New Zealand Housing Prices: Analysing Inflation Immunity Amid COVID-19 Pandemic and Economic Recession

Dan HE

A dissertation submitted to Auckland University of Technology in partial fulfilment of the requirements for the degree of Master of Business (MBus)

2024

School of Business

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where explicitly defined in the acknowledgements), nor used artificial intelligence tools or generative artificial intelligence tools (unless it is clearly stated, and referenced, along with the purpose of use), nor material which to a substantial extent has been submitted for the award of any other degree or diploma of a university or other institution of higher learning.

Table of Contents

Table of Tables

Table of Graphs

Abstract

Purpose - This study examines the long-term inflation-hedging capability of the New Zealand housing market during the economic recession and the COVID-19 pandemic.

Design/methodology/approach – The ARDL bounds testing model and Granger causality tests are employed to investigate whether housing serves as an effective long-term hedge against inflation and recession. This analysis utilizes quarterly data on the House Price Index (HPI), Consumer Price Index (CPI), and Gross Domestic Product (GDP) from 2007Q1 to 2023Q4.

Key findings - A significant long-term cointegration relationship was identified between house prices and inflation. However, the causality tests indicate that causality runs from inflation to housing and vice versa, suggesting the house prices comove with inflation changes. Therefore, housing fails to serve as an effective hedging tool against inflation during recession and the pandemic.

Practical implications/limitations – This study highlights the importance for policymakers to maintain stable housing prices and sufficient housing supply to foster social harmony, economic stability, and prosperity. Nonetheless, varying empirical findings demonstrate the evolving role of housing as an inflation hedge over time, suggesting that continued observation of this relationship in future research is valuable.

Originality/value - This study offers a new perspective on the inflation-hedging effectiveness of the housing market during the pandemic and recession and enhances the existing body of knowledge regarding the inflation-hedging attributes of housing in New Zealand. Such knowledge is crucial for policymakers, economists, and market participants seeking to understand and navigate the evolving landscape of New Zealand's housing market during these challenging times.

Abbreviations:

AI (The Actual Inflation)

Augmented Dickey-Fuller Test (ADF)

Auto Regressive Distributed Lag Bounds Test (ARDL)

CPI (Consumer Price Index)

EG (The Economic Growth)

GDP (Gross Domestic Product)

GFC (Global Financial Crisis)

HPI (House Price Index)

OCR (The Official Cash Rate)

OECD (Organisation for Economic Co-operation and Development)

RBNZ (Reserve Bank of New Zealand)

SPAR (Sales Price Appraisal Ratio)

VECM (Vector Error Correct Model)

Chapter 1. Introduction

1.1 Background

The crucial role that housing plays in modern economies is not limited to providing stability and shelter, it has evolved into an integral component of people's investment portfolios, providing opportunities for capital appreciation and wealth accumulation. In New Zealand, the housing market has experienced substantial growth alongside marked fluctuations in recent decades. By 2021, the total combined value of land and housing in New Zealand, including both rental and owner-occupied properties, stood at approximately $1.5 trillion, which is nearly five times the magnitude of New Zealand's annual gross domestic product (Carvalho, Baker & Farquharson, 2022). Likewise, housing represents not only over half of all domestic household assets, but also entails significant exposure for financial institutions from a balance-sheet standpoint, with nearly two-thirds of all domestic bank lending consisting of mortgage debt (Carvalho, Baker & Farquharson, 2022). As a result, New Zealand's housing market is among the most indebted countries within the OECD (Steenkamp, 2010), with households carrying significantly high levels of home loan debt (Fraser & McAlevey, 2015). Given the substantial exposure of households and financial institutions to the housing market, fluctuations in house prices strongly influence both the social and economic landscape of New Zealand. Vice versa, the housing market is also highly sensitive to economic volatility. In particular, when economic risks disrupt the housing market and reduce property values, the resulting decline in household wealth and increase in mortgage payment burden can potentially pose challenges to economic stability.

The recent global economic downturn, compounded by the detrimental impacts of the Covid-19 pandemic, has multiplied the economic risks on a worldwide scale. New Zealand has also suffered from a series of shocks including the housing market volatility and high inflation squeezing people's living space, etc. More specially, the house prices in New Zealand skyrocketed by 22.1% year-on-year in early 2021, followed by a sharp fall by 17.5% in 2023 due to economic conditions shifted (REINZ, 2023). It suggests that New Zealand's housing is not sustainable, making them susceptible to a possible correction and/or sluggish growth in the future (Carvalho, Baker & Farquharson, 2022). The inflation rate, on the other hand, soared to an average of 7.2% in 2022 (NZ Herald, 2023). Meanwhile, GDP performance showed a knock-on effect, with four consecutive quarters of negative annual growth since 2020Q2, demonstrating that the economy has entered a recession (StatsNZ, 2024). During economic recessions, asset devaluation and financial market volatility can severely erode the wealth of households and investors, prompting them to seek safe assets to preserve their wealth. However, identifying truly safe assets during a recession remains a challenging puzzle. Previous studies have demonstrated that investment assets such as short-term bills, long-term bonds, stocks, and certain infrastructure investments are not effective hedges against inflation from a long-run perspective (see examples on Gunasekarage, Power and Zhou, 2008; Wurstbauer & Schafers, 2015). Therefore, the heightened volatility raises a critical question: what about houses, can New Zealand's housing market serve as an effective hedge against inflation during economic uncertainty?

1.2 Motivation for this research

The motivation for this study stems from the necessity of analysing the above critical question of housing's role in mitigating inflationary risk. And recent global events provide real-world opportunities and fresh data to examine how effectively the housing market can counter inflation in New Zealand. This study particularly examines two key factors — inflationary risk and economic growth, and their direct impacts on house prices. Inflationary risk has been the focal point of social and media scrutiny and discourse since the pandemic. The adverse effects of high inflation encompass currency devaluation, reducing purchasing power, and making borrowing more expensive as interest rates rise to slow the economy. These result in increasing debt costs for households and businesses, adding financial strain and potentially leading to a cost-of-living crisis.

Historically, New Zealand confronted a significant challenge with inflationary pressure. From the late 1970s to the late 1980s, the inflation rate exceeded 10% as oil prices shocks. As a reaction, the Reserve Bank of New Zealand (RBNZ) Act of 1989 was enacted, tasking the RBNZ with the responsibility of stabilising inflation within the range of 0 to 3% (Gunasekarage, Power & Zhou, 2008). After the millennium, the inflation rate fluctuated between 1.5% and 4% until the Global Financial Crisis (GFC) hit this country, causing it to rise to 5.1% in the third quarter of 2008. Recently, the lasting impact of the pandemic has driven New Zealand's inflation rate to new highs with a peak of 7.3% in the third quarter of 2022. In response to sustained high inflation, the RBNZ has raised the Official Cash Rate (OCR) 12 times, from 0.25% in March 2020, to 5.5% as of the latest review in July 2024 (RBNZ, 2024). According to the RBNZ data, these OCR hikes have effectively contained inflation, with the inflation rate dropping from its peak of 7.3% to 3.3% in June 2024. However, fluctuations of inflation inevitably amplify the financial strain on household expenditure and reduce their wealth, making it challenging to identify low-risk and value-preserving assets.

Intuitively, people expect return rates generated from assets to outpace actual inflation rates. Otherwise, underperforming assets cannot be regarded effective hedges. Housing is traditionally seen as a reliable "safe haven" asset for hedging against inflation, and has demonstrated a consistent long-term increase in value. However, this assumption requires empirical validation, especially in New Zealand's current economic circumstance, where inflation has surged beyond historical norms due to events such as the Covid-19 pandemic. Moreover, while housing prices display long-term growth, does this increase effectively counter inflation from an econometric perspective? On the other hand, high inflation often accompanies economic downturns, and given that the housing market is considered as a backbone for an economy, could fluctuations in housing prices impact boarder economic performance from a long-term perspective? The answers to these questions will validate this perception, and also shed new light for households and policymakers.

1.3 Research gaps and dissertation structure

Within academic literature, a considerable amount of recent research has concentrated on examining fluctuations in housing prices in New Zealand. Notably, two recent studies have specifically analysed the New Zealand housing market during periods of turbulence. The author Yiu (2021) linked the prosperity of the New Zealand housing market during the Covid-19 pandemic to the negative real interest rate and illustrated its statistically significant impact on the growth rate of New Zealand house prices (Yiu, 2021). In Yiu's (2023) second study, it demonstrated the subsequent New Zealand housing market collapse to the notable shift in RBNZ monetary policy. In particular, the monetary policy introduced a historically low OCR in 2020, followed by its increase to the highest level in 13-year time by 2022. In response, this monetary policy caused a drastic downturn in the annual growth rate of the house price index since July 2022 (REINZ, 2022). Yiu (2021) argues that the New Zealand housing boom was spurred by the negative real interest rate, while Yiu (2023) attributes the subsequent New Zealand housing bust to elevated mortgage lending rates. These two studies primarily seek to pinpoint the key factor driving the fluctuations in the New Zealand housing market during the pandemic, with a particular emphasis regarding the effects of monetary policy shocks on housing market volatility. However, the primary objective of these studies did not center around assessing whether housing has the capability to hedge against inflation across uncertain times.

