

Study on the Factors Affecting Housing Prices in Chengdu

—Empirical analysis based on data from 2002-2022

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ABSTRACT

Based on the background of the sluggish real estate market in recent years, this paper organizes the relevant data on the average selling price of commercial housing in Chengdu from 2002 to 2022 and studies the factors affecting housing prices. It also collects data such as per capita GDP, housing completion area, and real estate development investment in Chengdu from 2002 to 2022, and constructs the STIRPAT model for multiple linear regression. After a series of model tests and empirical analysis, it is concluded that both per capita GDP and real estate development investment have a positive effect on Chengdu housing prices, while the housing completion area is negatively correlated with Chengdu housing prices. Based on the research results, this paper summarizes the conclusions and puts forward suggestions for the Chengdu Municipal Government and real estate developers.

KEYWORDS

Chengdu housing prices; STIRPAT model; Multiple linear regression

1. INTRODUCTION

Unlike other commodity markets, housing is the closest fixed asset to ordinary people, with the characteristics of non-liquidity, regionality, cyclicity, weak supply, etc. In order to reduce housing prices, avoid real estate bubbles as much as possible, protect people's basic living rights and interests, and ensure the healthy and orderly development of the real estate market, the government has been strengthening supervision of the real estate industry. Under the influence of the three-year epidemic, housing prices in many cities have been sluggish, but housing prices in Chengdu have increased instead of decreased. The average housing price has increased by as much as 50% in the past five years. Although Chengdu's economic development level has grown rapidly, the rapid growth of housing prices has a great negative effect on improving people's happiness in buying houses and attracting foreign talents. Therefore, this paper studies the factors affecting housing prices in Chengdu, striving to explore more effective real estate regulation policies.

Due to differences in location, economic development level, culture, geographical environment, etc., the factors and weights affecting housing prices in each city are also different. Research on the factors affecting housing prices in Chengdu can provide certain empirical evidence and development suggestions for relevant departments to formulate the most suitable development strategy for Chengdu.

2. LITERATURE REVIEW

2.1. Research Progress Abroad

Econometrics developed early abroad, and research on factors affecting real estate prices also began early. Capozza D R, Hendershott P H, Mack C, et al (2002) conducted a regression analysis on data from 62 cities in the United States over a 25-year period. After analyzing the regression results, they concluded that cities with higher levels of economic development tend to have higher significance for housing prices. Wheaton W C, Nechayev G (2008) conducted time series model forecasting on 59 cities from 1998 to 2005. The results showed that the main reason for the increase in housing prices was the influx of foreign population. IC Tsai, CW Peng (2012) established a panel data model and concluded that there is a significant positive correlation between housing prices and per capita disposable income. Algieri and Bernardina (2013) took major European and American countries as research objects and concluded that per capita income, loan interest rates and inflation have a significant impact on housing prices.

2.2. Domestic Research Progress

Due to the large land area of my country, housing prices and their influencing factors vary greatly in different regions. At the same time, housing prices have always been a hot topic in China, so there are many studies from different angles. Liang Yunfang and Gao Tiemei (2007) established a panel data model to study the reasons for the large differences in housing price fluctuations between the central, western and eastern regions. They studied whether the surface fluctuation differences were caused by mortgage interest rates and local economic development levels. Yu Yongze and Zhang Shaohui (2017) selected corporate data from 230 prefecture-level cities and 1,272 listed companies and established a DID model. The study found that rising housing prices inhibited urban technological innovation, and that housing prices had a spatial spillover effect. The spillover of urban housing prices also had a suppressive effect on technological innovation in surrounding cities.

2.3. Research Review

In summary, domestic and foreign scholars have conducted in-depth research on the formation, fluctuation, influencing factors, and mechanism of real estate prices from different perspectives in theory and practice. These research results provide a solid theoretical foundation and literature support for this article.

3. MODEL CONSTRUCTION

This paper uses the STIRPAT model to explore the influencing factors of Chengdu housing prices and their relationship. Its expression is:

$$I=aP^bA^cT^de \quad (1)$$

Where e is heteroscedasticity. To avoid heteroscedasticity, we take the logarithm of (1) and get (2):

$$\ln I=\ln a+b(\ln P)+c(\ln A)+d(\ln T)+\ln e \quad (2)$$

Among them, x_1 , x_2 , x_3 are GDP per capita, real estate development investment, and housing completion area respectively, and c is a constant term. The data used are all from the Chengdu Statistical Yearbook published by the Chengdu Statistics Bureau (Average Housing Price in Chengdu = Chengdu Commercial Housing Sales / Chengdu Commercial Housing Sales Area).

