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# Factors Influencing Real Estate Prices: An Empirical Analysis Based on STATA Using Panel Data from China, Japan, and the U.S.

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**Abstract:**
The real estate acts as an essential and indispensable part of the national economy, strongly associated with the economic development. Since the real estate market and the economic development interact and influence each other, the study on the dynamics of real estate prices is very significant for monitor of the economy and formulation of policy making.The aim of this paper is to investigate the key determinants influencing real estate prices in three major economies: China, Japan, and the United States. By identifying and analyzing periods of significant price fluctuations, the study employs Stata software to examine the relationship between selected explanatory variables and housing price trends. The study shows that residential land price, population density and real gross domestic product per capita has the greatest influence on real estate price.

**Keywords:** Real Estate Price, Real Estate, Stata Analysis, Cross-Country Comparison

## 1. Introduction

As a crucial component of the national economy, the real estate industry plays a fundamental role in the economic structure of many countries. Various economic theories suggest that changes in a country's economy significantly impact real estate prices. A stable economic environment fosters real estate market expansion, while fluctuations in real estate prices, in turn, affect economic growth. A healthy and stable real estate market not only promotes investment and consumption but also contributes to sustained economic growth. Conversely, market instability may lead to severe economic fluctuations, disrupting the normal operation of the national economy. As a result, the dynamics of real estate prices have long been a focal point of economic regulation and policy-making worldwide.

Over the past decades, many countries have experienced large-scale fluctuations in their real estate markets. According to existing literature, real estate price trends can be considered leading indicators of the overall economic cycle. Therefore, analyzing the factors influencing housing prices is of great significance. This study selects three critical periods of significant real estate market fluctuations in China,

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Japan, and the U.S. Using panel data, it explores the factors influencing housing prices from three dimensions: demand, supply, and monetary policy. A multiple linear regression model is employed to analyze real estate price dynamics, evaluating the varying degrees of impact of different explanatory variables on real estate prices.

## 2. Variable Selection and Research Hypotheses

### 2.1 Variable Selection

Researchers worldwide have examined the factors influencing real estate prices from multiple perspectives. Based on existing research, relevant studies mainly focus on demand, supply, regulatory policies, and individual consumer behavior. This paper selects three periods of significant real estate market fluctuations in China, Japan, and the U.S. and utilises national-level panel data from the National Bureau of Statistics of China (2010–2023), the U.S. Bureau of Economic Analysis and the Federal Reserve Bank of St. Louis (2000–2013), and the Statistics Bureau of Japan (1985–2010). The study constructs explanatory variables from the three dimensions of demand, supply, and monetary policy to explore the mechanisms influencing housing prices.

This article selected real per capita GDP index and population density on the demand side as explanatory variables; the number of residential buildings started two years ago (accounting for construction cycles) and the residential land price index are used as explanatory variables of supply side; On the monetary side, different interest rate indicators are selected for the three countries : China uses the loan prime rate (LPR) for loans exceeding five years, Japan uses the long-term benchmark lending rate, and the U.S. uses the average 30-year and 15-year fixed mortgage rates. The actual real estate price index is chosen as the dependent variable. By constructing a multiple linear regression model, this study aims to verify the significance of these explanatory variables in influencing the actual real estate price index, as shown in Table 1.

Table 1: Variable Names and Descriptions

| Variable | Variable Name | Symbol | Unit |
|---|---|---|---|
| **Explained Variable** | Real Residential Property Price Indexes | $Y$ | (Index Jan 2010=100) |
| **Explanatory Variable** | | | |
| *Demand Side* | Real GDP per Capita | $X_1$ | (Index Jan 2010=100) |
| | Population Density | $X_2$ | (Persons per kilometre) |
| *Supply Side* | Constructing Dwellings and Residential Buildings Two Years Ago | $X_3$ | (Buildings) |
| | Residential Land Price Index | $X_4$ | (Index Jan 2010=100) |
| *Monetary Policy* | Interest Rate | $X_5$ | (%/year) |

### 2.2 Research Hypotheses

i. Real per capita GDP index: This metric represents the inflation-adjusted GDP divided by the total population, reflecting the average economic output per person and serving as a major cost component in housing development.