In the New Zealand context, Gunasekarage, Power and Zhou (2008) had the first study on the long-run effect of inflation on real estate returns in New Zealand over the time frame of 1979 to 2003. This paper has found a robust and enduring relationship between the returns of different real estate properties and inflation. Furthermore, the causality analysis indicates that the causes of the actual inflation are independent of the returns of all categories of properties. They thus concluded that all categories of real estate assets offer effective hedging against inflation over time. However, their study has some limitations, mainly because it covers the time frame from 1979 to 2003. This period predates the Global Financial Crisis (GFC) that resulted from the subprime mortgage crisis in the U.S. and extends two decades into the present. Clearly, the GFC significantly affected the New Zealand housing market and the economy starting in late 2007. Since 2019, the Covid-19 pandemic has also caused a series of unprecedented economic challenges, including house price fluctuations, recession, and sustained high inflation rates. As a relatively small economy in the world, the New Zealand housing market exhibits unique characteristics and is highly responsive to both global and domestic economic fluctuations. It remains uncertain whether the housing market reacts consistently to inflation movements. Although previous empirical findings have been mixed and have not reached a consensus, it is crucial to investigate this socially relevant question. Doing so would effectively address existing research gaps and carry significant implications for both academic inquiry and practical real-world applications.

This paper is structured as follows: Section 2 discusses the relevant literature review, Section 3 outlines the data sources and collection information, Section 4 elaborates the applied methodology and empirical findings, and Section 5 is the conclusion of this study and recommends policy implications and limitations for further research.

Chapter 2. Literature Review

2.1 Real estate and inflation rate

As a multifaceted asset, housing fulfils the essential need for shelter while also serving as a valuable investment, providing both security and potential financial returns. Because of its critically dual role in economic and social development, housing has become an indispensable pillar that holds significant implications for financial investment and the whole economy. The puzzle of whether housing can be an effective hedge against inflation has attracted attention of numerous academics and practitioners across various economies over time. The rationale behind this concept comes from the belief that housing possesses certain inherent characteristics that make it a potentially valuable inflationary buffer. The strands of proper investigations have predominantly focused on short-term and long-term inflation-hedging attributes of different real estate classes. Specifically, from the seminal article of Fama and Schwert (1977), a number of studies primarily utilised ordinary least squares (OLS) regression to analyse the short-term relationship of the inflation and real estate (see examples from Chu & Sing, 2004; Ekemode, 2021; Fama & Schwert, 1977; Ekemode, 2021, etc.). The OLS methodology is aimed to examine the short-term inflation hedging efficacy by analysing the statistical significance and magnitude of the coefficient associated with inflation in the regression model. While in order to capture the long-run dynamics and causality relationship, researchers have employed nonlinear analytical methodologies such as the Auto Regressive Distributed Lag (ARDL), Cointegration test and more to evidence their hypotheses (see examples from Ekemode, 2021; Gunasekarage, Power & Zhou, 2008; Sahoo, 2022, etc.). The employed nonlinear models captured the dynamics, lagged effects, and potential equilibrium association between inflation and housing assets over long-term time periods, while causality tests were commonly used to detect the direction and significance of causality between the two variables. However, the previous studies' empirical results have produced varying conclusions, failing to establish a consensus regarding the relationship between housing and inflation.

The pioneering study from Fama and Schwert (1977) investigated the short-term effectiveness of U.S. residential real estate as a hedge against Inflation, comparing it to other U.S. financial assets from 1953 to 1971. They employed the OLS regression model and concluded that the residential housing showed its complete hedging ability to unexpected and expected Inflation. From their study, the U.S. equities exhibited a negative relationship with Inflation, while the treasury bills and government bonds only hedged against expected Inflation. Since this seminal study, a significant body of empirical research has been dedicated to examining the inflation-hedging capacity of real estate assets across diverse economies and time periods. For instance, Fogler et al. (1985) affirmed that the U.S. flats showed superior performance against Inflation in their journal, and in Rubens et al. (1989)'s study, they argued that the U.S. residential housing assets could hedge Inflation in comparison to other chosen financial assets over the time period from 1960 to 1986. Stevenson (1999) investigated the relationship between residential housing and Inflation in the U.K. The analysis revealed that residential dwellings could effectively hedge Inflation based on the observed data from 1983 to 1995. Likewise, the inflation-hedging ability of commercial and residential properties in Canada exhibited significant results by using data from 1985 to 1993 (Newell, 1995), whereas Sing and Low (2000) affirmed that industrial property in Singapore outperformed Inflation in comparison to other financial investments. In similar studies on developing economies, Ekemode (2021) had a fresh look at the residential housing investment as a hedge against Inflation in Nigeria; the author reinvestigated both short-term and long-term inflation-hedging ability of three residential property types using regional data from 1999 to 2018. The results argued that residential property assets, including the types of bungalows, blocks of flats, and detached houses, all offered significant protection against actual, expected, and unexpected Inflation in the short term. However, the long-term analysis showed mixed results; some of the property types cannot effectively hedge against Inflation. In another examination focused on house prices in China, the researchers analysed panel databases of 35 key cities over the time period of 1996 to 2010; an asymmetric association was found between two variables, and the impact of Inflation on house prices showed more significance in comparison to that of house prices on Inflation, and the house prices demonstrated a considerable ability to outperform Inflation, which revealed that housing prices demonstrated greater sensitivity to Inflation compared to the reverse relationship, where Inflation impacted housing prices. (Kuang & Liu, 2015).

Recent studies have been placing significant emphasis on investigating the long-term inflation hedging effectiveness of the housing market. For example, Korkmaz (2019) utilised Konya Causality test methodology to examine the causal relationship between housing price index (HPI) and consumer price index (CPI) in Turkey, using data from 26 regions from 2010 to 2019. The results from the author's analysis indicated that 8 out of 26 observed regions having the causality relationship. Further examination indicated that the direction of causality varied across the observed regions. Some regions showed housing prices impacting inflation, while the others demonstrated an opposite outcome. Sahoo (2022) presented some Indian evidence in regard to the long-term effect of housing prices movements on major macroeconomic indicators. Based on the analysis of quarterly data over the period of 2008 to 2017, the test affirmed the long-term relationship of housing prices with economic growth and inflation, and the empirical result suggested housing prices did not impact economic growth but positively affected inflation. Therefore, the author emphasised the necessity of taking actions to discourage housing prices bubbles in Indian.

Gunasekarage, Power and Zhou (2008) conducted their initial investigation on the long-run effect of inflation on asset returns over the time frame of 1979- 2003 in New Zealand. The authors sought to identify ideal candidates that can serve as good hedges against inflation by comparing the return of real estate to those of other financial assets exchanged in New Zealand markets. This study considered four key classes of real estate in the examination, namely residential real estate, farming buildings, industrial and commercial real estate, along with the other financial assets include long-term government bonds, short-term government bills, and the New Zealand stock market as the counterpart. The empirical findings demonstrated that all classes of real estate assets possessed the ability to effectively hedge inflation in the long term. Conversely, the other selected financial assets were not the proper candidates that provided long-run inflation-hedging capacity. Moreover, inflation is independent of the price fluctuation of real estate assets. While real estate prices may be impacted by inflation, the causes of inflation are unrelated to the specific movements in the real estate market. The article reached the conclusion that New Zealand real estate outperformed the other financial assets when comparing their inflation-hedging effectiveness, and it further suggested that the substantial risk of investment portfolios can be mitigated by investing in diversified financial assets including New Zealand real estate. The limitation of this study, however, primarily pertains to the observation time frame of 1979- 2003, which predated the Global Financial Crisis that originated from subprime mortgage crisis in the U.S. The devastating impacts of the Global Financial Crisis hit the New Zealand housing market from the end of 2007 and led to housing price plummeting to approximately 10% in 2009. Meanwhile, the inflation rate climbed rapidly, and the sustained negative GDP indicated New Zealand had entered into an economic recession (RBNZ, 2023). It is sceptical about the conclusion that this study established since the analysis did not take into account the severe impacts of phenomenal Global Financial Crisis on the New Zealand economy as well as the local housing market. It is plausible to hypothesize that the relationship between housing prices volatility and major economic variables, such as inflation rate, could be dynamically shifted under newly provoked circumstances, for instance, Black Swan event Covid-19 pandemic, economic recession, sustained high inflation rates, etc. In a nutshell, it is worthwhile to study the dynamic relationship between the housing market and the other economic variables in light of the most recent events.

The empirical findings presented thus far by previous studies exhibit a lack of consensus regarding the relationship between the real estate market and inflation. In terms of short-run relationship, including the pioneer research from Fama and Schwert (1977), a number of researchers affirmed that the real estate properties were possessing significant inflation-hedging effectiveness (for example, Spellman, 1981, Fogler et al., 1985, , Lee, 2013, etc.), yet others argued no significant outcomes found in their studies (for example, Chu & Sing, 2004, Ma & Liu, 2008, etc.). Placing emphasis on the long-term correlation, mixed conclusions also have yielded on the foregoing findings. Inglesi-Lotz and Gupta (2013) found long-run cointegration linkage between housing prices and inflation in South Africa, and Gunasekarage, Power and Zhou (2008) suggested a strong relationship between inflation and all types of real estate assets in the first New Zealand study. On the other hand, Zhou and Clements (2010) did not find long-term equilibrium relationship between inflation and Chinese property investment. And in another Hong Kong study, the authors found no correlation between real estate and inflation (Ganesan & Chiang, 1998). Considering the crucial role that housing industry plays in the whole economy, it is central for policy makers, first home buyers, investors, and academia to undertake timely and up-to-date investigation in order to explore the dynamic and intricate association between real estate and inflation rate.

