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Factors Effecting Private Residential Prices in Mainland China during 2003-2009

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Abstract- This paper explores the most effective factors of housing price swings in recent years in Mainland China. According to the fundamental model of real estate market dynamics, housing prices together with 6 other ratios and figures were used. The sample covered 8 years from 2003 to 2009 and 31 administrative areas in Mainland China. Housing prices are considered as dependent variable, while income per capita, land prices, mortgage rates, density of population, unemployment rates, and savings are measured as independent variables. Multiple regression analysis was used for the investigation. To locate the fittest factors, both Panel Fixed Effect Model and Ordinary Least Square Model Newey-West HAC Modification were applied. The results of models indicated that the most effective factors affecting the housing prices are income per capita, land prices, and mortgage rates.

Index Terms- Housing prices, China administrative areas, real estate, metropolitan housing market, urban housing market, residential property market, income per capita, land prices, mortgage rates, density of population, unemployment rates, savings, multiple regression analysis, Panel Fixed Effect Model, Least Square Model.

I. INTRODUCTION

The first real estate company in China was founded in Beijing in the year 1980. Twelve years later, China experienced its first real estate boom for about a year. Thereafter, it suffered negative growth until the year 2000.

In the 21st century, the continuous urbanization and population movements increased the demand for housing, especially in major cities. The total value of China's residential housing market reached 91.5 trillion RMB at the end of 2009, which is nearly three times the size of China's NGDP in the same year.

In recent years, the commercial residential housing market prices (dependent variable of this research) significantly rose all over the country. Real estate prices for this market increased at a rate greater than the local economic growth and hit its peak in the year 2005.

There are various factors that can effect housing price changes in Mainland China. This research selects six independent variables and determines if there are any statistical relationship between them and housing prices changes. The six independent variables were concluded from fundamental model of housing price dynamics. And the data of six variables obtained from the National Bureau of Statistics of China (NBSC) are as follows:

1) Disposable income per capita
2) Land price changes
3) Mortgage rates
4) Density of population
5) Unemployment rates
6) Savings

The extent of this research covers a total of 7 years – from the year 2003 to 2009.

This research focuses on commercial housing market and not the property market as a whole. Therefore, properties used for purposes of industrial, business office, governmental and utility are excluded.

II. PREVIOUS STUDIES

DiPasquale & Wheaton (1996) defined real estate as the stock of buildings owned by a nation. These include the land where those buildings sit on and all vacant land.

Lizieri & MacGregor (2001) found that prices of residential market are determined by principles of supply and demand. It is a principle that the market always adapts to, and in this case, it is the real estate market. The supply and demand principle is further supported by the works of Quigley (1999); Case & Shiller (2003); Krainer (2005); Chen (2008).

There are various models used to determine housing prices dynamics. The model of interest here is the Fundamental Model. Some examples are GDP, rent, income, mortgage rate, tax rate, inflation rate, savings, market supply and demand, financial fluctuation and interest rate. The Fundamental model uses these determination variables to determine changes in housing prices. This model is supported by the researches of Quigley (1999); Hwang & Gary (2006). These researchers found correlations between several determination variables and fluctuations in housing prices.

With a higher level of disposable income, which is a determination variable in the fundamental model, there would be more demand for houses. Housing prices would increase in tandem to balance out the higher demand of potential house buyers. Herring & Wachter (1999) found that increases in housing prices were positively linked with real income growth. This correlation is also supported by the works of Case & Shiller (2003); Aziz (2006); Quigley (2009).

As the price of a piece of land increases, so will the total purchase price of a property on that said land. Additionally, an infrastructure that has recently been completed raises the value of the land retroactively. This rationale is supported by researches of Case & Shiller (2003); Bottelier (2010).

With a higher mortgage rate, properties that can be mortgaged would be depressed in order to entice buyers who are put off by high mortgage rates. Herring & Wachter (1999) found

that to be the case in Bangkok's property prices in 1995 when mortgage rates soared. McCarthy, Jonathan & Peach (2004) also support this notion in their research.

