Determining Causality between Stock Market Gross Index, Capital Index and Housing Price Index: A case of New Zealand

Niaz Hussain Ghumro*, Muhammad Abaid Ullah Waqih†, Sarfraz Ahmed Dakhan‡ and Faiz Mohammad Khawaja§

Abstract

The causal relationship between stock market gross index, capital index and housing price index of New Zealand has not been studied independently so far. There is huge economic activity at New Zealand Exchange and market is touching new heights. Housing price has been almost quadrupled in the past few years. This paper investigates causal relationship between New Zealand Stock Market Gross Index (NZX 50G), New Zealand Stock Market Capital Index (NZX 50C) and New Zealand Housing Price Index (NZHPIHP). Bi-directional Granger causality has been found from NZHPIHP to NZX 50G and bi-directional Granger causality has been predicted between NZX 50C.On the other hand, there has found unidirectional granger causality from NZX50C to NZX50 G but no causality from NZX 50G to NZX 50C.

Keywords: NZX50G, NZX50C, Granger Causality, and Stock Market Capital Index.

Introduction

Inspirations are from the work of scholars who had researched causality between stock market index and housing prices in different context. New Zealand ranks 53rd national economy in the world measured by nominal gross domestic product (GDP) and 68th largest by Purchasing Power Parity (PPP). Despite all this affordability of houses to households has been decreased that was two to three times the household income some thirty years back and now it has shifted to more than three times the median regional income. The house prices rose dramatically in 21st century. Though a positive correlation has been observed between real estate and stock price in an international study of seventeen countries including New Zealand (Quan & Titman, 1999) but causality between

* Dr. Niaz Hussain Ghumro, Assistant Professor, Sukkur IBA University, Sukkur, Sindh, Pakistan. Email: niaz_ghumro@iba-suk.edu.pk..

† MS Scholar at Sukkur IBA University, Sukkur, Sindh, Pakistan. Email: abaidullah.mgt16@iba-suk.edu.pk

‡ Sarfraz Ahmed Dakhan, Lecturer, Sukkur IBA University, Sukkur, Sindh, Pakistan. Email: sarfraz@iba-suk.edu.pk

§ Dr. Faiz Muhammad Khawaja, Assistant Professor, Sukkur IBA University, Sukkur, Sindh, Pakistan. Email: faiz@iba-suk.edu.pk

New Zealand real estate market and stock market is a question mark. It hence leaves a gap for study to find the causality between real estate market and stock market of New Zealand. This escalation in housing price is different in various parts of New Zealand i.e. In Auckland, it is very high as compared to the other parts of New Zealand. In the broader prospectus, this study would be complied by using New Zealand Stock Exchange Gross index (NZ50G), New Zealand Stock Exchange Capital index (NZ50C), Housing Price Index of New Zealand and individual Housing Price Indices of provinces of the country. One of the many reasons to choose this topic is not scarcity of knowledge developed in this field but the diversity that had been observed in various parts of the world with different approaches used to determine the causality between these two variables. Furthermore, as per best knowledge of the author this topic had not been researched so far with reference to New Zealand stock market and housing market. In addition, author has tried to find the causality by using Linear Granger Causality Test by using all three variables. Graphical presentation of the return series is shown in fig.1. Graphs of NZX 50G, NZX 50C and NZHPIHP show that New Zealand stock exchange is very volatile New Zealand housing market has also shown remarkable hike in 21st century, specially, after the year 2005 it has become an expensive one. This study would help to find the direction of housing market in collaboration with stock market and would try to determine any future upheavals that can disturb the market and would hence suggest government based on these predictions to take necessary measures. New Zealand gross, capital stock and housing markets are very volatile and have shown huge variation in the past. The variation can be viewed in graphical presentation of the data in this paper as Fig 1, Fig 2 and Fig 3 for gross index, capital index and housing price index respectively. Gross index has a high value of 4,269 in 2007Q3and lowest value of 2,590 in 2009Q1. CapitalmarketindexNZX50Cthatwasat 3,199 on 2007Q3 fell to 1,780 on 2009Q1 suddenly. Whereas, housing price index that was at 1, 533 on 2007Q3 dropped to 1,382 2009Q1. Stock exchange New Zealand is bullish and index NZX 50G has recently crossed 8,0000 points for the first time in history and there is huge economic activity in the country. While, capital index and housing price index are floating at 2, 046 and 4, 340.9 till date. This exuberance in economic activity may be due to wealth effect or credit-price effect in the economy. The wealth effect emphasis that increases in stock market index would increase investment in real estate. On the other hand, credit-price effect predicts that real estate market will lead the stock market.

