

The Analysis on the Factors of Housing Price of the Cities in Pearl River Delta

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Abstract

The housing price in cities is affected by many factors. Due to the differences of economic development level, geographical conditions, cultural background and other factors in different cities in the same region, the housing price in different cities presents obvious differences. The housing price of urban agglomeration in the Pearl River Delta shows obvious stratification. By stratifying the housing price of nine cities in the Pearl River Delta, this paper selects certain economic indicators to analyze the factors affecting the housing price of each city. The results show that per capita disposable income and population density have a greater impact on the housing price of each tier of cities, while per capita GDP, population urbanization rate, real estate development investment, completed area of housing construction and other factors have different impacts on the housing price of different tiers cities.

Keywords

Housing price; Panel data; The Pearl River Delta; Influence factors.

1. INTRODUCTION

The influencing factors of housing price are complex, and they are also different when analyzed from different perspectives. As a commodity, it is affected by the market supply and demand; As an investment product, it is influenced by individual consumer behavior. As a consumer product with maximized utility, it is affected by the characteristic functions associated with it. As a part of the whole market economy, regional housing price are affected by other regional markets. At the same time, housing price are also influenced by national policies [1]. In addition, the economic development of different regions, the impact of housing price are different. Under the condition of market economy, the price of commodity house is mainly formed by the interaction of supply and demand of commodity house market. Commercial housing includes residential commercial housing and non-residential commercial housing. The main research object of this paper is residential commercial housing. If there is no special explanation below, commercial housing refers to residential commercial housing. The housing price studied in this paper is the selling price of residential commercial housing. Unless otherwise specified, the "housing price" below also refers to the selling price of residential commercial housing.

Like other commodities, the price of commercial housing is determined by both supply and demand factors. Compared with other general commodities, residential commercial housing also has its particularity. For example, the supply and demand of housing are very regional and local; Housing has the dual characteristics of consumer goods and investment goods; In the context of Chinese culture, housing is a necessity for everyone and so on. The particularity of commercial housing determines that its price influencing factors are more complicated than general commodities.

As for the influencing factors of housing price, scholars at home and abroad have conducted theoretical and empirical studies and achieved a series of results. For example, Poterba, J.M(1991) studied the relationship between the selling price of residential commercial housing and construction cost, population and per capita disposable income [2]. Chai, Li and Tang studied the factors that influenced Singapore's housing price between year 1990 and 2015 based on a dynamic stochastic general equilibrium model and found that supply and demand factors explained 47.6% and 81.3% of price increases in the public and private housing markets, respectively.

In terms of domestic research results, Xiao Lei, Xiao Jia-wen, Gu Jia-xin and Li Li (2011) divided the influencing factors on housing price into supply side, demand side and macro side, and analyzed the influence of different factors on housing price in three aspects with the data of 30 provincial capitals [3]. Han Zhenglong and Wang Hongwei (2014) studied the relationship between regional differences, urbanization and housing price. They believe that the improvement of urbanization level will provide huge demand potential for the development of the real estate market, thus promoting the sharp rise of housing price. The empirical conclusion shows that for every 1 percentage point increase in the urbanization rate, the real estate price changes only 0.13 percentage points [4]. Wang Liping and Li Yanping (2014) studied the influence of FDI and urbanization level on housing price in the Pan-Yangtze River Delta region. The study found that the internal correlation of space is an important factor affecting the housing price. The improvement of the urbanization level has accelerated the internal links between provinces, which has led to the rise of housing price in Zhejiang, Jiangsu and Anhui [5]. Li Yonghui, Chen Yongqiang and He Ling also studied the differences in housing price between the east, the middle and the west and the reasons for their formation, believing that the main reasons are the influence of economic development level, consumption level, consumption concept and national policies [6]. It can be seen that the research on the real estate industry mainly focuses on the impact of various economic indicators on the housing price of the country or a certain key region.

Based on the existing research results at home and abroad, the factors affecting the price demand of commercial housing, theoretically speaking, mainly include the local economic development level, people's income level, population size and age structure, labor market boom, etc. The factors affecting the price supply of commercial housing mainly include local housing stock, new housing supply, construction and construction cost, etc.