2.2 Housing and the Pandemic

The global spread of the Covid-19 virus in late 2019 initiated a pandemic crisis with significant socioeconomic impacts. This crisis has led to a substantial loss of lives, border closures, travel restrictions, stringent lockdowns, and isolation and quarantine measures, resulting in substantial economic recessions. Despite the significant impact on sectors such as tourism and retail, the housing market has displayed an unexpected trend during the Pandemic. Contrary to expectations, the housing market has shown an upward trajectory amidst the Pandemic. Data from Knight Frank's Global House Price Index (HPI) for 2020 to 2021 indicates that more than 90% of the 56 sampled countries experienced increased housing prices. Remarkably, even the Five Eye countries, namely the United States, United Kingdom, Canada, Australia, and New Zealand indicated housing price appreciation during the Covid-19 pandemic (Yiu, 2021). This phenomenon challenges conventional wisdom and highlights the unique dynamics in the housing market during this crisis. Despite the widespread economic downturn, the housing market has displayed resilience and thrived in certain regions.

Notably, the U.S. as the world's largest economy, the housing prices generally rose during the pandemic (Li & Zhang, 2021). Data analysis demonstrated a year-on-year percentage change in the housing price index (HPI) of 3.7%, 3.6%, 4.9%, and 5.3% from Q2 of 2020 to Q1 of 2021 (Yiu, 2021). Further research from Li and Zhang (2021), focusing on an analysis of 2,856 counties in the U.S., found that the impact of the Pandemic on housing price movements varied across different cities and areas. They identified specific housing price growth hot spots, predominantly in rural areas, small towns, and affordable suburbs with lower population density and living costs. The authors concluded that the U.S. housing boom during the pandemic was driven by historically low mortgage rates and a significant imbalance between housing supply and demand, marked by reduced supply and heightened demand.

Similar patterns were observed in European countries. For example, in the U.K., the year-on-year percentage change in the House Price Index (HPI) recorded increases of 1.5%, 6%, and 7.6% from the quarter 3 of 2020 to the quarter 1 of 2021 (Yiu, 2021). In Turkey, an event study based on regional analysis of residential real estate prices documented predominantly positive abnormal returns (ARs) during the pandemic. The study argued that the loosening of credit conditions had a more significant impact on ARs of residential property prices than interest rate sensitivity during the COVID-19 period (Kaynak, Ekinci & Kaya, 2021).

Yang and Zhou (2022) investigated housing market movements in China during the pandemic and found a significant positive increase in housing prices in the Yangtze River Delta region following the outbreak of COVID-19. They concluded that this rise reflected the urgent need for housing to accommodate family members during the pandemic for more effective home quarantine.

Yiu (2021) employed panel regression analysis to examine the impact of real interest rates on housing prices during the COVID-19 pandemic in New Zealand, Australia, the European Union, the U.K., and the U.S. The empirical results from these five housing markets demonstrated that real interest rates had a negative and significant effect on housing prices during the observed period. Consequently, the author concluded that low and even negative real interest rates played a crucial role in driving the housing price boom across the Five Eyes countries during the COVID-19 pandemic.

Numerous prior studies have extensively examined the relationships between the New Zealand housing market and various explanatory variables, seeking to identify the factors influencing this market and understand the dynamics driving its fluctuations. Fraser and McAlevey (2015), for instance, investigated the impacts of standard macroeconomic shocks on national and regional house prices in New Zealand using a two-part SVAR model. They found that GDP and interest rate shocks significantly influenced both national and city-level housing prices over a five-year horizon, with the magnitude of price responses varying across different cities.

In terms of social conditions, Chong (2020) explored the effects of mortgage interest rates and immigration on housing price changes in New Zealand, arguing that increased immigration and lower mortgage rates significantly drive up housing prices. From a financial perspective, Nunns (2021) highlighted those divergences in New Zealand house prices stem from rising demand for housing coupled with supply constraints. Shi, Young, and Hargreaves (2010) examined the dynamics of house trading volumes and prices using a VECM model, finding that these two factors are cointegrated.

Additionally, cross-country studies have investigated the impact of monetary policies on housing price movements. For example, Cerutti, Dagher, and Dell'Ariccia (2017) analysed data from over 50 countries, including New Zealand, and demonstrated a dynamic and closely linked relationship between house-price booms and household credit in housing finance. Previous studies have examined the impact of this specific event on housing prices from multiple perspectives, considering various social and economic factors within the housing market. However, these studies have not specifically focused on investigating whether housing can serve as a hedge against high inflation during the pandemic. This presents an academic gap that warrants further investigation.

Chapter 3. Data

This study investigates the long-term impact of house price volatility on the actual inflation (AI) and economic growth (EG) in New Zealand. The quarterly data of House Price Index (HPI), the Consumer Price Index (CPI) and the Gross Domestic Product (GDP) at Reserve Bank of New Zealand (RBNZ) from the quarter one in 2007 to the quarter four in 2023 will be utilised to assess the relationship between house price volatility, inflation, and economic growth over the observation time period. The HPI measures the movement in house prices for local council areas throughout New Zealand, providing an indicator of capital growth and how prices are trending in an area. The HPI employs the SPAR (sales price appraisal ratio) index methodology to incorporate recent sales performance to evaluate how market movements affect all properties within an area (RBNZ, 2024). By computing average property values in each area, it facilitates comparisons with previous periods, providing a more stable and reflective measure of property value change over time than methods using sales prices in a given period. The HPI is commonly utilised in the previous studies as the proxy for monitoring and measuring the New Zealand housing price changes (e.g. Chong, 2020; Yiu, 2021; Sahoo, 2022).

The Consumer Price Index (CPI) is based on the Laspeyres index method, gauges the average price change of a fixed basket of goods and services consumed by surveyed households, compared to a base year (RBNZ, 2024). This study calculates the quarterly percentage change in the CPI serves as a proxy for actual inflation as the equation stated below. In this equation (1), AI represents the actual rate of inflation, while CPI_t denotes the Consumer Price Index at the end of quarter t.

$$AI_t = \frac{CPI_t - CPI_{t-1}}{CPI_{t-1}} \quad (1)$$

The Gross Domestic Product (GDP) signifies the income generated from production within New Zealand, encompassing earnings from both domestic production activities conducted by New Zealanders and those by foreign firms operating within the country (RBNZ, 2024). The quarterly percentage change in GDP is used as a proxy of economic growth. The equation (2) is as follows, where EG is the rate of economic growth and GDP_t denotes the Gross Domestic Product at the end of quarter t.

$$EG_t = \frac{GDP_t - GDP_{t-1}}{GDP_{t-1}} \qquad (2)$$

In terms of the dependent variable House Price Index (HPI), the original time series data will be utilised in the ARDL bounds testing models. In addition, the natural logarithm of its quarterly ratio at time t and time t-1 will be calculated to perform the Granger causality test. As equation (3) stated below, dlog $(HPI)_t$ denotes the natural logarithm of the ratio for HPI.

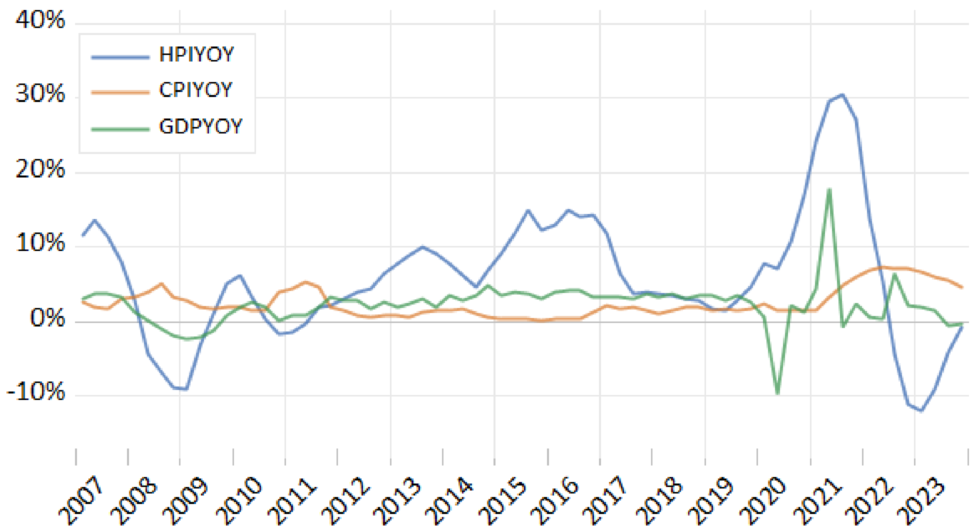
$$\text{dlog}\ (HPI)_t = \text{Ln}\left(\frac{HPI_t}{HPI_{t-1}}\right) \qquad (3)$$

Table 1 presents descriptive statistics of the variables analysed throughout the observed time period of this study. HPI denotes House Price Index in New Zealand, while EG and AI represent the quarterly percentage change of GDP and CPI. Based on the information detailed in Table 1 below, the observation period is from 2007 quarter one to 2023 quarter four, and the number of observations is 67 quarters. The maximum and minimum values of HPI are 3920 and 1383. While the maximum and minimum values for quarterly percentage changes in the actual inflation and economic growth are 2.318% and -0.509, and 15.191% and -10.322%, respectively. In addition, the values of Mean, Median, Standard deviation, Skewness and Kurtosis are also computed and presented in Table 1.