• Hypothesis 1: The real per capita GDP index is positively correlated with the actual real estate price index.

ii. Population density: This measure reflects the number of people per unit area and is commonly used to assess the intensity of residential use and resource pressure.

• Hypothesis 2: Population density is positively correlated with the actual real estate price index.

iii. Number of residential buildings started two years prior: Given the construction cycle, this study uses the number of housing starts from two years prior. For example, if the analysis year is 2023, the data reflects housing starts from 2021.

• Hypothesis 3: The number of residential buildings started two years prior is negatively correlated with the actual real estate price index.

iv. Residential land price index: This index measures changes in land prices for residential use. The data is indexed with January 2010 as the base period.

• Hypothesis 4: The residential land price index is positively correlated with the actual real estate price index.

v. Interest rate: This reflects loan interest rates in each country.

• Hypothesis 5: Interest rates are negatively correlated with the actual real estate price index.

## 3. Data Sources and Model Construction

### 3.1 Data Sources

This study uses data from China (2010–2023), Japan (1985–2010), and the U.S. (2000–2013) to conduct an empirical analysis of housing price determinants. The data sources include the National Bureau of Statistics of China, the U.S. Bureau of Economic Analysis, the Federal Reserve Bank of St. Louis, and the Statistics Bureau of Japan, as shown in Tables 2, 3, and 4.

Table 2 : Data of influencing factors of real estate in China from 2010 to 2023

| year | Real GDP per capita | Population Density ( Persons per kilometre) | Constructing Buildings Two Years Ago | Residential land price index | Loan Prime Rate(¿5 years) | Real Residential Property Price Indexes |
|---|---|---|---|---|---|---|
| 2010 | 100 | 141.94 | 283266 | 100 | 6.27 | 100 |
| 2011 | 109 | 142.71 | 320368 | 107 | 6.82 | 98.65 |
| 2012 | 116.7 | 143.69 | 405356 | 111 | 6.68 | 95.49 |
| 2013 | 125 | 144.65 | 5057959 | 123 | 6.15 | 98.62 |
| 2014 | 133.4 | 145.56 | 573418 | 130 | 5.4 | 99.13 |
| 2015 | 142 | 146.41 | 665572 | 136 | 4.9 | 93.92 |
| 2016 | 150.8 | 147.25 | 726483 | 150 | 4.9 | 98.03 |
| 2017 | 160.3 | 148.14 | 735693 | 166 | 4.9 | 103.3 |
| 2018 | 170.3 | 148.84 | 758975 | 178 | 5.46 | 106.72 |
| 2019 | 179.8 | 149.37 | 781484 | 187 | 4.85 | 109.78 |
| 2020 | 183.4 | 149.72 | 822300 | 193 | 4.75 | 109.65 |
| 2021 | 198.7 | 149.86 | 893821 | 202 | 4.65 | 111.82 |
| 2022 | 204.6 | 150.44 | 926759 | 187 | 4.6 | 107.16 |
| 2023 | 215.6 | 149.18 | 975387 | 175 | 4.2 | 103.45 |

