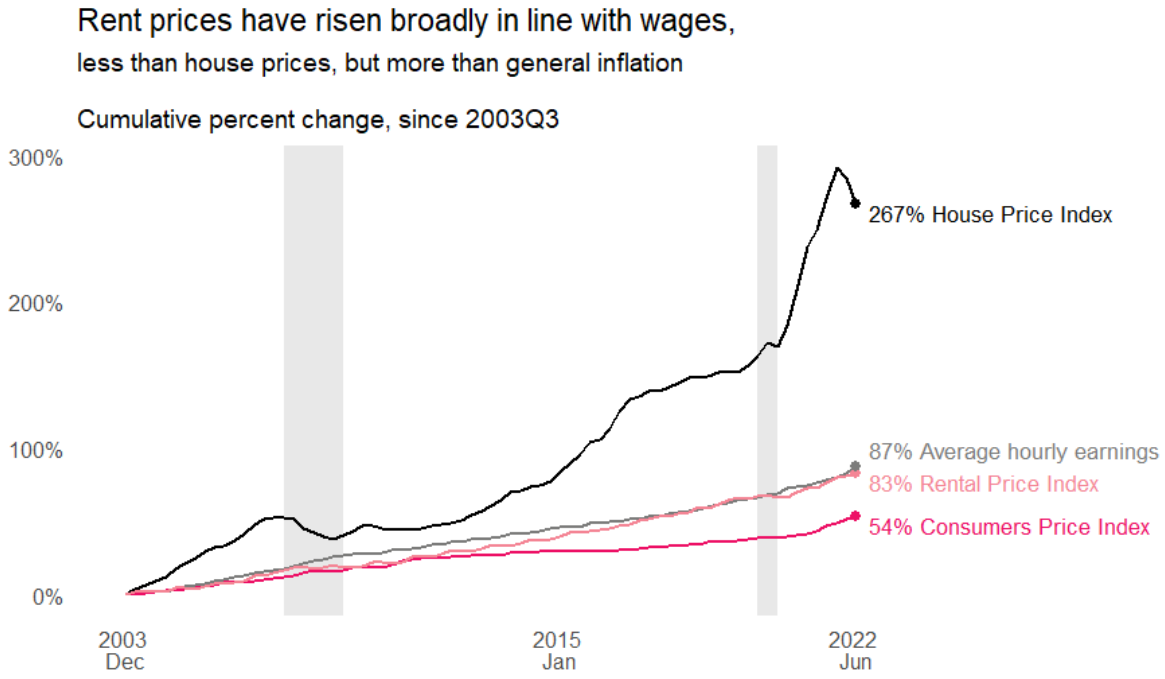
4. The identified key drivers are robust to local circumstances, although unobserved region-specific factors can dampen or magnify the effects in particular regions.

Introduction

New Zealand rents have received growing attention as the proportion of people who rent has been increasing since the early 1990s. This paper aims to provide an initial framework to improve our understanding of the factors that impact housing rentals in New Zealand.[2] This analysis is useful for several reasons. Firstly, rents provide a better signal of the balance of supply and demand for dwellings than house prices do. This is because rents do not reflect expectation for future gains as house prices do. Secondly, providing a better understanding of rent drivers can lead to better government policy as renters typically pay a larger proportion of their incomes on housing costs than owner occupiers and so they are more vulnerable to large movements in housing costs. Thirdly, forecasting rents can also improve the accuracy of house price forecasts, as they are one of the factors that influence house prices. Finally, the framework helps us to test theories of how land and housing markets operate.

2 Throughout this paper we use rents as shorthand for actual rentals for housing. We do not consider or model imputed rents on owner-occupied housing.

Figure 1 – New Zealand rents in context



Overall rents have increased broadly in line with wage growth over the past two decades, albeit at a faster rate than general inflation, as measured by the Consumers Price Index (Fig. 1). In contrast, house prices have risen further than rents. The tri-agency Housing Technical Working Group (HTWG)[3] identified these differing growth rates, amongst other things, as evidence to support their conclusions presented in *Assessment of the Housing System: with insights from the Hamilton-Waikato Area* (HTWG, 2022). The report demonstrated the relative importance of systematic interest rate declines and the tax system, in the context of restricted land supply (land use rules, regulations, and constraints), compared to the impact of dwelling supply relative to population growth. The group concluded that physical dwelling supply has not been the major driver of house prices over the past 20 years. If this had been the case, we would have expected house price increases to have been more in line with the increase in rents. Underpinning this assessment is an assumption that rents are influenced by the relative supply and demand of physical dwellings. Research presented in this paper aims to further our understanding of the drivers of rents.

The rest of the paper is organized as follows: section 2 summarises key features of rents in New Zealand, section 3 reviews the previous literature on modelling rents internationally and in New Zealand, section 4 describes the theoretical framework for analyzing rents, section 5 describes the data and modelling approach. The results are presented in section 6, followed by the conclusion in section 7.

Key Facts of Rents in New Zealand

The share of New Zealand households who pay rent has increased significantly during the past three decades, rising from about 23 percent in 1991 to 32 percent in 2018 (Stats NZ, 2020). The

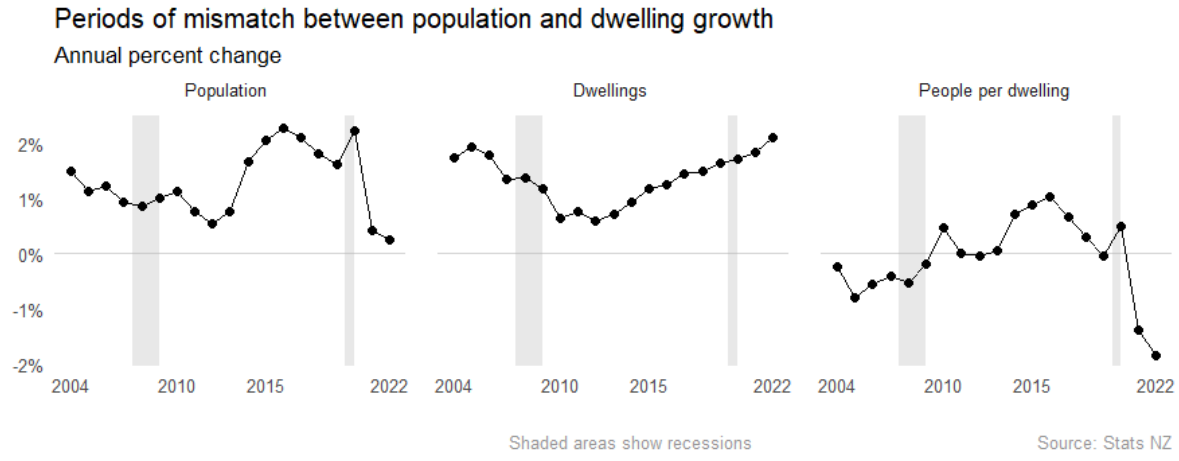
3 Members of the HTWG are affiliated with the Treasury, Reserve Bank of New Zealand, and Ministry of Housing and Urban Development.

associated decline in home ownership has been particularly acute for young adults, with the proportion of New Zealanders aged 25 to 34 who are owner-occupiers declining from about 65 percent in 1988 to 35 percent in 2018 (Bentley, 2021). The number of households in rented dwellings increased from about 290,000 in 1996 to 530,000 in 2018.

From a wellbeing perspective, rents matter since low-income households have little discretion over their level of housing expenditure. Renters typically have lower incomes than owner-occupiers, spend a greater share of their income on housing costs, and have lower material wealth (ibid). New Zealand rental properties are typically of lower physical quality compared with owner-occupied properties (New Zealand Treasury, 2022).

