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THE INTER-RELATIONS BETWEEN CHINESE HOUSING MARKET, STOCK MARKET AND CONSUMPTION MARKET

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Abstract

Recent years have witnessed a dramatic increase in real estate prices in mainland China. Current research mainly takes the Chinese housing market as an independent market and focuses on potential future growth or the increasing asset bubble in this market. This research, however, studies the short- and long-run interrelationship between the housing market and two other major markets in mainland China - the stock market and the domestic consumption market - from 2005 to 2019. In addition, the codependency between China's economy and the real estate market is also examined. After detecting the structural breaks in the time series of property price index by using the recursive CUSUM test, the whole examining period is divided into sub-periods. In each sub-period, the variance decomposition and Granger causality tests are used to identify the time-varying short- and long-run interdependencies between these markets. Results indicate that there is time-varying relation between property prices and stock indexes, and the correlation between property prices and stock indexes becomes weaker over time. In terms of housing market and the domestic consumption market, a weak relation between these two markets is observed over the whole period. These findings are of vital importance for China domestic investors to help them understand and diversify the risk of their portfolios, which are mainly composed by property and stock assets. In addition, these results offer new insight into the impact of the housing market on the domestic consumption market within Chinese context. This further aids the Chinese government in regulating these three markets more efficiently and avoiding any unwanted "domino effect" between them.

Keywords: Variance decomposition, Stock market, Property market, Domestic consumption market, China.

JEL Classification: C12, R21, R31.

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1. Introduction

A sharp increase in real estate prices combined with an extraordinary lending growth in China during 2009 has led to increasing scholarly attention on the Chinese housing market (Ahuja et al., 2010). The changes in housing prices may have an important spillover effect on the economic and financial stability of the public, especially when housing prices are clearly out of line with the fundamentals (Hilbers et al., 2008). However, most existing researches are limited to only two aspects, i.e., identifying the driving factors behind the skyrocketing housing prices, and quantifying the risk or "bubble" of the housing market. In terms of identifying the driving factors, speculative capital inflow, the expansionary monetary policy, changes in fundamental factors like wage income, land supply and construction costs and other important ratios, e.g., price to rent ratio and price to income ratio, are believed to have accelerated the subsequent home price growth (Guo and Huang, 2010; Xu and Chen, 2012; Wu et al., 2012; Wang and Zhang, 2014). The research of Wu et al. (2016) delivers a comprehensive overview of the driving factors behind the rise in housing prices in China. The other research area, i.e., identifying and quantifying the housing market bubble in China, has attracted even more scholarly interest, as bursting real estate bubbles has traditionally done great harm when they are closely associated with financial crises (Glaeser et al., 2017; Zhao et al., 2017). Most scholars claim that there is no evidence of a real estate bubble at the national level, but that it exists at the regional level (Ahuja et al., 2010; Ren et al., 2012; Dreger and Zhang, 2013; Feng and Wu, 2015, Glaeser et al., 2017).

Traditionally, both houses and stocks are considered as investment alternatives, and the causal correlation between stock market and property market is either due to the wealth effect or the credit effect or both. The wealth effect is observed when unexpected gains in stock prices take place. The increasing proportion of stocks in investment portfolios and the perceived change in wealth can motivate households to rebalance their portfolios by investing in or consuming more housing services. The credit price effect, on the other hand, suggests a reverse causation from house prices to stock prices (Kapopoulos and Siokis, 2005; Ibrahim, 2009). From the perspective of risk diversifications, the interrelationship between property and the stock market, and especially the magnitude of this relationship, is a crucial topic in real world investment, as it can shed light into the strategies retail investors use in portfolio optimization (Hui et al., 2009a,b; Hui and Yu, 2010; Hui et al., 2011; Hui and Ng, 2012). From the perspective of investment decision making, the correlation, and especially the causality of this correlation, between these two markets yields a number of insights that can aid investors and speculators in forecasting future performance from one market to the other (Okunev et al., 2000). According to Credit Suisse Global Wealth Databook (2017) and the China Family Wealth Survey Report (2017), the Chinese middle class comprises of around 385 million individuals, with 66% and 11% wealth from their property and financial investment respectively. Therefore, the relation between the housing market and stock market is crucial for Chinese retail investors in diversifying their portfolio and making their investment decisions. This is further of vital importance for the stability of Chinese middle-class and needs to be more fully understood.

