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FACTORS AFFECTING THE RESIDENTIAL REAL ESTATE PRICES IN CHINA

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Abstract

From the end of the last century to now, China's real estate developed rapidly and became a pillar industry of the national economy. However, at the same time the booming of real estate development has caused the housing prices in China to continuously rise. High prices bring a series of social problems. Therefore, it is very necessary to analyze the real estate prices in china and explore the influencing factors of prices from the root. This study will provide the evidence for real estate companies and control policies from theoretical and practical standpoints.

According to these standpoints, this paper chooses seven factors, namely: gross domestic product; customer price index; monetary supply; exchange rate; interest rate; urban per capita disposable income and land price to study the relationship between residential real estate price and the above based on quarterly data from 2005 to 2016. This paper uses multiple linear regression to analyze influencing factors on property prices. According to the results; gross domestic product negatively affects the housing in some regions, interest rates and exchange rates show the positive and negative effects in different areas, monetary supply positively affects prices in each region. Consumer price index, urban per capita disposable income and land price negatively influence prices in some areas. Lastly, base on the results of this research this paper gives some suggestions to companies and organizations.

Keywords: Residential Real Estate Prices, Eight Economic Regions, Factors

Introduction

From the beginning to now, China's real estate development experienced four stages: theory breakthrough and experimentation (1978-1991), irrational speculation and readjustment (1992-1995), relative stability and development (1995-2002), housing prices increased sharply and Macro-control (2002-now). In 1998, the State Council issued the abolishment of the welfare housing system and realization of monetization. It marked that Chinese real estate had entered a new stage of development. In recent years the housing prices and residential real estate investments have soared. Along with rapid economic growth and a great deal of investment, the domestic estate is going higher. Worldwide, the property prices of most cities are overvalued and some are on the verge of a real estate bubble. According to the statistics of the International Monetary Foundation (IMF), Chinese real estate investment accounts for Gross Domestic Product (GDP) from 7.39% to 14.18% from 2003 to 2015. In the last century, this proportion was only 8.7% at the height of the Japanese real estate bubble. The highest number was 6.5% during the American secondary mortgage crisis. High prices are daunting, and that has become a hot issue for society and the government in recent years. The State and local government have put forward a series of policies regarding real estate control, including home purchase restrictions, the launch of property tax and increased mortgage rates, but the effect was not obvious. However, the housing prices directly affect the revenue of real estate companies. Therefore, it is necessary and important to analysis the factors of the real estate price and explore the root causes of housing price increases. Based on the 11th Five-Year Plan, China is divided into eight economic regions: North-East China: Heilongjiang, Jilin, Liaoning; Northern Coast Area: Beijing, Tianjin, Hebei, Shandong; Middle Reaches of the Yellow River Area: Henan, Shanxi, Shanxi, Inner Mongolia; South-West China: Sichuan, Chongqing, Guizhou, Guangxi, Yunnan; Middle Reaches of the Yangtze River Area : Hunan, Hubei, Jiangxi, Anhui; Southern Coastal Area: Guangdong, Hainan, Fujian; Eastern Coastal Area: Shanghai, Zhejiang, Jiangsu; North-West China: Ningxia, Gansu, Qinghai, Xinjiang, Xizang. This paper studies and comparatively analyzes the factors affecting residential real estate prices in above eight areas.

Research of objectives

This paper researches the relationship between the influencing factors on residential real estate prices in each of the eight regions. Influencing factors include: GDP, interest rate (Five-year benchmark lending rate), monetary supply(M2), consumer price index (CPI), the exchange rate(¥/$), urban per capita disposable income and land price.