The crux of our study in this paper is not to discuss the wealth effect or credit-price effect. Our point of focus is to determine the causality between the stock prices (gross and capital) and housing price index. Causality will itself determine the direction of economic activity. Further studies may verify the wealth effect or credit-price effect in the economy. The rest of the paper is managed as follows. Section two explains empirical review of literature. Section 3 describes methodology and data description. Section 4 discusses the results for the analysis. In the end, section 5 gives the conclusion.

Literature Review

Causality between stock and real estate has been studied a lot. A variety of knowledge has been developed while studding these two variables (Anderson & Beracha, 2012; Bekhet & Matar, 2013; Brahmasrene & Jiranyakul, 2007; Chuang, Kuan, & Lin, 2009; Ding, Chong, & Park, 2014; Fama, 1981; Glascock, Lu, & So, 2000; Ibrahim, 2010; Kapopoulos* & Siokis, 2005; Lin & Lin, 2011; Liu & Su, 2010; Okunev, Wilson, & Zurbruegg, 2002; Su, 2011; Tsai, 2015). This literature had shown a wide range of diversity in results too. This diversity depends not only economic environments but also the type of method used to find the relationship. In some economies, there is no causal relationship between stock and real estate while some show contrary results. No causality between stock and real estate and vice versa has been observed while using Linear Granger Causality Test in Chines economy. However, unidirectional, non-linear causality had been identified with the use of conditional quantile intervals. Sup-Wald test statistics of tail quantile intervals are significant for the effects of stock returns on housing and land returns when the latter are extremely high (Ding et al., 2014). Use of Granger Causality test has shown different outcomes in empirical study of six Asian economies (Lin & Lin, 2011). No causality has been observed between stock and real estate markets in China, Hong Kong, Japan and South Korea. Whereas a unidirectional causality has been observed from real estate to stock markets in Taiwan and Singapore. Tsai (2015) in his study to evaluate dynamic information transfer between stock and housing markets, has experienced a bidirectional causal relationship between the two markets in United States. In a research from Australian context, a strong unidirectional causality has been observed from stock market to real estate market (Okunev et al., 2002). In as study of housing price and volume data of the entire USA and its four major regions (Northeast, Midwest, West and South), with linear causality test, a unidirectional correlation was revealed in which volume variation led housing returns but no versa except in Western Region. On the other hand , nonlinear causality test revealed bidirectional relationship in which housing returns can lead trading volumes and reflect relevant information, except in Western

Region (Tsai & Peng, 2016). In another paper, linear test results show a uni-directional relationship to exist from real estate market to stock markets which are inconsistent with theory. In contrast, non-linear causality test shows a strong uni-directional relationship running from stock market to real estate market. Su, Chi-Wei (2011) determined long-run unidirectional and bidirectional causality between the real estate market and housing stock market in the regions both below and above the threshold level by using Causality Test based on threshold error-correction model (TECM). Another study carried out in San Francisco, Santa Clara County, Los Angeles County and Orange County predict that Russell 2000 does not Granger cause house and house prices in these markets do not Granger Cause Russell 2000 (Green, 1999). In an attempt, to determine wealth effect in Greece economy (Kapopoulos* & Siokis, 2005) depicts that Greece Stock Exchange (GSE) index Granger causes Athens house prices but surprisingly does not Granger causes other urban area house prices. Additionally, house prices do not Granger cause stock exchange index. In an empirical analysis of house price-stock price it Thailand, a unidirectional Granger causality was noted from stock prices and other variables to housing price (Ibrahim, 2010). Turkish economy study reals that during crisis period, while real estate is dependent variable, causality is absent from stock market to real estate and vice versa while results are different for pre-crisis period(Yuksel, 2016). Based on rolling window boot-strap, it is evident that causality mainly exists in Bullish market periods and financial crises and result indicates that relation between stock and housing prices change across time and city tiers (Shi, Liu, & Zhang, 2017). Going more into detail about causality between stock and housing prices with domain of frequency cum time wavelet analysis, it is determined that causal relationship between the two occurs in long run in frequency domain. While in time domain it is analyzed that time varying nature of long run causalities implies structural changes in two markets(Li, Chang, Miller, Balcilar, & Gupta, 2015). The most important thing about this study is that it ranges from 1890 to 2012. The more and more scholars are considering this topic, using stock price and housing price discovering new realities about the economy's worldwide. A similar study done in stock and housing market of Korea, using vector auto regression (VAR),a unidirectional Granger Causality has been examined from land and house prices to stock prices in most regional land and housing markets (Chang). Another study on stock markets and real estate markets in US and UK through Error Correction modeling has investigated that bidirectional causal relationship exists between two markets(Apergis & Lambrinidis, 2007). Ansari and Oladunjoye (2004)concluded an inverse causal relationship between the recent housing market boom and stock market decline in United States, based on monthly data from January 2000 to September 2002. The study further suggested to apply more tests on other episodes of data before any definite conclusion in this regard however: the behavior will vary not only different time scales but also with different REIT (Chou & Chen, 2011).Investigating relationship between stock and real estate markets via wavelet analysis revealed that the relationship between these two variables is neither simply segmented nor purely intergraded. Similar findings to that of Ibrahim's (2011) were obtained in Malaysia during causality check between real estate markets and stock market (Lean & Smyth, 2012). The beauty of this topic is such that every author is putting his color into this important aspect of the time. More research on these variables is clarifying the relationship between the variables and time, frequency, methodology, context aspect is evident from the latest researches.