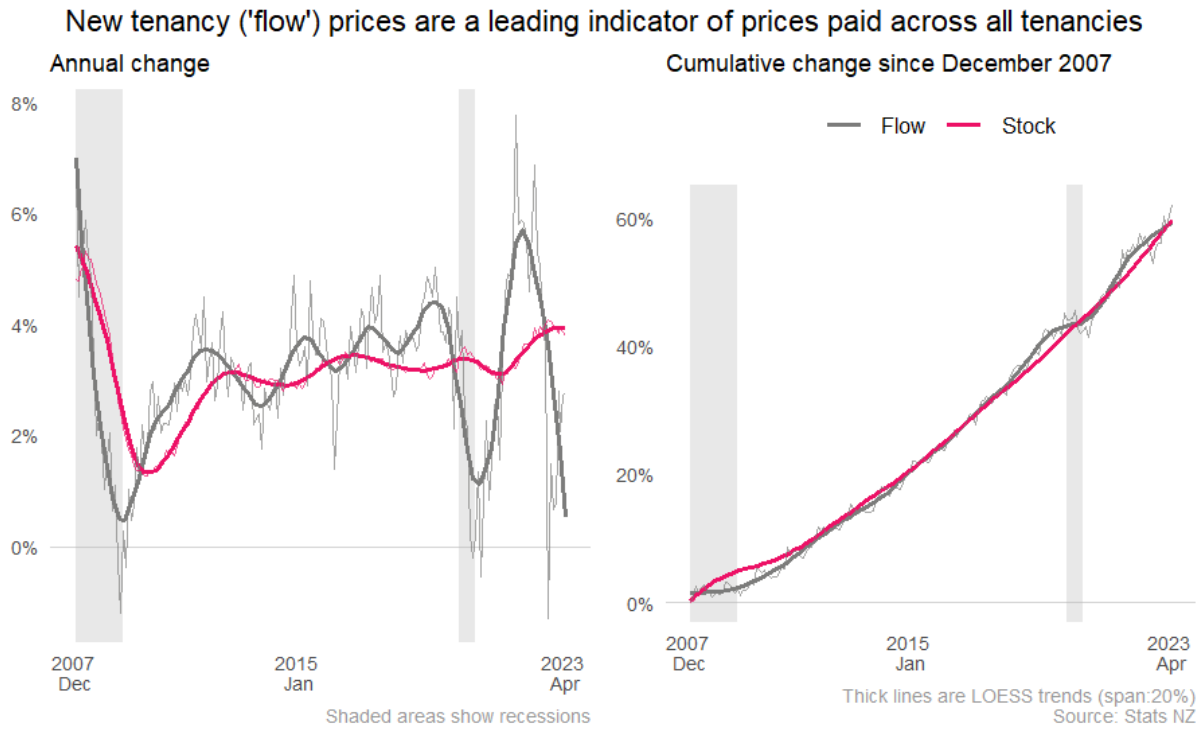
The usually resident population in New Zealand increased by over 1 million people during the study period, from an estimated 4.0 million in June 2003 to 5.1 million in June 2022, at an average growth rate of 1.3% per year. Over the same period, the number of dwellings also increased by 1.3% per year, by 500,000 to 2 million. However, these long-run growth rates hide periods of mismatch between population and dwelling growth (Fig. 2). Variation over time in New Zealand's population growth rate is driven primarily by changes in net external migration. Notably, the population was growing at a faster rate than dwellings during the period 2015–20, increasing the number of people per dwelling to a high of 2.64 as at June 2020. Border restrictions over the following two years curtailed population growth, whilst dwelling growth continued, reducing people per dwelling to 2.56 as at June 2022. This is similar to the 2.58 people per dwelling as at June 2003, at the beginning of our study period.

Figure 2 – Population and dwelling growth rates compared



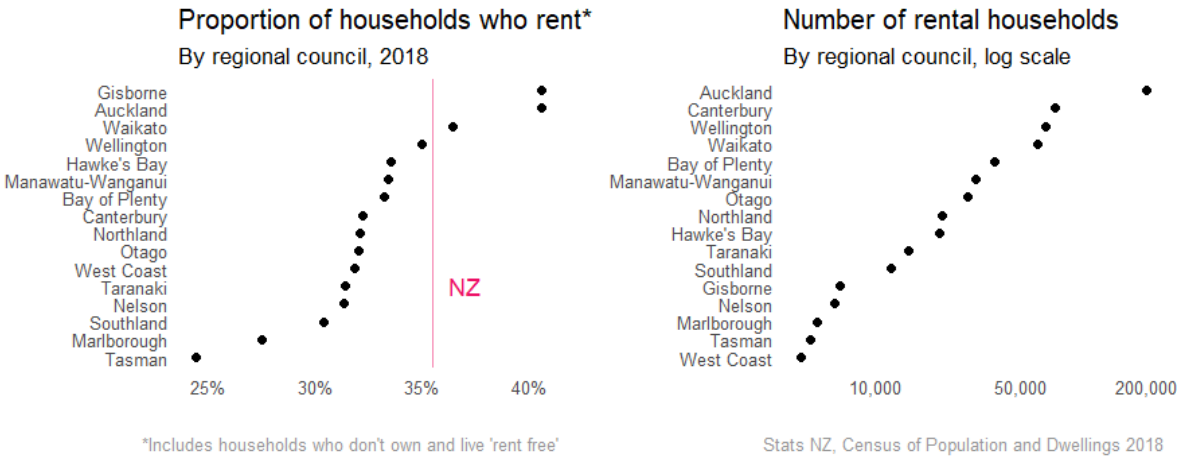
Enhancements to the measurement of rent inflation, including the use of granular administrative data and a new approach for quality-adjustment, has improved the reliability of rental price indices. The changes also facilitated the introduction of an additional 'flow' series in 2019, which shows price change for new tenancies (Stats NZ, 2019; Bentley, 2022a). In comparison, the 'stock' series, used as an input into the overall Consumers Price Index, measures price change across all tenancies. Movements in the latter series tend to be lagged and less volatile (Fig. 3), reflecting the stickiness of rents for sitting tenants, who can be said to enjoy a 'tenancy discount' (Bentley, 2021).

Figure 3 – New tenancy rent inflation compared with inflation for all rentals



Just over a third of rental households are in Auckland, another third in the major urban areas of Canterbury, Wellington and Waikato, with the remainder in less densely populated regions (Fig. 4). There is substantial regional variation in the proportion of households who are not owner-occupiers, the vast majority of who pay rent.[4] Over 40 percent of households are non-homeowners in Gisborne and Auckland, compared with less than 30 percent in Marlborough and Tasman regions.

