

Analysis on Housing Price Using Macroeconomic Indicators in China

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Abstract. In China, one of the most important stimulations in economic development has belonged to real estate market after the reform and opening, and it also contributes a lot to the financial market. However, there are many arguments nowadays, believing that Chinese real estate market is on the process of bubbles, almost about to burst. This study aims at discussing the influences of some macroeconomic indicators on price of commercial housing in China between 2013 and 2022. GDP, interest rate, inflation rate and money supply are chosen to be the independent variables. Using correlation and regression models, the results show that the indicators are correlated with each other. The analysis shows that there is a strong positive correlation between China's GDP and commercial housing price which is the key for future economic development. Inflation positively correlates with the commercial housing price and a strong negative correlation is found between commercial housing price and interest rate and money supply. This research suggests that government should regulate and control macroeconomic indicators to protect the development in real estate market.

Keywords: Housing price, gross domestic product, interest rate.

1. Introduction

The real estate market is the circulation market of real estate as the transaction object, and it is also the sum of the exchange relationship of housing commodities. It is responsible for land purchasing, selling and leasing, mortgage and other transaction activities or fields. The price of it refers to the market value of a building with its occupied land natural resources, over a time period. This market played a key role in the economic development [1]. In many countries, dominating reason have resulted on financial sector distress and macroeconomic imbalances is supposed to unbalanced asset price developments, which could be considered in development in real estate market [2]. It is true for every perspective that the real estate market is always the most preferred worldwide investment form, by considering returns of investment [3]. However, certain kinds of mechanisms behind could trigger or enlarge the growing of cycles and bubbles in real estate market [4]. As long as bubbles bursting, it would cause chain reactions on industries promoted by real estate industry like infrastructure sector, steel, cement wooden fittings as well as architectural and engineering sectors. These effects then spreading to other states, generating social upheaval, financial crisis and economic collapse [3].

Macroeconomics is a segment of economics that uses general statistical concepts such as national income, investment and consumption of the economy as a whole to analyze the laws of economic operation, which is relative to microeconomics. The variables used in this study including gross domestic product (GDP), determined by the value of the total amount of goods and services produced in an economy over a certain period. Interest rate is the second one, understood as the proportion of cost borrower giving to lender. The other is inflation rate, which refers to the percentage change in consumer price index (CPI) in each period. Last one, money supply is the sum of liquid assets held by publics (individuals and banks) for a period.

The real estate market and its sub-industries are not only an important sector in China's economy, but also played an important role in China's financial system. From the public data of National Bureau of Statistics of China, total amount of 13.37 trillion RMB housing sale took 16.4% of China's GDP. Even in the late stage of COVID-19 period in 2022, they took the promotion approximately 13-14% in overall China's aggregate economic output. Housing price, generally controlled by demand of housing, revealed the situation of real estate market. This leads to the problem this study wants to

seek for. How do those variables interact housing price? Investors' ability and government policy making will be influenced by several macroeconomic or microeconomic factors, when they plan to invest or government plan to issue policies, it is significant to understand or predict the relationship between. This study tries to research the extent GDP, inflation rate, interest rate and money supply will influence housing price in China.

2. Literature Review

2.1. Housing Price and GDP

Macro economy has strong correlation with real estate market both in single economy side and international level [5]. GDP as the dominant factor that shows the hard consistency and reliability with the economic situations and cycles, affects real estate price. The outcome in the study of the variables influenced real estate growth in Kenya, demonstrated positive relationship with those two research objects [6]. Since Chinese government encouraged commercial housing construction in the year near 2000, its housing investment achieved a high-speed growth rate, ended with 27.3% in 2001. Because of the integral segment commercial housing is in the whole real estate market in China, this increasing rate directly led to contribution of GDP growth rate [7]. According to the data from the annual report in Monetary Policy Analysis Group of People's Bank of China, 1.3% out of 7.3% GDP increasing rate in 2001 is the contribution from commercial housing investment, which illustrated the high dependence of GDP on housing investment, which includes the role of housing price.