Hypotheses

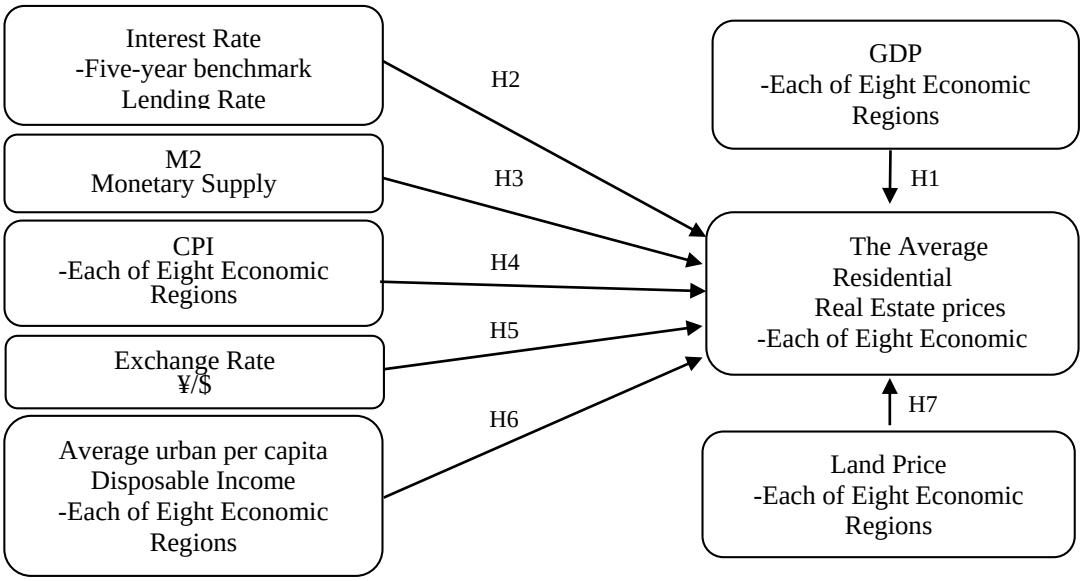

Figure 1 Research framework

Note: In this research, the residential real estate prices and affecting factors are compared and analyzed in eight different regions.

H1: The GDP affects residential real estate price in each of eight regions of China

H2: The interest rate (five-year benchmark lending rate) affects residential real estate prices in each of eight regions of China.

H3: The M2 affects residential real estate prices in each of eight regions of China

H4: The CPI affects residential real estate prices in each of eight regions of China.

H5: The exchange rate affects residential real estate prices in each of eight regions of China.

H6: The urban per capita disposable income affects residential real estate prices in each of eight regions of China.

H7: The land price affects residential real estate prices in each of eight regions of China.

Benefits of the research

Based on this paper, the relationship between the residential real estate prices and affecting factors would be estimated by empirical research results. There are four dimensions to elaborate the expected benefits of this research. This paper lists

and detailed analyzes some impact factors of the real. So the real estate companies understand the price formation mechanisms and make an appropriate decision can base on the results of this paper. They can adjust the strategy of companies and investment direction according to this study timely when the conditions change. Thus the companies can control the business risk, protect the loss of the assets and expend the profits. The results of this study can provide the evidences and policy reference of real estate regulation for government. Finding the trend of the real estate price is helpful for the consumers in regards to making appropriate decisions on purchasing houses. The results of this paper also are expected to make a contribution to the future academic research related to the real estate market.

Literature review

Li&Wang (2011) used Kalman filtering to study the factors affecting changes in real estate prices. They found there was a positive relationship between GDP and price. Li and Hu (2011) studied the fluctuation between China's real estate prices and macroeconomic based on PVAR model. The finding of this research is that GDP and housing prices are interrelated through cause and effect. M Belej and R Cellmer (2014) studied the macro-economic factors: GDP, inflation rate, unemployment rate and interest rate, all of which influence the real estate prices in Europe. There is a very strong positive correlation between prices and GDP.

Harris (1989) Proposed that nominal interest rates are a major variable that negatively affect housing prices, this was deduced through the use of the econometric analysis method. Zheng and Guo (2011) studied the reason behind high housing prices based on credit channel. The results show that the interest rate increase lead to the real estate price rise. Englund and Ioannides (1997) researched the property prices of fifteen members of Organization for Economic Cooperation and Development. They found the interest rates and prices have a negative relationship. Liang, Gao and He (2006) empirically analyzed the real estate industry and the national economy in China using quarterly data between 1995-2005. The results were that interest rates and housing price were negatively correlated.

William (2002) found that money supply positively impacted on the housing market through establishing vector auto regression (VAR) models based on monthly data. Gao (2008) studied the transmission mechanism of Chinese monetary policy on real estate prices based on VAR model. The result of this paper is that money supply increase caused the real estate investment and sales increase, which finally resulted in the rise of real estate prices. Elbourne (2008) empirically analyzed the impact of money supply on housing prices. He found that money supply changes have a positive impact on housing prices. Huang

and Wang (2010) adopted empirical analysis and used the SVAR model to study the effect of monetary supply on housing prices based on data in 2005-2009. They found that monetary supply increased which causes real estate prices to increase sharply. Xu (2011) adopted econometric analysis which includes Co-integration, the error correction model and the Grainger causality test for impulse response to research the transmission effect of money supply M2 and loan interest rate impact on real estate prices. The results show that there is a long-term stable relationship among these three, and that money supply (M2) influences housing prices positively.

Yu (2012) made the Grainger causality test of CPI and housing sales price index based on the data from January 2006 to December 2010. He found that the housing sales price index change would cause CPI changes, and that the changes of CPI did not cause price index changes, there is a one-way causal relationship between them. Pang and Mao (2013) conducted research about correlation between Chinese housing prices and CPI by utilizing the error correction model. They think there is a long-term equilibrium relationship between these two variables, and they are interdependent. Yuan (2012) analyzed the impact of CPI on real estate prices. The result is that CPI's influence on housing price is significant. Xu and Zhang (2012) pointed out that China's housing prices and Inflation is different from other countries and high CPI caused a negative interest rate which drives the residents to buy assets in order to reduce losses. This reason causes demand that prompts high real estate prices. The research result from Zhang (2013) stated that inflation did not have significant influence on Chinese housing price in recent years.