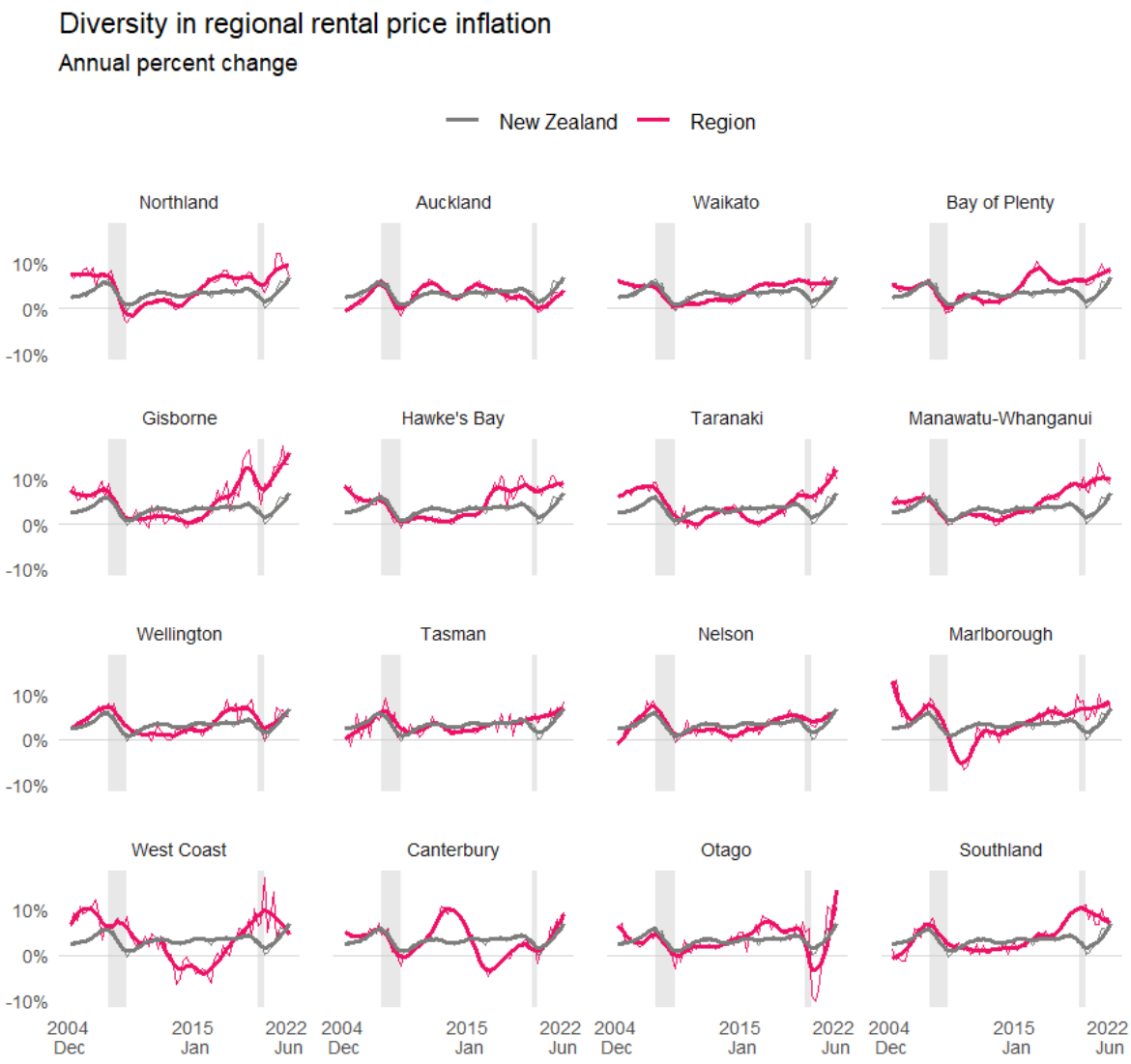
Figure 4 - Regional diversity in rental markets



4 A small proportion of household who are not owner-occupiers do not pay rent.

National trends can hide regional diversity of rent inflation (Fig. 5). We found evidence of spatial correlation in rent growth, where periods of higher price growth occurred in one region at the same time as neighbouring regions.

Figure 5 – Regional rent inflation



Rent inflation has been above average in many provincial North Island regions[5] since about 2016. Counter-balancing this has been below-average growth rates in Auckland, home to over a third of renters. The Canterbury region experienced major earthquakes in 2010 and 2011, reducing the number of dwellings available for habitation. Rents increased markedly over the following few years, subsequently reversing once supply and demand were brought back into balance after the rebuild. These key trends hint at the role of physical supply and demand for rental properties on rents. Later we provide a more rigorous empirical assessment of this finding.

5 Namely, Northland, Waikato, Bay of Plenty, Gisborne, Hawke's Bay, Taranaki, Manawatu-Whanganui.

Literature Review

A number of different frameworks can be used to model the drivers of rents. Previous studies have used a range of data sources. Some studies have used individual level rent data, whereas other studies have used aggregate data. Individual level data is well suited to inferring the causal impact of specific events or policy changes, such as changes in the level of the Accommodation Supplement. However, aggregate rental data are more useful for estimating the relationship between rents and macroeconomic factors such as wages and interest rates. Our study uses aggregate level data as we are primarily interested in these macroeconomic relationships.

Previous studies have used a variety of modelling techniques to study rent growth. Studies focused on identifying the impact of individual factors on rents tend to use single equation econometric methods, such as Ordinary Least Squares (OLS) or panel data techniques. In contrast, studies that concentrate on forecasting rents may use methods such as Vector Autoregressions (VARs). In this study we are interested in the macroeconomic relationship between rents and other factors, so we use OLS for the national level analysis and panel estimation for the regional analysis.

Another distinction in the literature is whether to estimate the structural demand and supply curves for rent or the combined reduced form relationship. Based on economic theory and the previous empirical literature, the demand for rental housing depends on factors such as household income, house prices, the number of people per dwelling and interest rates. The supply of rental housing depends on factors including interest rates and inflation.

Compared to the extensive empirical work on drivers of house prices, research on drivers of rents is much more limited, both internationally and in New Zealand.[6] The available studies have used a variety of methods and focus on the role of different factors.

In the time series analysis, much of the empirical work has focussed on modelling US rents. Duca, Muellbauer and Murphy (2016) model real rents (deflated by the PCE deflator). They find a positive long-run impact of real incomes and house prices on rents, and a negative impact of user costs, which incorporates the impact of lagged house price changes and interest rates. Dias and Duarte (2019) use a structural VAR approach to examine the impact of US monetary policy on rents, and find that after a tightening in monetary policy, house prices decline whereas rents increase, indicating that monetary policy may influence households' decision to own a house or rent.

Saunders and Tulip (2019) include equations for rents and rental vacancies in a broader model of the Australian housing market. They find dwelling completions and changes in population drive the rental vacancy rate, which in turn has a strong impact on rents. In addition, rents have a large impact on house prices, along with interest rates and house price momentum. Howard and Liebersohn (2021) use a spatial equilibrium framework to decompose the drivers of US rents, and find an increasing role for demand to live in cities in which housing supply is inelastic.

Relatively few studies have analysed the New Zealand rental market. Coleman and Scobie (2009) build a simple structural model with parameters of supply and demand for owner-occupied and rental housing to assess the impact of various policy actions. They find a reduction in tax concessions for landlords would increase rents and moderate house prices. In addition, lower housing costs, such as through lower regulatory and consent costs, would reduce rents and house prices. Lower real interest rates would reduce rents and increase house prices. The only study we

6 For a broader review of the literature on modelling house prices and rents, see Duca, Muellbauer and Murphy (2021)

are aware of that has analysed the New Zealand rental market at a regional level is Nunns (2019). His study develops a calibrated spatial equilibrium model to analyse the impact on regional house prices and rents of rising housing demand arising from population growth, credit availability and tax policy settings combined with constrained supply due to zoning rules. His analysis finds regions with more binding supply constraints have experienced larger rent (and house price) increases in response to migration shocks.

Theoretical Framework of the Rental Market

The theoretical framework for our model of rents is similar to the approaches used by Coleman and Scobie (2009) and Watson (2013) for modelling the property market. Whereas those models allow individuals to choose between renting and owner occupying, our model focuses only on the rental segment of the property market. In the model, rents P_r and the number of households that are renting H_r are determined by the demand for and supply of rental services.

We assume in the short-run the supply of rental properties is fixed. In longer term, the supply can adjust as more (or less) people chose to become landlords or more (or fewer) houses are built to rent to tenants

$$S_r = f(P_r, P_H, i, Inf).$$

Higher rents increase the return to landlords, increasing the supply of rental properties. Higher house prices P_H reduce the supply of rental properties as the yield to landlords is reduced. Higher mortgage rates i reduce the supply of rentals as the cost of capital to invest in property rises. Higher inflation reduces the supply of rentals as it increases landlords' expenses.

The demand side of the rental market D_r can be written as

$$D_r = f(P_r, P_H, Y, i, PPD).$$

Higher rents relative to the cost of buying a house, which is captured by house prices and mortgage interest rates, lowers the demand for rental properties. Higher household income Y increases demand for rent by increasing renters' ability to pay. We also include the average number of people per dwelling as influencing the demand for rentals. People per dwelling is often used as an indicator of the demand-supply imbalance in the rental market. However, the theoretical relationship between rents and people per dwelling is not clear cut. An increase in people per dwelling may reflect social factors, such as young people choosing to live with their parents for longer. This would reflect a shift down in the rental demand curve, and put downward pressure on rents. On the other hand, if people chose to live in large households in response to rising rents, this represents a shift along the demand curve, and higher people per dwelling would be positively correlated with rents. The estimated coefficient in our model captures the net impact of both of these channels. As part of our empirical analysis we also examine the impact of splitting people per dwelling into population growth and increases in the number of dwellings to examine whether each factor has a different impact on rent growth.