Housing price is closely related to national life, and the stability of housing price has a direct impact on national happiness index. Excessively high housing price will increase people's burden of buying houses and repaying loans, reduce people's living standards, and increase China's overall financial and economic risks. Excessively low housing price indicates that the local economic development level is not high and the cost of living is low, which indirectly reflects the low consumption level of local people. Therefore, housing price is a prominent factor related to the international people's livelihood. The formation and influence factors of housing price and the mechanism of these factors' influence on housing price are not only related to the trend of national economy and regional economic development, but also related to the reality of social livelihood.

The study and analysis of the differences of housing price influencing factors in different cities is of great significance for fully understanding the housing price characteristics of a city, enabling the government to better predict the future housing price trend and supply and demand structure, and then reasonably regulate housing price. The Pearl River Delta as one of the most economically developed areas in China, the main part of a large bay area of Guangdong, clarify the differences of the influence factors on housing price in different cities in the Pearl River Delta, so as to make a sound progress for the real estate market. At present, the research

on the housing price in the Pearl River Delta region mostly stays at the overall level or individual cities, but the research on the stratification of housing price in the Pearl River Delta region is less. This article summarizes related theory knowledge and on the basis of existing research results, based on the Pearl River Delta in nine cities in year 2000-2017 housing price data, through the Ward hierarchical clustering analysis method will be nine cities, prices of similar cities into a group, with the aid of a series of economic indicators, the influence factors of the Pearl River Delta urban property prices to establish regression model, quantitatively determine the influencing factors of commodity house price, and to assess the influence degree of various factors, to explore the influence factors of different levels of urban property prices similarities and differences, and then the brief analysis of the causes of the similarities and differences.

2. EMPIRICAL MODEL, DATA SOURCES, AND OVERVIEW OF THE RESEARCH AREA

2.1. Empirical Model

In this paper, mixed OLS regression, fixed panel effect model and random effect model are mainly used for empirical test.

2.2. Overview of Data Sources

This paper selects the panel data of nine cities in the Pearl River Delta city cluster from year 2000 to 2017, including 8 factors data in total, including housing price, per capita disposable income, per capita deposit balance of urban and rural residents, per capita GDP, population density, population urbanization rate, completed area of residential buildings, and real estate (residential) development investment. The 8 factors data are all from the Statistical Yearbook of Guangdong Province over the years, in which the housing price is calculated by dividing the sales volume of residential commercial housing by the sales area. The per capita deposit balance of urban and rural residents is calculated by dividing the savings deposit balance of urban and rural residents in each city by the permanent resident population at the end of each city. Data on urbanization rate from year 2001 to 2004 are missing. All data analysis and calculated charts below are based on the above data.

2.3. Overview of the Research Area

In this paper, nine cities in the Pearl River Delta city cluster are selected as research objects, specifically including Guangzhou, Shenzhen, Zhuhai, Foshan, Huizhou, Dongguan, Zhongshan, Jiangmen and Zhaoqing. The Pearl River Delta city cluster is one of the most economically dynamic regions in China, and also a major component of the Guangdong-Hong Kong-Macao Greater Bay Area. The Pearl River Delta city cluster is one of the most economically developed regions in China, and the overall real estate market develops rapidly. However, due to the economic, cultural and historical differences among cities within the region, the housing price levels in different cities are quite different, and the influencing factors are also quite different. According to the collected housing price data, it is found that the housing price level of nine cities in the Pearl River Delta shows obvious stratification characteristics. Therefore, this paper divides the housing price of nine cities into different tiers and studies the similarities and differences of housing price influencing factors in cities of different tiers.

At present, among the academic studies on housing price and its influencing factors, some scholars have done relevant studies on some cities in the Pearl River Delta, but there are few empirical studies on the stratified analysis of housing price influencing factors on the nine cities in the Pearl River Delta city cluster. This paper attempts to study regional housing price and its influencing factors in modeling, and using the method of a series of econometric analysis for inspection, a research area is to reveal the main factors affecting housing price, the second is to

reveal the differences of influence factors on housing price in different tiers of cities. At last, based on the research results, we will raise some suggestions for the government and residents, so as to promote the real estate market healthy and reasonable development.

3. ANALYSIS OF THE ACTION MECHANISM OF ECONOMIC INDICATORS

According to the validity, accuracy and accessibility of the data, this paper will select some economic indicators from the two aspects of demand and supply to explore the factors affecting the housing price. Demand factors include per capita disposable income of urban residents, per capita deposit balance, per capita GDP, and population density. Supply factors are mainly real estate (residential) development investment, residential housing construction completed area. The following analysis of the economic indicators of the action mechanism.