Table 1. Descriptive statistics

Variable	HPI	EG%	AI%
Mean	2216	0.723	0.637
Median	2045	0.685	0.479
Maximum	3920	15.191	2.318
Minimum	1383	-10.322	-0.509
Std. Dev.	774	4.739	0.645
Skewness	0.695	0.202	0.651
Kurtosis	2.221	3.076	3.072
Obs. 67		2007Q1 – 2023Q4	

To provide a more comprehensive view of the trends in house prices, inflation, and GDP, the year-on-year percentage changes for each of these variables over the observation period are calculated and displayed in Graph 1. Although the New Zealand housing market demonstrated substantial momentum in the post-2000 period (Murphy, 2011), it has encountered significant turbulence since 2007. Based on Graph 1, the blue line representing the House Price Index indicates that house prices in New Zealand have historically experienced three notable declines. The first crash occurred from 2007 to the end of 2008, attributed to the contagion effects of the Global Finance Crisis. The second drop spanned from 2017 to the end of 2019, driven by the onset of the Covid-19 pandemic. The most substantial decline transpired from 2021 to the end of 2023, impacted by the enduring effects of the pandemic, a subsequent global economic recession, etc. The HPI shows a notable 22.1% year-on-year increase in housing prices in the first quarter of 2021, followed by a drastic decline of 17.5% from its peak by the second quarter of 2023. The rollercoaster-like fluctuations in housing prices reflect the vulnerability of the housing market and its high sensitivity to various economic risks. On the other hand, there were two significant peaks in HPI occurred in 2015Q3 (15.02%), and throughout 2021 (Q1 24.14%, Q2 29.64%, Q3 30.47% and Q4 27.23%). The yellow line representing the CPI demonstrates a relatively stable trend, with three notable peaks observed at 5.02% in 2008Q3, 5.36% in 2011Q2 and 7.3% in 2022Q3, respectively. The first peak was attributed to the impact of GFC, while the third one was due to the pandemic. The inflation peak in 2011 was artificially elevated due to the goods and services tax increase in 2010 (Ryan, 2024). The year-on-year change in GDP indicates the severe recession in 2020Q2 (-9.7%) due to the long-term pandemic lockdown in New Zealand, followed by a swift recovery with a growth of 17.8% in 2021Q2. However, GDP subsequently endured continued negative growth throughout 2023Q3 and Q4, indicating the lingering effects of the post-Covid recession. It is noteworthy that the co-movements in HPI, CPI, and GDP from Graph 1. do not consistently align in the same direction, sometimes move along the same trend but sometimes display a reverse trend. Notably, the most significant fluctuations were observed during the pandemic period, underscoring the complexity of their interrelationships. Therefore, conducting a comprehensive analysis of their current long-term dynamics is crucial for comprehending their interconnections and their implications for the economy.



Graph 1. year-on-year change of HPI (HPIYOY), year-on-year change of CPI (CPIYOY), and year-on-year change of GDP (GDPYOY) of New Zealand, 2007Q1 – 2023Q4.

Sources: RBNZ (2024)

Chapter 4. Methodology and Empirical findings

This study utilises the Auto Regressive Distributed Lag (ARDL) bounds test to explore the long-term relationships among house price index (HPI), real inflation rate (AI), and economic growth (EG) in New Zealand. The ARDL model was extensively utilised by numerous academics in their studies to analyse the long-term relationship from an econometric perspective (see examples from Ekemode, 2021; Gunasekarage, Power & Zhou, 2008; Sahoo, 2022, etc.). In addition, this study employs the Granger Causality test to assess the causal dynamics between the paired variables. In this paper, the results of ARDL models demonstrate whether the price movements in New Zealand's housing market have a long-term co-integration relationship with the actual inflation and economic growth. Meanwhile, the Granger Causality tests determine whether housing price fluctuations granger cause the actual inflation or the economic growth, or vice versa. In other words, are their Granger causality relationships independent, or are they mutually influenced? The combined empirical results of these two methods address the critical question of whether housing in New Zealand can serve as a hedge against high inflation during the economic turbulence. Theoretically, if housing in New Zealand effectively work as a hedge to encounter inflation, its price movements should remain independent of inflationary causes. Likewise, if housing in New Zealand can be proved as an effective hedge during periods of negative economic growth, then the price fluctuations in the housing market should not influence the New Zealand's economic growth, regardless of whether it is positive or negative.

This paper follows the subsequent methodological steps to achieve the study objective: 1. Assessing the time series data of each variable to determine the stationarity and order of integration, 2. Assessing the direction of relationships among the regressors via correlation tests, 3. Utilising the ARDL bounds testing model to investigate the relationship of cointegration in the long run between selected variables, 4. Investigating the causal relationship between dependent and independent variables through Pairwise Granger Causality tests.

4.1 Stationarity and unit-root testing

The Augmented Dickey-Fuller (1981) test (ADF) is utilised to conduct stationary tests for each individual time series data. This test examines the Augmented Dickey-Fuller (ADF) function for a data time series, stated as per below:

$$\Delta\alpha_t = C + \beta\alpha_{t-1} + \delta \sum_{i=1}^{m} \Delta\alpha_{t-i} + \varepsilon_t \tag{4}$$

where $\alpha_t$represents the quarterly time series data in t, $\Delta\alpha_t = (\alpha_t - \alpha_{t-1})$, a purely random white noise error term is denoted as ε_t. Based on the ADF test approach, the estimated t-value of the coefficient of α_{t-1} in the above equation (4) adheres the T-tau distribution, as well as the null hypothesis being β = 0. This study computes the equation (4) above for each of the selected time series data. As the information shown Table 2 per below, the t-statistics are computed for each data series of HPI, economic growth and actual inflation rate in terms of 'with constant' and 'with constant and trend', respectively. In addition, the t-statistics are also calculated for HPI at the first difference due to its insignificance at level. Upon analysis, it is found that the t-values for the data series of actual inflation rates and economic growth are statistically significant at level. Therefore, the null hypothesis of a unit root (β = 0) can be rejected, indicating that the actual inflation rates and economic growth follow a stationary process. However, when examining the time series data of HPI at level, the null hypothesis cannot be rejected. Since the ADF t-statistics are less than the critical value of 3.4794, the original data series is not stationary. The first difference of HPI was then tested, the tau statistic is significantly different from zero. These findings suggest that the actual inflation rates and economic growth are stationary at I(0), while the HPI is integrated of order one (I(1)), meaning HPI requires first-order differencing to achieve stationarity.

Table 2. Unit Root test result – ADF test

Level I(0)	With Constant	Probability	95% Critical ADF Value	With Constant and Trend	Probability	95% Critical ADF Value
HPI	0.8502	0.9942	-2.9069	-3.1519	0.1033	-3.4794
AI	-3.1657**	0.0267	-2.9069	-5.0739*	0.0005	-3.4794
EG	-15.5648*	0.0000	-2.9069	-15.9044*	0.0001	-3.4794

1^{ST} Difference I(1)	With Constant	Probability	95% Critical ADF Value	With Constant and Trend	Probability	95% Critical ADF Value
HPI	-5.0881*	0.0001	-2.9069	-5.3438*	0.0002	-3.4794

Note: * indicates statistical significance at the 1 % level, and ** signifies statistical significance at the 5 % level. ADF, Augmented Dickey–Fuller; HPI, Housing Price Index; AI, Actual inflation; EG, economic growth.

4.2 Correlation test

The correlation test is employed to assess how robust the relationship exists between the time series data. The correlation coefficient ranges from +1 to -1, indicating whether the relationship is positive or negative. A negative correlation coefficient indicates the two data series move in opposite directions, while a positive coefficient indicates that the variables trend in the same direction. If the correlation coefficient is close to zero, it suggests a very weak relationship between the variables. Conversely, a correlation coefficient closer to one signifies a strong relationship between them.

Therefore, testing correlation coefficient is to quantify the robustness and direction of the correlation between variables. Based on Table 3 shown below, both AI and EG have got a positive correlation with HPI. However, only AI shows a statistically significant correlation with HPI at 1% level, while EG does not indicate a statistically significant relationship for the observation time period. Therefore, it is evident that the movements of HPI are positively related to the changes in AI. On the other hand, EG and AI have a negative correlation. It is plausible that high inflation is often accompanied by cost-of-living pressures, high unemployment and subdued business activity, all of which can negatively impact economic growth. However, this correlation is not statistically significant over the observation period.

Table 3. Correlation test result

Sample: 2007Q2- 2023Q4

Observation: 67

Variable	HPI	AI	EG
HPI	1		
AI	0.4258* (0.0003)	1	
EG	0.0360 (0.7726)	-0.0780 (0.5304)	1

Note: * indicates statistical significance at the 1 % level. HPI, Housing Price Index; AI, Actual inflation; EG, economic growth.