Methodology and Data Description

When a variable x does not linear Granger caused another variable y, it suggests that

$\mathbb{E}(yt|(\mathcal{y},x)t-1 = \mathbb{E}(y\ t|\mathcal{y}_{t-1}),$ a.s.,

Where $(\mathcal{y},x)\ t-1$ denotes the information set generated by y_i and x_i at time t-1. Linear Granger causality test approach have been used to detect the causality of gross stock, capital stock and housing price indexes of New Zealand stock exchange. Linear Granger Causality Test is used to predict linear causality between HPI, GI and CI. Data presented in the article is stationary at *I (1).* Variance Auto Regressive VAR (2) model is used to estimate change in all three variables. Systems of equation for the model are presented as under to explain the model. Δ represents change in variable, *HPI* indicates housing price index, *GI* indicates gross stock index while *CI* stands for capital index. α, β and γ are coefficients for *HPI*, *GI* and *CI* respectively with different lags. To conduct Granger causality test we have estimated following three models: -

$$\Delta GI\ t = \alpha_{10} + \alpha_{11}GI_{t-1} + \alpha_{12}GI_{t-2} + \beta_{11}CI_{t-1} + \beta_{12}CI_{t-2} + \gamma_{11}HPI_{t-1} + \gamma_{12}HPI_{t-2} + \varepsilon_{GI,t} \quad \ldots\ldots (3.1)$$

Model 3.1 regresses change in *GI* at time t with the previous two lags of itself, and previous two lags of rest of the variables in the model. $\varepsilon_{GI,t}$ is i.i.d random disturbance.

$$\Delta CI_t = \alpha_{20} + \alpha_{21}GI_{t-1} + \alpha_{22}GI_{t-2} + \beta_{21}CI_{t-1} + \beta_{22}\ CI_{t-2} + \gamma_{21}HPI_{t-1} + \gamma_{22}HPI_{t-2} + \varepsilon_{CI,t} \quad \ldots\ldots (3.2)$$

Model 3.2 regresses change in *CI* at time t with the previous two lags of itself, and previous two lags of rest of the variables in the model. $\varepsilon_{CI,t}$ is i.i.d random disturbance.

$$\Delta HPI_{t} = \alpha_{30} + \alpha_{31} GI_{t-1} + \alpha_{32} GI_{t-2} + \beta_{31} CI_{t-1} + \beta_{32} CI_{t-1} + \gamma_{31} HPI_{t-1} + \gamma_{32} HPI_{t-2} + \varepsilon_{HPI,t} \quad (3.3)$$

Model 3.3 regresses change in *HPI* at time t with the previous two lags of itself, and previous two lags of rest of the variables in the model. $\varepsilon_{HPI,t}$ is i.i.d random disturbance.