It is a widespread empirical finding that house prices and levels of consumption are synchronized (Browning et al., 2013). The most accepted explanation is that changes in house prices affect household consumption. According to the Permanent Income

hypothesis (Friedman, 1957) and the Life-Cycle Analysis hypothesis (Modigliani and Brumberg, 1954; Modigliani and Ando, 1957), households make consumption decisions based on the latest information about the changes of their lifetime wealth. As housing is normally the most determined source of households' private wealth, any unexpected changes in housing price may affect households' consumption decisions. China used to rely heavily on exports for economic growth. However, in late 2008, following a sharp decline in overseas demand, China switched its focus to boosting domestic consumption to shore up the economy (Chen et al., 2009). In the year of 2019, the total domestic retail sales of consumer goods was 41.2 trillion RMB and was responsible for 57.6% of the total economic growth in China. Six years in a row, the domestic consumption has been the most important driving factor behind economic growth in China. However, China's property prices are volatile and are believed to be overestimated. Thus, understanding the impact of housing prices on consumption is of great interest for policy makers in China trying to stimulate domestic consumption.

The present paper seeks to provide a new perspective on the China's housing market by examining the interrelations between the property market and two other important markets, the stock market and the domestic consumption market. As shown in the literature, movements in housing prices have a significant impact on the other two markets, meaning that shock from the property market can be strongly transmitted to other markets in short- to medium-run. Besides, in the long-term, the interrelationship between these markets might be not stable. Any structural break in the examining time series can lead to changes in the relationship between the markets. Furthermore, due to the unstable relationship between these markets, the causal relation between them can be also time-varying. This research will shed light on the interaction between the Chinese property market and stock market and domestic consumption market within this context.

This study proceeds as follows: Section 1 is the introduction. Section 2 presents a literature review of previous studies on relations between residential property prices, the stock index and domestic consumption. In Section 3, the econometric techniques and the dataset are described. Section 4 reports and discusses the research findings. Conclusions are drawn in Section 5.

2. Literature review

The relation between property market and stock market and domestic consumption market are studied by a number of researches. However, the results are mixed due to the differences in data, data frequency, econometric methods and geographically researched areas.

As to the correlation between property market and stock market, two research areas are under focus. The first one is whether there is a co-movement between these two markets. Ibbotson and Siegel (1984) using annual data find the correlation between U.S. housing market and S&P 500 is -0.06. However, based on quarterly data, Hartzell (1986) detects the correlation coefficient to be -0.25. Worzala and Vandell (1993) estimate this correlation in U.K. to be 0.039. Newell and Chau (1996) use a simple correlation method and show a low positive correlation exists between these two markets in Hong Kong. In the same year, Eichholtz and Hartzell (1996) find that the correlation between these two markets is negative in Canada, the United Kingdom, and the United States. Quan and Titman (1999) also conduct an international study and find, by contrast, a low significant

positive relation between stock returns and changes in commercial real estate values. Fu and Ng (2001) estimate a moderate correlation (0.44) between these two markets in Hong Kong using Present-Value Approach. Berg et al. (2007) reveal that there are time-varying correlations between residential property price indexes and S&P 500 index.

The second research filed concerns the causal relations, i.e., wealth effect or credit price effect, between property and stock markets. Okunev et al. (2000) show a strong unidirectional non-linear causal relationship from the stock market to the real estate. Chen (2001) examines causal relation between the two asset prices for Taiwan and suggests the existence of wealth effect. Sutton (2002) also finds the wealth effect existing between housing and stock markets in six advanced economies. Kakes and Van den End (2004), as well as Kapopoulos and Siokis (2005), detect the causal relation from stock market to property market in their researches. Sim and Chang (2006), by contrast, find that property prices Granger-cause stock prices in South Korea. Also in Asia, Ibrahim (2010) using VEC model, however, indicates the existing wealth effect in Thailand. Anderson and Beracha (2012) find the effect of property price on stock pricing, but this effect is strongly time-varying. Aye et al. (2013) employ a non-parametric co-integration test to identify a long-term bidirectional causal relationship between the two markets.