4.3 Auto Regressive Distributed Lag (ARDL) bounds test

4.3.1 ARDL bounds testing model design

Since Pesaran, Shin, and Smith (2001) had developed the Auto Regressive Distributed Lag (ARDL) bounds test model, it was then widely employed in academic circles within economics and finance to investigate enduring relationships over time (e.g. Zhou & Clement, 2010; Sahoo, 2022, etc.). The ARDL bounds testing procedure enables researchers to draw conclusive insights even when it is uncertain whether the chosen variables data are integrated of order zero or one (I(0) or I (1)) (Pesaran, Shin, & Smith, 2001). According to Shahbaz, Kumar, & Nasir's study (2013), various variables data may require different optimal lag structures in an ARDL model. The ARDL model employs the Akaike Information Criterion (AIC) to determine the optimal lag length for variables, known for its lower mean prediction error, making it superior to other criteria. In order to investigate the long-term relationship between housing prices with the actual inflation rates and economic growth in the New Zealand market, this research designs three ARDL bounds testing models to examine. As the equations (5), (6) and (7) structured as below:

$$\Delta HPI_t = C + \sum_{i=1}^{n} \beta_i \Delta HPI_{t-i} + \sum_{i=1}^{p} \Upsilon_i \Delta AI_{t-i} + \delta_1 HPI_{t-1} + \delta_2 AI_{t-1} + \varepsilon_t \quad (5)$$

$$\Delta HPI_t = C + \sum_{i=1}^{n} \beta_i \Delta HPI_{t-i} + \sum_{i=1}^{q} \sigma_i \Delta EG_{t-i} + \delta_1 HPI_{t-1} + \delta_2 EG_{t-1} + \varepsilon_t \quad (6)$$

$$\Delta HPI_t = C + \sum_{i=1}^{n} \beta_i \Delta HPI_{t-i} + \sum_{i=1}^{p} \Upsilon_i \Delta AI_{t-i} + \sum_{i=1}^{q} \sigma_i \Delta EG_{t-i} + \delta_1 HPI_{t-1} + \delta_2 AI_{t-1} + \delta_3 EG_{t-1} + \varepsilon_t \quad (7)$$

Where HPI, EG and AI are representing Housing Price Index, economic growth and the actual inflation rate, respectively. Δ denotes the first-difference operator, and c is drift component. While n, p, q are optimal lag orders for different variables, but they might not necessarily be the same lag length. β_i, Υ_i and σ_i are the short-term coefficients, whereas δ_1, δ_2 and δ_3 denote the long-term coefficients, respectively. The error term ε_t denotes a white noise vector component that is serially independent or uncorrelated. The null hypothesis of no cointegration between the selected variables represents H_0: $\delta_1 = \delta_2 = \delta_3 = 0$; H_1: $\delta_1 \neq \delta_2 \neq \delta_3 \neq 0$. The results of F-statistics for joint coefficient significance will be utilised to assess this hypothesis. Due to the non-standard asymptotic distribution of this F-statistic, the test statistics are compared against the critical value bounds (Pesaran, Shin & Smith, 2001). More Specially, the estimated F-statistic will be compared to the lower and upper critical bounds, the H_0 null hypothesis of no co-integrating relationship cannot be rejected when F-statistic shows below the lower bound. If the F-statistic falls between upper and lower bounds, the analysis is inconclusive. However, the F-statistic shows beyond the upper bounds, then we can reject the null hypothesis, which means that the long-term equilibrium relationships exist between the analysed variables.

If the hypothesis that New Zealand's housing can work as an effective hedge against inflation is not rejected, the ARDL models' empirical results must confirm a long-term relationship between HPI and AI. Likewise, a long-term relationship between HPI and EG should be evident as well if supported by the ARDL models' empirical results. If a long-term cointegration relationship is confirmed, the Granger Causality test can further determine whether the variables are mutually related or independently related. Only an independent relationship can be considered indicative of a hedging effect. Therefore, the three ARDL bounds testing models (5), (6) and (7) will firstly examine the long-term relationships between the House Price Index and actual inflation rates, the House Price Index and economic growth, and the combined impacts of actual inflation rates and economic growth on House Price Index. respectively. In this context, AI and EG are both integrated of order zero , I(0), while HPI is integrated of order one, I(1) based on the unit root testing results, the ARDL model can thus be appropriately applied to these variables. In addition, these models are examined over two separate time periods, which are from 2007 to 2023, and from 2019 to 2023, respectively. Testing the former time frame provides a more comprehensive view of the events that occurred during this observation period, and their impacts on house prices in New Zealand, while the latter time frame focuses more on the Covid-19 pandemic and its effects. By analysing these variables over two distinct time frames, enables us to better capture and compare these relationships across different economic cycles. Especially in response to significant economic events like the Global Financial Crisis and the Covid-19 pandemic.

4.3.2 ARDL bounds testing model and empirical results

Table 4 represents the ARDL bounds testing results for models (5) and (6) across two distinct observation periods: 2007 to 2023, and 2019 to 2023. Table 5 displays the results for model (7). Optimal lag lengths for each variable are calculated using the Akaike Information Criterion (AIC). When comparing F-statistics from each model to the critical values of upper bounds, if the F-statistics value exceeds the upper bounds critical value, the null hypothesis of no cointegration can be rejected. In simpler terms, there is a long-term relationship between the independent and dependent variables. Therefore, the null hypothesis of no cointegration can be rejected for models (5) and (6) over the time period of 2007Q1 and 2023Q4. The F-statistic from model (5) is larger than the upper bound critical values at 1% significance level, and the F-statistic from model (6) exceeds the bound critical values at 5% significance level. On the other hand, when the time frame shortens to the Covid-19 pandemic period, the null hypothesis cannot be rejected for model (6) as its F-statistic is even smaller than the lower bound critical values. However, the F-statistic from model (5) shows significant at 5% level over the timeframe 2019 to 2023. Furthermore, the aggregated ARDL model (7) is to evaluate the combined long-term impact of the actual inflation and economic growth on house prices. The F-statistic for the time frame from 2007 to 2023 is significant at the 5% level, whereas the F-statistic for the period from 2019 to 2023 is significant at the 10% level from the model (7).

The empirical results provide compelling evidence of the long-term equilibrium relationship between New Zealand house prices and inflation since 2007 and also throughout the Covid-19 pandemic. At this stage, it is plausible hypothesized that inflation has a prolonged and direct impact on price movements in New Zealand’s housing market, or vice versa. On the other hand, the economic growth has shown a long-term equilibrium relationship with the housing market in New Zealand from 2007 to 2023, while such long-term relationship cannot be validated during the Covid-19 pandemic period. That is to say, economic growth has only shown a long-term impact on New Zealand’s housing prices in the period from 2007 to 2023. However, it is plausible to propose that the empirical finding of New Zealand’s housing prices showing insensitivity to economic growth rates during the Covid-19 pandemic period, as observed in ARDL Model (6), could be attributed to two factors: firstly, the limited sample size of observation in Model (6) from 2019 to 2023, coupled with the response lag of the housing market to economic turbulence, so the observation period fails to capture this volatility lag. Secondly, housing price fluctuations tend to respond more strongly to inflation than to economic recession, which might suggest inflation is a more dominant factor influencing New Zealand’s housing market compared to economic growth. These two hypothesized factors are revealed in the next sections: the ARDL cumulative dynamic multiplier shock evolution tracks the magnitude and decay of the dependent variable’s cumulative responses to changes in the independent variable(s), whereas the Granger Causality tests identify whether the direction of their causality relationship is unidirectional or bidirectional, which further explains if housing can be regarded as an effective hedge against inflation.

Table 4. ARDL Bounds Testing Models (5) & (6)

Time period: 2007Q1 – 2023Q4

Panel A: Results of ARDL cointegration tests			
Model	*Lags*	*F-statistics*	*Obs.*
(5)	ARDL(2,2)	7.4987	65
(6)	ARDL(1,0)	5.9786	66
Panel B: Lower and upper bounds critical values			
Sample size	*10%*	*5%*	*1%*
60	[3.127 3.650]	[3.803 4.363]	[5.383 6.033]
65	[3.143 3.623]	[3.787 4.343]	[5.350 6.017]
70	[3.120 3.623]	[3.780 4.327]	[5.157 5.957]
Asymptotic	[3.020 3.510]	[3.620 4.160]	[4.940 5.580]

Time period: 2019Q1 – 2023Q4

Panel A: Results of ARDL cointegration tests			
Model	*Lags*	*F-statistics*	*Obs.*
(5)	ARDL(2,3)	5.3186	20
(6)	ARDL(1,0)	3.2166	20
Panel B: Lower and upper bounds critical values			
Sample size	*10%*	*5%*	*1%*
30	[3.303 3.797]	[4.090 4.663]	[6.027 6.670]
Asymptotic	[3.020 3.510]	[3.620 4.160]	[4.940 5.580]

Table 5. ARDL Bounds Testing Model (7)

Time period: 2007Q1 – 2023Q4

Panel A: Results of ARDL cointegration tests			
Model	*Lags*	*F-statistics*	*Obs.*
(7)	ARDL(6,2,6)	4.6970	61
Panel B: Lower and upper bounds critical values			
Sample size	*10%*	*5%*	*1%*
60	[2.738 3.465]	[3.288 4.070]	[4.558 5.590]
65	[2.740 3.455]	[3.285 4.070]	[4.538 5.475]
Asymptotic	[2.630 3.350]	[3.100 3.870]	[4.130 5.000]

Time period: 2019Q1 – 2023Q4

Panel A: Results of ARDL cointegration tests			
Model	*Lags*	*F-statistics*	*Obs.*
(7)	ARDL(4,3,3)	3.9145	20
Panel B: Lower and upper bounds critical values			
Sample size	*10%*	*5%*	*1%*
30	[2.915 3.695]	[3.538 4.428]	[5.155 6.265]
Asymptotic	[2.630 3.350]	[3.100 3.870]	[4.130 5.000]

4.3.3 The ARDL Cumulative Dynamic Multiplier Shock Evolution

The ARDL Cumulative Dynamic Multiplier quantifies the overall impact of a one-unit change in an independent variable on a dependent variable over time, and it captures the cumulative response of the dependent variable to changes in the independent variable(s) within the ARDL model framework (Shin & Greenwood-Nimmo, 2014). This measurement is especially valuable for comprehending term shocks and dynamics between the variables. Examining the cumulative dynamic multiplier allows researchers to ascertain how long it takes for the dependent variable to fully adjust to changes in the independent variable(s) and the magnitude of this adjustment. As shown in Graph 2 and Graph 3, the vertical axis (Y-Axis) represents the magnitude of cumulative response of the dependent variables – Actual inflation (AI) and Economic growth (EG) on the independent variable – House price index (HPI); whereas the horizontal Axis (X-Axis) represents the time horizon that the shock of cumulative response decays.

