The Empirical Analysis of Affecting Factors of Shanghai Housing Prices

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Abstract

In recent years, China's commodity housing prices is soaring highly, especially in large cities such as Shanghai. To research the factors affecting Shanghai housing prices, screening variables by the supply and demand perspective, making the variable linear regression by gradually removing the variable method, the results showed that: In the Shanghai-specific context, lending rates and GDP impact commodity housing prices higher.

Keywords: Housing prices; Factors; Gradually removing linear regression

1. Foreword

Since China's housing system reform in 1998, commodity housing prices have returned to market-leading type. With economic development, housing prices have been soaring all the way from 2003, the price and earnings ratio greatly exceeded international reasonable limits, resulting in that more and more people cannot afford the housing. With the face of expanding demand for housing and the prices soaring, many countries have adopted policies for administrative intervention, but the effect was not good, rising to become a strange phenomenon that the more control, the higher the price is, where large cities like Shanghai housing prices rose among the top . With house prices rising year by year, price issue has become the focus of the general public criticism.

Housing prices must have its internal factors. Many scholars have been researching on the various factors that affect the price of the house, and draw various conclusions. Scholars study the level of influence factors from the national macro-level as well as between provinces. By using structural vector auto-regression model, Shuqing Huang makes empirical analysis of the rate of inflation and its associated factors in common , and that a variety of factors, after adjusting for inflation , have a strong linkage between the inflation rates, M2 affects most. The time lag of monetary policy, and income level have steady influence for price and inflation. Capacity and anticipation's effects are more than inflation. Interest rates and inflation have a strong correlation (Shuqing Huang, Tingting Wang, Jing Wu,2012). Yali Su and Yujian Zhang use double elastic panel data model of the congregation factors to research the relationship between our price and flexibility. And they come to the conclusion that construction costs, the disposable income of urban residents, the residents' savings at the end of the year, rent, CPI, land supply, etc. have great influence on housing price(Yali Su, Yujian Zhang, 2011). Yuemin Hu and others study the factors of housing price and indicate that short-term rates of GDP and income changes have a little role on housing price (Yuemin Hu, Chunyu Jin, Hao Cheng, 2011).

Zhiyong Dong, Hao Guan and Yan Ming analyse the factors affecting prices, and obtain the result that per capita income , government, interest rates injustice are good for housing price, and the actual interest rates curb housing prices(Zhi-yong Dong, Hao Guan and Yan Ming,2010) . Chinyue Zheng and Yan Zhang make an empirical study of housing price factors and conclude that the prices have an impact on short-term revenue , while long-term effect is small. The housing price is mainly caused by broad money prices and interest rates(Chinyue Zheng, Yan Zhang, 2010). Jianxiao Guo points out that land transaction price have big effect(Jianxiao Guo, Hongli Wang, Hongchen Han, et al, 2010). Jianbang Xu and Fushan Liang study the price fluctuations on the local financial effects and conclude that price fluctuations obtain a positive correlation with local fiscal revenue. In short, the number of macro-level factors affecting housing price is small. Some academics have also studied the impact of local factors of urban housing (Jianbang Xu, Fushan Liang, 2011).

Wengao Lin studies the impact of price factors in the city of Foshan and concludes that control policies, economic growth and anticipation' impact on prices are on top, while the gap between supply and demand plays a rather small role(Wengao Lin, 2012).

Xingna He uses gray correlation study method and draws that the impact factors affecting Lanzhou are descending as urban per capita disposable income, GDP, real estate sales, business and personal loans, the total urban population, urban per capita habitable area , completed housing area. Based on the city's housing influencing factors, the paper explains the factors that affect the price in different cities are different(Xin-na He, 2010).

Many factors affect the housing price, together they can form factor system. From the perspective of empirical factors affecting prices, it is generally necessary to consider a number of factors, but due to that many factors aren't quantitative or have no appropriate data, empirical analysis is not easy. Therefore, this paper analyzes the factors that affect the Shanghai housing prices, and select a variable from the aspect of supply and demand. Through empirical testing procedure, it explains Shanghai housing prices' influential factors on the basis of recommendations, and gives readers some inspiration.