We combine the supply and demand equations for rental services to solve the reduced form of the model for rents and the number of households that are renting

$$P_r = f(Y, i, PPD, P_H, Inf)$$

and

$$H_r = f(Y, PPD, i, P_H, Inf).$$

Estimating the demand curve and the supply curve separately would allow us to identify the impact of a shock that shifts the demand curve or a supply curve, such as an income shock or a shock in the number of people per dwelling. However, in this study we are primarily interested in using our models to understand the relationship between rents and other macroeconomic variables. As a result, we concentrate on estimating the reduced form of the relationship between rent growth and exogenous factors that impact it. The parameters we estimate are a combination of the separate coefficients on each factor in the demand curve and the supply curve, so the estimated coefficients represent the correlation of rents with each factor rather than necessarily the causal relationships.

Data and Methodology

Data Sources

This section describes the data sources used for our empirical analysis. Based on the availability of time series, our study period is from 2003Q4 to 2022Q2. Rates of change are calculated for all variables: quarterly change is defined as the change from previous quarter; annual change is defined as the change from the same period in the previous year.

Stats NZ's Rental Price Index (RPI)[7] is used at the national level. This is a quality-adjusted price index of rental inflation, derived from the Ministry of Business, Innovation and Employment (MBIE)'s Tenancy Bond data (Stats NZ, 2019; Bentley, 2022a). The 'flow' series is used, which shows the change in rents for new tenancies, except where it is stated that the 'stock' series is used. The latter shows rent changes across all renters, including sitting tenants. Regional council level RPIs are sourced from the Ministry of Housing and Urban Development (HUD). These use the same quality adjustment methodology as Stats NZ's national RPI (HUD, 2022). CoreLogic's House Price Index (HPI) has been sourced from HUD. The index methodology uses a *Sales Price Appraisal Ratio*, a quality adjustment approach widely used in New Zealand for HPIs (ibid). Consumers Price Index less rentals for housing subgroup is a non-standard series available from Stats NZ's infoshare service (table reference: CPI017AA).

Wage measures are sourced from Stats NZ: average weekly earnings from the Quarterly Employment Survey (QES), a sample survey of about 4,000 enterprises; median earnings per job from the quarterly Linked employer-employee data (LEED), created from administrative pay-as-you-earn income tax data (Stats NZ, 2021). QES data is used for national level regressions. Since the survey does not contain regional breakdowns, LEED data is used for regional regressions. Modelled household disposable income time series are sourced from HUD. These use quarterly LEED earnings benchmarked to annual household survey estimates of disposable (after tax)

7 Backcast using longer timeseries from Ministry of Housing and Urban Development prior to Stats NZ RPI, which starts in November 2006.

income (HUD, 2022). Unemployment rates are sourced from Stats NZ's Household Labour Force Survey, a sample survey of about 16,000 households (Stats NZ, 2021).

Stats NZ's national and subnational population estimates are based on Censuses of Population and Dwellings (Stats NZ, 2022a; Stats NZ, 2022b). Intercensal estimates are derived from registered births, deaths, and net migration of residents. Dwelling estimates are based on Censuses of Population and Dwellings, interpolated and extrapolated using Stats NZ's building consents data (see Bentley, 2022b, for a full description of the methodology used).

Mortgage rates are sourced from the Reserve Bank of New Zealand (RBNZ). Two series were explored, both are a simple average of rates advertised to new customers by registered banks. Standard rates are used for the floating mortgage rate (RBNZ, 2023a), whereas the 2-year fixed mortgage rate refers to 'special' rates offered to borrowers who meet certain conditions as specified by the bank (RBNZ, 2023b)[8].

Methodology

For the national-level analysis, we use a simple regression model of rental inflation on the potential determinants, and use Ordinary Least Squares (OLS) to estimate model coefficients.

$$\Delta Rent_t = \sum_{k=1}^{K} \beta_k \, \Delta X_t + \varepsilon_t$$

Where the change in rent $\Delta Rent$ at time t is a function of $k(k = 1, \dots, K)$ variables X.

For national-level analysis, we use the general-to-specific approach to estimate the models and include both the contemporaneous and lagged values of the explanatory variables. We use quarterly data in order to ensure sufficient sample size for the number of variables. However, there are concerns that for rental inflation and several of the explanatory variables, quarterly data may include too much noise and hide the underlying signal. Therefore, we test our model with annual changes instead of quarterly changes. To maintain the sample size but also avoid serial correlation, we include the lag of four instead of one for all variables.

For regional analysis, we use panel regressions to jointly estimate relationships for all regions,

$$\Delta Rent_t = \sum_{k=1}^{K} \beta_k \Delta X_{rt}^{Regional} + \sum_{j=1}^{J} \beta_J \Delta X_t^{National} + \sum_{r=1}^{R-1} \beta_r Z_r + \varepsilon_t,$$

where region r fixed-effects Z_r are estimated for all but one region[9] $R-1$. The structure imposes the same relationships between dependent and independent variables for all regions, but allows for a different constant for each region. We also investigate: (i) the impact of including the interaction of regional fixed-effects with the other variables; and (ii) omitting the region fixed-effects in a pooled regression.

8 Backcast using standard rates prior to the start of special rate series in 2017
9 One region is omitted to identify the model.

Results

National Results

In this section we present the results of the aggregate national level modelling. There are a number of findings about the impact of macroeconomic factors on rent growth.

All else equal, an increase in nominal wages leads directly into a 1-to-1 ratio increase in rents, as shown in all columns of Table 1. The correlation is stronger contemporaneously, but we also find that lagged wage inflation contributes to rental inflation.

In terms of relative supply and demand, a 1 percent increase in people per dwelling leads to a 1.5 per cent increase in rents (Table 1). There is some limited evidence suggesting that the higher the increase in the supply/demand gap, the stronger the wage-rent relationship, due to competition for rental properties allowing landlords to capitalize on renters' wage gains. The interaction term between wage and people per dwelling in table A.2 is positive but not statistically significant.

Across all model specifications in Table 1, the unemployment rate is negatively correlated with rental inflation, i.e an increase in unemployment rate would lead to a decrease in rental inflation. There are two possible explanations for this. Firstly, better job security can encourage people to form new and smaller households, which in turn, increases the demand for rental properties. For example, young adults may be more inclined to leave the family home when unemployment is low. Secondly, a strong labour market and positive economic outlook would ensure tenants' current and future ability to pay, allowing landlords to raise rents.

Table 1: Baseline model

	Rent inflation (nominal, flow)	**Rent inflation** (nominal, flow)	**Rent inflation** (nominal, flow)	**Rent inflation** (nominal, flow)
Predictors	*(1)*	*(2)*	*(3)*	*(4)*
Rent inflation (lagged)	-0.19 (0.12)	-0.19 * (0.11)	-0.17 (0.11)	-0.15 (0.11)
Wage growth	0.54 *** (0.11)	0.56 *** (0.08)	0.54 *** (0.09)	0.54 *** (0.09)
Wage growth (lagged)	0.35 *** (0.12)	0.36 *** (0.11)	0.39 *** (0.12)	0.39 *** (0.12)
People per dwelling	-0.51 (0.78)			
People per dwelling (lagged)	1.97 ** (0.86)	1.73 *** (0.52)	1.63 *** (0.53)	1.51 *** (0.53)
Mortgage rate	0.02 (0.02)			
Mortgage rate (lagged)	0.02 (0.02)	0.03 (0.02)	0.03 (0.02)	
Inflation excluding rents	-0.12 (0.20)			

	Rent inflation (nominal, flow)	**Rent inflation** (nominal, flow)	**Rent inflation** (nominal, flow)	**Rent inflation** (nominal, flow)
Inflation excluding rents (lagged)	0.15 (0.20)	0.14 (0.17)	0.13 (0.17)	0.15 (0.17)
Unemployment rate	0.01 (0.01)			
Unemployment rate (lagged)	-0.02 (0.01)	-0.02 (0.01)	-0.02 (0.01)	-0.02 * (0.01)
House price inflation	-0.01 (0.06)			
House price inflation (lagged)	0.08 (0.07)	0.08 * (0.04)		
Observations	73	73	73	73
R2 / R2 adjusted	0.489 / 0.376	0.470 / 0.404	0.440 / 0.380	0.423 / 0.371

All variables enter the model as percentage change from the previous quarter
** p<0.1 ** p<0.05 *** p<0.01*

We test the robustness of the results by using population growth and dwelling growth separately instead of the change in people per dwelling, as shown in the third column of table 2. The signs and magnitudes of the regression coefficients are as expected. All else equal, an increase in population is positively correlated with rent inflation, while an increase in dwellings is negatively correlated with rental inflation. As the Wald test cannot reject the null hypothesis of equal coefficients, we conclude that the contributions of population and dwellings growth towards rental inflation are equally important, thus combining both into the people per dwelling variable as in the baseline model is plausible.