3.1. The Effect Mechanism of Demand Factors on Housing Price

3.1.1 The impact of people's living standards on housing price

Per capita GDP, per capita disposable income of urban residents, per capita deposit balance and other indicators can reflect the level of people's living standards.

The level of per capita GDP reflects the economic development situation of the city. The rapid development of the economy will certainly promote the development of the real estate industry. There is a close relationship between the level of per capita GDP and the housing price. A city with a higher economic level tends to attract more investment and more talents, which makes the city have more development potential and constantly increases the local housing demand, driving up the housing price [7].

Residential real estate who is the main demand of urban residents, urban residents disposable income affect real estate demand from two aspects: one is the increase of per capita income is the result of the development of the whole macro economy, and economic development means active investment, production and management activities, the factory building, office, shopping mall, all kinds of recreational facilities such as demand increases, cause the entire real estate prices; Second, per capita income is improved, people's living quantity, living conditions have more higher requirement or the marginal consumption demand of people, leading to increasing effective demand for real estate, the housing price rising situation of urban residents disposable income increase will make the residents can be used to purchase housing capital increase, also caused the conditional residents the desire of the improvement of living level, thus stimulating the demand for residential real estate, then push the prices rise [8]. Theoretically, there is a positive relationship between the level of housing price and the per capita disposable income of urban residents.

The per capita deposit balance reflects the wealth level of residents. With the increase of the per capita deposit balance, consumers' purchasing power and demand for residential goods will also increase, thus driving up the housing price. It is mainly manifested in two aspects: on the one hand, the increase of the per capita deposit balance of residents will increase the purchasing power of consumers' housing, thus stimulating the demand of consumers for housing and driving up the housing price; On the other hand, when residents have more deposit balance, they will seek for the preservation and appreciation of the idle funds. Residential commercial housing often becomes the investment object of many investors, which also stimulates the increase of the demand of residential commercial housing as the investment object. But at the same time, because higher housing price increase consumers' spending on housing, rising housing price may also lead to a decrease in households' savings balance.

3.1.2. The impact of demographic factors on housing price

The first is population density. Population agglomeration is beneficial to the development of urban economy, and the development of urban economy brings further population

agglomeration, which intensifies the demand for housing. Generally speaking, the higher the degree of population concentration, that is, the higher the population density, the more people have the desire to buy a house, the greater the demand for housing. The difference of population agglomeration ability in different cities leads to the difference of effective demand for housing, which in turn leads to the difference of housing price level [9].

The second is the rate of population urbanization. Cities have rich and high-quality social resources, economic resources, political resources, cultural resources and public resources, and the increase of population urbanization rate is the embodiment of people's pursuit of a better life. The increase of population urbanization rate, mean that more of the rural population living in cities, followed by their need to purchase commercial housing in the city, on the basis of the commercial housing supply quantity, it will inevitably drive prices due to the growth of the demand for commercial housing, the population urbanization rate should present positive correlation with prices. But at the same time, the excessively rapid rise of housing price may also hinder the improvement of population urbanization rate.

3.2. The Impact of Real Estate Supply on the Housing Price

Completed residential housing construction area is a city that year to check in and conditions of use, has reached the completion inspection and acceptance standard, can be formally combined use of residential housing area, therefore, housing construction completion area is an important index of the scale of real estate development, is also a reflection of real estate developers will supply, directly on behalf of the [10] the total supply of residential real estate market. It can be known from the theory of supply and demand price mechanism that when the housing demand remains unchanged, the larger the completed area of residential housing construction is, the greater the supply of residential real estate market will be, and the increase of supply will naturally reduce the housing price. Therefore, the completed area of housing construction affects the price of commercial housing from the aspect of supply. However, due to the different development levels and stages of real estate in different cities, there are differences in the supply willingness of real estate developers, which will lead to the difference in the price of commercial housing.

The investment in real estate development reflects the scale of investment in the real estate industry, which determines the development speed of the real estate industry and the supply willingness of developers. The investment of real estate development can effectively reflect the active degree of the market and represent the general supply level of housing in the city that year. According to the principle of supply and demand, the change of supply will lead to the change of housing price. Theoretically, the increase of real estate investment will lead to the increase of housing supply in the real estate market. If the demand remains unchanged or the elasticity of demand is less than the elasticity of supply, the housing price will decline. It can be seen that the growth of real estate investment and housing price should be reversed. However, at the same time, the rise of housing price will increase developers' expectations of the real estate market and stimulate developers' investment in the real estate market. At this time, the growth of housing price and the growth of real estate investment are in a positive direction. It can be seen that the investment amount of real estate development is closely related to the fluctuation of housing price [11].