Table 1. Explanation of variables

Variable	Notation	Unit
Average Housing Price	Y	Yuan/square meter
GDP per capita	X1	Yuan
real estate development investment	X2	Million Yuan
housing completion area	X3	Ten thousand square meters

In order to eliminate the impact of price levels, the original data is first deflated before building the model. This article takes 2002 as the base year, the CPI of the t th year is CPI_t , the CPI index of the t th year is ID_t , and the annual conversion number $M_t = M_{t-1} \times ID_0 / ID_t$; among them, M_0 is the base year (value=1), and ID_0 is 100.

4. STATIONARITY TEST AND COINTEGRATION TEST OF TIME SERIES

4.1. Stationarity Analysis of Time Series

This paper conducts ADF tests on the explained variables and explanatory variables in turn to examine their single integral order.

Among them, the significance level of the test is set to 0.05, and the results are as follows: (Note: the significance level of $\ln y$ is valid when $\alpha=0.10$).

Table 2. Stationarity test results of each variable

Variable	Result
$\ln y$	I(1) with intercept
$\ln x_1$	I(1) with intercept and trend terms
$\ln x_2$	I(0) with intercept
X3	I(1) with intercept

4.2. Cointegration Test—EG Two-Step Method

After testing the stability of the variables in the model, it is found that the explained variable $\ln y$ is first-order integrated, and there are first-order integrated and stable sequences in the explanatory variables, so the EG cointegration test can be further performed. According to the formula:

$$C(\alpha) = \Phi_{\infty} + \Phi_1 T^{-1} + \Phi_2 T^{-2}$$

It can be seen that when there are 4 variables and the significance level $\alpha=0.10$: $\Phi_{\infty}=-4.1000$, $\Phi_1 = -10.475$, $\Phi_2 = -21.57$. Substituting the sample size $T=21$, the critical value can be obtained. $C(\alpha) = -4.2188$. It is greater than the t-statistic value of -4.4231 , which proves that there is a cointegration relationship between $\ln y$ and $\ln x_1$, $\ln x_2$, and X3.

5. MODEL VERIFICATION

5.1. Heteroskedasticity Test

In order to ensure that the established model meets the assumption of homoscedasticity, this paper uses White test, Glejser test and ARCH test to test the model for heteroscedasticity. The test results are shown in Table 4, Table 5 and Table 6 respectively:

Table 3. White test results

α	nR^2	P value	Result
0.05	13.35263	0.1473	Do not reject the null hypothesis

Table 4. Glejser test results

Form	nR^2	P value	Result
$\ln x_1 + \ln x_2 + X_3$	0.048437	0.8258	Do not reject the null hypothesis
$\ln x_1 + X_3$	0.049934	0.8232	Do not reject the null hypothesis
$\ln x_1 * X_3$	0.000150	0.9902	Do not reject the null hypothesis
$\ln x_2 * X_3$	0.000246	0.9875	Do not reject the null hypothesis
$X_3^{0.5}$	0.001669	0.9674	Do not reject the null hypothesis
.....	Do not reject the null hypothesis

Table 5. ARCH test results

Order	$(n-p)R^2$	P value	AIC	SIC	Result
p=1	1.397785	0.2371	-7.148705	-7.049142	Set p=1, do not reject the null hypothesis
p=2	2.727210	0.2557	-7.108688	-6.959566	
p=3	2.627168	0.4527	-6.930683	-6.732822	
p=4	2.421315	0.6588	-6.779319	-6.534256	
p=5	4.145551	0.5287	-6.744266	-6.454545	

From the above test results, we can see that the model has passed the heteroskedasticity test, which means that the model does not have heteroskedasticity problem.

5.2. Autocorrelation Test of Sequence

Then, the variance expansion factor method was used to test the multicollinearity among the explanatory variables of the model.