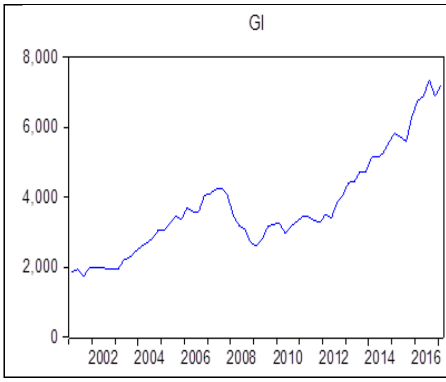
The notations used in the model are *GI* for gross stock index, *CI* for capital stock index and *HPI* for housing price index. Table 2 shows that there is unidirectional causal relationship for *HPI* to *CI* but not reverse causal relationship is detected. Table 3 exhibits that there is bidirectional causal relationship from *CI* to *HPI.* Table determines that there is not causal relationship from *CI* to *GI* and no causality from *GI* to *CI.*

Data Description:

Quarterly data of NZX 50G and NZX 50C for period 2001Q1 to 2017Q1has been acquired form Bloomberg Terminal, a software system and computer interface that gives financial professionals the ability to track and analyze breaking news across the globe. The data for the NZX 50 index, with Bloomberg is available from 2001Q1 to 2017Q1and same has been chosen for the study. At the same time data for the housing price index of New Zealand for the same period has been selected from quarterly data available at Reserve Bank of New Zealand site, uploaded on 31st July 2017.Basis reason to approach Reserve Bank of New Zealand website was that a very brief time data for housing price index was available at Bloomberg terminal.

Results:

First of all the trends of all the variables in the study such as GI, CI, and HPI are mentioned in Figure01, Figure02 and Figure03 respectively. There are highs and lows in the graphs of GI and CI where as there is positive and upward trend in the graph of HPI in case of New Zealand.



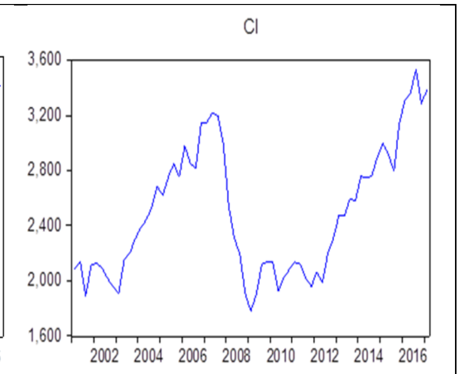


Figure 01: time graph of GI

Figure 02: time graph of CI

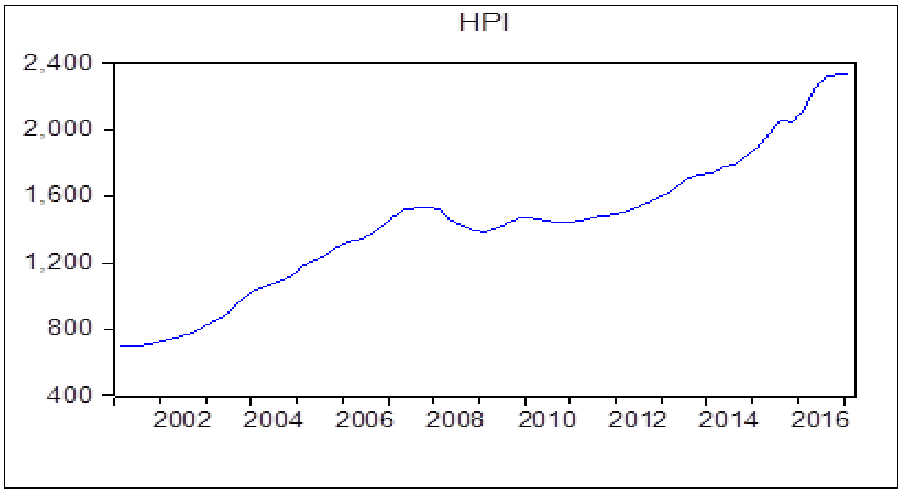


Figure03: Time Graph of HPI

The summary statistics of the data had been provided in Table01. Mean value is more than median. It illustrates values after median are high and GI show an increasing tendency. Hypothesis of unit root is failed to reject at level. Data is stationary at *I (1)*. Furthermore, Jarque-Bera descriptive statistics indicate that data of HPI and CI is not normally distributed as probability is > 0.05 in both series. Data series of GI is normally distributed as probability is < 0.05. There is problem of unit root in the data on the level and there is no unit root in first difference. It means that data is stationary a first difference. The minimum values of GI and CI are very close but highest values are quite different. But on the other hand, CI has more volatility over the same period.