4. EMPIRICAL ANALYSIS

4.1. Cluster Analysis

First, Ward method was used in this paper to conduct cluster analysis of housing price in nine cities in the Pearl River Delta from year 2000 to 2017. The results are shown in Figure 1, in which the ordinate numbers 1-9 represent Guangzhou, Shenzhen, Zhuhai, Foshan, Huizhou,

Dongguan, Zhongshan, Jiangmen and Zhaoqing respectively. The nine cities can be divided into four tiers: the first-tier cities includes Shenzhen, the second-tier cities includes Guangzhou and Zhuhai, the third-tier cities include Foshan and Dongguan, and the fourth-tier cities include Huizhou, Zhongshan, Jiangmen and Zhaoqing.

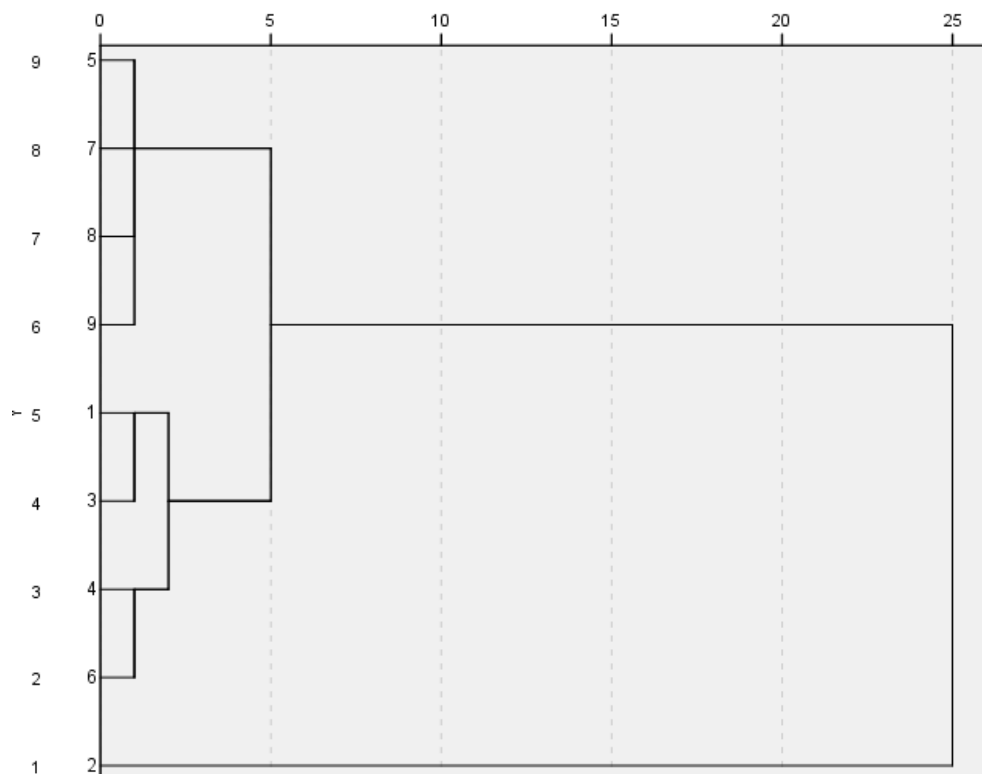


Figure 1. Ward cluster analysis results

4.2. Regression Analysis

Based on the above analysis, this paper assumes that the influencing factors of housing price is the housing supply and demand for housing, the main influence factors of housing demand is disposable income per capita (inc), urban per capita disposable income (inc), urban per capita GDP (pcgdp), population density (den), population urbanization rate (urb), real estate development investment (inv), housing construction completion area (area). The model uses a logarithmic model to measure the impact of each variable on housing price (hp).