To check the robustness of the results found with people per dwellings, we also calculate the vacancy rate of rental properties as an alternative indicator of the supply-demand imbalance. We use unit record bond data to create a measure of the time between tenancies at property level as a proxy for the vacancy rate. Column 4 in table 2 show the results from using the vacancy rate instead of people per dwelling to capture the relative supply-demand balance. These results are consistent with the baseline model. An increase in the vacancy rate signals the easing of pressure in the rental market and leads to a decrease in rental inflation.

Another finding is that the sensitivity of rent inflation to mortgage interest rates is positive. However, the sensitivity is quite small and is not always statistically significant across model specifications. There are several possible explanations for the sensitivity of rent inflation to mortgage rates. For example, first home buyers may delay buying due to rising mortgage unaffordability, increasing demand for rental property. Higher financing costs and restricted land markets may limit the supply response to increased demand for rentals when interest rates rise, putting further pressure on rent inflation. There may also be feedback loops in the banking sector, which can limit the supply response of rental properties to lower interest rates. As supply begins to increase relative to demand this will increase vacancy rates and reduce yields for property investors. This may lessen banks' appetite to lend for further rental property development.

Across all specifications in table 1, the impact of general inflation beyond that already captured by the nominal wage coefficient, measured by CPI less rents, is positive but not statistically and economically significant.

Table 2 Alternative measure of relative supply and demand

	Rent inflation (nominal, flow)	**Rent inflation** (nominal, flow)	**Rent inflation** (nominal, flow)	**Rent inflation** (nominal, flow)
Predictors	*(1)*	*(2)*	*(3)*	*(4)*
Wage	0.56 *** (0.08)	0.52 *** (0.08)	0.54 *** (0.09)	0.34 *** (0.09)
Wage (lagged)	0.36 *** (0.11)	0.39 *** (0.11)	0.39 *** (0.12)	0.28 ** (0.12)
People per dwelling (lagged)	1.73 *** (0.52)			
Adults per dwelling (lagged)		1.46 *** (0.46)		
Population growth (lagged)			1.68 *** (0.58)	
Dwellings growth (lagged)			-1.43 (0.97)	
Change in vacant time (lagged)				-0.01 *** (0.00)
Observations	73	73	73	73
R2 / R2 adjusted	0.470 / 0.404	0.445 / 0.385	0.441 / 0.371	0.457 / 0.398

All variables enter the model as percentage change from the previous quarter
** p<0.1 ** p<0.05 *** p<0.01*

In column 3 of table 3, we look at the impact real wage on real rents by deflating both by the CPI excluding rents. All regression coefficients retain their expected signs and significances which suggest that the impact of wages on rents is direct rather than through inflation.

While the flow RPI, created using new tenancies, is a good real-time indicator of rental inflation, the stock measure of RPI is considered a more comprehensive and reliable representation of the situation facing most tenants, who remain in their current rental properties. In column 2 of table 3, we test our model using stock rental inflation as the dependent variable.

The results are consistent with the flow measure. All regression coefficients retain their expected signs and significances. However, the magnitudes are smaller, which may be because rental inflation for existing tenancies is typically less volatile than rental inflation for new tenancies, because existing rents only tend to adjust infrequently.

Table 3: Alternative measure of rental inflation

	Rent inflation (nominal, flow)	**Rent inflation** (nominal, stock)	**Rent inflation** (real, flow)
Predictors	*(1)*	*(2)*	*(3)*
Rent inflation (lagged)	-0.17 (0.11)	0.65 *** (0.10)	-0.27 ** (0.11)
Wage growth	0.54 *** (0.09)	0.09 *** (0.02)	0.62 *** (0.08)
Wage growth (lagged)	0.39 *** (0.12)	0.09 *** (0.03)	0.38 *** (0.12)
People per dwelling (lagged)	1.63 *** (0.53)	0.30 ** (0.14)	1.99 *** (0.53)
Mortgage rate (lagged)	0.03 (0.02)	0.01 (0.00)	0.03 (0.02)
Inflation excluding rents (lagged)	0.13 (0.17)	0.02 (0.04)	
Unemployment rate (lagged)	-0.02 (0.01)	-0.00 (0.00)	-0.01 (0.01)
Observations	73	61	72
R^2 / R^2 adjusted	0.440 / 0.380	0.573 / 0.516	0.560 / 0.520

All variables enter the model as percentage change from the previous quarter
In Model 3, both rents and wages are deflated using CPI excluding rents
** p<0.1 ** p<0.05 *** p<0.01*

Regional Results

In this section we extend the analysis to consider data for the 16 regional council areas of New Zealand. Our motivation for investigating regional rent data is two-fold: (i) to increase the amount of data available for modelling, and hence incorporate additional variation in the data due to region-specific events; and (ii) to understand differences and commonalities between regions.

A disadvantage of using regional data is the increase in statistical volatility due to smaller quantities of data in any given region compared with modelling the country as a whole. This 'noise' lead us to focus on modelling the annual change rather than the quarterly change of rents. To avoid issues with multicollinearity we retained only one observation per year (June).

Simple Panel Regressions, Using Annual Change

A simple model (Table 4: Model R1) with only change in household income and people per dwelling, explains just over 31% of the variation in regional rents. Splitting people per dwelling into separate coefficients (people; dwellings) allows us to see the modelled impacts separately (Model R2), and examination of the statistical significance of the variables shows the relative importance of the explanatory variables, in order of priority: income, population, dwellings.

Household disposable income is a marginally stronger predictor than personal earnings (Model R2: R-squared 29.2%; compared with Model R3: 31.6%). This makes intuitive sense since household income represents the resources of that households collectively have available for rent and other expenditure.

Including some national-level explanatory variables, CPI inflation and mortgage rates (average 2-year fixed special rates), we observe that price inflation looks to already be captured in (nominal) household income growth. Mortgage rates are significant (Models R4 & R5) and improve the R-squared to nearly 35%.