Earl Benson, Julia Hansen, Arthur Schwartz, and Greg Smersh (1999) studied the factors affecting housing price in Bellingham, Washington. The conclusion is that a rise of Canadian/U.S. exchange rate results in an increase of real estate prices. Han and Wang (2011) researched the fluctuations on real estate prices, money supply, fluctuations of exchange rate and interest rate using the VAR model. The result is exchange rates negatively impact on housing prices. Wang (2009) analyzed the relationship between RMB exchange rate and real estate price after the reform of exchange rates based on the co-integration test, Granger causality test and impulse response. The empirical results show that there is a negative relationship between the nominal exchange rate and real estate price. Chen and Liu (2009) analyzed the mechanism of exchange rate impact on housing prices, based on data during July, 2005 to December, 2007 through establishing VAR model. The result showed that the real effective exchange rate of RMB positively impacts on real estate prices.

Abraham and Hendershott (1996) built the price model to empirically research the influencing factors on housing prices and found that the rise of housing prices is largely due to the residents' increasing

income. Tu and Zhang (2005) empirical analyzed the Shanghai property prices based on data from July 2000 to March 2004. The finding of this article shows that per-capita disposable is an important factor which drives the real estate prices to rise. David (2005) constructed the VEC model to research the relationship between commodity house price, household disposable income, and mortgage rates. He found income increases lead to price increases, and mortgage rate increases lead to price decreases. Égert,and Mihaljek (2007) found that there is a positive relationship between per capita income and real estate prices in central Europe and Eastern Europe.

Edward, Joseph and Hilber (2002) selected: land price, housing price, regional economic development and human capital as variables to do regression analysis. The results show that there is no direct relationship between land price and housing price. Cao (2000) studied the commercial housing prices in Guangzhou, and then he found land prices positively impact on prices. Kuang (2005) explored the relationship between land price and housing price. The finding is that they are negatively correlated when supply exceeds demand, and they are positively correlated if supply is smaller than demand.

Methodology

Data collection

Due to the fact that the value of sales revenue and sales areas are cumulated monthly this study uses the sales revenues of the next three months minus the sales of the last three months to get the sales for the quarter. Then the gross sales of residential real estate and total sales area in the same region are calculated, at last, using the gross sales divide by total areas to obtain the average selling price of one region. In the same way, this paper gets the average land price per square meter. CPI and urban per capita disposable are also based on a monthly cumulated value and therefore a similar method is used to process the data. These four variables above are all regional averages of each quarter. GDP is the sum of each quarter of a region's domestic product of all provinces and cities in that region. Interest rate is weighted average of each quarter, M2 is also an average of each quarter.

Model

This paper uses the ordinary least square (OLS) to estimate the regression coefficient in a regression equation using the ample data, and then analyzes the degree of influence that the independent variables has on the dependent variables. It finds the best-fitting function to a set of data by minimizing the error squares.

There are many of factors affecting the residential real estate prices, but the researcher cannot study all of them due to the method and data limitation in this paper. As mentioned above, there are

seven explanatory variables to analysis in each of eight regions.

Based on the descriptive statistic of variables, differences among them are very large, in order to minimize these effects of difference and reduce the heteroscedasticity, therefore some variable are processed with logarithm. According the factors affecting the real estate prices, the multiple linear regression model can be described as follow:

$$LnAREP_t = \beta_0 + \beta_1 LnGDP_t + \beta_2 IR_t + \beta_3 ER_t + \beta_4 LnCPI_t + \beta_5 LnUDI_t + \beta_6 LnM2_t + \beta_7 LnLP_t + \mu$$

Note: This model runs 8 times in North-East China, Northern Coast Area, Middle Reaches of the Yellow River Area, South-West China, Middle Reaches of the Yangtze River Area, Southern Coastal Area, Eastern Coastal Area and North-West China.

Dependent variable:
- LnAREP: Natural logarithm of average residential real estate prices in each region.