Although theoretically, the per capita deposit balance may have a certain impact on the housing price, the housing price also has an important impact on the per capita deposit balance. Therefore, the inclusion of the per capita deposit balance into the explanatory variable may cause serious endogeneity problems in the model. Considering that there is an important causal relationship between per capita disposable income, per capita GDP and per capita deposit balance in theory, the following is to take $\ln$ per capita deposit balance as the explained variable and $\ln$ per capita disposable income and per capita GDP as the explanatory variable for regression:

$$\ln(\text{dep}_i) = \alpha + \beta_1 \ln(\text{inc}_i) + \beta_2 \ln(\text{pcgdp}_i) + \varepsilon_i \quad (1)$$

The regression results are shown in Table 1:

Table 1. Regression results of three variables

Variables	Coefficients	Standard deviation
lnhp	-	-
lninc	-0.2143**	0.9365
lnpcgdp	1.0621***	0.6096
Constant	1.1849***	0.3974
Sample size	162	
R ²	0.9237	
Significance level	***p<0.01, **p<0.05, * p<0.1	

It can be seen that the fitting degree of the regression model is as high as 92.37%, indicating that per capita disposable income and per capita GDP can well explain the per capita deposit balance. Therefore, the per capita deposit balance is not included in the following regression.

Therefore, this paper assumes that per capita disposable income of urban residents (inc), per capita GDP of urban residents (pcgdp), population density (den), population urbanization rate (urb), real estate development investment (inv), and completed area of housing construction (area) have influences on housing price (hp).

4.2.1. Overall regression of the nine cities in the Pearl River Delta

To set the fixed effect model:

$$\ln(hp_{it}) = \alpha + \beta_1 \ln(inc_{it}) + \beta_2 \ln(pcgdp_{it}) + \beta_3 \ln(den_{it}) + \beta_4 \ln(urb_{it}) + \beta_5 \ln(area_{it}) + \beta_6 \ln(inv_{it}) + \varepsilon_i \quad (2)$$

The results of fixed effect model regression are shown in Table 2:

Table 2. Regression results of the overall fixed panel in nine cities

Variables	Coefficients	Standard deviation
lnhp	-	-
lninc	0.433**	-0.174
lnpcgdp	0.235	-0.145
ln den	1.677***	-0.306
lnurb	-0.613*	-0.337
lnarea	-0.115**	-0.05
lninv	0.158**	-0.064
Constant	-10.402***	-1.752
Sample size	126	
R ²	0.907	
Significance level	***p<0.01, **p<0.05, * p<0.1	

Through the regression results, it can be found that among the explanatory variables, all the other explanatory variables have a significant impact on the housing price except that the lnpcgdp is not significant, and the coefficient of lnden is the largest, indicating that the population density has the most significant impact on the housing price. At the significance level

of 95%, the coefficients of $\ln inc$, $\ln den$, $\ln area$ and $\ln inv$ are all significant, which are consistent with the theoretical analysis above.

4.2.2. Urban regression analysis on the first-tier cities

The first-tier cities only includes Shenzhen. Since the urbanization rate of Shenzhen has been 100% since 2004, the variable of population urbanization rate can be excluded to make the regression result more accurate, so the model can be set as:

$$\ln(hp_i) = \alpha + \beta_1 \ln(inc_i) + \beta_2 \ln(pcgdp_i) + \beta_3 \ln(den_i) + \beta_5 \ln(area_i) + \beta_6 \ln(inv_i) + \varepsilon_i \quad (3)$$

The regression results of the above equations are shown in Table 3:

Table 3. OLS regression results on the first-tier cities

Variables	Coefficients	Standard deviation
$\ln hp$	-	-
$\ln inc$	-0.268	-0.422
$\ln pcgdp$	-0.857**	-0.332
$\ln den$	4.316***	-0.916
$\ln area$	-0.352**	-0.124
$\ln inv$	0.704***	-0.164
Constant	-16.622**	-7.032
Sample size	18	
R^2	0.987	
Significance level	*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$	

Through the regression results, it can be found that the explanatory variables $\ln pcgdp$, $\ln den$, $\ln area$ and $\ln inv$ are all significant, while $\ln inc$ is not significant. Besides, the coefficient of population density has the largest impact on housing price, followed by the investment in real estate development. Where, $\ln den$, $\ln inv$ are positively correlated with $\ln hp$, indicating that the increase of population density and the increase of real estate development investment both promote the rise of housing price, which is also consistent with the above theoretical analysis. While $\ln pcgdp$ and $\ln area$ are negatively correlated with $\ln hp$, indicating that with the increase of completed area of building construction, housing price may decrease accordingly.

4.2.3. Urban regression on the second-tier cities

The second-tier cities includes Guangzhou and Zhuhai.