As a demographic factor, density of population is one of the key elements to determine the level of human settlement. A lower population density of neighborhoods would attract more house buyers in the vicinity. As a result, Yan & Knaap (2003) found a negative correlation between population density and housing values from previous market surveys. Aziz et al. (2006) found that real estate price swings were positively linked with the urban population rate in 7 developed countries. Kranier (2005) also stressed that there was an interesting relationship between demographic factors and home prices.

Another fundamental factor in question is unemployment rate. When the unemployment rate is high, there will be more people with less disposable income to make a house purchase. This hypothesis is supported by works of Herring & Wheaton (1996); Aziz et al. (2006).

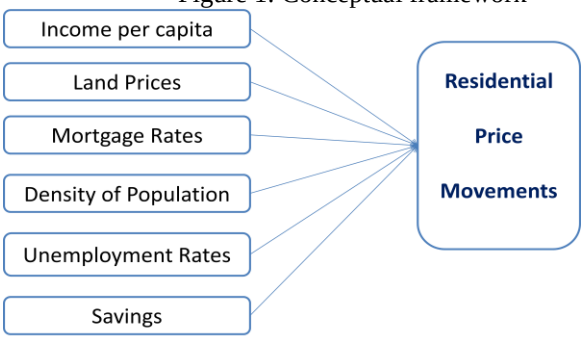
Savings as defined by Todaro (1994) is the portion of disposable income not spent on consumption by households plus profits retained by firms. Since the purchase of a house can involve a large percentage of a household's savings, consumers need to save up a significant portion of their earnings to prepare for a purchase. As a result, higher savings would result in higher demand for properties. Gale & Sabelhaus (1999); Case & Shiller (2003) also found evidence that higher savings result in higher property prices.

III. RESEARCH FRAMEWORK

The majority of studies on the residential market adopted the fundamental model for their research analysis, such as, Malpezzi (1998), Meen (2002), Schnure (2005), and Abelson *et al.* (2005). The Fundamental Model (Gallin, 2008) assumes that the movements of the real estate market are defined by fundamental economic factors. In this research, the fundamental model is selected to determine the factors that have an effect on residential price movements.

The following figure shows the conceptual framework modified from the fundamental model to be used in this research.

Figure 1: Conceptual framework



Source: Constructed by author

RESEARCH METHODOLOGY

In this research secondary data was collected from the Chinese Yearbooks resource full-text database from years 2003 to 2010. This represented the market data from 2002 to 2009. The annual data are managed and published by the National Bureau of Statistic of China by which the China Central Government is represented. The researcher calculated and organized those data to match the fitness and reliability in to suit the framework's requirement.

SAMPLING PROCEDURES

The researcher used a target population which contained 31 administrative regions in Mainland China, based on geographical division. Those 31 regions are selected according to Divisions of Administrative Areas in China of the People's Republic Central Government. These 31 Administrative Areas include 22 Provinces, 5 Ethnic Minority Autonomous Regions and 4 Municipalities directly under the Central Government of People's Republic of China. Additionally, these 31 areas are controlled by the Communist Party of China, and have represent politics adopted by the China Central Government in 1949, in which year the People Republic of China was founded, up till now. The list of 31 Administrative Areas together with their code can be found in table 1 of the appendix.

DATA ANALYSIS

The researcher first conducts descriptive statistics analysis. The descriptive statistics analysis was based on each variable under the Mainland China housing market. The panel data collected a 7 year period with 31 cross-sections (administrative areas), in total 271 observations. Table 2 in the appendix shows the descriptive statistic results. All variables were measured in terms of the percentage changes in the value from the previous year's data.

Then, a multicollinearity test using the Ordinary Least Square method is applied. There will be a problem for multicollinearity when then the value of correlation is greater than 0.8 or lower than -0.8. The results can be found in table 3 in the appendix.