In terms of the interplay between housing market and domestic consumption market, researchers mainly focus on the nature and strength of the correlation between them. However, the division of opinions is huge. Early research by Elliott (1980) indicates that there is no effect of housing wealth upon consumption. This finding is questioned by Peek (1983) and Bhatia (1987) in terms of the methods used in the research. Case (1992) finds the effect of change in housing price on consumption by examining the data used in Elliott's study but with different method. Using the individual household data, many researchers find small but significant impact of housing wealth on consumption behavior of household (Skinner, 1989; Sheiner, 1995; Engelhardt, 1996). This result is, again, challenged by serval researchers (Thaler, 1990; Hoynes and McFadden, 1997; Levin, 1998). They argue that there is no significant influence of housing price on consumption. In the 20th century, Bradbury et al. (2001), Case and Quigley (2008), Gan (2010), Carroll et al. (2011) and Simo-Kengne (2015) continue arguing that there exists wealth effect of housing on consumption, while Lettau and Ludvigson (2001, 2004), Chen (2006), Iacoviello (2011) and Browning et al. (2013) believe in vanishing of this effect. This topic is also discussed in China, and the results are quite similar that increasing in housing wealth positively affect the consumption (Zang, 1994; He, 2000; Song, 2007; Lai and Bai 2008). However, the methodology used in these works are questionable as argued in Lettau and Ludvigson (2004).

3. Data and Methodology

This section will describe the data and the methodology used in this study. The data is collected from various online open sources databanks, and the statistical analysis is conducted in R using different packages.

3.1. Data

Inconsistences between China's residential property price indices published by different institutes can lead to controversial results as mentioned beforehand in the literature

review. Therefore, in this study the data for housing price is collected from an international official data source so as to avoid the "book cocking" of the institute from mainland China in reporting property price and control the data quality. For the Chinese housing price (CHP), the China Nominal Residential Property Price Index from 2005Q2 to 2019Q2 is obtained from Bank for International Settlements. This price index, different from many other price indices that only report certain cities housing price, is a China national wide housing price index on quarterly base. In the same period, the quarterly SSE Composite Index collected from the Shanghai Stock Exchange is used for the Chinese stock market index (CSMI). The Total Retail Sales of Consumer Goods in RMB, published monthly by National Bureau of Statistics of China (NBSC), is collected to represent the chronological situation of the Chinese domestic consumption market (CDCM).

In order to better explore the interaction between the property market and the other two markets in China, as well as the market fundamentals, two additional macroeconomic variables are included in this study - firstly, the Chinese inflation rate represented by monthly CPI, and secondly, China's nominal GDP in RMB as economic indicator. Both variables are obtained from the NBSC for the period from 2005Q2 to 2019Q2.

As the data on CDCM and CPI is on a monthly basis, in order to stay in line with the data frequency of CHP, the monthly values of these two variables are converted to quarterly values. In total, the examining period is from 2005Q2 to 2019Q2 on a quarterly base with 5 variables, i.e., CHP, CSMI, CDCM, CPI and GDP, with the sample size being 57.

3.2. Methodology

The methods to study the interaction between the housing market, stock market, domestic consumption market, as well as other economic factors in China, follow those used by Ng & Hui (2012). Firstly, the existence of structural breaks in the examined housing price time series is tested by using recursive CUSUM (Chow, 1960; Brown et al., 1975; Ploberger and Krämer, 1992; Hansen, 2001; Hjort, and Koning, 2002; Zeileis, 2006). This test, with the null hypothesis that there is no structural break in the time series, generally examines the stationarity of the focused variable. The test result is crucial for the next-step variance decomposition and Granger causality test, since any undetected structural breaks in the time series can lead to a huge forecasting error (Hansen, 2001). If structural breaks are detected in the China's property price time series, they are used as separate points by which to divide the whole sample period into sub-samples. In each sub-period, the short- and long-run causal relation are tested between different markets to deliver more accurate results.

Since both variance decomposition and Granger causality tests require the tested data series to be stationary, the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test with two specifications, i.e. level stationarity and trend stationarity, is deployed beforehand to test the existence of the unit root of the all the time series under research (Kwiatkowski et al., 1992; Hobijn et al. 2004). The KPSS test has the null hypothesis of the stationarity against the alternative hypothesis of non-stationarity. If the null hypothesis cannot be rejected, the time series can be considered as stationary. Any examined non-stationary data series are stabilized using first level difference. After all the data series being

stationary on the same level, the data is ready for the short- and long-run causality testing.

In terms of identifying the short-run relation between the housing market, stock market and domestic consumption market in China, the method used in this study is the spillover index approach proposed by Diebold and Yilmaz (2009, 2012, and 2014) with the core idea of variance decomposition built on the Vector Autoregressive (VAR) model. As to the long-run causal relation, the Granger causality test based on Wald-test is deployed to identify a relatively long run relationship between the housing market, stock market and domestic consumption market, respectively (Granger, 1969 and 1980).

