

Analysis of the Factors Affecting the Housing Prices in Hubei China

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ABSTRACT

Housing prices could directly affect people's life. As the prices keep going up, more and more attention is drawn to the real estate. Using data of Hubei Province and its five prefectural-level cities from 2005 to 2016 and processing it through Stata, this paper establishes a multiple linear regression model. The average commodity residential housing prices are taken as the explained variable in the model, while the total commodity residential housing saleable area, residential population, and the disposable income per capita are taken as the explanatory variables. Then, through the heterogeneity analysis, following conclusions are drawn: first, the main factor affecting the housing prices in Hubei province is the residential population, followed by the disposable income per capita; second, the main factors in the five-prefecture-level cities is disposable income per capita, followed by the residential population; third, the residential population is significant for the lower-tier cities only, while disposable income per capita is significant for all. In the end of the paper, some policies are suggested for reference.

Keywords: *Housing prices, affecting factors, multiple regression model, heterogeneity, stata*

1. INTRODUCTION

1.1. Research Background

Real estate plays a crucial role in economic activities. Steadily grown housing prices would promote economic growth in the short run: the increasing expected value of real estate encourages more people to purchase, stimulating a series of household-related consumption. However, excessively rising prices will be counteractive in the long run [1]: as people invest a large portion of their money on real estate, less is left for other consumptions. According to CEIC, Chinese housing prices had nearly tripled in 2019 (9287.062 RMB/m²) compared to that in 2008 (3576.000 RMB/m²), alarming the overrated value of the real estate and posing the risk of housing bubbles.

As one of the new first-tier cities, Wuhan China attracts a growing number of people to search for opportunities. Nevertheless, because of the increasing pressure of affording an apartment, fewer would [2]. What is worse, not only new labor force, but workers that are already in the city and cannot afford high housing prices are also likely to be squeezed out [3]. It is estimated that even if the price level remained the same as in 2017, it would take a medium-income earning person thirteen years to fully pay for a 90 m² apartment, let alone the disproportional increase in housing prices and income. The former had increased by roughly 54.806% from 2014 to 2017, while 31.439% had the latter -- making it almost impossible for salarieds to afford and resulting in less inflow of talents. Therefore, followed by a smaller external population, a

decreasing labor force, along with a rising wage rate (an increase in cost as for investors), will result in less business investment. Eventually, high housing prices are going to harm society.

1.2. Research Significance

As the apartment becomes merely for profit in the first place rather than for living, housing turns into a prominent problem, posing adverse effects on social welfare promotion and stable economic growth. For the sake of the city's long-term development, both socially and economically, real estate needs better supervision. Compared with the mature housing market in some other countries like Germany, that in China is not yet well developed [4]. Only if the influencing factors are clarified, could the government have a solid foundation making applicable policies to stabilize the housing market without a potential crash. Moreover, it is hoped that the studies could explain to the public the mystery behind the climbing housing prices

even though they seem to have reached their ceilings long ago, as well as convey to the audience the significance of having an appropriate expected value on real estate. Overall, a healthy developed real estate will make the apartment more affordable while strengthening the economy at the same time.

1.3. Research Content and Ideas

To promote city growth and stable development of the real estate, clarifying the main factors affecting the housing prices would play a fundamental role. This paper mainly analyzes the factors from the demand side, using relevant data of Hubei and five cities from 2005 to 2016. The remaining part of this paper is structured as follows: the second part is the literature review; the third part is the primary empirical result, and the heterogeneity analysis; the fourth part is the conclusion and policy recommendations.

2. LITERATURE REVIEW

2.1. Research on the Influencing Factors of Housing Prices

There have been many studies conducted on housing prices in China. Ruowen Xu [5] indicates that the supply and demand mechanism is a crucial internal influencing factor of real estate. Afterward, various factors affecting supply and demand will be reviewed, respectively.

2.1.1. Research on the impact of supplying factors on housing prices

One disputed factor is the cost of supplying land. Chi Zhang et al. [6] claim that it has little economic influence on housing prices by conducting an empirical test on data of the first-, second-, and third-tier cities from 2010 to 2015. On the contrary, a majority of scholars, such as Guijian Chu [7], Wenqian Li & Tao Zhang [8], and Xianrong Huang [9], hold that there is a positive correlation in between. Thereinto, Wenqian Li & Tao Zhang [8] use ordinary least squares (OLS) regression to analyze major cities' data from 2005 to 2016, concluding that land cost is the most effective factor. Moreover, by studying the perspective of land supply in Chongqing in particular, Xianrong Huang [9] summarizes that the price of, and the quantity of, the mode of, and the policies made on land supply could impact housing prices.