Table 6. VIF of each explanatory variable in the model

Variable	Centered VIF
$\ln x_1$	21.51565
$\ln x_2$	24.05826
X_3	1.930163

Only the VIF of X_3 (completed housing area) is less than 10, indicating that the model has serious multicollinearity problems. In the multivariate regression model established in this paper, the various explanatory variables have a strong correlation. The main reason for this is that the economic variables that affect housing prices selected in this paper are interrelated and have similar changing trends over time. Therefore, it can be considered that the regression results are in line with reality.

6. ANALYSIS OF EMPIRICAL RESULTS AND ERROR CORRECTION MODEL

6.1. Model Analysis

This paper uses Eviews software and obtains the model expression as follows:

$$\hat{\ln y}_t = -1.886092 + 0.734418 \ln x_{1t} + 0.258397 \ln x_{2t} - 0.000121 X_{3t}$$

$$(0.597293) \quad (0.162706) \quad (0.105224) \quad (0.0000544)$$

$$t = (-3.157734) \quad (4.513762) \quad (2.455692) \quad (-2.228774)$$

$$R^2 = 0.982469 \quad \bar{R}^2 = 0.979376$$

$$F = 317.5789 \quad DW = 1.969725$$

At the significance level of 0.05, the t values of the models $\ln x_1$, $\ln x_2$, and x_3 are all significant. The modified coefficient of determination of the model is large, indicating that the model fits well; the F statistic corresponding to the model is large, and the p value is less than 0.05, which indicates that all the explanatory variables combined explain the explained variables well.

6.2. Error Correction Model

There is cointegration between the explained variable in the model and the series of the three explanatory variables, indicating that there is a long-term equilibrium relationship between the variables, but in the short term, there may be an imbalance. In order to enhance the accuracy of the model, the following error correction model can be established to link the short-term behavior of the average house price with the long-term changes:

$$\Delta \ln y_t = 0.044402 + 0.256331 \Delta \ln x_{1t} + 0.200966 \Delta \ln x_{2t} - 0.00004 \Delta X_{3t} - 0.677594 \text{resid_eg}(-1)$$

With a significance level of 0.05, the coefficient t-test p value of $\text{resid_eg}(-1)$ is 0.0078, which means the coefficient is significantly negative. Therefore, the coefficient of the error term $\text{resid_eg}(-1)$ reflects the correction of deviation, that is, there is an error correction mechanism in the system.

7. CONCLUSION

7.1. Research Conclusions

Among the factors that affect Chengdu's housing prices, per capita GDP is positively correlated with Chengdu's housing prices. This means that the improvement of economic development levels has a significant positive impact on housing prices by increasing residents' income and purchasing power.

In addition, there is a positive correlation between real estate development investment and Chengdu housing prices, which illustrates the interactive relationship between market confidence and actual investment. Developers' optimistic expectations for the future have prompted them to increase investment, which is not only reflected in the launch of new projects, but also in the renovation and upgrading of existing projects and the development of emerging areas.

Finally, the completed housing area is negatively correlated with Chengdu housing prices, indicating the inhibitory effect of increased market supply on housing prices. The increase in completed area means that the supply of houses on the market has increased. If the growth rate of demand cannot keep up with the increase in supply, it will lead to an oversupply situation, thus exerting downward pressure on housing prices.

7.2. Research Recommendations

Given the positive impact of GDP per capita on housing prices, the government should continue to promote stable economic growth. But at the same time, it should also pay attention to the health and stability of the real estate market to avoid the risk of bubbles and inconvenience to residents caused by the rapid rise in housing prices. In view of the inhibitory effect of the increase in housing completion area on housing prices, the government should rationally plan land and adjust the housing supply structure according to the trend of population inflow and market demand. Public housing projects should be launched in a timely manner to increase the supply of low- and medium-priced housing to meet the housing needs of different income levels, so as to balance market supply and demand and prevent the inflated housing prices caused by over-reliance on the high-end market.

For real estate developers, during the real estate development process, they should conduct in-depth research on market trends and consumer demands to avoid blindly following the trend of developing high-end projects. In the context of the positive correlation between real estate development investment and housing prices, developers should focus on improving project quality and innovative design, increasing the uniqueness and competitiveness of projects, rather than simply relying on market expectations to raise housing prices and make blind investments. When there is oversupply in the market, it is appropriate to slow down the launch of new projects, or adopt differentiated marketing strategies to avoid direct price wars and maintain project value.

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