4. Results and Discussion

In order to systematically study the causal relationship between these three entities, the following test procedures will be utilized:

4.1. Overview and Descriptive Statistics

To deliver a first impression of the trends in the China's housing market, stock market and domestic consumption market during the study period, the courses of these three markets with 2005Q2 as the basis of 100% are plotted in Figure 1. In addition, Table 1 summarizes the descriptive statistics of all the studied variables for the whole research period.

Table 1. Descriptive Statistics of the Variables

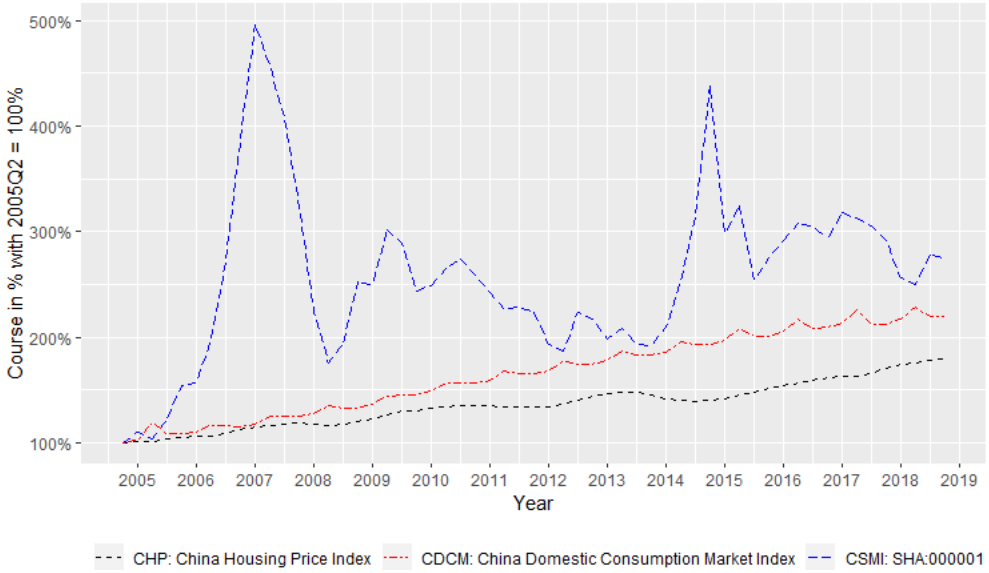
Variables	Min	Median	Mean	Max	SD
CHP (in %)	100.00	135.30	136.20	179.70	21.24
CSMI	1060.00	2688.00	2724.00	5258.00	850.61
CDCM (in 100 Mio RMB)	14498.00	50415.00	53806.00	106688.00	27463.73
GDP (in 1 Bn RMB)	4479.30	245289.60	292926.70	768653.10	226124.70
CPI (in %)	-1.30	0.69	0.61	3.10	0.97

Source: Bank for International Settlements, Shanghai Stock Exchange and National Bureau of Statistics of China

As seen in Figure 1, housing prices and the domestic consumption index increased gradually from 2005Q2 to 2019Q2, while the stock index fluctuated strongly during the same period. From 2005 to 2007, the Chinese stock index represented by the SSE Composite Index was on a strong upward trend. In October 2007, the SSE Composite Index reached its historical high at 6124.04, increasing by over 500% since 2005. While the stock market in China was obviously over-heated in this period, both the housing and domestic consumption markets showed a mild upward tendency. In 2007Q4, the People's Bank of China raised its benchmark interest rate and China's stock index started to crash from 6124.04 to 1644. From 2010 to 2014, the stock market was generally bearish in China. However, during the same period, both the housing and

domestic consumption markets followed an accelerated upward trend. As the stock market once again started to boom from 2014 to 2015, both the housing and domestic consumption market showed a clear decline. Starting from 2016, housing price resumed its upward trend, while both the domestic consumption market and stock market entered into fluctuation period. Different from stock market, in this period, the fluctuation of consumption market seemed to come from a significant seasonality effect. In general, during the whole period, China's housing market shared a slowly rising tendency with the domestic consumption market, while the tendency of stock market deviated strongly from it of property market.