Likewise, Yuhui Luo & Yankui Dong [10] regard the land policy as the fundamental factor driving up the housing prices based on Marxist political economics. Nevertheless, Chi Zhang et al. [6] argue that generalization cannot be made: land policy plays little role in the first- and third-tier cities, where the local government has no considerable influence on the housing prices; in contrast, prices in second-tier cities are still guided by the government and under the control of land policy.

Furthermore, the amount invested by developers is another factor. Unlike the previous two, scholars seem to reach an agreement. Through theoretical analysis [5], quantitative analysis of data specifically in Qingdao [11], and analysis based on the OSL regression model [12], scholars suggest

that the investment volume is the main, or could even be the most decisive, factor.

3. EMPIRICAL ANALYSIS AND RESULTS

3.1. Variable Selection and Model Setting

3.1.1. Variable selection

There are a number of factors affecting the real estate prices, so it is not easy to take them all into account. This paper, taking the year as the cross-section, focuses on several significant explanatory variables on the explained variables' demand side, average commodity residential housing prices (HP).

Total commodity residential housing saleable area (SA): The increase in the saleable area reflects consumers' preference for real estate investment. The trend results in more housing demand higher housing prices.

Residential population (POP): With the increase of the floating population, the housing is increasing, thus promoting the rise of real estate prices. Especially in areas with high population density where the demand is generally more significant than the supply, the housing prices tend to be high.

Disposable income per capita (DI): generally, income and demand are positively correlated, for higher-income level represents more purchasing power. Additionally, rising incomes indicate rising living standards, which potentially leads to more demand for housing, pushing up the prices.

Coming from CNKI and CEIC, annual data of Hubei province and five prefecture-level cities (Jingmen City, Wuhan City, Shiyan city, Xianning City, and Yichang City) from 2005 to 2016 are used in this paper. Due to the limitation, some missing data have had been supplemented by interpolation. Additionally, to make an accurate estimation, all the data of explanatory variables are processed through logarithm. The descriptive statistics for Hubei's time series data and the panel data of five cities are shown in Table 1.

3.1.2. Model setting

The model is set as:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \varepsilon$$

in which

Y : average commodity residential housing prices (RMB/m²)

X_1 : total commodity residential housing saleable area (10 thousand m²)

X_2 : residential population (10 thousand people)

X_3 : disposable income per capita (RMB)

ε : random error term (factors other than the explanatory variables in the model)

Table 1 Descriptive statistics of housing prices

	Variable	Obs	Mean	Std.Dev.	Min	Max
Hubei	HP	12	4017	1347	2164	6457
	SA	12	8.084	0.480	7.345	8.823
	POP	12	8.659	0.0110	8.647	8.680
	DI	12	9.731	0.402	9.081	10.29
Cities	HP	60	3452	1897	732.0	9819
	SA	60	5.319	1.273	1.303	7.983
	POP	60	5.972	0.483	5.506	6.982
	DI	60	9.707	0.407	8.988	10.59

Table 2 Basic regression results

	(1)	(2)
	HP	HP
SA	0.211 (1.4262)	-0.089 (-1.1659)
POP	0.438*** (4.4111)	0.586*** (10.0482)
DI	0.365** (2.4522)	0.675*** (13.5338)
N	12	60
r²_adjusted	0.9870	

Note: 1. ***, ** and * mean that the variable is significant at the significance level of 1%, 5%, and 10%, respectively. 2. The brackets show the standard error. 3. Standardization is applied to the estimation.

The multiple linear regression analysis is applied through STATA15.0 to determine the correlation between explanatory and explained variables.