Table 4 – Regional panel regressions (annual change)

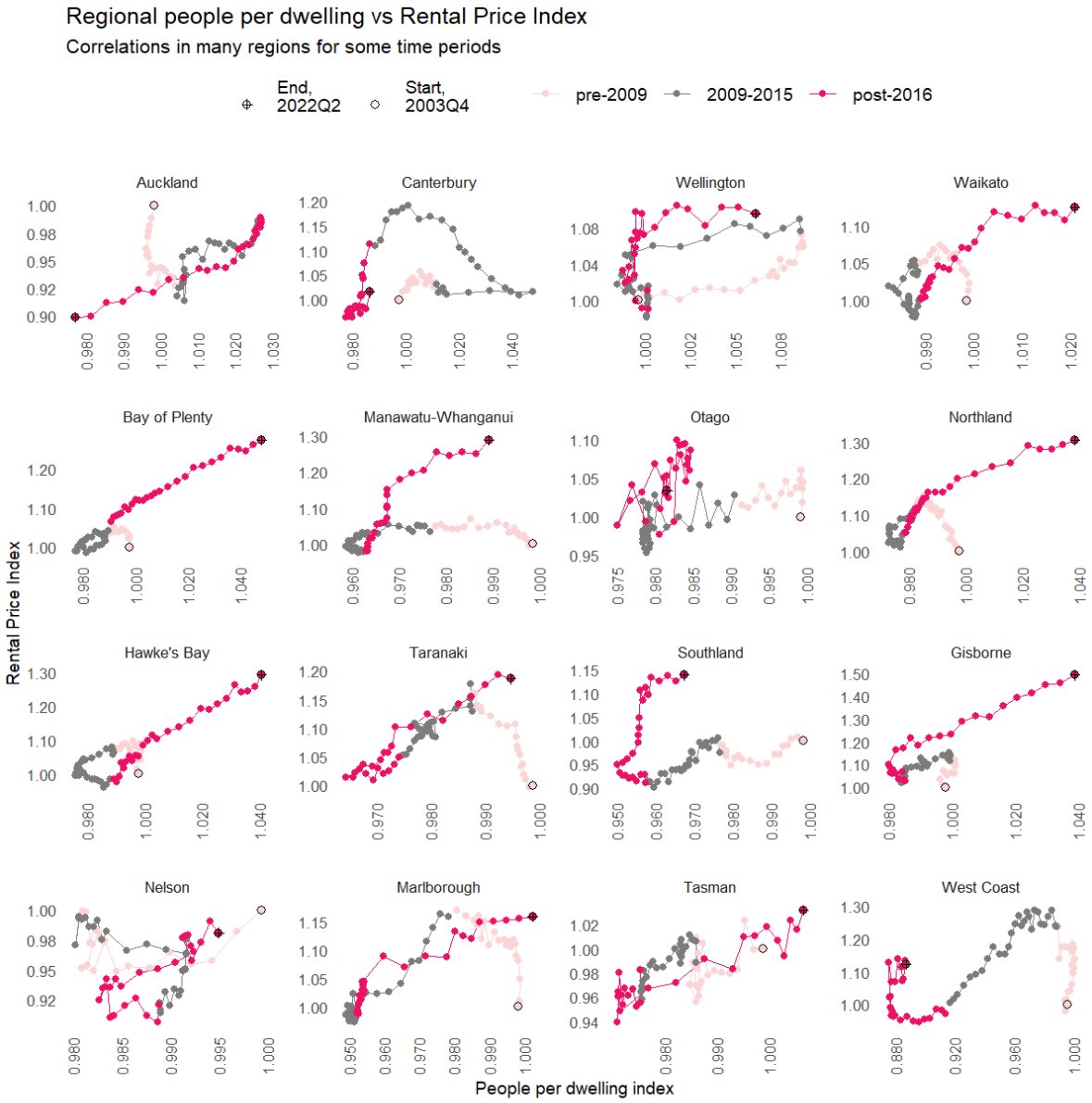
	Model R1	**Model R2**	**Model R3**	**Model R4**	**Model R5**	**Model R6**
Predictors	*Estimates*	*Estimates*	*Estimates*	*Estimates*	*Estimates*	*Estimates*
Household income	1.25 *** (0.12)	1.30 *** (0.14)		1.19 *** (0.14)	1.21 *** (0.14)	1.00 *** (0.13)
People per dwelling	0.80 *** (0.23)					
Population		0.74 ** (0.24)	1.10 *** (0.25)	1.08 *** (0.26)	1.02 *** (0.25)	0.54 * (0.24)
Dwellings		-1.15 * (0.52)	-0.79 (0.51)	-1.44 ** (0.52)	-1.38 ** (0.51)	-2.92 *** (0.50)
Median earnings			1.43 *** (0.16)			
CPI				0.10 (0.15)		
Mortgage rate (2-year fixed)				0.02 ** (0.01)	0.02 *** (0.01)	0.02 ** (0.01)
Period 2009-15						-0.03 *** (0.01)
Period post-2016						0.01 (0.00)
Observations	288	288	288	288	288	288
R2 / R2 adjusted	0.314 / 0.271	0.316 / 0.270	0.292 / 0.245	0.349 / 0.301	0.348 / 0.302	0.492 / 0.452

Predictors are expressed as annual percent change (except dummy variables).
Regional dummies and intercept not shown.
** p<0.05 ** p<0.01 *** p<0.001*

Including Period Dummy Variables

Exploratory data analysis found differences in the relationship between rents and other variables over time. Dummy variables for three periods of similar duration, but differing rates of population growth (pre-2009, 2009-15, post-2016),10 are found to be significant and increase the overall explanatory power (Table 4: Model R6). This suggests compounding factors may be at play during sustained periods of imbalance between the supply and demand of rental properties. Visual inspection of the long run relationship between people per dwelling and rents also illuminates variation in the strength of the relationships over time (Fig. 6).

Figure 6 – Temporal and spatial differences in people-per-dwelling and rent growth correlations



Index = 1 in 2003Q4. Regional indexes have been deflated by national index. Regions ordered largest to smallest rental markets.

Interpretation example: From 2003 to 2009 rents in Auckland increased at a rate below the national average, while changes in people-per-dwelling were in sync with national trends (pink link starting top centre). Over the period 2009-2015, both Auckland rents and people-per-dwelling increased faster than the national average (grey line). After 2016, both rents and people-per-dwelling changes were consistently below national trends (red line, ending 2022Q2 in bottom left).

Source: Authors' calculations

10 Period mean annual population growths: 2002-08 ('pre-2009'): 1.3%; 2009-15: 1.1%; 2016-2022 ('post-2016'): 1.5%

Including Regional Interactions and Pooled Regressions

The models so far have included regional dummy variables, which creates panel fixed-effects: that is, the model allows for an overall higher or lower RPI growth for each region, as a constant factor across all time periods. Alternatively, by including interactions of the regional dummies with other variables (Table 5: Model R7) the model allows for the estimation of region-specific coefficients for other explanatory variables. Conceptually, this is equivalent to running separate regression models for each region. Such models may be most appropriate if we are interested in the best coefficient estimates for a particular region.

Conversely, if we are attempting to understand the general relationship between the factors in the model and RPI growth we can remove the regional dummy variables and run a pooled regression (Model R8). In this case we are using the regional data to increase the number of data points available for modelling, without a need to understand the impact region-specific effects. We found that the pooled regression coefficients are similar to those in the panel regressions suggesting the key drivers are robust to local circumstances in different regions.

Table 5 – Regional interactions and pooled regressions (annual change)