To check for stationarity of data, this research used the Augmented Dickey-Fuller Fisher (ADF-Fisher) unit root test to determine whether the residual of the cross-section equation exhibit a unit root. If p value > 0.05 (5%), the data is non-stationary. If p value ≤ 0.05 (5%), the data is stationary. The result of unit root test can be found in table 4 in the appendix.

Next, a multiple regression analysis was carried out to investigate the association among the indicators of housing market fundamental factors, utilising Ordinary Least Square Multiple Regression Models. To locate the most effective explanatory variables, two statistical methods were employed in this study. They are the Panel Fixed Effect Ordinary Least Square Model (fixed effect) and the Newer-West HAC (heteroscedasticity and autocorrelation consistent) standard Errors and Covariance Modification (Newer-West).

After checking for stationarity of data, the Panel Fixed Effect Ordinary Least Squares regression model with dummy variables was used to compute the data. The results are shown in table 5 in the appendix.

The second method, Least Squares Model with Newer-West HAC focused on the data structure and to determine the explainable factors. This model ignored the panel data function and emphasised on the time serial data function. Therefore,

before employing the regression, the serial correlation needed to be tested first.

This research used the Breusch-Godfrey Serial Correlation LM Test to detect how well the past fundamental values impact on the future house prices. When p value ≤ 0.05 (5%), there is no serial correlation amongst the residual orders. When p value > 0.05(5%), there is serial correlation amongst the residual orders. The results of the serial correlation test can be found in table 6 in the appendix.

To solve the autocorrelation issue in the time serial dataset, the researcher adopted the Ordinary Least Square Newey-West standard error modification method. Since the sample size of 271 is fairly large, the researcher computed OLS with Newer-West procedure in Eviews to correct OLS standard errors, not only in situations of autocorrelation but also in cases of heteroscedasticity. The results of this test can be found in table 7 in the appendix.

Finally, the independent variables were tested against the dependent variable, which is house price.

IV. RESULTS AND DISCUSSIONS

The following are results of statistical treatment of data based on the conceptual framework of this research.

The researcher found that disposable income per capita highly contributed to house prices swings in Mainland China during the discovered period. The correlation between house prices and income per capita was proved by both of the statistical methods. The disposable income per capita was strong and positively related to house prices as well. Comparably, the disposable income per capita was the most powerful explanatory variable among all variables.

For the variable of land prices, the researcher found that land prices showed a significant increase along with the house prices uprising during the year 2003 to 2009 in Mainland China. The pair of the methods indicated the relationship between land prices and house prices was positive.

The researcher tested the correlation between mortgage rates and housing price changes and found that the mortgage rates were a considerable factor which influenced the housing prices in the research period. When the mortgage rates floated up 1 unit, the house prices had increased at least 4%.

For the next determination variable of density population, the researcher found that The Fixed Effect Model failed the null hypothesis and rejected the dynamic relationship between house prices and density of population. However, based on the stationary time serial data function, the Ordinary Least Square Newey-West HAC Modification proved the significant relationship in between these two predictors.

The next variable is unemployment. The findings of this research indicated that the unemployment rates failed to influence the housing prices movement. The results were identified by both static methods. The only significant finding here was that the unemployment rates were negatively associated with the Chinese mainland housing market prices dynamics.

The last variable is savings. The researcher found that variable saving was positively associated with residential property prices behaviors in Chinese mainland market in the sample period. However, regardless of the evidence from none of the static methods, the correlation between the two indicators would not be proved. In other words, there was no statistically significant relationship between housing price changes and savings in Mainland China.

V. CONCLUSION AND RECOMMENDATIONS

In this research, several fundamental factors can influence price variance in residential market of Mainland China. On the demand side, income per capita, density of populations, banking mortgage rates, unemployment rates and savings have been shown to have effects on house prices. However, variables of unemployment rates and savings were insignificantly correlated with housing price dynamics in Mainland China.