Independent variables
- LnGDP: logarithm of gross domestic product in each region.
- IR: Nominal interest rate (Five-year benchmark lending rate)
- ER: Nominal exchange rate of RMB against US dollar
- LnCPI: Natural logarithm of consumer price index in each region
- LnUDI: Natural logarithm of urban per captia disposable income in each region
- LnM2: Natural logarithm of monetary supply
- LnLP: Natural logarithm of average land prices in each region

β_0: Intercept

β_i : Regression coefficient

μ: Random error

Results

This research analyzes the GDP, CPI, M2, exchange rate, lending interest rate, urban per capita disposable income, and how it affects the real estate price in eight economic zones based on the data during the period of first quarter of 2005 to the last quarter of 2016. Descriptive statistics, a multicollinearity tests, heteroscedasticity tests, autocorrelation tests, Regression result and interpretations will be performed, meanwhile, the relationships of variables will be confirmed.

Descriptive statistics

Table 1 Descriptive statistics results of original data in North-East China

Variable	Maximum	Minimum	Std. Dev.	Observations
AREP	5803.538	2193.683	1028.379	48
CPI	107.9556	98.9778	2.0398	48
ER	8.2765	6.1176	0.687	48
GDP	20008.77	3154.23	4401.514	48
IR	7.83	5.3022	0.6843	48
LP	5042.593	444.7167	1058.174	48
M2	1550067	264588.9	401491.3	48
UDI	7312.39	2064.6	1644.05	48

Table 2 Descriptive statistics results of original data in Northern Coast Area

Variable	Maximum	Minimum	Std. Dev.	Observations
AREP	8182.744	3213.942	1277.323	48
CPI	114.8333	98.4417	2.5289	48
ER	8.2765	6.1176	0.687	48
GDP	39713.55	7278.8	9037.138	48
IR	7.83	5.3022	0.6843	48
LP	15798.45	600.0473	3873.925	48
M2	1550067	264588.9	401491.3	48
UDI	10389.2	2960.675	2137.691	48

Table 3 Descriptive statistics results of original data in Middle Reaches of the Yellow River Area

Variable	Maximum	Minimum	Std. Dev.	Observations
AREP	5076.488	1612.212	1049.423	48
CPI	109.0333	99.3167	2.2024	48
ER	8.2765	6.1176	0.687	48
GDP	27530.08	3992.37	6385.245	48
IR	7.83	5.3022	0.6843	48
LP	6513.165	311.098	1551.646	48
M2	1550067	264588.9	401491.3	48
UDI	7494.413	2079.275	1688.391	48

Table 4 Descriptive statistics results of original data in South-West China

Variable	Maximum	Minimum	Std. Dev.	Observations
AREP	5203.358	1594.156	1124.111	48
CPI	109.6867	98.3133	2.3473	48
ER	8.2765	6.1177	0.687	48
GDP	29772.21	3840.93	6848.705	48
IR	7.83	5.3022	0.6844	48
LP	7211.685	434.2846	1789.241	48
M2	1550067	264588.9	401491.3	48
UDI	7738.126	2116.72	1620.012	48

Table 5 Descriptive statistics results of testing data in Middle Reaches of the Yangtze River Area

Variable	Maximum	Minimum	Std. Dev.	Observations
AREP	5739.857	1646.608	1212.595	48
CPI	108.25	98.4583	2.1022	48
ER	8.2765	6.1176	0.687	48
GDP	32336.14	4726.28	7600.514	48
IR	7.83	5.3022	0.6843	48
LP	5363.432	417.2442	1356.333	48
M2	1550067	264588.9	401491.3	48
UDI	8116.665	2027.75	1732.71	48

Table 6 Descriptive statistics results of original data in Southern Coastal Area

Variable	Maximum	Minimum	Std. Dev.	Observations
AREP	11062.42	3142.917	2051.855	48
CPI	107.7556	97.6222	2.1708	48
ER	8.2765	6.1176	0.687	48
GDP	33846.65	5511.06	7306.529	48
IR	7.83	5.3022	0.6843	48
LP	17292.58	566.0038	4110.782	48
M2	1550067	264588.9	401491.3	48
UDI	9575.583	2670.567	1921.97	48

Table 7 Descriptive statistics results of original data in Eastern Coastal Area

Variable	Maximum	Minimum	Std. Dev.	Observations
AREP	11713.57	3586.57	2165.757	48
CPI	107.2444	98.2333	1.9205	48
ER	8.2765	6.1176	0.687	48
GDP	42991.84	8104.25	9417.684	48
IR	7.83	5.3022	0.6843	48
LP	24803.76	1582.406	5668.001	48
M2	1550067	264588.9	401491.3	48
UDI	14089.47	3573.2	2774.567	48

Table 8 Descriptive statistics results of original data in North-West China

Variable	Maximum	Minimum	Std. Dev.	Observations
AREP	4537.106	1529.207	993.7658	48
CPI	110.1733	100.78	2.3371	48
ER	8.2765	6.1176	0.687	48
GDP	7674.94	916.72	1902.382	48
IR	7.83	5.3022	0.6843	48
LP	3795.033	249.2187	802.0951	48
M2	1550067	264588.9	401491.3	48
UDI	7176.296	1964	1541.121	48

Table 1 to 8 elaborates the descriptive statistics of all independent variables and dependent variables in each of eight regions. These descriptive statistics include: maximum, minimum, standard deviation and observing samples size.