2.2. Housing Price and Interest Rate

Supply and demand in the real estate market can be seen as determinants of housing price. Supply of housing is negatively correlated with the interest rate [8]. As the early investment stage of real estate development is essential in the market, most of the investors gain loans from banks, in this case as soon as the interest rate increases, costs will push upwards. Therefore, supply decreases and price rises. On the demand side, since interest rate will influence price of commodities at the same time, high interest rate will bring low housing demand as a result price falling. Consequently, the aggregate impact on price will be determined by the extent interest rate effects on demand and supply sides [9].

2.3. Housing Price and Inflation Rate

There are several reasons for changes in inflation rate, generally, reflection of inflation tendency in one particular economy can be suggested to refer to assets demand. When inflation rate increases, to maintain the power of savings, individuals tend to maintain their savings in housing estate as precaution against inflation. Investment and demand for houses increases leads to rise in price. However, as no supplier sell her real estate lower than a specific price level at the time of high inflation and recession, housing price can be seen with strong descending price stickiness [10]. Consequently, housing price tend to decline during inflation, but the effects of housing returns on inflation could be positive.

2.4. Housing Price and Money Supply

Incredible money supply growth is always an impressive characteristic of macro-economy in China. According to Chinese Central Bank, the broad money supply (M2) increased by about 500% in 2016 compared with past decade. With the advantage of high return and low volatility, many Chinese residents prefer this investment vehicle. Therefore, large amounts of money went to real estate market, resulting an upward trend of housing price [11].

3. Methodology

3.1. Data Collection

This study used secondary data. Annual average GDP, price of commercial housing and inflation rate are collected from annual reports of National Bureau of Statistics in China (NBS), between 2013 and 2022. GDP is in the unit trillion RMB. Average housing price is calculated by using total sales of commercial housing with unit of 100 million RMB divided by total sales area in million square meters as account unit. Interest rate and money supply are from CEIC China Premium database. The sources are the most reliable and valid data can be offered in international level.

3.2. Correlation and Regression Analysis

Data analysis includes using statistic technology systemically to explain, evaluate and conclude the trend or feature of data. In this research, it used Statistical Package for Social Sciences (SPSS) to do correlation and regression analysis.

This study applies multiple linear regression model, to show the relationship of various independent variables acting on one dependent variable. The model is shown below:

$$P_t = B_0 + B_1GDP_t + B_2r_t + B_3CPI_t + B_4M2_t + e_t \quad (1)$$

P_t is the dependent variable, price of commercial housing in China. GDP_t , r_t , CPI_t , $M2_t$, represents other independent variables respectively, which are GDP in China, interest rate, inflation rate and money supply during the same period. B_0 means constant and e_t is the error term in this model.

4. Results

4.1. Macroeconomic Indicators

4.1.1. Annual average price of commercial housing

Figure 1 is a graphical representation of average price of certain type of housing in China.

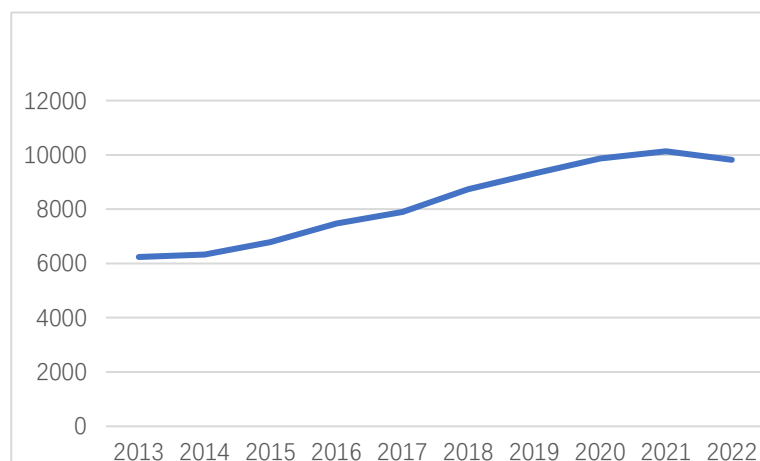


Figure 1. Annual average housing price (RMB/m²)

Data in the chart are from part of the annual report in National Bureau of Statistics in China, which shows the variance and tendency of the commercial housing price in recently 10 years in China. To be specific, the overall trend of housing price per square meter increases gradually, with the higher speed of increasing in year between 2017 to 2020. Price rose from 8,000RMB to almost 10,000RMB per square meter. However, it can be seen that the trend changed in recent years, with decreasing prices. The highest value is in 2021 for about 10,000RMB, and lowest is in 2013 for about 6,000RMB.

