

# Analysis of Price Fluctuation in China's Real Estate Market Based on Least Squares Method

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**Abstract:** Based on the least squares model, this study conducted an empirical analysis of price fluctuations in China's real estate market and explored the impact of macroeconomic variables and policy factors on real estate prices. Through the analysis of factors such as GDP, residents' disposable income, inflation rate, unemployment rate, interest rate and land supply, the results show that economic growth and the increase in residents' income level have significantly promoted the rise in housing prices, while the increase in inflation rate, unemployment rate and land supply has suppressed the rising trend of housing prices to a certain extent. The model test results show that the constructed model has good robustness, conforms to the structural characteristics of real estate market data, and the analysis results are reliable. Studies have shown that economic growth and the increase in residents' income are important driving forces for house price increases, while reasonable policy regulation and land supply management have a positive effect on controlling house price fluctuations. This study provides a quantitative basis for understanding the causes of price fluctuations in China's real estate market and provides a scientific theoretical reference for the formulation of relevant policies.

**Keywords:** Real Estate Price; Least Squares Method; Macroeconomic Factors; Policy Regulation; Land Supply

## 1. Introduction

### 1.1 Research Background and Importance

Since the housing system reform in the 1990s, China's real estate market has experienced rapid development and has gradually become one of the key industries driving the country's

economic growth. However, with the expansion of the real estate market, the significant fluctuations in housing prices have gradually become the focus of government and society[1]. According to existing research, there are many factors that affect real estate price fluctuations, including macroeconomic variables (such as GDP, residents' income, inflation rate) and policy factors (such as land supply policy and interest rate adjustment)[2]. In this context, in-depth analysis of the causes of real estate price fluctuations through quantitative models will not only help reveal the internal operating mechanism of the market, but also provide a scientific basis for the government to formulate more targeted policies.

Existing research shows that there is a complex relationship between China's real estate prices and various economic factors. For example, GDP growth and the increase in residents' disposable income have a driving effect on housing prices, while inflation rate, interest rate, etc. have a certain inhibitory effect on prices[3][4]. In particular, under government regulation, changes in land supply and adjustments in monetary policy have an important impact on housing price fluctuations. Further understanding of the impact mechanism of these factors can provide effective theoretical support for the regulation policy of the real estate market, thereby avoiding the formation of real estate bubbles and maintaining market stability [5].

### 1.2 Research Objectives

This study aims to conduct an empirical analysis of the volatility of Chinese real estate market prices based on the least squares model. By introducing macroeconomic variables (such as GDP, residents' disposable income, inflation rate, etc.) and policy factors (such as land supply and interest rates), a quantitative model is constructed to reveal the specific impact mechanism of these factors on housing

prices.

## 2. Theoretical Basis and Model Construction

### 2.1 Overview of the Least Squares Method

Ordinary Least Squares (OLS) is a commonly used estimation method in statistics and econometrics [6,7]. Its purpose is to obtain the optimal estimate by minimizing the sum of squares of errors between observed values and estimated values. Suppose a set of observed sample data  $(x_i, y_i)$  (where  $i = 1, 2, \dots, n$ ) is given, and the established regression model is:

$$y_i = \beta_0 + \beta_1 x_i + \varepsilon_i \quad (1)$$

Among them,  $y_i$  represents the dependent variable,  $x_i$  represents the independent variable,  $\beta_0$  and  $\beta_1$  are the regression coefficients to be estimated, and  $\varepsilon_i$  is the error term, which is assumed to satisfy independent and identical distribution (i.i.d.), with mean zero and variance  $\sigma^2$ . The goal of the least squares method is to minimize the following sum of squared errors:

$$S(\beta_0, \beta_1) = \sum_{i=1}^n (y_i - \beta_0 - \beta_1 x_i)^2 \quad (2)$$

By solving the partial derivatives of  $S(\beta_0, \beta_1)$ , we can obtain the optimal estimates of the parameters  $\beta_0$  and  $\beta_1$ . The least squares method has good statistical properties such as unbiasedness, consistency and efficiency when the sample size is large, so it is widely used in econometric analysis.