2. Modeling Process

Commodity housing transactions are in the market, the price is determined by the commodity housing demand and supply. The impact of factors affecting the price directly effects on supply and demand, and then affects the price, so demand and supply is the middle of the bridge. Therefore, factors can be grouped into the factors affecting demand and affecting supply, that is to say, housing prices are the function of commodity housing demand and supply. We can set up housing prices supply demand equation as:

$$CHP = F(Dq, Sq) \quad (1)$$

Among which, CHP represents the average price of commercial housing, Dq is commodity housing demand, Sq is the commodity housing supply.

2.1 .Demand equation

Firstly, the price of commodity housing is a very crucial factor to determine housing demand. If prices are too high, the effective demand will decrease ; Otherwise, effective demand will increase. Secondly, the resident population has a great influence on the demand for commodity housing. The resident population increases, the demand for housing will inevitably increase. Even if the relationship is not linear, housing demand will be affected by the increase in population. Thirdly, the per capita annual disposable income is a direct factor in the formation of effective demand. As long as there is a strong potential demand for housing, and there are enough disposable income cases, the capacity to pay will turn into effective demand. Fourthly, 5 years loan interest rate loans have a great impact on buying a house of the buyers. High interest rates and capital costs will suppress the corresponding desire to buy a house; Instead, low loan interest rates and low cost of capital will increase the desire to buy a house. Fifthly, CPI devaluate on value for money. Capital owners will funds for investment to expect capital preservation and appreciation, and investing commodity housing is a good choice. Based on the above mentioned factors, now building commodity housing demand function, as follows:

$$Dq=d(CHP,PO,IN,RA,CPI) \quad (2)$$

Among which, CHP is the average price of commercial housing, PO is total resident population for the city, IN is the per capita annual disposable income, RA is lending rates of more than 5 years, CPI is the consumer price index.

2.2 .Supply equation

Firstly, when the price is high, developers will increase supply, and supply reduction when the price is low. Secondly, 5 year benchmark lending rate is directly related to the cost of the developer's use of loan funds. When interest rate is high, the corresponding cost is also high, so that investment in housing construction decreases, and developers reduce the quantity; otherwise develop increase. Thirdly, the price of land constitutes a large part of commodity housing construction costs. With high land costs, development costs are high, in the case of limited development funds, the quantity of house is reduced. And in this paper, land price index takes charge. Fourthly, when the cost of commercial housing construction is high, the developers reduce; otherwise developers increase.

Fifthly, the GDP increases, the reflection on infrastructure and real estate development on the corresponding increase, with a corresponding increase in supply. Based on the above factors, the supply of commercial housing construction function is:

Sq=s（CHP,RA,LPI,HCAC,GDP） （3）

Among which, CHP is the average price of commercial housing, RA is the benchmark lending rate over five years, HCAC is the average cost of commodity housing construction, GDP is gross domestic product.

2.3 .Commodity housing price model

Put the above (2) and (3) into (1), we obtain:
CHP = F (PO, IN, RA, CPI, GDP, LPI, HCAC) (4)

Let equation F is a logarithmic function of the variables, it can be set as:

$$\ln(CHP_t) = c_0 + c_1 \ln(PO_t) + c_2 \ln(IN_t) + c_3 \ln(RA_t) + c_4 \ln(CPI_t) + c_5 \ln(GDP_t) + c_6 \ln(LPI_t) + c_7 \ln(HCAC_t) + \partial$$

3. Data Description and Research Approach

In 1988, China's housing market began reforming. Till 2000 it was fully market-oriented. Therefore, here selects 12 samples of Shanghai from 2000 to 2011 on an annual unit, data sources are as follows Table 1:

Table 1. Data Source

	Name(unit)	Code	Source
Dependent variable	The average price of commercial housing（RMB/㎡）	CHP	Shanghai Statistical Yearbook for each year
Arguments	CPI（%，taking the year 2000 as standard）	CPI	
	Urban resident population(million people）	PO	
	Per capita disposable income（RMB）	IN	
	5-year benchmark lending rate over financial institutions（%）	RA	
	Total output value（One hundred million yuan）	GDP	
	Land transaction price index（%，taking the year 2000 as standard）	LPI	
	The average cost of residential construction(RMB/㎡)	HCAC	

The average price of commercial housing is reached by residential sales divided by the corresponding year of residential sales area; with 1988 as the base year for the index, CPI price index is converted to the year 2000 as the base index, the price of land transactions index is the same; Because that 5 years lending rates of financial institutions changed in one year, here we select the longest interest rates during the impact as the standard. This paper bases on the fail of the value of t test and large collinearity these two indicators to gradually eliminate the variable multiple regression, and takes a variety of tests on the final mode. And it uses the Spearman rank correlation coefficient and calculates the t statistic for heteroscedasticity inspection, and uses LM method to make residuals autocorrelation test.