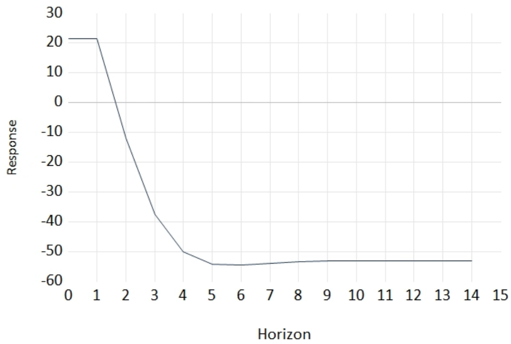
In Graph 2, the top two line plots (a) and (b) depict the impact of AI on HPI for ARDL Model (5), while the bottom two graphs (c) and (d) illustrate the impact of EG on HPI for ARDL Model (6). It is evident that HPI has a strong and positive initial shock response to AI, with both reaching peak levels at time horizon 1 across two distinct time frames – 2007 to 2023, and 2019 to 2023. That suggests that a one-unit positive change in AI will lead HPI to go up by the shock amount. Especially during the Covid-19 pandemic time period, HPI responses increasingly strongly to changes in AI. However, the decay observed in the plots demonstrates that over time, the impact of a shock to HPI diminishes dramatically until it eventually dissipates, possibly turning negative. On the other hand, the pattern in line plots (c) and (d) indicates a distinct trend in HPI's response to EG. Although the magnitude of response is smaller compared to that of AI to HPI, the line curve exhibits an increasing upward trend, with the magnitude of response strengthening over time horizon and no signs of decay. Given the dominant role of the housing industry in the New Zealand economy, it is logical to observe a sustained increase in positive shock trends over time in the cumulative Dynamic Multiplier graphs. Based on plots (c) and (d), the magnitude of housing prices responses to economic growth from 2019 to 2023 is larger than that of the 2007 to 2023 period, suggesting a relatively stronger response of New Zealand’s housing market to economic growth during the pandemic period. Although the ARDL results indicate that the relationship between HPI and EG from 2019 to 2023 is not statistically significant, line plot (c) still confirms a long-term positive relationship between these two variables. Moreover, the distinct patterns of AI and EG to HPI suggest that the housing prices in New Zealand are sensitively responsive to inflation but decaying rapidly. Since the housing market is slowly and gradually responding to the shock of economic growth, this supports the hypothesized factors outlined in the Section 4.3.2, suggesting that there might be a lag effect in the housing market response to economic turbulence. As a result, the observation period fails to capture this volatility lag. Moreover, housing price fluctuations tend to respond more strongly to inflation than to economic volatility.

Graph 3 displays the combined impact of two independent variables on HPI. It is evident that a positive shock initially impacts HPI in response to AI, but this effect diminishes over time. However, the response of HPI to shocks in New Zealand’s economic growth is weak, observed consistently from 2007 to 2023 and during the pandemic period. It is noteworthy that the magnitude of the shock from actual inflation rates on housing prices is notably greater than that from economic growth on it. The shock of magnitudes indicates a strong and dynamic response from the movements of actual inflation to house prices. In term of the duration of positive shocks, however, show a relatively rapid decline from the observation time frames.

Graph 2. Cumulative Dynamic Multiplier for Equation (5) & (6)

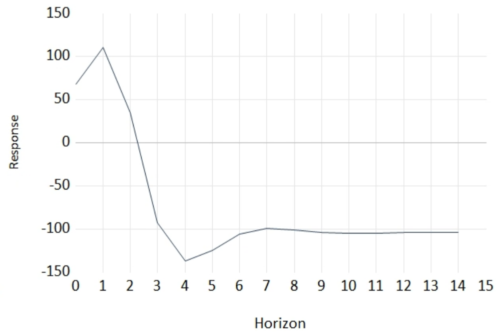
a). Cumulative Dynamic Multiplier:

AI on HPI Shock Evolution 2007Q1-2023Q4



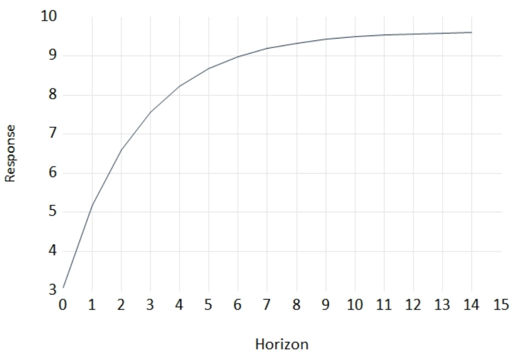
b). Cumulative Dynamic Multiplier:

AI on HPI Shock Evolution 2019Q1-2023Q4



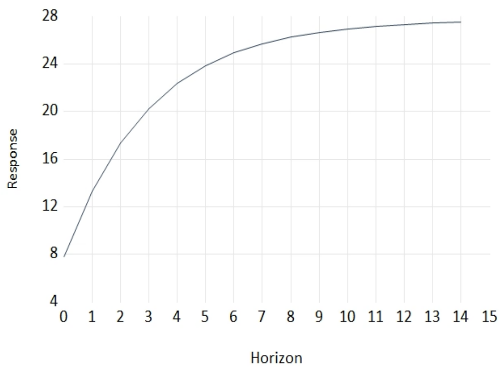
c). Cumulative Dynamic Multiplier:

EG on HPI Shock Evolution 2007Q1-2023Q4



d). Cumulative Dynamic Multiplier:

EG on HPI Shock Evolution 2019Q1-2023Q4

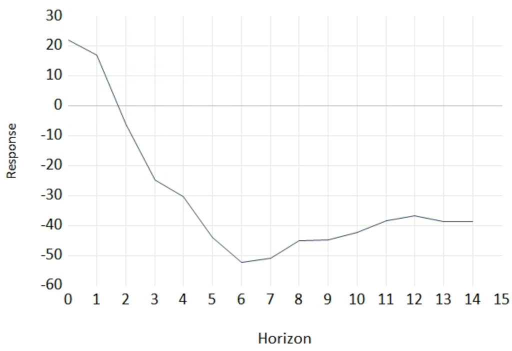


(Note: Cumulative Dynamic Multiplier Graphs for the ARDL Bounds testing from Model (5) and (6))

Graph 3. Cumulative Dynamic Multiplier for Equation(7)

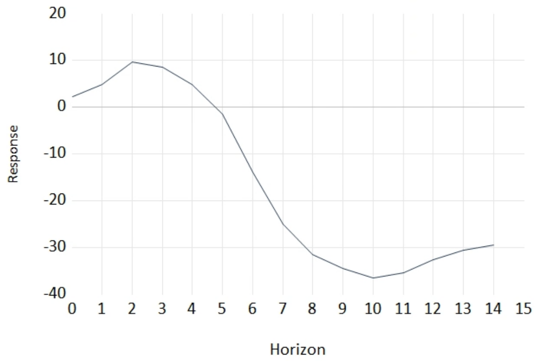
e). Cumulative Dynamic Multiplier:

AI on HPI/EG Shock Evolution 2007Q1-2023Q4



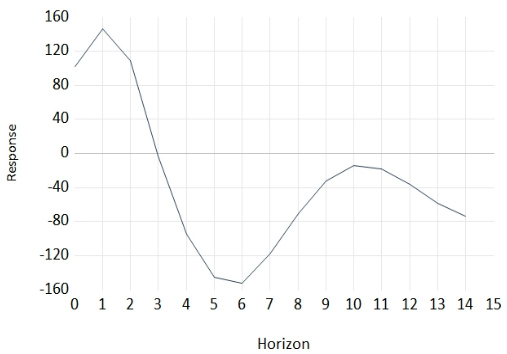
f). Cumulative Dynamic Multiplier:

EG on HPI/AI Shock Evolution 2007Q1-2023Q4



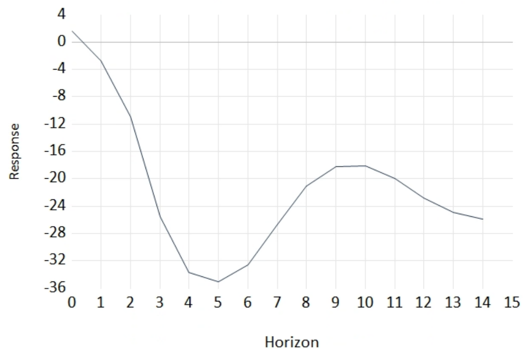
g). Cumulative Dynamic Multiplier:

AI on HPI/EG Shock Evolution 2019Q1-2023Q4



h). Cumulative Dynamic Multiplier:

EG on HPI/AI Shock Evolution 2019Q1-2023Q4



(Note: Cumulative Dynamic Multiplier Graphs for the ARDL Bounds testing from Model (7))

4.4 Granger Causality test

The empirical results of ARDL models revealed robust long-term cointegration relationships between house prices and inflation, and house prices and economic growth. However, the presence of a long-term relationship between house prices and inflation does not inherently indicate that houses can function as a long-term hedge (Gunasekarage, Power & Zhou, 2008). That is because property prices may potentially lead inflation, given the housing industry occupies a considerable fraction of the New Zealand economy, the rise in housing values might lead to rise in inflation rate. Therefore, to define an effective inflation hedge for an asset, the inflation movements should be unrelated to the price fluctuations of that asset (Gunasekarage, Power & Zhou, 2008). In other words, if houses can be deemed as an effective hedge tool against inflation from a long-run perspective, the causes of inflation should be independent from the house values' movements. Furthermore, the Granger Causality tests also determine whether the increase/decrease in house prices leading to positive/negative economic growth, and vice versa.