Table01: Summary statistics for the series.

	CI	GI	HPI
Mean	2495.551	3745.827	1429.197
Median	2443.295	3399.835	1454.500
St. deviation	471.1817	1441.484	421.9985
Skewness	0.427590	0.856108	0.134399
Kurtosis	1.979817	3.042510	2.729609
Minimum	1780.062	1731.981	698.4000
Maximum	3533.700	7361.089	2336.400
Jarque-Bera	4.799451	7.944870	0.393694
Probability	0.090743	0.018828	0.821316

Note: CI, GI and HPI represent capital index, gross index and housing price index respectively.

Table02 illustrates the results of granger causality between GI and HPI. The null hypothesis that gross index does not Granger causes housing price index is significant and one rejects the null hypothesis of GI does not Granger causes HPI during the period at 1% of significance. So, it is evidence that GI granger causes the HPI. However, null hypothesis that HPI does not Granger causes GI is rejected at the level of 5% significance and one concludes that HPI also granger causes GI. This indicates bidirectional causality between HPI and GI. Thus, both variables are predicted from their previous own lags and other variable's lags.

Table 02:Granger causality: housing and gross stock indexes.

Null hypothesis	p-value	Results
GI⇏ HPI	0.00002***	GI Granger causes HPI
HPI⇏ GI	0.0230**	HPI Granger causes GI

Note: GI and HPI represent gross index and housing price index respectively. Symbol ⇏ shows direction of Granger causality.*** indicates significant at 1% level, ** indicates significance at 5% level, * indicates significant at 10% level.

Results of granger causality between CI and HPI are presented in Table 03. The null hypothesis in both cases is rejected between housing price index and capital index at 1% level of significance. It also shows that bidirectional causality has been observed between HPI and CI.Thus, both variables are predicted from their previous own lags and other variable's lags.

Table 03: Granger causality: housing and capital stock indexes.

Null hypothesis	p-value	Results
CI ⇏HPI	0.0003***	CI Granger causes HPI
HPI ⇏ CI	0.0029***	HPI Granger causes CI

Note: CI and HPI represent capital index and housing price index respectively. Symbols ⇒ and ⇏ show direction of Granger causality.*** indicates significant at 1% level, ** indicates significance at 5% level, * indicates significant at 10% level.

Table04 shows the results of granger causality between GI and CI. It is clear from Table04 that one fails to reject null hypothesis of causality between gross index and capital index at 5% level. However, results in Table 04 reject the null hypothesis at 10% level unidirectional. Therefore, there has been determined 'unidirectional causality' from capital index to gross index of New Zealand.

Table 04: Granger causality: gross stock and capital stock indexes.

Null hypothesis	p-value	Results
CI ⇏GI	0.0773*	CI Granger cause GI
GI ⇏CI	0.3141	No causality

Note: CI, GI represent capital index and gross index respectively. Symbol ⇏ shows direction of Granger causality.
*** indicates significant at 1% level, ** indicates significance at 5% level, * indicates significant at 10% level.

Conclusion

The causality between stock and real estate in New Zealand is new addition to literature and need to further address by using other econometric model and techniques. The bidirectional causality relationship between housing price index, gross index and housing price index, capital index indicates that housing prices granger cause stock prices. Due to this interdependence investors cannot hedge risk across housing price and stock price especially when they are more volatile. From the past few years, hike has been observed in the house prices in New Zealand. This is clear from the findings that housing price index significantly affect stock market gross index and capital index at the same time. Contrary to this gross index has no effect on housing price index but capital index has. Government should consider the matter and there might be lot of foreign direct investment that may prove harm. Capital market has shown volatility in the recent past. Some viable measures should be adopted to offset this harmful effect. This might create a bubble and can burst at some unexpected time to turn the market into crises. A rational control and check and balance of funds being injected into the economy should be exercised to avoid a sudden shock. Casualty results shows that a housing prices has a significant impact on gross market index of the Kiwis economy. This effect can be diversified into another opportunity. Government can collect a lot of revenue from the housing industry to avoid unexpected hike and providing less expensive shelter to the citizens. A lot more study may be conducted in to find the pre-crises, in-crises causality of the variables to know the direction. As in results we have found that there is no linear causality between NZX 50G and NZX 50C, so this aspect of the economy be further investigated by using non-linear test. This would not only explore the windows to new knowledge but also would beneficial to the Kiwis economy in the coming future.