Figure 1. Trends of Housing Price, Stock Index and Domestic Consumption Index



Source: Bank for International Settlements, Shanghai Stock Exchange and National Bureau of Statistics of China

4.2. Structural Breaks in the Chinese Housing Market

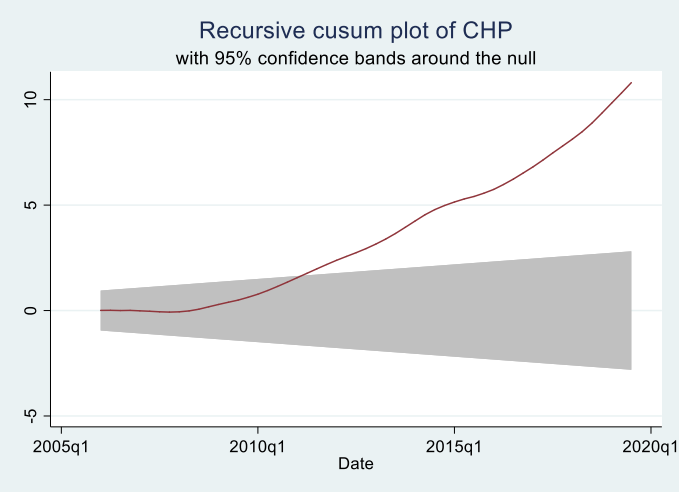
Since a causal relationship can only exist between two objects, to study the relationship between the housing market and other two markets, two research pairs are defined. The housing market together with the stock market and the other macroeconomic factors, i.e. GDP and CPI, constitute the first studied pair. The second analysis pair is the housing market, domestic consumption market and the two market fundamental factors.

In order to obtain reliable causal relationship test results in both the short- and long-run, the structural break must first be detected in each analyzed pair. If, for example, a structural break exists in the analysis pair of the housing market and stock market, the original equilibrium between these two markets before the structural break point is replaced by a new one after this point. Then it is inappropriate to just take the total sample period as one research period, since the period prior to the structural break should have a different causal relation between the two markets than the period post to the structural break.

As shown in Figure 1, the housing price deviated significantly from the stock market after 2011 suggesting in this analysis pair there exists a structural break in year 2011. The clearly shared trend between property market and domestic consumption market during the whole period indicates that there might be no structural break in the housing price time series of this research pair.

To statistically test the structural break in both research pairs, the recursive CUSUM is applied in each pair. As shown in Figure 2, the recursive CUSUM of housing price is within the 95% confidence area before 2011Q2, and then goes across the 95% confidence band. This suggests that there exists a structural break in housing price time series locating in the time point 2011Q2. Therefore, the whole sample period is divided into two sub-samples, i.e., 2005Q2-2011Q1 and 2011Q2-2019Q2, to identify the possible time-varying short- and long-run causal relationships.

Figure 2. Recursive CUSUM Test for Housing Market and Stock Market



Note: the grey area is the 95% confidence level, the red line is the recursive CUSUM of China's housing price (CHP).

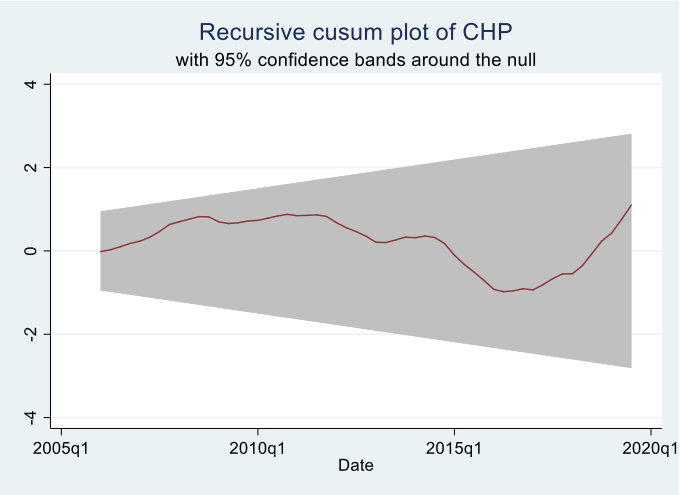
Pearson correlation tests are also conducted for these two sub-samples, the results of which are summarized in Table 2. It is clear that there is an observable difference between correlation coefficients between the housing market and stock market in these two periods.

Table 2. Pearson Correlation Coefficients among the Variables for Both Sub-sample Periods

Variables	**CHP**	**CSMI**	**CDCM**	**GDP**	**CPI**
Period 1: 2005Q2-2011Q1					
CHP	1.00	0.63	0.95	0.93	0.25
CSMI	0.63	1.00	0.47	0.67	0.52
CDCM	0.95	0.47	1.00	0.92	0.21
GDP	0.93	0.67	0.92	1.00	0.23
CPI	0.25	0.52	0.21	0.23	1.00
Period 2: 2011Q2-2019Q2					
CHP	1.00	0.35	0.87	0.90	-0.12
CSMI	0.35	1.00	0.54	0.52	-0.15
CDCM	0.87	0.54	1.00	0.98	-0.20
GDP	0.90	0.52	0.98	1.00	-0.20
CPI	-0.12	-0.15	-0.20	-0.20	1.00

For the research pair housing market and domestic consumption market, no structural break is detected in the period from 2005Q2 to 2009Q2, as seen in Figure 3. This result is expected, since these two markets generally shared the same trend in the whole sample period. Therefore, there is no need to split the total sample into sub-samples to study the causal relation. The causal relation between housing market and domestic consumption market is stable over the whole sample period.