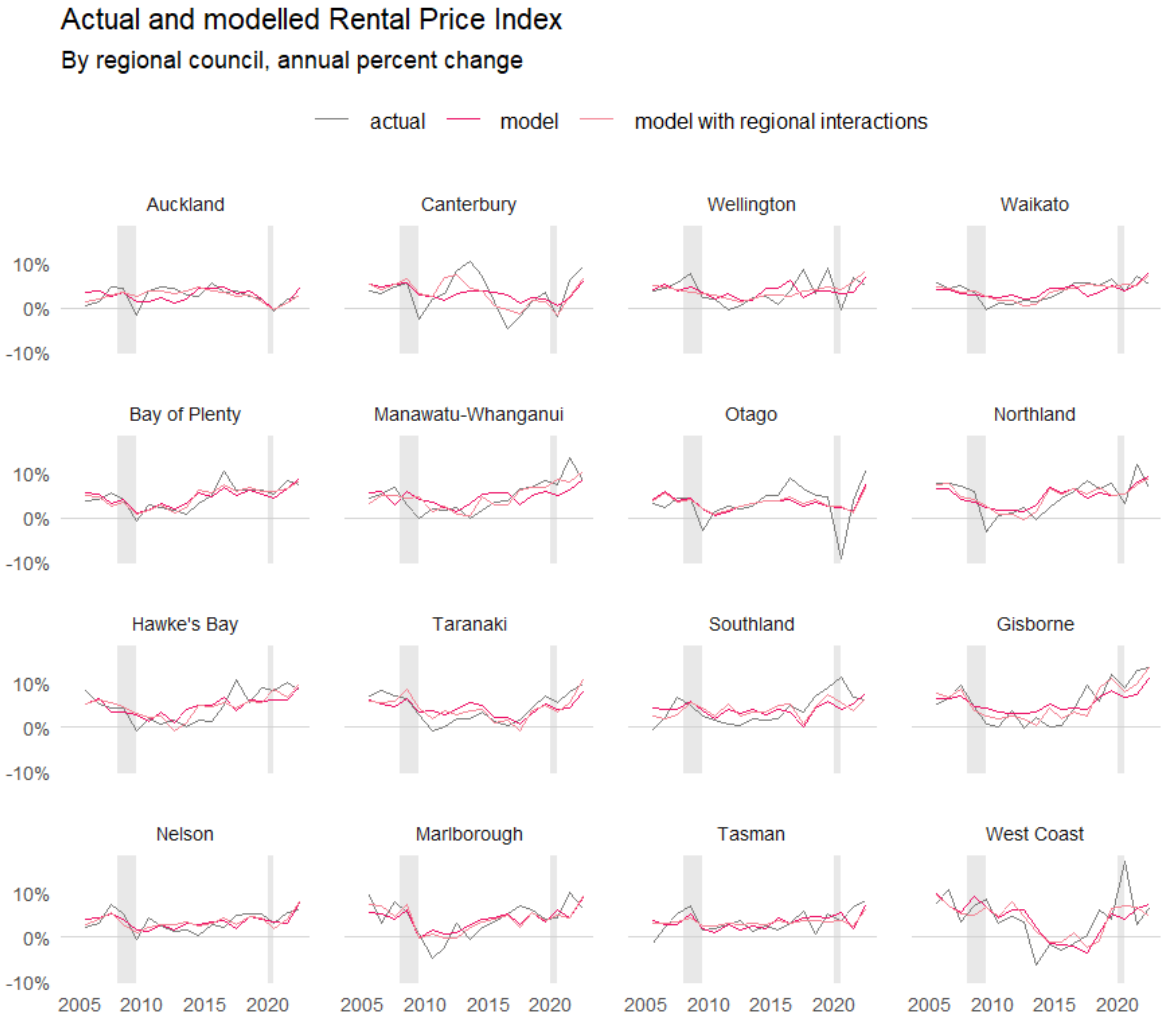
	Model R5	**Model R7 (interactions)**	**Model R8 (pooled)**
Predictors	*Estimates*	*Estimates*	*Estimates*
Household income	1.21 *** (0.14)	0.55 (0.76)	1.26 *** (0.13)
Population	1.02 *** (0.25)	0.15 (0.91)	1.00 *** (0.23)
Dwellings	-1.38 ** (0.51)	-2.13 (1.32)	-1.92 *** (0.41)
Mortgage rate (2-year fixed)	0.02 *** (0.01)	0.02 *** (0.01)	0.02 *** (0.01)
Observations	288	288	288
R2 / R2 adjusted	0.348 / 0.302	0.488 / 0.342	0.320 / 0.311

Predictors are expressed as annual percent change (except dummy variables).
Regional dummies and intercept not shown.
** p<0.05 ** p<0.01 *** p<0.001*

Including regional interactions markedly improves model fit (R-squared increases from 34.8% to 48.8%), suggesting a variety of unobserved region-specific factors affect the magnitude of impacts on rent inflation (Table 5; Fig. 7). These differences may include local planning restrictions, infrastructure, and capacity of the local construction industry to respond to changes in demand.

Including house prices as an explanatory variable (Appendix Table B1) is significant and has a positive relationship. This could indicate that many of the unobserved region-specific factors act on the housing market as a whole, rather than just the rental market. It may also reflect less incentive to make properties available for rent in a rising market. Conversely, in a falling market time to sell would be expected to increase which may lead to an increase in the rental stock, and therefore downward pressure on prices.

Figure 7 – Model fit, with and without regional interactions



Regions ordered largest to smallest rental markets
Panel regression: predictors - income, mortgage rate, population, and dwelling growth

Source: Authors' calculations

In Model R2 we found evidence that contemporaneous population changes have a stronger impact on rents than contemporaneous dwelling changes. Investigating the impact of including lagged variables (Appendix Table B2) we found dwelling changes also impact rents with one– and two–year lags. This supports a view that a capacity-constrained construction industry takes time to respond to very strong population growth.

As a robustness check on the annual change rates used in the regional regressions reported, we investigated using rates of change over longer time horizons. The models were found to fit the data better over longer time horizons (Appendix Table B3). This may be due to (i) less noise in the series, and/or (ii) that the explanatory variables affect rents over a longer time horizon.

Conclusion

Recent data innovations have facilitated the empirical research presented in this paper. We have focused our study on rent growth for new tenancies (a leading indicator of inflation for all tenancies). A new tenancy ('flow') Rental Price Index (RPI) has been produced monthly for all of New Zealand, since February 2019 (Stats NZ, 2019). The new index methodology, designed for use with granular administrative rent microdata, has also enable the construction of region-level RPIs underpinning our regional analysis.

The primary finding from our study is that income growth and relative supply and demand of dwellings have been the key drivers of rents in New Zealand over the past 20 years. The impact of mortgage rates has been smaller, and not statistically significant at the national level. Mortgage rates were statistically significant in the regional regressions, but with small coefficients. These empirical findings are consistent with the Housing Technical Working Group's (HTWG, 2022) conclusion that restrictions on the supply of land for urban use mean that financial factors, such as interest rates, will have a greater impact on house prices than rents. These results provide evidence to support another Housing Technical Working Group conclusion that the New Zealand land market in aggregate lies somewhere on a spectrum between completely abundant and completely restricted supply, with variation in the degree of restrictiveness across the regions. In theory, in a completely restricted land supply, interest rate changes should have no impact on rents.

This research is part of a broader programme of work being undertaken by the Housing Technical Working Group, which includes: developing a suite of direct indicators to help quantify the magnitude of land supply restrictions in New Zealand; and developing a better understanding of the implications of New Zealand's tax system on the housing market.

We expect that the analysis presented in this paper will be a useful starting point for a variety of housing market related policy applications, such as: understanding the likely impact of changes in incomes, dwelling supply, and/or population growth on rents; and to build macroeconomic forecasts of rents (and by implication aid house price forecasts). Further research could include a look at the drivers of rents at the lower end of the market and the relationship with measures of unmet housing need. Low-income households often have little discretion over their level of housing expenditure meaning rent is often the first call on income. In this light, we hope improving our understanding of factors that drive rents will be useful for developing public policy.

References

Bentley, A. (2021). Sticky Rents and the Affordability of Rentals for Housing in New Zealand. *New Zealand Population Review*, 47, pp.145-170. Population Association of New Zealand.