Based on Chu and Sing's (2004) approach, the Granger Causality test is utilised to analyse the direction of causality relationship between dependent variable HPI and independent variables – AI and EG. That is to say, the empirical results indicate whether changes in actual inflation rates, and changes in economic growth cause movements in housing prices over the observation time frame in New Zealand, or vice versa. Because the Granger Causality test necessitates stationary time series, the equations (8) and (9) include natural logarithm values of HPI to facilitate the Granger Causality test assessment:

$$Y_t = \sum_{i=1}^{n} \alpha_i Y_{t-i} + \sum_{j=1}^{n} \beta_J X_{t-J} + u_{1t} \quad (8)$$

$$X_t = \sum_{i=1}^{n} \lambda_i X_{t-i} + \sum_{j=1}^{n} \sigma_J Y_{t-J} + u_{2t} \quad (9)$$

Whereas that u_{1t} and u_{2t} are assumed uncorrelated, the null hypothesis (H_0) for equation (8) is $\beta_J = 0$, indicating variable X does not Granger cause variable Y. For equation (9), the null hypothesis (H_0) is $\sigma_J = 0$, suggesting that variable Y does not Granger cause variable X. The Alternative hypothesis (H_1) for equation (8) and (9), however, is $\beta_J \neq 0$, and $\sigma_J \neq 0$. These tests will provide valuable insights into the nature and dynamics of the relationship between the variables, aiding in the understanding of their interdependencies and potential causal effects.

As depicted in Table 5 below, the F-statistics are significant at 5% level and 1% level for the pair wise Granger Causality test of HPI and AI, the null hypothesis thus can be rejected. It is evident that there is a bidirectional causality relationship between housing prices and inflation over the observation period. On the other hand, the results of Granger Causality tests between HPI and EG reveal a F-statistic at 10% level from economic growth to housing prices, which indicates economic growth Granger causes house prices in New Zealand for the same period. However, housing prices do not Granger causes economic growth, so there is a unidirectional causality relationship between them.

To sum up, the empirical results suggest that inflation granger cause the fluctuations in house prices and vice versa in the New Zealand market. Although the results of ARDL bounds tests confirm a long-term cointegration relationship between house prices and inflation, the Granger Causality tests reveal a bidirectional relationship between them, indicating that New Zealand houses fail to work as long-run hedging assets against inflation during the observation period. This conclusion contradicts the argument made by Gunasekarage, Power and Zhou (2008), who contended that all types of New Zealand's properties possess hedging capabilities against inflation from 1970 to 2003. The differing results further suggest that New Zealand's housing market exhibits distinct characteristics during these global events. On the other hand, economic growth granger causes movements in house prices, while the volatility in the housing market does not cause fluctuations in New Zealand's economy. These findings imply that New Zealand's economic performance does affect housing prices movements in the observation period, while volatility in New Zealand's housing market has minimal impacts on this country's boarder economy. Nonetheless, it is noteworthy that the Granger Causality test only examines a predictive relationship between paired variables for a specific observation period, yet it does not confirm causation or elucidate the underlying mechanisms.

Table 6. Granger Causality Tests

Granger Causality Tests						
Null Hypothesis	Obs.	Lags	F-statistics	Probability	Granger Cause	Direction
HPI does not Granger cause AI	65	2	4.8462**	0.0112	Yes	Bidirectional
AI does not Granger cause HPI	65	2	5.3187*	0.0075	Yes	
HPI does not Granger cause EG	65	2	2.1924	0.1205	No	Unidirectional
EG does not Granger cause HPI	65	2	2.6672***	0.0777	Yes	

(Note: * denotes significant at 1% level, ** denotes significant at 5% level, *** denotes significant at 10% level. HPI here denotes the natural logarithm of House price index, AI: Actual inflation rates, EG: Economic growth)

Chapter 5. Conclusion, Policy implications & Study limitations

5.1 Discussion and Conclusion

This paper is aimed to investigate whether the New Zealand housing values provide immunity against inflation amid the economic recessionary periods. Autoregressive Distributed Lag (ARDL) bounds testing model and Granger Causality tests are employed to address this research question. The ARDL model is commonly utilised in financial and economic academia to examine long-run effects between variables, while the Granger Causality test identifies the causality direction between them. The empirical findings reveal a robust long-term equilibrium cointegration between housing prices and inflation over both observation periods, 2007Q1 to 2023Q4, and 2019Q1 to 2023Q4. Moreover, the Granger Causality tests confirm a unidirectional causality relationship between housing prices and inflation, while a bidirectional causality relationship between housing prices and economic growth. The combined results suggested that New Zealand houses cannot effectively hedge inflation, because the house prices are comoving with the inflation and they are mutually impacted by each other. The empirical findings contradict the conclusion from Gunasekarage, Power and Zhou's (2008) first New Zealand study, which is all types of properties can serve as effective inflation hedges. On the other hand, the long-term relationship between housing prices and economic growth shows less robust. A long-term cointegration relationship between them is observed from 2007Q1 to 2023Q4, however, this relationship is not evident in the period from 2019Q1 to 2023Q4. Furthermore, economic growth granger causes movements in house prices, rather than the other way around, indicating their unidirectional causality relationship. In essence, this paper can draw a conclusion that New Zealand housing values cannot continually offer protection against inflationary and recessionary periods. Nevertheless, despite the New Zealand housing market responses sensitive to inflation, it is less likely impacted by broader economic growth trends across the periods examined. To some extent, this paper demonstrates the dynamic and volatile nature of the New Zealand housing market during economic downturns. Especially nowadays many investors and speculators pour hot money into the housing market, so that the function of housing as an investment asset outweighs its intrinsic function as a shelter. As a result, the housing market's inherent risk inevitably increases. The housing values become increasingly vulnerable in face of extreme events, and the ability of housing to hedge against inflation may become weakened.

5.2 Policy Implications

In New Zealand, housing accounts for more than half of all domestic household assets and poses significant exposure for financial institutions from a balance-sheet standpoint (Carvalho, Baker & Farquharson, 2022). As a result of this substantial weight, the stability of the housing market plays a critical role in the boarder economic and financial system. From the perspective of the board masses, the volatility in the housing market effectively impacts households' consumption patterns and personal wealth. While in terms of the economic and financial systems, the exposure of financial industry in the housing market through various financial products, such as home mortgage, tightly links the stability of the financial industry to the housing market fluctuations. The primary intention of this dissertation is to better understand the relationship and logic behind the dynamic trajectory of the housing market and economic conditions. Intuitive insights from this study will empower households, the financial industry, and policymakers to make informed decisions, and establish effective financial practices and regulatory measures. This approach enables us to mitigate risks associated to the housing market, ensuring economic stability and boosting sustainable growth. This dissertation examines a number of policy implications as elaborated in the following sections.

5.2.1 Housing and monetary policies

Policymakers ought to figure out a more integrated measure to housing and monetary policies. This should involve coordinated efforts between RBNZ and housing authorities to effectively manage interest rates and housing supply. For instance, during periods of elevated inflation, central banks could collaborate with housing authorities to implement measures aimed at stabilizing the housing market, such as targeted subsidies for affordable housing projects or temporary adjustments to mortgage lending criteria.

5.2.2 Communication and education

Policymakers ought to engage in proactive and effective communications to obtain first-hand and real-time information with the variety of front-line practitioners in the housing industry through industrial forums, sector surveys and conferences and other channels. The biggest benefit of such active communication is that policymakers can stay informed about the fluctuations in the housing market and modify the polices timely to tackle potential issues before they arise. In order for people to make informed financial decisions, it is crucially important to enhance financial literacy among the public, especially the relationship between economic conditions and the housing market. For instances, accessible public service advertisements, flyers, and webpages are effective for disseminating financial knowledge.

5.2.3 Affordability and sustainability of housing

New Zealand's successive governments have committed to providing affordable housing to the community. They have launched a number of social projects including Kiwibuild, Social Housing Reform Program and more, to address the issues of housing affordability in New Zealand. In addition, as a country that prioritizes climate change and environmental protection, New Zealand should also actively promote sustainable housing projects. The Government and financial institution should provide preferential policies and assistance to sustainable housing projects. Promoting and subsidizing green energy and sustainable building materials will yield public benefits as well.

5.3 Research limitations

While this study provides an up-to-date analysis of the dynamic relationship between New Zealand’s housing prices, inflation, and economic growth, it has several limitations. First, the study focuses primarily on the period from 2007 to 2023, with an emphasis on the Covid-19 pandemic period from 2019 to 2023. Significant global events during this period, such as the Global Financial Crisis, the COVID-19 pandemic, and the post-pandemic economic downturn, introduced abnormal volatility into the housing market. As a result, the empirical findings suggest that housing did not effectively hedge against inflation within this timeframe, however, the findings in this study may not capture the longer-term picture of how housing interacts with economic challenges.

Moreover, the study is limited to inflation and economic growth as influencing factors, overlooking other important variables that may affect the housing market, such as unemployment rates, mortgage interest rates, and regulatory changes. Including these additional variables may reveal different dynamics in housing's relationship to inflation and economic growth.

In sum, this study’s limitations offer opportunities for further research, whether by using longer-term data to gain a holistic view of these relationships or by incorporating additional influential variables to provide a more nuanced analysis. These areas merit further exploration.