Figure 3. Recursive CUSUM Test for Housing Market and Domestic Consumption Market



Note: The grey area is the 95% confidence level, the red line is the recursive CUSUM of China's housing price (CHP).

4.3. Stationarity Test of the Variable

Before conducting short- and long-run causal relationship test using variance decomposition and the Granger causality test, the stationarity of all the tested variables is examined by the KPSS test. The KPSS test has the null hypothesis of stationarity against the alternative hypothesis of non-stationarity.

In terms of the housing market and stock market, since the whole sample period is divided by the identified structural break into two sub-samples, the KPSS stationarity test for all the variables in each period must be conducted. Before testing the stationarity of the variables, the natural logarithm is taken for the variables China's housing price (ln(CHP)), stock market index (ln(CSMI)), domestic consumption market (ln(CDCM)) and GDP (ln(GDP)) to stabilize the data series. The results for 2005Q2-2011Q1 and 2011Q2-2019Q2 are summarized in Table 3. As shown in Panel A and Panel B, after the first difference (I(0)) the null hypothesis of all the variables cannot be rejected. This result indicates that all the variables are stationary in both periods and ready for the variance decomposition and Granger causality test.

Table 3. KPSS Test for Variables Stationarity for Test Pair Housing Market and Stock Market in Two Sub-sample Periods

Variable	Null Hypothesis	*p*-Value	Null Hypothesis	*p*-Value
Panel A: 2005Q2-2011Q1				
I(0)				
ln(CHP)	Level	<0.01	Trend	>0.1
ln(CSMI)	Level	>0.1	Trend	<0.05
ln(CDCM)	Level	<0.01	Trend	>0.1
ln(GDP)	Level	<0.01	Trend	<0.05
CPI	Level	>0.1	Trend	>0.1
I(1)				
ln(CHP)	Level	>0.1	Trend	>0.1
ln(CSMI)	Level	>0.1	Trend	>0.1
ln(CDCM)	Level	>0.1	Trend	>0.1
ln(GDP)	Level	>0.05	Trend	>0.05
CPI	Level	>0.1	Trend	>0.1
Panel B: 2011Q2-2019Q2				
I(0)				
ln(CHP)	Level	<0.01	Trend	<0.05
ln(CSMI)	Level	<0.05	Trend	>0.1
ln(CDCM)	Level	<0.01	Trend	<0.01
ln(GDP)	Level	<0.01	Trend	<0.01
CPI	Level	>0.1	Trend	>0.05
I(1)				
ln(CHP)	Level	>0.1	Trend	>0.1
ln(CSMI)	Level	>0.1	Trend	>0.1
ln(CDCM)	Level	>0.05	Trend	>0.05
ln(GDP)	Level	>0.05	Trend	>0.05
CPI	Level	>0.1	Trend	>0.05

Note: KPSS test tests the unit root with null hypothesis of stationary against alternative hypothesis of non-stationary.

As to the stationarity test for the research pair of the housing market and domestic consumption market, the stationarity of the same variables for the whole sample period is tested. Similarly to before, the natural logarithm is also taken for CHP, CSMI, CDCM and GDP to stabilize the data series. The results reported in Table 4 indicate the stationarity of all the variables after the first difference.

Table 4. KPSS Test for Variables Stationarity for Test Pair Housing Market and Stock Market in Whole Sample Period

Variable	**Null Hypothesis**	***p*-Value**	**Null Hypothesis**	***p*-Value**
I(0)				
ln(CHP)	Level	<0.01	Trend	>0.01
ln(CSMI)	Level	>0.1	Trend	>0.1
ln(CDCM)	Level	<0.01	Trend	<0.01
ln(GDP)	Level	<0.01	Trend	<0.01
CPI	Level	>0.1	Trend	>0.1
I(1)				
ln(CHP)	Level	>0.1	Trend	>0.1
ln(CSMI)	Level	>0.1	Trend	>0.1
ln(CDCM)	Level	>0.01	Trend	>0.1
ln(GDP)	Level	>0.05	Trend	>0.05
CPI	Level	>0.1	Trend	>0.1

Note: KPSS test tests the unit root with null hypothesis of stationary against alternative hypothesis of non-stationary.