Bentley, A. (2022a). Rentals for housing: A property fixed-effects estimator of inflation from administrative data. *Journal of Official Statistics*, 38(1), pp.187-211. https://doi.org/10.2478/jos-2022-0009

Bentley, A. (2022b). Timely Rental Price Indices for thin markets: Revisiting a chained property fixed-effects estimator. Paper presented at the 17th meeting of the Ottawa Group on Price Indices, Rome, 7-10 June 2022. Available at www.ottawagroup.org

Coleman, A and Scobie, G (2009) "A Simple Model of Housing Rental and Ownership with Policy Simulations", *Working Paper 09/05*, New Zealand Treasury

Dias, D. and Duarte, J (2019) "Monetary Policy, Housing Rents, and Inflation Dynamics", *International Finance Discussion Paper Number 1248*, Board of Governors of the Federal Reserve System

Duca, J, Muellbauer, J and Murphy, A (2016) "How Mortgage Finance Reform Could Affect Housing", *American Economic Review: Papers and Proceedings*, 106(5), pp.620-624

Duca, J, Muellbauer, J and Murphy, A (2021) "What Drives House Price Cycles? International Experience and Policy Issues", *Journal of Economic Literature*, 59(3), pp.773-864

Housing Technical Working Group (2022). Assessment of the Housing System: with insights from the Hamilton-Waikato Area. August 2022. Available at Assessment of the Housing System: with insights from the Hamilton-Waikato Area (treasury.govt.nz)

Howard, G and Liebersohn, J (2021) "Why is the rent so darn high? The role of growing demand to live in housing-supply-inelastic cities", *Journal of Urban Economics*, Vol.124 pp.1-14

Ministry of Housing and Urban Development (2022). Change in housing affordability indicators: Concepts, sources, and methods. November 2022. Available at www.hud.govt.nz

New Zealand Treasury (2022). Trends in Wellbeing in Aotearoa New Zealand: 2000-2020. Background Paper for the 2022 Wellbeing Report. April 2022. Available from https://www.treasury.govt.nz

Nunns, P. (2019) "The Causes and Economic Consequences of Rising Regional House Prices in New Zealand", *Working Paper No.005*, Centre for Applied Research in Economics, University of Auckland

Reserve Bank of New Zealand (2023a). New residential mortgage standard interest rates (B20). May 2023. Available at www.rbnz.govt.nz

Reserve Bank of New Zealand (2023b). New residential mortgage special interest rates (B21). May 2023. Available at www.rbnz.govt.nz

Saunders, T and Tulip, P (2019) "A Model of the Australian Housing Market", *Research Discussion Paper RDP 2019-01*, Reserve Bank of Australia

Stats NZ (2019). New methodology for rental prices in the CPI. February 2019. Available at www.stats.govt.nz

Stats NZ (2020). Housing in Aotearoa: 2020. December 2020. Available at www.stats.govt.nz

Stats NZ (2021). User guide for Stats NZ's employment measures. March 2021. Available at www.stats.govt.nz

Stats NZ (2022a). National population estimates: At 30 June 2022. August 2022. Available at www.stats.govt.nz

Stats NZ (2022b). Subnational population estimates: At 30 June 2022 (provisional). October 2022. Available at www.stats.govt.nz

Watson, E (2013) "A Closer Look at some of the Supply and Demand Factors Influencing Residential Property Markets", *Analytical Note 2013/11*, Reserve Bank of New Zealand

Appendix – Additional Regression Results

National Results

Table A.1: Results using annual change

	Annual rent inflation (nominal, flow)
Predictors	*(1)*
Rent inflation (t-4)	-0.54 *** (0.14)
Wage	0.62 *** (0.10)
Wage (t-4)	0.75 *** (0.14)
People per dwelling (t-4)	1.18 *** (0.38)
Floating mortgage rate (t-4)	0.01 (0.02)
Inflation excluding rents (t-4)	-0.37 *** (0.12)
Unemployment rate (t-4)	-0.03 ** (0.01)
Observations	67
R^2 / R^2 adjusted	0.508 / 0.449

All variables enter the model as change from the same quarter last year
** p<0.1 ** p<0.05 *** p<0.01*

Table A.2: Interaction between wage growth and relative supply and demand

	Quarterly rent inflation (nominal, flow)
Predictors	*(1)*
Wage (rolling two-period average)	0.98 *** (0.15)
People per dwelling (lagged)	1.57 *** (0.54)
Wage x People per dwelling	0.04 (0.62)
Observations	73
R^2 / R^2 adjusted	0.430 / 0.368

All variables enter the model as percentage change from the previous quarter.
** p<0.1 ** p<0.05 *** p<0.01*

Regional Results

Table B1 - Panel regressions, including house prices (annual change)

	Model R5	Model R9	Model R10	Model R11	Model R12
Predictors	*Estimates*	*Estimates*	*Estimates*	*Estimates*	*Estimates*
Household income	1.21 *** (0.14)	1.00 *** (0.13)	0.94 *** (0.13)	0.85 *** (0.13)	0.82 *** (0.13)
Population	1.02 *** (0.25)	0.54 * (0.24)	0.53 * (0.21)	0.81 *** (0.22)	0.57 * (0.23)
Dwellings	-1.38 ** (0.51)	-2.92 *** (0.50)	-1.21 ** (0.46)	-1.44 ** (0.45)	-2.50 *** (0.48)
Mortgage rate (2-year fixed)	0.02 *** (0.01)	0.02 ** (0.01)		0.02 *** (0.01)	0.02 *** (0.01)
Period 2009-15		-0.03 *** (0.01)			-0.02 *** (0.01)
Period post-2016		0.01 (0.00)			0.01 (0.00)
House Price Index			0.15 *** (0.02)	0.15 *** (0.02)	0.10 *** (0.02)
Observations	288	288	288	288	288
R2 / R2 adjusted	0.348 / 0.302	0.492 / 0.452	0.456 / 0.417	0.489 / 0.451	0.542 / 0.504

Predictors are expressed as annual percent change (except dummy variables).
Regional dummies and intercept not shown.
** p<0.05 ** p<0.01 *** p<0.001*

Table B2 - Panel regressions with lagged variables (annual change)

	Model R5	Model R13	Model R14	Model R15	Model R16	Model R17	Model R18
Predictors	*Estimates*	*Estimates*	*Estimates*	*Estimates*	*Estimates*	*Estimates*	*Estimates*
Household income	1.21 *** (0.14)			1.11 *** (0.15)	1.13 *** (0.14)	1.26 *** (0.13)	0.86 *** (0.13)
Population	1.02 *** (0.25)			0.98 ** (0.30)	0.97 *** (0.24)	0.84 *** (0.23)	0.84 *** (0.22)
Dwellings	-1.38 ** (0.51)			-1.71 ** (0.56)	-1.64 ** (0.53)	-1.68 ** (0.52)	-1.62 *** (0.47)
Mortgage rate (2-year fixed)	0.02 *** (0.01)			0.02 (0.02)	0.02 *** (0.01)		0.02 *** (0.01)
Household income (1-year lagged)		0.27 (0.15)		0.08 (0.15)			
Population (1-year lagged)		-0.10 (0.27)		0.03 (0.31)			
Dwellings (1-year lagged)		1.87 ** (0.57)		1.06 (0.54)	1.17 * (0.49)		
Mortgage rate (1-year lagged)		0.02 ** (0.01)		-0.00 (0.02)			
Household income (2-year lagged)			0.21 (0.15)				
Population (2-year lagged)			0.15 (0.28)				
Dwellings (2-year lagged)			1.45 * (0.58)				
Mortgage rate (2-year lagged)			0.02 ** (0.01)				
Rental Price Index (1-year lagged)						0.24 *** (0.05)	0.11 * (0.05)
House Price Index							0.14 *** (0.02)
Observations	288	287	286	287	287	287	287
R2 / R2 adjusted	0.348 / 0.302	0.188 / 0.130	0.155 / 0.094	0.363 / 0.308	0.362 / 0.315	0.367 / 0.322	0.498 / 0.458

Predictors are expressed as annual percent change (except dummy variables).
Regional dummies and intercept not shown.
** p<0.05 ** p<0.01 *** p<0.001*

Table B3 - Panel regressions with longer time horizons

	1 year	2 year	3 year	4 year
Predictors	*Estimates*	*Estimates*	*Estimates*	*Estimates*
Household income	1.21 *** (0.14)	1.66 *** (0.18)	1.56 *** (0.23)	1.48 *** (0.26)
Population	1.02 *** (0.25)	0.84 *** (0.30)	1.25 *** (0.40)	1.34 *** (0.47)
Dwellings	-1.38 *** (0.51)	-1.43 ** (0.65)	-1.01 (0.78)	-1.07 (1.08)
Observations	288	144	96	64
R^2 / R^2 adjusted	0.348 / 0.302	0.489 / 0.415	0.517 / 0.404	0.559 / 0.383

Predictors are expressed as percent change over specified time horizon (except dummy variables).
Regional dummies and intercept not shown
** p<0.1 ** p<0.05 *** p<0.01*