4. Empirical Process

Using SPSS17.0 to make Linear regression, the process is as follows:

4.1. To make linear regression, put all the variables into the regression in accordance with the access method,the regression equation Is

$$\ln(CHP) = -3.367 + 0.987\ln(PO) + 0.669\ln(IN) - 0.88\ln(RA) - 1.033\ln(CPI) + 0.415\ln(GDP) - 0.014\ln(LPI) + 0.103\ln(HCAC_t)$$

The regression equation's R^2 = 0.994, adjusted R^2 = 0.984, its goodness of fit is better; F value is 98.391, the corresponding P values close to 0, the overall regression of the equation is significant; DW value is 2.312, the autocorrelation of regression residuals was not significant . But the corresponding P-value of the t-test is more than 0.05, and the VIF values of ln (PO), ln (LPI), ln (IN), ln (CPI), ln (GDP) are significantly greater than 10, and some reach thousands , indicating that there is a serious multicollinearity in the regression equation.

4.2. because there is a serious collinearity in the equation, and therefore the t-test failed and VIF value larger variable removed, in accordance with the P-value of t-test exceeding 0.05 and VIF values in descending order , repeat linear regression and exclude ineligible variable,the variables ln (IN), ln (PO), ln (LPI), ln (CPI), ln (HCAC) were removed in order.

4.3. after removing the above variables, the remaining variables are ln (RA) and ln (GDP), the regression equation is:

$$\ln(CHP_t) = 0.578 - 1.057\ln(RA_t) + 1.113\ln(GDP_t)$$

The equation's R^2 = 0.993, adjusted R^2 = 0.991, its goodness of fit is more better than the previous regression equation ; F value is 633.775, and the corresponding P values is very close to zero, so the overall regression of the equation is very significant; the corresponding P value of the t-test closes to the amount of 0, the coefficient test is significant too; tolerance of the two variables are 0.782, VIF value is 1.279,the equation's collinearity is weak.

Doing the regression residuals autocorrelation test, firstly calculate the residuals Spearman rank correlation coefficient, the calculated result r_s = 0.0839, Substituting t Statistical Functions to get the result $t_{0.025}(10) = 0.266 < 2.228$, so that there is no heteroscedasticity in residual.

The DW is 2.749,the negative correlation of the error term may exist, so use the LM method of Eviews6.0 to test, select the highest level, the results show in Figure 2:

Figure 1. LM method test results

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	2.411243	Prob. F(2,7)	0.1597
Obs*R-squared	4.894895	Prob. Chi-Square(2)	0.0865

Test Equation:

Dependent Variable: RESID
Method: Least Squares
Date: 04/29/13 Time: 19:11
Sample: 2000 2011
Included observations: 12
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.064837	0.279515	-0.231962	0.8232
RA	0.078073	0.151580	0.515061	0.6224
GDP	-0.008582	0.028860	-0.297372	0.7748
RESID(-1)	-0.680462	0.338135	-2.012399	0.0841
RESID(-2)	-0.519350	0.331249	-1.567853	0.1609

R-squared	0.407908	Mean dependent var	1.47E-16
Adjusted R-squared	0.069570	S.D. dependent var	0.041688
S.E. of regression	0.040212	Akaike info criterion	-3.294961
Sum squared resid	0.011319	Schwarz criterion	-3.092917
Log likelihood	24.76977	Hannan-Quinn criter.	-3.369765
F-statistic	1.205622	Durbin-Watson stat	1.857555
Prob(F-statistic)	0.387751		

In Figure 1, LM test statistic Obs * R-squared = 4.894895, the corresponding probability value P = 0.0865> 0.05, so reject that there is residual autocorrelation of the original assumption, means that there is no residual autocorrelation .