4.4. Short-run Causal Relation

To identify the short-run causal relation, the spill-over index approach developed by Diebold and Yilmaz is adopted. The measurement of the spillovers of the housing market onto the other two markets is the variance decomposition based on vector autoregressive (VAR) models. This technique allows the aggregation of spillover effects across markets, and distills vital information into a single spillover measure (Diebold & Yilmaz 2009). Therefore, the variance decomposition enables the quantification of a causal relationship between markets.

Panel A and Panel B of Table 5 summarize the variance decomposition test of the housing market and stock market for both sub-periods. In the first period from 2005Q2 to 2011Q1, China's housing market prices from the short- to medium-run (1 quarter to 1 year) are strongly affected by previous prices. China's stock market also has a strong impact on the housing market in the same period, accounting for 39.44% of the shock that the housing market receives. Regarding the stock market in China, the housing market has the second strongest effect (29.93%) after the stock market's previous course

(64.40%) over the 1-year horizon. After the structural break in 2011Q2, a different situation is found for the housing market and stock market. Both housing prices and the stock index in China are strongly influenced by their own previous courses. Only 7.20% variation of housing prices can be explained by the shock from the stock market, and the shock from the housing market can induce 14.95% course variation of the stock market. All in all, the stock market and housing market have strong bilateral impacts and can mainly explain the movements of each other, but these impacts diminish over time. By contrast, the impact of GDP and CPI on the housing market and stock market are negligible in both period. Furthermore, a significant difference between both periods is clearly observed.

Table 5. Variance Decomposition for the Test Pair Housing Market and Stock Market

Period	**Variables**			
(in Quarter)	**CHP**	**CSMI**	**GDP**	**CPI**
Panel A: 2005Q2-2011Q1				
Variance Decomposition of China Housing Price Index (CHP)				
1	100.00	0.00	0.00	0.00
2	62.30	29.38	6.85	0.47
3	48.81	38.66	9.03	3.50
4	48.83	39.44	8.30	3.43
Variance Decomposition of China Stock Market Index (CSMI)				
1	37.89	62.11	0.00	0.00
2	21.93	71.17	5.83	1.08
3	27.43	67.24	4.50	0.83
4	29.93	64.60	4.60	3.43
Panel B: 2011Q2-2019Q2				
Variance Decomposition of China Housing Price Index (CHP)				
1	100.00	0.00	0.00	0.00
2	91.43	7.71	0.01	0.85
3	91.29	7.06	0.46	1.18
4	91.20	7.20	0.48	1.12
Variance Decomposition of China Stock Market Index (CSMI)				
1	2.57	97.43	0.00	0.00
2	11.48	83.93	2.28	2.31
3	11.79	81.49	4.47	2.25
4	14.95	77.45	4.91	2.70

In terms of the housing market and domestic consumption market, since there is no structural break detected, the whole sample period is taken to conduct the variance decomposition test. As seen in Table 6, in a 1-year time span, the housing market does not receive a strong impact (1%) derived from the domestic consumption market, with over 95% property prices being explained by itself. Similarly, the domestic consumption market is also almost insensitive to the housing market, since the shock from the housing market can only explain 3.44% to 5.68% volatility of the domestic consumption market. This finding indicates a weak correlation between both markets from the short- to medium-run. On the contrary, CPI can largely explain the variation in domestic consumption market, with 31.64% received shock. The GDP does not play an important role in explaining the variation in housing prices and the domestic consumption market index.

Table 6. Variance Decomposition for the Test Pair Housing Market and Domestic Consumption Market

Period	**Variables**			
(in Quarter)	**CHP**	**CDCM**	**GDP**	**CPI**
Variance Decomposition of China Housing Price Index (CHP)				
1	100.00	0.00	0.00	0.00
2	98.33	0.63	0.01	1.04
3	96.71	1.02	0.08	2.19
4	96.55	1.00	0.28	2.16
Variance Decomposition of China Domestic Consumption Market Index (CDCM)				
1	4.90	95.10	0.00	0.00
2	5.68	90.67	0.73	2.92
3	3.81	70.82	0.91	24.46
4	3.44	63.88	1.03	31.64

Since variance decomposition tests are only able to inform us of the general relationship between different variables with the corresponding strength, in order to understand the directions of the transmission of shocks, the Granger causality test is used to find the shock transmission channels between markets.