4.1.2. Annual average GDP

Figure 2 is a graphical representation of average GDP in China.

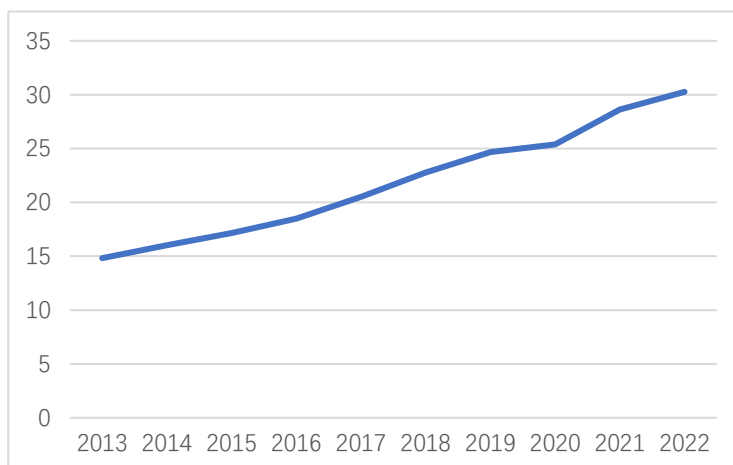


Figure 2. Annual average GDP (trillion RMB)

This figure illustrates the trend of GDP development in China in 10 years. Data is collected from annual reports in National Bureau of Statistics in China. At the beginning, the GDP is approximately 15 trillion RMB and end with 30 trillion RMB, which is two times of total amount in 10 years. Although there may be some slowing downs due to events such as COVID-19, later, the speed of increase in average GDP reached the same as in previous years.

4.1.3. Annual average interest rate

Figure 3 below is the graphical representation of interest rate.

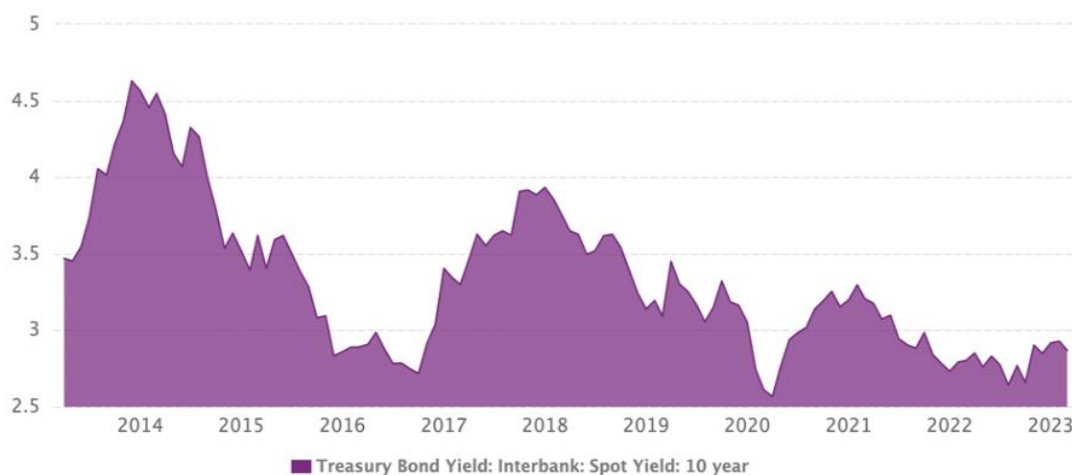


Figure 3. Annual average interest rate (in %, Source: CEIC China Premium database)

This figure shows annual average interest rate in China in 10 years. Data came from CEIC China Premium database. The interest rate achieved the highest level above 4.5% at the beginning of 2014, and lowest in 2020, only above 2.5%. During this period, the rate continues to fluctuate, but with lower percentage in later years than 2014 and 2015.