On the supply side, attention has been paid to land prices. These findings were similar to the cross country study of OECD Economic working paper about recent house price developments (2005), which investigated evidence of each cointegrating vector in each of the eighteen countries examined.

The income growth alone explained the pattern of home price increases, especially in Beijing, Shanghai, and fast developing regions. Other factors included a negative correlation between house prices and changes in unemployment rates, which may reflect weaker consumer confidence in provinces that have experienced an increase in unemployment rates. However, the real interest lending rates (mortgage rates) appeared to be positively correlated with residential prices, which is the opposite expectation. This correlation may arise from the use of the consumer price index to derive real interest rates and to deflate real house prices, thereby giving rise to a spurious correlation. Density of population was negatively correlated with home prices. Savings were positively correlated with residential prices but were not statistically significant.

To the point of this research, the current residential market of Mainland China is the combination of high demand for residence and low perceived cost of homeownership. Structurally low mortgage rates, high income growth, stable savings, and lack of alternative investment and property policy all work to promote excessive residential price uprising.

Considering the intention of buying residence property, Chinese consumers are more alike natural buyers. In addition, the Chinese traditional view of wealth becomes a driving force of investing in residence. Moreover, from past experience of housing market, investing into property becomes an optimistic option for households of China. Indeed, there are less alternative investment options for Chinese investors who have stable savings and who prefer low risks.

This research attached importance to fundamental factors of housing prices. Due to the myriad of fundamental factors, there are many other factors that were not examined in this study. Future researches can be conducted with other fundamental factors not covered in this research. Additionally, China, as a single party communist country, may have policies that are unconventional and can skew consumer behavior in a way that may not follow the supply and demand principle. Future researchers can also put government policy into consideration when researching the Chinese real estate market.

APPENDIX

Table 1: 31 Administrative Areas

Provinces, Autonomous Regions and Municipalities	Code	Provinces, Autonomous Regions and Municipalities	Code
Beijing	001	Tianjin	002
Hebei	003	Shanxi	004
Inner Mongolia	005	Liaoning	006
Jilin	007	Heilongjiang	008
Shanghai	009	Jiangsu	010
Zhejiang	011	Anhui	012
Fujian	013	Jiangxi	014
Shandong	015	Henan	016
Hubei	017	Hunan	018
Guangdong	019	Guangxi	020
Hainan	021	Chongqing	022
Sichuan	023	Guizhou	024
Yunnan	025	Tibet	026
Shaaxi	027	Gansu	028
Qinghai	029	Ningxia	030
Xinjiang	031		

Source: Tabled by the author, information collected from National Bureau of Statistics of China.

Table 2: Descriptive Statistics

Variables	Mean	Median	Std. Dev.	Max.	Min.	Observations
House Price (HP)	0.1190	0.1218	0.1072	0.4563	-0.6012	217
Income per capita (INC)	0.1098	0.1095	0.0321	0.2191	-0.0534	217
Land Price (LP)	0.2247	0.2375	0.4286	2.4415	-1.7566	217
Mortgage (MORTG)	0.0257	0.2700	0.8306	0.7200	-1.8900	217
Density (DENS)	0.1403	0.0178	0.5467	3.4841	-1.9899	217
Unemployment (UNEMP)	-0.0246	-0.0100	0.2132	0.8100	-0.8800	217
Savings(SAV)	0.1573	0.1570	0.0530	0.2719	0.2719	217

Source: Eviews output, modified by author.

Table 3: Correlation Matrix of the Independent Variables

	INC	LP	MORT	DENS	UNEMP	SAV
INC	1.00	-0.09	-0.11	-0.08	-0.15	-0.13
LP	-0.09	1.00	-0.01	0.01	0.02	-0.12
MORT	-0.11	-0.01	1.00	0.16	-0.14	-0.71
DENS	-0.08	0.01	0.16	1.00	-0.06	-0.06
UNEMP	-0.15	0.02	-0.14	-0.06	1.00	0.14
SAV	-0.13	-0.12	-0.71	-0.06	0.14	1.00

Source: Eviews output, modified by author.