References

Braithwaite, F. D., & Kemp, S. (2007). Safe As Houses: Investor Confidence in New Zealand. *New Zealand Economic Papers,* 41(2), 225–236. https://doi.org/10.1080/00779950709558510

Carvalho, P. A., Baker, B., & Farquharson, A. (2022, June). Housing as an Investment Asset in New Zealand (No. AN2022/07). *Reserve Bank of New Zealand.* https://www.rbnz.govt.nz/-/media/fd9fa649c29340d7b9f466ba41bf8d9e.ashx

Cerutti, E., Dagher, J., & Dell'Ariccia, G. (2017). Housing Finance and Real-Estate booms: A Cross Country Perspective. *Journal of Housing Economics*, 38, 1-13. https://doi.org/10.1016/j.jhe.2017.02.001

Chong, F. (2020). Housing price, Mortgage Interest Rate and Immigration. *Real Estate Management and Valuation*, 28(3), 36-44. https://doi.org/10.1515/remav-2020-0022

Chu, Y.Q., & Sing, T.E. (2004). Inflation Hedging Characteristics of the Chinese Real Estate Market. *Journal of Real Estate Portfolio Management, Vol. 10 No. 2, pp.* 145-154. https://doi.org/10.1080/10835547.2004.12089697

Christou, C., Gupta, R., Nyakabawo, W., & Wohar, M.E. (2018). Do House Prices Hedge Inflation in the United States? A Quantile Co-integration Approach. *International Review of Economics and Finance, Vol. 54, pp*. 152-156. https://doi.org/10.1016/j.iref.2017.12.012

De-Bruin, A., & Flint-Hartle, S. (2003). A Bounded Rationality Framework for Property Investment Behaviour. *Journal of Property Investment & Finance*, 21(3), 271–284. https://doi.org/10.1108/14635780310481685

Dickey, D. A., & Fuller, W. A. (1981). Likelihood Ratio Statistics for Autoregressive Time Series with a Unit Root. *Econometrica: journal of the Econometric Society*, 1057–1072. https://doi.org/10.2307/1912517

Ekemode, B. G. (2021). A Fresh Look at the Inflation-hedging Attributes of Residential Property Investments in Emerging Markets: Evidence from Nigeria. *Property Management.* https://doi.org/10.1108/PM-03-2020-0020

Fama, E.F., & Schwert, G.W. (1977). Asset Returns and Inflation. *Journal of Financial Economics, Vol. 5 No. 2, pp*. 115-146. https://doi.org/10.1016/0304-405X(77)90014-9

Fogler, R., Granito, M., & Smith, L. (1985). A Theoretical Analysis of Real Estate Returns. *The Journal of Finance, Vol. 40 No. 3, pp*. 711-721. https://doi.org/10.1111/j.1540-6261.1985.tb04994.x

Fraser, P., & McAlevey, L. (2015). New Zealand Regional House Prices and Macroeconomic Shocks. *Journal of Property Research, 32(4),* 279-300. https://doi.org/10.1080/09599916.2015.1083606

Ganesan, S., & Chiang, Y.H. (1998). The Inflation-Hedging Characteristics of Real and Financial Assets in Hong Kong. *Journal of Real Estate Portfolio Management, Vol. 4 No. 1, pp*. 55-67. https://doi.org/10.1080/10835547.1998.12089548

Gunasekarage, A., Power, D.M., & Zhou, T.T. (2008). The Long Term Inflation Hedging Effectiveness of Real Estate and Financial Assets: a New Zealand Investigation. *Studies in Economics and Finance, Vol. 25 No. 4, pp*. 267-278. https://doi.org/10.1108/10867370810918155

Inglesi-Lotz, R., & Gupta, R. (2013). The Long Run Relationship between House Prices and Inflation in South Africa: an ARDL Approach. *International Journal of Strategic Property Management, Vol. 17 No. 2, pp*. 188-198. https://doi.org/10.3846/1648715X.2013.807400

Kaynak, S., Ekinci, A., & Kaya, H. F. (2021). The Effect of COVID-19 Pandemic on Residential Real Estate Prices: Turkish Case. *Quantitative Finance and Economics*, 5(4), 623-639. https://doi.org/10.3934/QFE.202102

Kuang, W., & Liu, P. (2015). Inflation and House Prices: Theory and Evidence from 35 Major Cities in China. *International Real Estate Review*, 18(1), 217-240. https://doi.org/10.53383/100200

Lee, H.K.N. (2013). A Cointegration Analysis of Inflation and Real Estate Returns. *Journal of Real Estate Portfolio Management, Vol. 19 No. 3, pp*. 207-223. https://doi.org/10.1080/10835547.2013.12089956

Li, L.H., & Ge, C.L. (2008). Inflation and Housing Market in Shanghai, *Property Management, Vol. 26 No. 4, pp*. 273-288. https://doi.org/10.1108/02637470810894902

Ma, L & Liu, C (2008). Estimating Impacts of Consumer Prices on House Prices. *Deakin University. Conference contribution*. https://hdl.handle.net/10536/DRO/DU:30018088 .

Murphy, L. (2011). The Global Financial Crisis and the Australian and NZ Housing Markets. *Journal of Housing and the Built Environment,* 26, 335–351. https://doi.org/10.1007/s10901-011- 9226-9

NZherald. (2023, January 25). Inflation: How high will New Zealand go as cost of living bites? *NZherald*. https://www.nzherald.co.nz/business/economy/official-cash-rate/inflation-how-high-will-new-zealand-go-as-cost-of-living-bites/5D5UOS2OSBA3NBK74TIZLZE2GE/

Nunns, P. (2021). The Causes and Economic Consequences of Rising Regional Housing Prices in New Zealand. *New Zealand Economic Papers*, 55(1), 66-104. https://doi.org/10.1080/00779954.2020.1791939

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds Testing Approaches to the Analysis of Level Relationships. *Journal of Applied Econometrics,* 16 (3), 289–326. https://doi.org/10.1002/jae.616

RBNZ. (2022). Official Cash Rate (OCR) decisions and current rate. *Reserve Bank of New Zealand.* www.rbnz.govt.nz/monetary-policy/official-cash-rate-decisions

RBNZ. (2024). Past Monetary Policy Decisions. *Reserve Bank of New Zealand.* www.rbnz.govt.nz/monetary-policy/official-cash-rate-decisions

REINZ. (2022). Monthly House Price Index Report*, Real Estate Institute of New Zealand, October 2022.* https://www.reinz. co.nz/residential-property-data-gallery

REINZ. (2023). Monthly House Price Index Report*, Real Estate Institute of New Zealand, May 2023* https://www.reinz. co.nz/residential-property-data-gallery

Rubens, J.H., Bond, M.T., & Webb, J.R. (1989). The Inflation Hedging Effectiveness of Real Estate, *Journal of Real Estate Research, Vol. 4 No. 2, pp*. 45-55. https://doi.org/10.1080/10835547.1989.12090578

Ryan, M. (2024). Does Fighting Inflation Always Lead to Recession? What 60 years of NZ data can tell us. https://www.waikato.ac.nz/news-events/news/does-fighting-inflation-always-lead-to-recession-what-60-years-of-nz-data-can-tell-us/

Sahoo, M. (2022). House Price Bubbles and Its Predictive Capacity on Inflation and Economic Growth: Some Indian Evidence. *Journal of Public Affairs*, 22(2), ve2464. https://doi.org/10.1002/pa.2464

Shahbaz, M., Kumar, A., & Nasir, M. (2013). The Effects of Financial Development, Economic Growth, Coal Consumption and Trade Openness on CO2 Emissions in South Africa. *Energy Policy*, 61, 1452–1459. https://doi.org/10.1016/j.enpol.2013.07.006

Shi, S., Young, M., & Hargreaves, B. (2010). House Price–volume Dynamics: Evidence from 12 Cities in New Zealand. *Journal of Real Estate Research*, 32(1), 75-100. https://doi.org/10.1080/10835547.2010.12091266

Shin, Y., Yu, B., & Greenwood-Nimmo, M. (2014). Modelling Asymmetric Cointegration and Dynamic Multipliers in a Nonlinear ARDL Framework. *Festschrift in honor of Peter Schmidt: Econometric methods and applications*, 281-314. https://doi.org/10.1007/978-1-4899-8008-3_9

Spellman, L.J. (1981). Inflation and Housing Prices. *Journal of the American Real Estate and Urban Economics Association, Vol. 9 No. 3, pp*. 205-222. https://doi.org/10.1111/1540-6229.00240

StatsNZ. (n.d.). Gross Domestic Product (GDP). https://www.stats.govt.nz/indicators/gross-domestic-product-gdp/

Steenkamp, D. (2010, December 01). New Zealand's Imbalances in a Cross-country Context. *Reserve Bank of New Zealand Bulletin,* 73(4), 37-49. https://www.rbnz.govt.nz/hub/publications/bulletin/2010/rbb2010-73-04-04

Stevenson, S. (1999). The Performance and Inflation Hedging Ability of Regional Housing Markets. *Journal of Property Investment and Finance, Vol. 17, pp*. 239-260. https://doi.org/10.1108/14635789910270503

Yang, M., & Zhou, J. (2022). The Impact of COVID-19 on The Housing Market: Evidence from the Yangtze River Delta Region in China. *Applied Economics Letters,* 29(5), 409-412. https://doi.org/10.1080/13504851.2020.1869159.

Yiu, C. Y. (2021). Why House Prices Increase in the COVID-19 Recession: A Five-Country Empirical Study on the Real Interest Rate Hypothesis. *Urban Science,* 5(4), 77. https://doi.org/10.3390/urbansci504007

Yiu, C. Y. (2023). A Natural Quasi-Experiment of the Monetary Policy Shocks on the Housing Markets of New Zealand during COVID-19. *Journal of Risk and Financial Management*, 16(2), 73. https://doi.org/10.3390/jrfm16020073

Zhou, X., & Clements, S. (2010). The Inflation Hedging Ability of Real Estate in China. *Journal of Real Estate Portfolio Management, Vol. 16 No. 3, pp*. 267-277. https://doi.org/10.1080/10835547.2010.12089885