To set the fixed effect model as:

$$\ln(hp_{it}) = \alpha + \beta_{1i} \ln(inc_{it}) + \beta_{2i} \ln(pcgdp_{it}) + \beta_{3i} \ln(den_{it}) + \beta_{5i} \ln(area_{it}) + \beta_{6i} \ln(inv_{it}) + \varepsilon_i \quad (4)$$

The results are shown in Table 4:

Table 4. Regression results of Fixed panels on the third-tier cities 1

Variables	Coefficients	Standard deviation
lnhp	-	-
lninc	0.385	-0.388
lnpcgdp	-0.016	-0.265
lnden	0.789	-0.696
lnurb	-0.674	-1.388
lnarea	0.076	-0.121
lninv	0.435***	-0.111
Constant	-3.333	-3.017
Sample size	28	
R ²	0.951	
Significance level	***p<0.01, **p<0.05, * p<0.1	

The results show that only the coefficient of lninv is significant among the explanatory variables. Exclude the two variables of lnpcgdp and lnurb, and reduce the explanatory variables to lninc, lnden, lnarea and lninv for regression. The regression results are shown in Table 5:

Table 5. Regression results of Fixed panels on the third-tier cities 2

Variables	Coefficients	Standard deviation
lnhp	-	-
lninc	0.505**	-0.235
lnden	0.724	-0.615
lnarea	0.047	-0.098
lninv	0.374***	-0.074
Constant	-3.668	-2.68
Sample size	36	
R ²	0.958	
Significance level	***p<0.01, **p<0.05, *p<0.1	

At this point, the coefficient of lninc and lninv is significant, indicating that per capita disposable income and real estate development investment have a significant impact on the housing price, and are positively correlated with the housing price.

4.2.4. Urban regression analysis on the third-tier cities

The third-tier cities are Foshan and Dongguan.

To set the mixed OLS model as:

$$\ln(hp_i) = \alpha + \beta_1 \ln(inc_i) + \beta_2 \ln(pcgdp_i) + \beta_3 \ln(den_i) + \beta_5 \ln(area_i) + \beta_6 \ln(inv_i) + \varepsilon_i \quad (5)$$

Regression results can be obtained through mixed OLS regression model, as shown in Table 6:

Table 6. Results of mixed OLS regression of the third-tier cities

Variables	Coefficients	Standard deviation
lnhp	-	-
lninc	0.281	-0.401
lnpcgdp	1.149***	-0.339
lnden	0.754***	-0.292
lnurb	-1.25	-0.939
lnarea	0.214**	-0.096
lninv	-0.178	-0.158
Constant	-13.048***	-2.784
Sample size	28	
R ²	0.927	
Significance level	***p<0.01, **p<0.05, * p<0.1	

It can be found from the mixed OLS regression results that per capita disposable income, population urbanization rate and real estate development investment have no significant impact on the housing price in the third-tier cities. Among the significant factors, the impact coefficient of per capita GDP is the largest, which is 1.149, followed by population density.

4.2.5 Urban regression analysis on the fourth-tier cities

The fourth-tier cities includes Huizhou, Zhongshan, Jiangmen and Zhaoqing.

To set the regression model:

$$\ln(hp_i) = \alpha + \beta_1 \ln(inc_i) + \beta_2 \ln(pcgdp_i) + \beta_3 \ln(den_i) + \beta_5 \ln(area_i) + \beta_6 \ln(inv_i) + \varepsilon_i \quad (6)$$

The regression results are shown in Table 7:

Table 7. Mixed OLS regression results of the fourth-tier cities

Variables	Coefficients	Standard deviation
lnhp	-	-
lninc	1.283***	-0.243
lnpcgdp	-0.345*	-0.182
lnden	0.160**	-0.077
lnurb	-0.599***	-0.202
lnarea	-0.046	-0.073
lninv	0.223***	-0.074
Constant	-2.985*	-1.562
Sample size	28	
R ²	0.933	
Significance level	***p<0.01, **p<0.05, * p<0.1	

According to the regression results, in addition to the coefficient of $\ln area$ is not significant, other factors' coefficient were significantly influence to the housing price, shows that in addition to housing construction completion area of no significant impact on fourth-tier of cities' housing price, other factors were significantly influence the housing price, especially the coefficient of $\ln inc$ is the largest, 1.283, shows that the per capita disposable income has the biggest influence on the housing price of the fourth tier of cities.