Table 4: Unit Root Test Output

Null Hypothesis	ADF-Fisher Test Statistic	Probability Value
HP	-6.8380	0.0000
INC	-5.1478	0.0000
LP	-6.0085	0.0000
MORT	-4.1737	0.0000
DENS	-6.5133	0.0000
UNEMP	-6.3276	0.0000
SAV	-5.5572	0.0000

Note: Test critical values at 5% level = -1.944105
Source: Eviews output, modified by author.

Table 5: Panel Fixed Effect

Cross-section fixed			
R-squared	***0.2133***	Mean dependent var	0.1190
Adjusted R-squared	0.0559	S.D. dependent var	0.1072
S.E. of regression	0.1042	Akaike info criterion	-1.5317
Sum squared resid	1.9528	Schwarz criterion	-0.9554
Log likelihood	203.1933	F-statistic	1.3555
Durbin-Watson stat	***2.4249***	Prob(F-statistic)	***0.1018***

Source: Eviews output, modified by author.

Table 6: Serial Correlation Test

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	5.0406	Prob. F(2,208)	***0.0073***
Obs*R-squared	10.0312	Prob. Chi-Square(2)	***0.0066***

Source: Eviews output, modified by author.

Table 7: Ordinary Least Square Newey-West HAC Modification HAC

Ordinary Least Squares (Newey-West)			
R-squared	0.1403	Mean dependent var	0.1190
Adjusted R-squared	0.1158	S.D. dependent var	0.1072
S.E. of regression	0.1008	Akaike info criterion	-1.7196
Sum squared resid	2.1339	Schwarz criterion	-1.6105
Log likelihood	193.5731	F-statistic	***5.7137***
Durbin-Watson stat	***2.2352***	Prob(F-statistic)	***0.0000***

Source: Eviews output, modified by author.

Table 8: Statistical significance between Income per Capita and House Prices

	Coefficient	t-Statistic	Prob.	Significant
Fixed Effect Model	0.7725	2.8118	***0.0055***	**Yes**
Least Squares Model	0.7533	2.2082	***0.0283***	**Yes**

Source: Eviews output, modified by author.

Table 9: Statistical significance between Land Prices and House Prices

	Coefficient	t-Statistic	Prob.	Significant
Fixed Effect Model	0.04	2.2666	***0.0246***	**Yes**
Least Squares Model	0.0402	1.6963	***0.0913***	**Yes**

Source: Eviews output, modified by author.

Table 10: Statistical significance between Mortgage Rates and House Prices

	Coefficient	t-Statistic	Prob.	Significant
Fixed Effect Model	0.0438	3.0187	***0.0029***	**Yes**
Least Squares Model	0.0474	4.0478	***0.0001***	**Yes**

Source: Eviews output, modified by author.

Table 11: Statistical significance between Density of Population and House Prices

	Coefficient	t-Statistic	Prob.	Significant
Fixed Effect Model	-0.0103	-0.7556	0.4509	**No**
Least Squares Model	-0.0138	-1.6908	***0.0924***	**Yes**

Source: Eviews output, modified by author.

Table 12: Statistical significance between Unemployment Rates and House Prices

	Coefficient	t-Statistic	Prob.	Significant
Fixed Effect Model	-0.0452	-1.1993	0.232	**No**
Least Squares Model	-0.0416	-0.9944	0.3212	**No**

Source: Eviews output, modified by author.

Table 13: Statistical significance between Savings and House Prices

	Coefficient	t-Statistic	Prob.	Significant
Fixed Effect Model	0.1895	0.7921	0.4293	**No**
Least Squares Model	0.2587	1.2913	0.198	**No**

Source: Eviews output, modified by author.

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