After the above tests, the final model is

$\ln(CHP_t) = 0.578 - 1.057\ln(RA_t) + 1.113\ln(GDP_t)$, its goodness of fit is good, and passed the residual autocorrelation test, regression equation significance tests, regression coefficients significance test, heteroskedasticity test, multicollinearity test. Seen by the equation $\ln(CHP_t) = 0.578 - 1.057\ln(RA_t) + 1.113\ln(GDP_t)$: the preliminary view is that interest rates can be increased by 1, housing prices fell 1.057 and GDP increase 1, commodity housing prices rose 1.113.

5 years loan interest rate and GDP give the greatest impact on housing prices, while these variables that were excluded total resident population, land price index, per capita disposable income, consumer price index, the average residential construction cost impact housing prices relatively small.

5. Conclusions

The above empirical results show that, select factors that affect housing prices from the perspective of the supply and demand, after the model construction and data processing, gradually exclud the total resident population, land price index, per capita disposable income, consumer price index , the average residential construction costs, and remain two factors five years of the benchmark lending rate and GDP, indicating that these two factors impact on housing prices more significantly, while the other variables' relative degree of influence in contrast with these two variables is smaller.

For Shanghai "unique" conditions, the loan interest rate and GDP become the major factor in housing prices.

5.1 .Lending rates

Lending rates affect both supply and demand side. On the demand side, the price of the commodity housing always is tens of millions count, In most cases, buyers are taking the form of mortgage, loan interest rate multiplied by the total cost is a huge number , every 1% change in interest rates , a more substantial change in the cost figures . Therefore ,it is necessary to consider loan rates and the possible changes in the size and trends for buying real estate, based on this to reduce the cost of pay . On the supply side , because the cost of land , labor wages and high cost of materials result in the high total development cost. Developers funding, in addition to its own funds, mostly from financial institutions , in particular to bank loans, since the loan is larger, every one percentage point increase in interest rates , the cost of capital will increase quite a bit. So developers will try to select a low interest rate loans, high interest rate loans will be reduced, resulting in lack of development funds and the corresponding reduction in the development , housing amount for selling will be reduced in the market. Loan interest rates affect both supply and demand , so the price of commodity housing is significantly affected .

5.2. GDP

High GDP growth and better economic development push the rising exception of housing price ,which increases housing demand, with the shortage of the housing supply, so that make housing price rise. A large part of the GDP comes from the real estate development and construction and its related real estate, the over-concentration of finance and high-level quest for the construction increase the added value of the housing, that push up prices. GDP increases, the corresponding people's per capita income will increase, so that enhance the consumer's consumption ability, in addition, pull price level higher, overall prices then rise .A part of the GDP are used to urban infrastructure and supporting facilities construction, various welfare building, bringing a corresponding increase in the added value of commodity housing, it also push up housing prices. GDP affects the price of commodity housing through various aspects and factors and a large degree, thus becoming one of the main factors affecting prices. In Shanghai, the main factors affecting housing prices have its own characteristics driven by economic and financial. However, other factors can't be denied, their affecting degree is only a relatively lesser extent, these factors affect each other, this co-constitute a systems and structures for factors affecting the price of commodity housing.

According to the established model, it shows that housing prices are inversely related with loan interest rates, and have a positive relationship with GDP, and both of these two factors have a great impact on housing prices. Therefore, when the government controls housing prices in the formulation of regulatory policy, they can take the financial means to raise lending rates in order to reduce the price of commodity housing.

Because higher interest rates increase the cost of developers and consumers, and fiscal policy, such as real estate taxes and other means can achieve the same increase in the cost of developers and consumers. So the financial instruments and fiscal policies should be combined together to exert control on housing prices.

Land prices are rising year by year. Therefore, to control housing prices, firstly, we need to control the price of land. Measures to increase the supply of land for housing have a certain role to increase the supply of goods, but due to the particularity of the use of land and the limited number of land itself, the land is more and the population is less, then to increase land supply is not so easily to be achieved. Thereby, turning to the rational planning of city and the validity of the number of housing construction, not just simply increasing land supply, is a good choice.

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