Results of multicollinearity, heteroskedasticity and autocorrelation test

Table 9 The results of multicollinearity, heteroskedasticity and autocorrelation test

Region	TEST		
	Multicollinearity test	Heteroscedasticity test	Autocorrelation test
	Correlation matrix	White test	DW Test
North-East China	Yes	No	Yes
Northern Coast Area	Yes	No	No
Middle Reaches of the Yellow River Area	Yes	No	No
South-West China	Yes	No	No
Middle Reaches of the Yangtze River Area	Yes	No	No
Southern Coastal Area	Yes	Yes	Yes
Eastern Coastal Area	Yes	No	Yes
North-West China	Yes	N0	No

Note: Yes=Have related problem, No=Have no related problem

Table 9 shows the results of the multicllinearity, hetetoskedasticity and autocorrelaton tests. In this table, there is a multicolllinearity problem in each region, there is a heteroscedasticity problem in South Coastal Area, and there are autocorrelation problems in North-East China, Southern Coastal Area and Eastern Coastal Area. Stepwise regression analysis is used in this study in order to deal with this problem. In the Southern Coastal Area, the equation has heteriskedasticity and autocorrelation problems, the Newey-West method is used to resolve these problems.This research uses the generalized difference method to deal with the autocorrelation problems in North-East China, Middle Reaches of the Yangtze River Area and North-West China.

Regression result and interpretation

Regression result

Table 10 Regression result in North-East China

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-3.512391	1.526933	-2.300292	0.0269
ER	-0.142253	0.029246	-4.864011	0.0000***
IR	-0.054472	0.021347	-2.551684	0.0148**
LNCPI	1.942202	0.397442	4.886759	0.0000***
LNGDP	-0.241831	0.034022	-7.108036	0.0000***
LNM2	0.29761	0.170209	1.748498	0.0882*
LNUDI	0.276115	0.187713	1.470945	0.1493
AR(1)	-0.299743	0.173568	-1.726945	0.0921
R-squared	0.985673	Durbin-Watson stat		2.067215
F-statistic	335.3845	Prob(F-statistic)		0.000000***

*Note: *, **, ***= significant at the level of 10%, 5% and 1 %.*

The explanatory variables ER, LnCPI and LnGDP have significant effects on LnAREP at level 0.01, IR influence on LnAREP at level 0.05 and LnM2 impact on LnAREP at level 0.1. LnUDI has no significant impact on LnAREP. When the exchange rate increases 1 ¥/$, the average real residential real estate price will decrease 14.23%. Average residential real estate prices will decline 5.45% when the interest increases 1unit and prices will increase 1.94% when CPI increases 1%. When GDP increases 1%, the average residential real estate price will decrease 0.24%. The price will increase 0.30% when the M2 increase 1%.

Table 11 Regression results in Northern Coast Area

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.214825	0.754338	1.610453	0.1143
ER	0.086835	0.0327	2.655539	0.0109***
LNM2	0.50322	0.040624	12.38726	0.0000 ***
R-squared	0.921418	Durbin-Watson stat		1.823735
F-statistic	263.826	Prob(F-statistic)		0.0000 ***

*Note: *, **, ***= significant at the level of 10%, 5% and 1 %.*

The LnM2 and ER have significant impact on lnAREP at level 1% and 5%. The monetary supply and exchange rate all positively affect the real estate price, the housing price will increase 0.5% if M2 increases 1%; the price will increase 8.68% if the exchange rates increase 1¥/$.

Table 12 Regression results in Middle Reaches of the Yellow River Area

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-3.938188	1.948983	-2.020637	0.0496
ER	-0.078326	0.024741	-3.165826	0.0028***
LNCPI	1.035666	0.3555	2.913263	0.0057***
LNGDP	-0.161187	0.046935	-3.434281	0.0013***
LNM2	0.686439	0.045556	15.06791	0.0000***
R-squared	0.984809	Durbin-Watson stat		1.518038
F-statistic	696.9121	Prob(F-statistic)		0.0000 ***

*Note: *, **, ***= significant at the level of 10%, 5% and 1 %.*

According to this result, exchange rate and GDP negatively influence the average residential real estate price, and CPI and M2 positively impact on housing prices in Middle Reaches of the Yellow River Area. When ER increase 1¥/$, prices will decrease 7.83%. A CPI increase of 1% will lead to housing prices increasing 1.0357%. When the GDP increases 1%, the price will decrease 0.16%. The real estate price will increase 0.68% if M2 increases 1%.