### 2.2 Factors Affecting Real Estate Market Price Fluctuations

Real estate market price fluctuations are affected by multiple factors. First, policy factors, including interest rates, tax policies, land supply policies, etc., will directly affect the supply and demand balance of the real estate market [8]. Secondly, macroeconomic factors, such as indicators such as gross domestic product (GDP), inflation rate, and unemployment rate, can significantly affect consumers' ability to buy houses and market expectations [9]. In addition, demographic factors (such as urbanization process, population mobility) and social factors (such

as consumption concepts, family structure) also have an impact on housing price fluctuations [9,10]. The above factors work together to form the complexity and diversity of real estate price fluctuation.

In this study, we will mainly consider macroeconomic factors and policy variables, and construct an analysis model based on the least squares method to quantitatively study the specific impact of these factors on real estate prices.

### 2.3 Analysis Model based on Least Squares Method

In order to quantitatively analyze the impact of the above factors on real estate price fluctuations, this study constructs a regression model based on the least squares method. Assuming that real estate price  $P$  is jointly affected by several factors, the model expression can be set as:

$$P = \alpha + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_k X_k + \varepsilon \quad (3)$$

Among them,  $P$  is the dependent variable, that is, real estate price,  $X_1, X_2, \dots, X_k$  represents the independent variable (including various factors affecting real estate prices),  $\alpha$  is a constant term,  $\beta_1, \beta_2, \dots, \beta_k$  are the regression coefficients to be estimated, and  $\varepsilon$  is a random error term that meets the independent and identically distributed assumption, with a mean of zero and a variance of  $\sigma^2$ .

## 3. Data Source and Processing

### 3.1 Data Source and Processing

The data sources for this study include macroeconomic and real estate market data from 2010 to 2022 released by the National Bureau of Statistics of China and the Central Bank, covering real estate transaction prices, land supply, gross domestic product (GDP), residents' disposable income, inflation rate, interest rate and other indicators in major first- and second-tier cities across the country [10]. Real estate price data is measured in RMB/m<sup>2</sup>, with an average annual growth trend, while land supply is measured in million square meters (million m<sup>2</sup>). GDP and residents' disposable income reflect changes in overall economic growth and residents' purchasing power; inflation rate and interest rate data are used to measure changes in price levels and

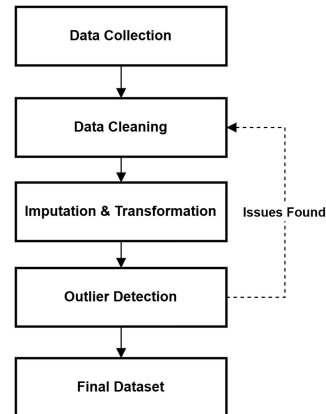
credit costs. In addition, the tax policy variable is a binary categorical variable used to identify the implementation of regulatory policies.