5. THE CONCLUSION

By studying the impact of per capita disposable income, per capita GDP, population density, population urbanization rate, completed area of housing construction and real estate development investment on the housing price in nine cities in the Pearl River Delta, this paper draws the following conclusions on the impact of these factors on the housing price through stratified analysis:

On the regression analysis of the second-tier cities and the fourth-tier cities, and nine cities in integral regression analysis, the per capita disposable income and housing price showing a significant positive correlation, in the second and the fourth-tier cities, per capita disposable is the decisive factor of the housing price. In the first-tier cities of Shenzhen and the third-tier cities of Foshan and Dongguan, per capita disposable income had no significant impact on housing price. Except for the second-tier cities, there is a significant positive correlation between the growth of population density and the growth of housing price, that is, the growth of population density will lead to the growth of housing price. In addition, in the first-tier urban regression analysis and the overall regression analysis of nine cities, the coefficient of population density variable is the largest among all variables, that is, the population density has the greatest impact on the housing price. Except for the third-tier cities, the investment in real estate development shows a significant positive correlation with the housing price, that is, the increase in the investment in real estate development will not lead to the decline of housing price caused by the increase in supply, but will lead to the increase of housing price, which indicates that the property of commercial housing as an investment is relatively prominent in the Pearl River Delta cities.

The three factors of per capita GDP, population urbanization rate and completed area of housing construction do not fully conform to the theoretical analysis in this paper. Per capita GDP has a significant positive correlation with housing price in third-tier cities, while a significant negative correlation in first-tier and fourth-tier cities. Except for the fourth-tier cities, the impact of population urbanization rate on housing price is not significant. However, the completed area of housing construction presents a significant negative correlation with the housing price in the first-tier city, a significant positive correlation with the housing price in the third-tier city, and no significant correlation in other cities.

Based on the results of theoretical analysis, namely empirical analysis, this paper briefly analyzes the reasons for the differences in the influencing factors of housing price on different tiers cities:

The first is Shenzhen, a first-tier city. Among the five explanatory variables, per capita disposable income, per capita GDP, population density, completed area of housing construction, and real estate development investment, population density and real estate development investment are the factors that have the greatest impact on the housing price. This suggests that Shenzhen's high housing price are a step ahead of the Pearl River Delta, partly due to the city's extremely high population density, which makes residential housing in short supply. On the other hand, high prices are due to investors' enthusiasm for commercial housing in Shenzhen. As a huge potential for development of international city of Shenzhen, but because of the limited land area caused by the shortage of land resources, the commercial housing is not only a

necessity, also is often as an investment, when real estate development investment growth, the housing market is not because of the increase in supply and a drop in prices, more reflects the commodity house as an investment, the housing development investment increase, the market actually think Shenzhen has good prospects for prices, pushing up prices.

In the second-tier cities of Guangzhou and Zhuhai, per capita disposable income has the greatest impact on the housing price, followed by the investment in real estate development. However, the impact of these two factors on the housing price is not significant, and other influencing factors are not significant. This shows that the housing price influencing factors in Guangzhou and Zhuhai are more complex than those in other cities, and the study on the housing price influencing factors in Guangzhou and Zhuhai remains to be further carried out.

In the third-tier cities of Foshan and Dongguan, per capita GDP is the most important factor affecting the housing price, and its influence coefficient is very prominent compared with other factors. Secondly, population density also has a great influence on the housing price. This shows that the increase of housing price in Foshan and Dongguan is mainly due to the improvement of local economic level and the increase of population density, and the impact of real estate development investment on housing price is not significant, indicating that the property of commercial housing in these two cities is not very prominent. On the whole, compared with other tier cities, the housing price growth in tier 3 cities is more reasonable and healthy.

The fourth-tier cities are mainly the cities in the Pearl River Delta that rank low in comprehensive strength. In the housing price of this tier, per capita disposable income is the most important factor influencing the housing price, and its influencing coefficient is much higher than other factors. It indicates that the rise of housing price in these cities is mainly due to the increase of purchasing power and demand for commercial housing brought by the improvement of local people's income level. Meanwhile, the increase of population density also promotes the rise of housing price in these cities. It is worth noting that the increase of real estate development investment will also lead to a significant rise in housing price, indicating that in the fourth-tier cities, the property of commercial housing investment is more prominent.

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