Table 13 Regression results in South-West China

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-7.549803	2.279593	-3.311909	0.0019
ER	-0.162627	0.025589	-6.355399	0.0000***
LNCPI	1.931299	0.378182	5.106804	0.0000***
LNGDP	-0.154264	0.058021	-2.658757	0.0111**
LNLP	-0.093374	0.033296	-2.804334	0.0077***
LNM2	1.040418	0.15163	6.861553	0.0000***
LNUDI	-0.478125	0.118496	-4.034944	0.0002***
R-squared	0.983336	Durbin-Watson stat		1.519262
F-statistic	403.2252	Prob(F-statistic)		0.0000 ***

*Note: *, **, ***= significant at the level of 10%, 5% and 1 %.*

The probability value is 0.0000 that means all independent variables can be used to determine their impact on dependent variable at significant statistic 5%. In this region, the independent variables ER, GDP, LP and UDI negatively impact on average residential estate prices; CPI and M2 positively influence prices. When the GDP, LP and UDI increase 1%, respectively, this will lead to the housing prices decreasing 0.15%, 0.09% and 0.48%. When ER increases 1¥/$, the prices will decrease 16.26%. If CPI and M2 increase 1% the average prices will increase 1.93% and 1.04% respectively.

Table 14 Regression results in Middle Reaches of the Yangtze River Area

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-7.373315	2.10271	-3.506576	0.0011
IR	0.046163	0.014366	3.213356	0.0025***
LNCPI	1.030272	0.453352	2.272564	0.0282**
LNGDP	-0.250392	0.057747	-4.335983	0.0001***
LNM2	1.10907	0.105276	10.53491	0.0000***
LNUDI	-0.253208	0.085135	-2.974188	0.0049***
R-squared	0.988253	Durbin-Watson stat		2.036069
F-statistic	706.6789	Prob(F-statistic)		0.0000***

*Note: *, **, ***= significant at the level of 10%, 5% and 1 %.*

According to these results, the probability value is 0.000 that means all independent variables can be used to determine their impact on dependent variable at significant statistic 1%. When IR increases 1 unit, the housing price will increase 1%, A CPI increase of 1% will lead to price increases of 1.03%. When monetary supply increases 1% the prices will go up 1.11%. When GDP and urban per capita disposable income increase 1%, respectively, the average residential real estate price will decline 0.2503% and 0.2532%.

Table 15 Regression results in Southern Coastal Area

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-5.138753	2.762289	-1.860324	0.0694
LNCPI	1.358926	0.570573	2.381687	0.0215**
LNM2	0.569164	0.031506	18.06502	0.0000***
R-squared	0.958401	Durbin-Watson stat		0.955717
F-statistic	518.3781	Wald F-statistic		163.7483
Prob(F-statistic)	0.0000***	Prob(Wald F-statistic)		0.0000

*Note: *, **, ***= significant at the level of 10%, 5% and 1 %.*

According to regression result, the probability value is 0.000 that means all independent variables can be used to determine their impact on dependent variable LnAREP at significant statistic 1%. In Southern Coastal Area, the independent variables LnCPI and LnM2 significantly impact on LnAREP. When CPI increases 1%, the prices will increase 1.36%. When M2 increases 1%, the housing prices will increase 0.57%.

Table 16 Regression results in Eastern Coastal Area

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-5.87342	3.877938	-1.514573	0.1376
LNCPI	1.578507	0.85778	1.840224	0.073*
LNGDP	-0.468293	0.130752	-3.581549	0.0009***
LNM2	1.184964	0.172123	6.884392	0.0000***
LNUDI	-0.432102	0.119991	-3.601129	0.0008***
AR(1)	0.395449	0.157856	2.505123	0.0163
SIGMASQ	0.003784	0.000858	4.41207	0.0001
R-squared	0.96031	Durbin-Watson stat	2.039547	
F-statistic	165.3348	Prob(F-statistic)	0.0000***	

*Note: *, **, ***= significant at the level of 10%, 5% and 1 %.*

According this result, the value of probability is 0.00 which is less than 0.01. That means all independent variables can use to determine their impact on the dependent variable LnAREP at significant statistic 0.01. When CPI increases 1%, the prices will increase 1.58%. When GDP increase 1%, the prices will decrease 0.47%. When the M2 increases 1%, the housing prices will increase 1.18%. The prices will decline 0.43% when UDI increases 1%.