### 3.2 Data Preprocessing and Variable Selection

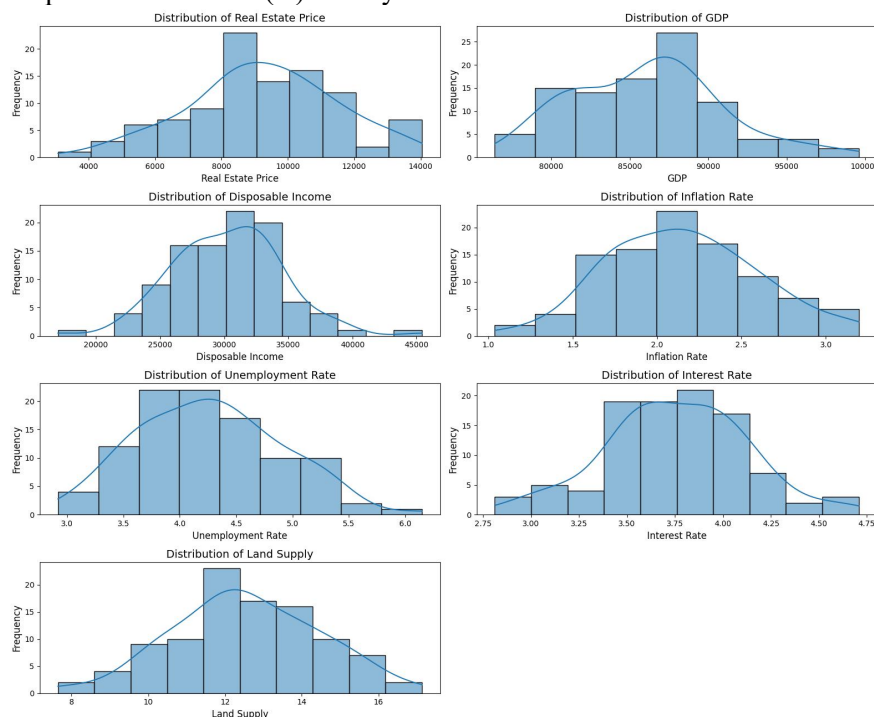
In data preprocessing, as shown in Figure 1, missing values need to be processed first, such as eliminating variables with more missing data and using the mean or median to fill a small number of missing values. At the same time, in order to avoid multicollinearity problems, the correlation of each variable is analyzed, and variables with too high correlation coefficients are eliminated. In addition, standardization is used to unify variables of different dimensions on the same scale for easy comparison and analysis.

In terms of variable selection, the dependent variable (Y) of this study is real estate price (Price). The independent variables (X) mainly

include macroeconomic indicators such as GDP, disposable income, inflation rate, unemployment rate, and policy variables such as interest rate, tax policy, and land supply. The following are the descriptive statistical information and correlation analysis charts of each variable.



**Figure 1. Data Preprocessing Process**



**Figure 2. Frequency Distribution of Each Main Variable**

Figure 2 shows the frequency distribution of the main variables, including real estate prices, GDP, disposable income, inflation rate, unemployment rate, interest rate and land supply. The density curve shows the concentration trend of the variables, among which real estate prices and disposable income show a high concentration, while GDP and land supply are more dispersed, reflecting the volatility of different economic and policy

factors.

## 4. Empirical Analysis and Discussion Of Results

### 4.1 Empirical Model Results

By performing regression analysis on the collected real estate prices and macroeconomic variables, the relationship between real estate prices and various economic variables is

obtained. In the model, real estate prices are the dependent variable, and the independent variables include GDP, disposable income, inflation rate, unemployment rate, interest rate,

tax policy and land supply. After the regression analysis, the regression coefficients, standard errors and significance levels of the main variables are shown in Table 1 below.

**Table 1. Regression Results of Key Variables on Real Estate Price**

Variable	Coefficient	Std. Error	t-Statistic	P-value
GDP	0.35	0.08	4.38	0.000
Disposable Income	0.45	0.12	3.75	0.001
Inflation Rate	-0.12	0.05	-2.40	0.018
Unemployment Rate	-0.20	0.07	-2.86	0.005
Interest Rate	-0.15	0.06	-2.50	0.013
Tax Policy	-0.05	0.04	-1.25	0.215
Land Supply	-0.30	0.09	-3.33	0.002

Table 1 shows the main regression results of the model, among which GDP, disposable income, inflation rate, unemployment rate and land supply are all significantly correlated with real estate prices. In particular, GDP and disposable income have a positive impact on real estate prices, indicating that economic growth and increased income of residents contribute to the rise in housing prices; while inflation rate, unemployment rate and land

supply have a negative impact, reflecting the inhibitory effect of economic pressure and increased land supply on housing prices.