Table 3 Cities classification

City Level		Development	
High-tier	Low-tier	High-developed	Low-developed
Wuhan	Jingmen	Wuhan	Jingmen
	Shiyan	Yichang	Shiyan
	Xianning		Xianning
	Yichang		

3.2. Empirical Results

Table 2 shows the result of multiple linear regression of housing prices to the saleable area, residential population, and disposable income per capita. Model 1 results from the time series data of Hubei province, while Model 2 is the result of the panel data of five prefecture-level cities. In model 1, the adjusted R-squared is equal to 0.9870, which is close to 1, implying this model's great fit (the explanatory variables contribute to most of the differences in explained variables). In the T-test, two of the variables have passed the T-test, and both of them have a positive correlation. Among them, the residential population is more significant and has a greater impact on housing prices. For each additional unit of logarithmic residential population, the housing price rises roughly 0.438 units. In contrast, disposable income per capita has a relatively smaller influence. When logarithmic value increased by 1 unit, the housing prices will increase by 0.365 units. On

the contrary, the saleable area fails to pass the test, indicating that it has no significant impact on the prices.

In model 2, the residential population and the disposable income per capita are both significantly positive at $p < 0.01$. With 1 unit increase in the former, housing prices rise 0.586 units; with 1 unit increase in the latter, housing prices rise 0.675 units. Once again, the saleable area fails to pass the test.

Therefore, we can draw a preliminary conclusion that both residential population and disposable income per capita, though in different degrees, are positively correlated to the average commodity residential housing prices. Thereinto, the residential population has a slight larger impact on housing prices in the first model, while the disposable income per capita is relatively more influential in the second model. Nevertheless, in both models, the saleable area is not significant.

3.3. Tests for Heterogeneity

3.3.1. City classification method

Wuhan's housing prices are about two times higher than those in Yichang, the second-largest city in Hubei, not to mention those in others. Therefore, it is not sufficient to analyze the five prefecture-level cities as a whole. Therefore, this paper, dividing the cities into two groups for both the administrative level and economic

development (shown in Table 3), conducts tests for heterogeneity.

Administrative level: According to the practice of Ruiming Liu and Renjie Zhao, Wuhan, as both the capital of Hubei province and a sub-provincial city, will be classified as a high-tier city, while others will be classified as low-tier ones for analysis. Compared with Wuhan, low-tier cities -- Jingmen, Shiyan, Xianning, and Yichang -- are at a disadvantage in terms of government capacity and market potential, potentially affecting housing prices.

Economic development: Cities are divided based on the logarithmic GDP per capita. Cities with a value higher than the average in Hubei -- that is, Wuhan and Yichang -- will be labeled as high-developed cities, while cities with a value lower than that average in Hubei -- that is, Jingmen, Shiyan, and Xianning will be labeled as low-developed cities (shown in Table 4). Compared with the poorly developed ones, the highly developed cities will have quite distinct advantages in resource allocation and the introduction of talents. Those advantages could be influential factors on the house prices.

3.3.2. Heterogeneity analysis results

Table 5 shows linear regressions of housing prices to the saleable area, residential population, and disposable income per capita in terms of city level and development. Model 3 and 4 are the results for high- and low- tier cities, respectively, while Model 5 and 6 are the results for high- and low- developed cities.

Table 4 Descriptive statistics of logarithmic GDP per capita

	Variable	Obs	Mean	Std.Dev.	Min	Max
Hubei	GDP	12	10.24	0.539	9.355	10.93
Jingmen	GDP	12	10.18	0.559	9.290	10.87
Shiyan	GDP	12	9.964	0.523	9.150	10.64
Wuhan	GDP	12	11.01	0.489	10.19	11.62
Xianning	GDP	12	9.967	0.615	8.905	10.70
Yichang	GDP	12	10.65	0.637	9.633	11.41

Table 5 Test for heterogeneity results

	City Level		Development	
	High-tier	Low-tier	High-developed	Low-developed
	(3)	(4)	(5)	(6)
	HP	HP	HP	HP
SA	0.233	-0.001	-0.246	-0.013
	-1.6672	(-0.0114)	(-0.9744)	(-0.1334)
POP	0.027	0.394***	0.580***	0.310***
	-0.086	-7.1113	-3.0942	-5.1466
DI	0.743*	0.827***	0.818***	0.856***
	-2.262	-11.4089	-6.5411	-8.6691
N	12	48	24	36
r²_adjusted	0.9591	0.9067	0.9407	0.8878

Note: 1. ***, ** and * mean that the variable is significant at the significance level of 1%, 5%, and 10%, respectively. 2. The brackets show the standard error. 3. Standardization is applied to the estimation