4.1.4. Annual average inflation rate

Figure 4 below is the graphical representation of inflation.

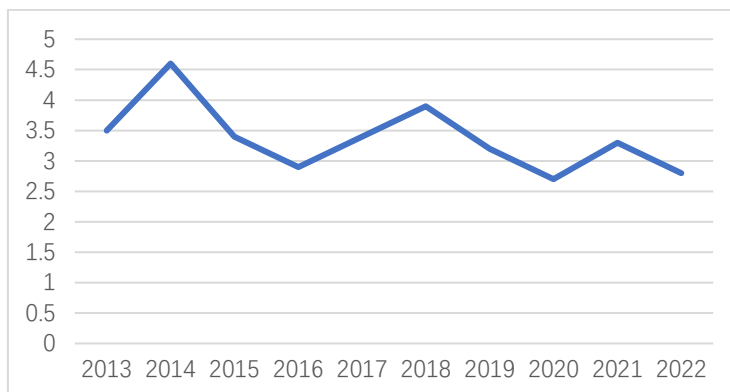


Figure 4. Annual average inflation rate (%)

This figure shows annual average inflation rate, which calculated by using consumer price index (CPI), in China from 2013 to 2022. Data collected from part of annual reports in National Bureau of Statistics in China. In 2013, the inflation rate was about 2.6%, and ended in 2022 with 2% inflation. During those 10 years, the inflation rate always fluctuated, reached peak with almost 3% inflation in 2019 and lowest in 2021 to about 1%.

4.1.5. Annual average money supply(M2)

Figure 5 below shows the change in annual average money supply between 2013 and 2022.

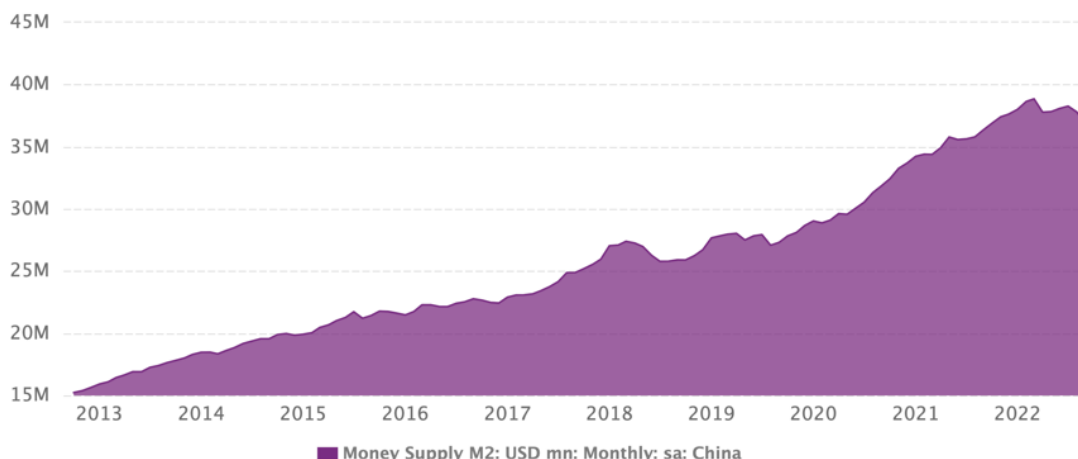


Figure 5. Annual average money supply (million RMB, Source: CEIC China Premium database)

These data were measured monthly by CEIC with using broadest money classification (M2). It could clearly show the variation using monthly data. For those 10 years, the money supply rose at a steady speed. The supply of M2 rose from 15 million RMB to approximately 37 million in 2022.

4.2. Descriptive Statistics

Table 1 below is the representation of the mean and standard deviation for each variable, from 2013 to 2022.