Table 17 Regression results in North-West China

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-4.352127	1.295593	-3.359179	0.0016
LNCPI	0.751929	0.274373	2.740537	0.0088***
LNLP	-0.041265	0.013719	-3.007961	0.0043***
LNM2	0.67629	0.017497	38.6513	0.0000***
R-squared	0.987171	Durbin-Watson stat	1.750582	
F-statistic	1128.582	Prob(F-statistic)	0.0000***	

*Note: *, **, ***= significant at the level of 10%, 5% and 1 %.*

According this result, the value of probability is 0.0000 which is less than 0.01 that means all independent variables can determine their impact on the dependent variable LnAREP at significant statistic 0.01. They have a negative relationship between LP and LnAREP. The prices will increase 0.75% when CPI increases 1%. When M2 increases 1%, the residential real estate price will increase 0.68%. When LP increases 1%, the housing prices will decline 0.04%.

Conclusion and discussion

Gross domestic product (GDP)

The results above show that GDP negatively affects residential real estate price in North-East China, Middle Reaches of the Yellow River Area, South-West China, Middle Reaches of the Yangtze River Area and Eastern Coastal Area. These results are not in concert with the previous studies. Belejand and Cellmer (2014), Li and Hu (2011) all pointed out that the GDP affects real estate price positively.

In this paper, the researcher investigates the eight economic regions; however, economic developments are unbalanced in different provinces and cities. When they are integrated into a large area this causes the result to be bias. In recently years, the government strengthened macro-control on real estate price and China's economic transition led to the growth of GDP slowdown. There are only seven independent variables, but factors affecting housing price are complicated. These variables which are selected cannot present the truth in some regions. That's why GDP negatively affects real estate prices in some areas.

Interest rate (IR)

The results of this research as follows, interest rate have a significantly negative effect on the residential real estate prices in Eastern Coastal Area and positive affects in Middle Reaches of the Yangtze River Area. That is in compliance with literature review, such as Harris (1989), Englund and Ioannides (1997), Gao and He (2006), all of which pointed out that there is a negative relationship between interest rate and housing prices. Zheng and Guo (2011), found the interest rate positively affects the housing priced.

This study chooses the Five-year benchmark lending rate. The rate increase leads to cost increase which causes prices to rise. On the other hand, high interest rates will increase the pressure of purchasing property. Some people will change their decision to purchase property which will lead to a change in supply and demand. Therefore, they have a negative relationship. At the same time, the data of some areas is missed. Therefore, the interest rate doesn't impact on housing prices in other areas.

Monetary supply (M2)

Based on the above results, monetary supply has a significant positive influence on residential real estate prices in each region; this is consistent with

previous research, such as William (2002), Gao (2008), Elbourne (2008), Huang and Wang (2010) and Xu(2011)

In past years, the growth rate of M2 has been higher than the GDP growth rate which results in money over issue. This meaning is the growth rate of money supply exceeds the growth rate of money demand, that is, the amount of money issued exceeds the amount of money needed to maintain the normal operation of the economy. Superfluous money leads to the purchasing power enhancement that promotes the housing prices to rise.

Consumer price index (CPI)

According to the result of this study, CPI positively affects the residential real estate prices in the North-East China, South-West China, Middle Reaches of the Yangtze River Area, Southern Coastal Area, Eastern Coastal Area and North-West China. Those are in compliance with previous studies. Yuan (2012), Zhang (2013), and Xu and Zhang (2012) believed that high CPI promotes high real estate prices. Pang and Mao (2013) believed they have a long-term equilibrium relationship between these two variables.

In China, even though the housing price doesn't factor into the calculation of the consumer price index, the rising housing prices still lead to CPI being driven up. At the same time, when prices rise rapidly it can be expressed as high inflation, demand exceeds supply and prices skyrocket. All of these factors will cause the housing prices to increase. The complexity of region and imbalance of development, selection of methodology and independent variables and sample size can be the reason why CPI affects the housing prices at different level in different regions.

Exchange rate (ER)

From the results of the analysis, the exchange rate affects residential real estate prices negatively in the North-east of China, Middle Reaches of the Yellow River Area and South-west China. However, Affects on housing prices are positive in Northern Coast Area. These results are in alignment with the forerunner's studies. Wang (2009) and Han and Wang (2011) pointed out that the exchange rate is negatively related to housing prices. Greg Smersh (1999), Chen and Liu (2009) believed that exchange rate increases lead to a rise in house prices

RMB exchange rate depends on supply and demand. When the RMB is depreciated, some investors will purchase the property to respond to loss that causes the price to increase. Therefore, exchange rate can negatively impact on housing prices. On the other hand, high RMB exchange rate leads international hot money in-flow to China. Finally, some hot money in-flow into real estate industry results in high housing prices. In the past, China adopted the strict currency control and intervention. At the same time the Research method, variable selection and sample size may be the reason why the

exchange rate doesn't influence prices in some areas.