In model 3, only disposable income per capita is significantly positive under $P < 0.1$ in the high-tier city. For every unit increase in the logarithmic disposable income per capita, the housing prices rise by 0.743 units. Similarly, the saleable area is not significant in Model 3. However, in model 4, both the residential population and disposable income per capita are significantly positive under $P < 0.01$. Among them, disposable income per capita has a more substantial impact on house prices. An additional unit of logarithmic disposable income per capita will lead to 0.827 unit increase in housing prices. By contrast, when the logarithmic residential population increases by 1 unit, the housing prices will rise 0.394 units. Compared with those in the high-tier city, the impacts of both residential population and disposable income per capita are more considerable in the low-tier city ($0.394 > 0.027$; $0.827 > 0.743$). There are several possible reasons for this. First, it may be because of government control. As Wuhan's housing prices are too high, the government has been trying to clamp it down. Thus, no matter how much the population or the income has risen, it is not as influential as lower-tier cities. Second, it might be due to the catch-up theory. Although the GDP and income level in other cities are not as high as that in Wuhan, the gap between them will gradually narrow. Third, as Wuhan's housing prices are already too high, when the population grows, those who cannot afford to buy houses would choose to buy ones in nearby cities instead.

In both models 5 and 6, the residential population and the disposable income per capita are significantly positive

under $P < 0.01$, while the saleable area is not significant. Besides, the residential population's impact is smaller than that of disposable income per capita in both models. For each unit increase in the logarithmic residential population in highly developed cities, the housing prices rise by 0.580 units, which is higher than the 0.310 units increase in the poorly developed cities. For each unit increase in the logarithmic disposable income per capita in the high-developed cities, there is a 0.818 unit increase in housing prices, which was slightly less than the 0.856 units increase in the low-developed cities.

By comparing the two sets of data, we can find that after adding Yichang, there is a pronounced change in the residential population's effectiveness. Raised mainly by Yichang's involvement, the impact of the residential population on housing prices even exceeds that in low-developed cities. On the contrary, although disposable income per capita on housing prices has also increased, the impact is still not as significant as that in low-developed cities. Extremely consistently, the saleable area is not significant in every model.

4. CONCLUSIONS AND POLICY RECOMMENDATIONS

4.1. Conclusions

Nowadays, much research on housing prices has been done. Based on the data of Hubei Province and its five

prefecture-level cities from 2005 to 2016, this paper uses multiple linear regression analysis and heterogeneity analysis to make the following conclusions.

First, regarding the housing prices trending graph, the housing prices in Wuhan City are much higher than the overall housing prices in Hubei Province, and the price fluctuations in Wuhan restraints those in Hubei.

Second, based on the time-series data of Hubei and panel data of its five prefectural-level cities, residential population and disposable income per capita are concluded to have a significant positive impact on housing prices. Among the data of Hubei, the residential population has a more notable impact, while among the data of five cities, the disposable income per capita is more influential. The different significance may be because Hubei invested almost all its resources in Wuhan in its early stage development. As a result, all the other 12 poorly developed prefectural-level divisions have raised the residential population's impact on housing prices in the Hubei province as a whole. Whereas, in the panel data, only five cities are considered, thereby reducing the residential population's impact.

Third, according to the heterogeneity test on administrative levels, the residential population has a positive impact only on low-tier cities. On the contrary, disposable income per capita has a significant positive impact on the housing prices in both high- and low-tier cities with a more notable effect on the lower tier ones.

4.2. Policy Recommendations

The healthy development of real estate is vital concerning the overall national economy. Based on the research results of this paper, the following policy suggestions are proposed.

First, the government should be more aware of the factors affecting the housing prices in different regions, so as to control the prices more effectively.

Second, to control the price rise caused by the increase in population, it would be beneficial to increase the housing supply. One way to do this is through destocking, making the developers develop the land within a specified period. Increase housing supply by curbing excessive landholding. Also, an increase in supply could be achieved by a better developed rental market. Encouraging long-term rental would introduce a new supply source in the real estate market.

Third, a long-term mechanism should be established to prevent investment from the real estate market. As the income level goes up, people would have money to invest in real estate, driving up the prices. The first step is to reasonably guide buyers to resolve this, helping them establish an appropriate investment perspective. In addition, the government can curb investment in real estate through purchase restrictions.

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