Table 1. Descriptive Statistics

	Mean	Standard Deviation	N
Price	8257.200	1511.036	10
GDP	21.871	5.336	10
Interest Rate	3.370	.562	10
Inflation	1.991	.568	10
Money Supply	25.400	7.183	10

It shows the dependent variable average price of commercial housing and several independent variables, GDP per year, interest rate, inflation rate and money supply, which are all in Chinese

economy. The average price has mean value 8257.200 and standard deviation 1511.036. GDP in China has mean value 21.871 and standard deviation 5.336. Interest rate in that period has mean of 3.370, with standard deviation 0.568. Data of inflation got mean 1.991 and standard deviation 0.568. Money supply gained average value 25.400 and 7.183 of standard deviation. The data collected annually in these 10 years, therefore, there are 10 observations.

4.3. Correlation Analysis and Regression Results

Table 2 shows the results of correlation coefficients and statistical significance is labeled by the asterisks on the coefficients between the variables.

Table 2. Correlations

	Price	GDP	Interest Rate	Inflation	Money Supply
Price	1.000	0.969**	-0.569**	-.0560	0.939**
GDP	0.969**	1.000	-0.530*	-0.140	0.991**
Interest Rate	-.0569**	-0.530*	1.000	-0.124	-0.520*
Inflation	-0.056	-0.140	-0.124	1.000	-0.192
Money Supply	0.939**	0.991**	-0.520*	-0.192	1.000

Correlation coefficient r between price and GDP is 0.969, representing that a very strong positive relationship exists between price of commercial housing and GDP in China. The p -value between them is lower than the level of 0.01, indicating that the relationship is statistically significant.

Coefficient r between price and interest rate equals to -0.569, that illustrates the negative correlation between price and interest rate. There is only a moderate negative correlation between these two variables. The p -value associated with the correlation coefficient is 0.043 indicates that the relationship is significant.

Correlation coefficient r between price and inflation rate is r equal to -0.056, which illustrates weak negative correlation between the inflation and average housing price level. The p -value is 0.439, much higher than the level of 0.1, so the correlation is not significant between the commercial house price and macroeconomic indicators.

The correlation coefficient r between price and money supply is 0.939, a representation of a strong enough positive relationship between average commercial house price and M2 in China, which is similar to the extent of price and GDP. The p -value between them is lower than the level of 0.01, as a result there is enough evidence to show the existence of correlation between them.

Table 3. Regression Results

	Coefficient	Standard Errors	p-Value
GDP	578.790	191.310	.029
Interest Rate	-177.368	271.744	.543
Inflation	17.912	251.132	.946
Money Supply	-235.460	143.466	.162
Adjusted R Square	.938		
F-statistics	34.908		
Observation	10		

For all independent variables, GDP, interest rate, inflation rate and money supply, the adjusted R-squared value is 0.938 means there is 93.8% variation of price of commercial house in China is contributed by those 4 variables.

According to data of all the p -values, only the coefficient of GDP is statistically significant, that there is a positive relationship between GDP and housing price. Other variables all show they are not statistically significant, and indicate no impact on housing price.

5. Conclusion

It can be concluded from the above research that in China, both GDP and money supply have a strong positive correlation with price of commercial housing, and the value is close to 1.0. This can prove that if the countries want to make a breakthrough in the real estate industry, they could accelerate the development of the economy, increase the money supply in various ways and speed up the development in the real estate market. The negative correlation between the interest rate proves that once the bank increases the interest rate, some investors will switch to other investment business due to the high investment cost and risk. The real estate industry demand will decrease and the price will drop. The inflation rate has only a negligible effect on house prices. From the data of 2013 to 2022, macroeconomic indicators have a corresponding impact on housing prices. Strong positive correlation, mild negative correlation and weak negative correlation can be all seen in this study.

Since housing prices are largely determined by macroeconomic variables, the government should take corresponding measures to use the available data on prices and variables to control macroeconomic indicators, and thereby increasing the prospects of the real estate industry. Available data are important for policy planning and investor decision-making. When a macroeconomic variable has a strong correlation with real estate prices, such as China's GDP, the government should take measures to intervene in its development to protect investors and consumers in acquiring real estate that is not harmed by exploitation. The government should use the existing data to forecast in advance, to conduct macro-market regulation and control policies, and ensure the rights and interests of consumers and investors.

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