References

Anderson, C. W., & Beracha, E. (2012). Frothy housing markets and local stock-price movements. *The Journal of Real Estate Finance and Economics, 45*(2), 326-346.

Ansari, M., & Oladunjoye, G. (2004). Impact of Stock Market Decline on the Recent Housing Boom in the United States: Some Empirical Evidence. *Southwest Business & Economics Journal, 13*.

Apergis, N., & Lambrinidis, L. (2007). More evidence on the relationship between the stock and the real estate market.

Bekhet, H. A., & Matar, A. (2013). Co-integration and causality analysis between stock market prices and their determinates in Jordan. *Economic Modelling, 35*, 508-514.

Brahmasrene, T., & Jiranyakul, K. (2007). Cointegration and causality between stock index and macroeconomic variables in an emerging market. *Academy of accounting and financial studies Journal, 11*(3), 17.

Chang, B.-K. Stock and Real Estate Markets in Korea: Wealth or Credit-Price Effect.

Chou, C.-c., & Chen, S.-l. (2011). Integrated or segmented? A wavelet transform analysis on relationship between stock and real estate markets. *Economics Bulletin, 31*(4), 3030-3040.

Chuang, C.-C., Kuan, C.-M., & Lin, H.-Y. (2009). Causality in quantiles and dynamic stock return–volume relations. *Journal of Banking & Finance, 33*(7), 1351-1360.

Ding, H., Chong, T. T.-l., & Park, S. Y. (2014). Nonlinear dependence between stock and real estate markets in China. *Economics Letters, 124*(3), 526-529.

Fama, E. F. (1981). Stock returns, real activity, inflation, and money. *The American Economic Review, 71*(4), 545-565.

Glascock, J. L., Lu, C., & So, R. W. (2000). Further evidence on the integration of REIT, bond, and stock returns. *The Journal of Real Estate Finance and Economics, 20*(2), 177-194.

Green, R. K. (1999). Stock Prices and House Prices in California: New Evidence of a Wealth Effect? A Note: University of Wisconsin Center for Urban Land Economic Research.

Ibrahim, M. H. (2010). House price-stock price relations in Thailand: an empirical analysis. *International Journal of Housing Markets and Analysis, 3*(1), 69-82.

Kapopoulos*, P., & Siokis, F. (2005). Stock and real estate prices in Greece: wealth versus ‘credit-price’effect. *Applied Economics Letters, 12*(2), 125-128.

Lean, H. H., & Smyth, R. (2012). REITs, interest rates and stock prices in Malaysia. *International Journal of Business and Society, 13*(1), 49.

Li, X.-L., Chang, T., Miller, S. M., Balcilar, M., & Gupta, R. (2015). The co-movement and causality between the US housing and stock markets in the time and frequency domains. *International Review of Economics & Finance, 38*, 220-233.

Lin, T. C., & Lin, Z.-H. (2011). Are stock and real estate markets integrated? An empirical study of six Asian economies. *Pacific-Basin Finance Journal, 19*(5), 571-585.

Liu, Y.-S., & Su, C.-W. (2010). The relationship between the real estate and stock markets of China: evidence from a nonlinear model. *Applied Financial Economics, 20*(22), 1741-1749.

Okunev, J., Wilson, P., & Zurbruegg, R. (2002). Relationships between Australian real estate and stock market prices—a case of market inefficiency. *Journal of forecasting, 21*(3), 181-192.

Quan, D. C., & Titman, S. (1999). Do real estate prices and stock prices move together? An international analysis. *Real Estate Economics*, *27*(2), 183-207.

Shi, G., Liu, X., & Zhang, X. (2017). Time-varying causality between stock and housing markets in China. *Finance Research Letters*.

Su, C.-W. (2011). Non-linear causality between the stock and real estate markets of Western European countries: Evidence from rank tests. *Economic Modelling, 28*(3), 845-851.

Tsai, I.-C. (2015). Dynamic information transfer in the United States housing and stock markets. *The North American Journal of Economics and Finance*, *34*, 215-230.

Tsai, I.-C., & Peng, C.-W. (2016). Linear and nonlinear dynamic relationships between housing prices and trading volumes. *The North American Journal of Economics and Finance, 38*, 172-184.

Yuksel, A. (2016). The relationship between stock and real estate prices in Turkey: Evidence around the global financial crisis. *Central Bank Review, 16*(1), 33-40.