4.5. Long-run Causal Relation

After using variance decomposition to study to short-run relation between markets as well as other important macroeconomic factors, the long-run causal relation is examined by adopting the Granger causality test based on Wald-test.

Table 7 Panel A indicates that according to the Granger causality test results for the research pair of the housing market and stock market for the period 2005Q2 to 2011Q1, China's housing market seems to Granger-cause the stock market. This result is in line

with the short-run causal relation tested by variance decomposition. As reported in Table 5, the housing market can largely explain the stock index variation in a one quarter to one year short to medium time span. The capital gain from transacting properties and wealth effect derived in possessing increasingly valuable real estate together increase the demand for stock in this period. Therefore, as shown in Figure 1, the stock market and property market follow the same upward trend during this period. In Panel B which shows the period from 2011Q2 to 2019Q2, the Granger causality appears to disappear. However, the macroeconomic variable GDP Granger-causes China's housing market and CPI. This result indicates that Chinese economic growth in recent years leads to an increase in housing prices, and housing prices is reflective to the economic fundamentals in China.

Table 7. Granger Causality Test for the Test Pair Housing Market and Stock Marke

Variables	CHP	CSMI	GDP	CPI
Panel A: 2005Q2-2011Q1				
CHP	NA	→*	-	-
CSMI	-	NA	-	-
GDP	-	-	NA	-
CPI	-	-	-	NA
Panel B: 2011Q2-2019Q2				
CHP	NA	-	-	-
CSMI	-	NA	-	-
GDP	→.	-	NA	→*
CPI	-	-	-	NA

Note: "***", "**", "*" and "." denote 99.9%, 99%, 95% and 90% significant levels.

In terms of the housing market and domestic consumption market in China, Table 8 shows that there is no Granger-causality observed between them. This finding within the Chinese context puts the Permanent Income hypothesis and Life-Cycle Analysis hypothesis into question, since the observed price increase in housing over the whole period cannot stimulate expenditure in consumer goods. The continually raised domestic consumption volume is mostly due to the GDP and CPI and vice versa, which confirms the fact that domestic consumption is the driving factor behind the Chinese economy in the recent years.

Table 8. Granger Causality Test for the Test Pair Housing Market and Domestic Consumption Market

Variables	CHP	CDCM	GDP	CPI
CHP	NA	-	-	-
CDCM	-	NA	→***	→**
GDP	-	→***	NA	→***
CPI	-	→**	→*	NA

Note: "***", "**", "*" and "." denote 99.9%, 99%, 95% and 90% significant levels.

5. Conclusion

In this paper, the interrelation between the property market and two other important markets in China, i.e., the stock market and consumption market, are examined using various econometric techniques. As indicated in the literature, the housing market is usually correlated with both the stock market and the domestic consumption market. However, by examining the Chinese context, this study reveals different facts.

In the short- and medium-run causal relationship, the strong correlation between the housing market and stock market vanishes after the structural break in 2011Q2. Furthermore, the correlation between the housing market and domestic consumption market stays weak over the whole sample period. In the long-run, the housing market can Granger-cause the stock market from 2005Q2 to 2011Q1, indicating a credit price effect. However, after the structural break, this causal relation disappears, inferring a time-varying causal relationship. In terms of the housing market and domestic consumption market, no Granger-causality between these markets is detected.

The finding regarding the causal relation between the housing market and stock market has important implications for Chinese investors. This vanishing correlation between the housing market and stock market indicates a better portfolio risk diversification condition for Chinese investors who hold both property and stock in their investment portfolio. Since China's middle-class investors generally lack in investment vehicles, most investors only have real estate and stock in their portfolio. If there is a strong correlation between these two heavily weighted investments, the systematic risk of the portfolio is high and cannot be diversified. This undiversified systematic risk can cause severe losses to Chinese retail investors and eventually threaten the stability of the China's middle-class.

Results also show a weak correlation between the housing market and the domestic consumption market, indicating a different spending and saving behavior of the Chinese compared to the one provided by the Permanent Income hypothesis and Life-Cycle Analysis hypothesis. For Chinese policy makers, this is good news that the boom of China's domestic consumption market is not attributed to an increase in housing prices. This enables new policy to be issued regarding the real estate market to restrain any future irrational housing price growth, and deal with the existing price bubbles without hurting the domestic consumption market, which plays a vital role in China's economic growth.

In summary, the findings in this study are contrary to those of most existing studies, and delivers valuable implications for both Chinese retail investors and policy makers in

terms of dealing China's housing market, stock market and domestic consumption market.

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