Urban per capita disposable income (UDI)

Following the result, urban per capita disposable income positively impacts on residential real estate prices in Northern Coast Area China. That is in accordance with previous studies, Such as Miller and Liang (2006), who believed that per capita income is a major reason for price volatility. Abraham and Hendershott (1996), Tu and Zhang (2005), David H (2005), Égert,and Mihaljek (2007). Disposable income negatively impacts on housing prices in South-west China, Middle Reaches of the Yangtze River and Eastern Coastal Area. Those results are different from the research mentioned above.

The purchasing power of people will increase along with rising disposable income. At the same time, more and more people hope to improve housing conditions as the residential income continues to grow. In recently years, the government strengthened macro-control on real estate prices. Most of the provinces and cities implemented the stringent restriction of purchase policy in particular. So they have a negative relationship between them. The average value in one region is analyzed; however, the income gap is very large in different provinces and cities. Sample size, research method and variables selection also leads to the research result being different.

Land price (LP)

The result of this paper presents that land prices have a negative effect on housing prices in South-West China and North-West China. That is different from the preceding researches, Cao (2000) pointed out that land prices positively affects the housing prices. Joseph and Hilber (2002) believed that there is no direct relationship between land prices and housing prices. Kuang (2005) confirmed that they are negatively correlated when supply exceeds demand, and they are positively correlated when supply is smaller than demand.

Pricing mechanisms are complicated, although land cost is an important part of housing price, it is not a determinant. Housing price is determined by supply and demand. In recently years, in South-West China and North-West China, The economy of these two regions developed rapidly which caused the high demand for real estate. This is not interrelated with other regions due to limitations in research methodology, analysis tools, data processing or variable selection.

Implication for the study

The results of this paper provide a reference for academicians and later researchers who want to study this field. The findings of this study provide some information for real estate enterprises, other companies and relevant industries when they make strategies. With the deepening of economic reform in China, real estate companies face more and more challenges and potential opportunities. They will be able to

respond quickly according to the results of this study, which determines the factor effecting real estate prices. When the factors trend becomes positive the company can increase their investment. Companies can assess the economic environment and formulate feasible and effective mechanism of cost and pricing. Companies can gather more information from the different channels, strengthen market research, enhance the performance of the company, and optimize the structure of the company. Different regions have different influencing factors. The company should distinguish these factors then make a reasonable decision.

Research recommendation

High monetary supply promotes the residential real estate prices to increase continually. Exchange rate affects housing price by capital flow. The government can control the property prices by changing interest rates. In general, they are all issued by the government. In other words, real estate enterprises and related industries should be wary of changes to monetary policy which tighten or loosen and adjust quickly according these changes. At the same time; they should pay more attention to capital flows and change of interest rate, then rationally adjust the capital structure to meet changes. After all, high interest rates lead to cost increases and cause the housing prices to go up. They also increase the cost to the company and decrease the purchasing demand. As mentioned above, the companies should make decisions considering the above factors as a whole.

Land is an important influencing factor on real estate prices. When the land prices change, the housing price will be affected. The real estate enterprises cannot blindly make decisions on purchasing at land auctions. Sales will reduce if people can't bear the higher prices. Moreover, the capital return of the company will be slowed down because of the increase in the cost of land and could create a series of problems. Therefore, the company should make reasonable land price policy.

The regions GDP reflects its' economic development. Urban per capita disposable income is used to measure the variation in living standard. Therefore, the real estate companies should modify the corporate strategy when economic growth is up or down. When disposable income increases this means that consumer power strengthen. The company can adjust the prices according to the economic growth and income status. CPI also has an affects on housing prices, high CPI promotes the price rising. However, the companies need to be concerned about high inflation that will endanger the real estate industry and even the whole national economy.

All of the factors affecting real estate prices present different effects in different areas. That is to say, one factor influencing house prices in one region may not have the same influence in another area. Therefore, the enterprise can modify the investment to other fields

and regions when some factors begin to deteriorate.

Limitations and further research

This paper only chooses seven factors affecting residential real estate price: gross domestic product, exchange rate, interest rate, monetary supply, consumer price index, land price and urban per capita disposable income. However, some others elements impacting on housing prices are omitted. This will cause the results to be contained within inevitable limitations.

This study researches eight regions in China, however, different provinces and cities within intra-regional areas adopt different policies. As a result the difference of economic development is large. That might lead to the results not reflecting the state of some parts of the country.

Some statistic data is missing which lead to the data generation process which has limitation. The data of average residential real estate prices and land prices are averages of all the provinces and cities in one economic area. Because the data types of some variables are monthly, they need to be adjusted into quarterly data that could cause error. In this article, there are 48 observations based on quarterly data between 2005 and 2016, therefore, the range is not big enough. In future, researchers should expand observation size to obtain more accurate research results.

This paper builds the multiple linear regression model to examine the factors influencing residential real estate prices. However, there are many research methods that can be used which may provide useful results. In the future researchers can adopt different models and methods to study residential real estate from different perspectives.

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