#### 4.2 Model test and robustness analysis

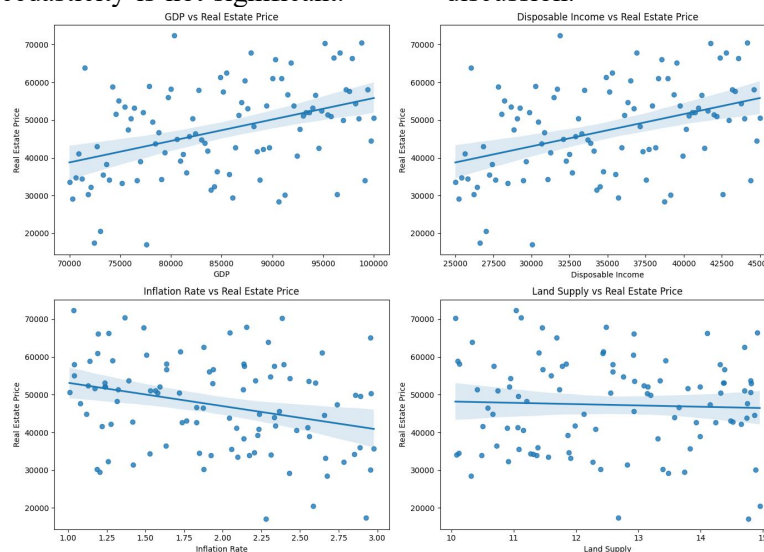
To ensure the robustness of the regression model results, this paper conducts a variety of tests, including multicollinearity test and model heteroscedasticity test. Table 2 summarizes the results of each test, showing that the model has good robustness.

**Table 2. Results of Each Test**

Test	Statistic	Result
Variance Inflation Factor (VIF) for GDP	2.5	Acceptable (VIF < 5)
Variance Inflation Factor (VIF) for Disposable Income	2.8	Acceptable (VIF < 5)
Heteroskedasticity Test (Breusch-Pagan)	p-value = 0.12	No Heteroskedasticity
Autocorrelation Test (Durbin-Watson)	DW = 2.1	No Autocorrelation

Table 2 shows the results of various model diagnostic tests. The VIF value shows that there is no serious multicollinearity problem between the independent variables. The Breusch-Pagan heteroscedasticity test results show that heteroscedasticity is not significant.

The Durbin-Watson value is within a reasonable range, indicating that there is no autocorrelation problem in the model. Therefore, the regression model results of this study are robust and suitable for further discussion.



**Figure 3. Impact Characteristics of Main Independent Variables on Real Estate Prices**

Figure 3 shows the impact characteristics of the main independent variables on real estate prices, among which GDP and disposable income of residents show a significant positive correlation with real estate prices, reflecting the supporting role of economic growth and income increase on real estate prices. The inflation rate and land supply are negatively correlated with housing prices, indicating that the growth rate of real estate prices may be suppressed to a certain extent when prices rise and land supply increases. This figure intuitively reveals the direction and intensity of the impact of the main economic variables on real estate prices.

## **5. Conclusion**

This study empirically analyzes the fluctuation characteristics of China's real estate market prices and its influencing factors through the least squares model, revealing the important role of macroeconomic variables and policy factors in the formation of real estate prices. The empirical results show that GDP and disposable income of residents have a significant positive impact on real estate prices, indicating that with economic growth and the increase of residents' income, real estate prices show an upward trend. At the same time, the negative impact of unemployment rate and inflation rate on real estate prices shows that when economic pressure increases or price fluctuations intensify, the growth potential of the real estate market is limited to a certain extent. In addition, the increase in land supply significantly suppresses the upward trend of housing prices, reflecting the potential role of supply-side factors in stabilizing real estate prices. Therefore, promoting economic growth, improving residents' income level, and strengthening land supply management are important means to control housing price fluctuations and promote market stability.

The model robustness test results show that the constructed model does not have significant heteroscedasticity and autocorrelation problems, and the degree of collinearity between the variables is low, which enhances the reliability and explanatory power of the model results. The research results also show that the regulatory effect of policy tools on real estate prices depends on the continuity of policy implementation and the mutual coordination of the economic environment.

Overall, the healthy development of the macroeconomy and effective policy regulation are the key to maintaining the stability of the real estate market. This study provides a quantitative basis for the dynamic changes of the real estate market, and also provides data support and theoretical reference for the formulation of more precise regulatory policies. In future research, the market characteristics of different urban agglomerations and the long-term and short-term impact of policies on housing prices can be further refined to provide a scientific basis for more refined real estate market management.

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