Table 3: Data of influencing factors of real estate in Japan from 1985 to 2010

| year | Real GDP per capita | Population Density ( Persons per kilometre) | Constructing Buildings Two Years Ago | Residential land price index | Long-term Prime Lending Rates | Real Residential Property Price Indexes |
|---|---|---|---|---|---|---|
| 1985 | 68.9 | 331.42 | 94733 | 159 | 7.36 | 122.2 |
| 1986 | 70.4 | 333.1 | 98940 | 164 | 6.56 | 125.41 |
| 1987 | 73 | 334.8 | 103006 | 173 | 5.4 | 134.75 |
| 1988 | 77.8 | 336.2 | 113717 | 190 | 5.6 | 142.58 |
| 1989 | 81.7 | 337.55 | 139525 | 205 | 5.93 | 153.66 |
| 1990 | 86 | 338.67 | 140387 | 233 | 7.97 | 174.55 |
| 1991 | 88.5 | 340 | 138551 | 257 | 7.14 | 181.98 |
| 1992 | 88.9 | 341.26 | 142259 | 253 | 6.02 | 174.95 |
| 1993 | 88.8 | 342.37 | 114177 | 228 | 4.71 | 167.36 |
| 1994 | 89.3 | 343.33 | 116883 | 224 | 4.45 | 163.44 |
| 1995 | 90.8 | 344.14 | 123807 | 220 | 3.31 | 160.94 |
| 1996 | 92.9 | 345.01 | 130854 | 210 | 3.01 | 158.02 |
| 1997 | 94.2 | 345.84 | 122527 | 201 | 2.7 | 155.95 |
| 1998 | 92.1 | 346.78 | 136939 | 194 | 2.41 | 153.33 |
| 1999 | 91.7 | 347.41 | 115585 | 185 | 2.39 | 148.56 |
| 2000 | 93.6 | 347.99 | 99858 | 174 | 2.23 | 142.91 |
| 2001 | 93.7 | 348.83 | 101217 | 163 | 2.09 | 136.64 |
| 2002 | 93.8 | 349.64 | 102487 | 151 | 1.93 | 129.41 |
| 2003 | 95.2 | 350.39 | 97822 | 139 | 1.56 | 121.36 |
| 2004 | 97.4 | 350.51 | 95918 | 127 | 1.71 | 113.93 |
| 2005 | 98.7 | 350.54 | 96674 | 118 | 1.65 | 108.42 |
| 2006 | 100.3 | 350.77 | 99087 | 112 | 2.31 | 105.18 |
| 2007 | 102.5 | 351.17 | 103015 | 110 | 2.34 | 104.09 |
| 2008 | 101.5 | 351.34 | 107533 | 109 | 2.29 | 102.45 |
| 2009 | 96 | 351.29 | 88395 | 105 | 1.94 | 98.58 |
| 2010 | 100 | 351.36 | 91127 | 100 | 1.49 | 100 |

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Table 4: Data of influencing factors of real estate in United States from 2000 to 2013

| year | Real GDP per capita | Population Density ( Persons per kilometre) | Constructing Buildings Two Years Ago | Residential land price index | 30-Year Fixed Rate Mortgage | 15-Year Fixed Rate Mortgage | Real Residential Property Price Indexes |
|---|---|---|---|---|---|---|---|
| 2000 | 92.1 | 30.8 | 1621000 | 66 | 8.05 | 7.72 | 97.35 |
| 2001 | 92.1 | 31.1 | 1647000 | 72 | 6.97 | 6.5 | 102.99 |
| 2002 | 92.8 | 31.39 | 1573000 | 85 | 6.54 | 5.98 | 109.95 |
| 2003 | 94.5 | 31.66 | 1601000 | 95 | 5.83 | 5.17 | 117.95 |
| 2004 | 97.2 | 31.96 | 1710000 | 108 | 5.84 | 5.21 | 131.16 |
| 2005 | 99.7 | 32.25 | 1854000 | 124 | 5.87 | 5.42 | 147.01 |
| 2006 | 101.5 | 32.57 | 1950000 | 125 | 6.41 | 6.07 | 150.67 |
| 2007 | 102.5 | 32.88 | 2073000 | 120 | 6.34 | 6.03 | 138.06 |
| 2008 | 101.7 | 33.24 | 1812000 | 109 | 6.03 | 5.62 | 113.77 |
| 2009 | 98.2 | 33.54 | 1342000 | 101 | 5.04 | 4.57 | 103.08 |
| 2010 | 100 | 33.82 | 900000 | 100 | 4.69 | 4.1 | 100 |
| 2011 | 100.8 | 34.06 | 554000 | 97 | 4.45 | 3.68 | 94.27 |
| 2012 | 102.4 | 34.31 | 586000 | 96 | 3.66 | 2.93 | 96.73 |
| 2013 | 103.7 | 34.55 | 612000 | 102 | 3.98 | 3.1 | 104.75 |

### 3.2 Model Construction

To explore the relationships between the dependent variable (actual real estate price index) and the explanatory variables (real per capita GDP index, population density, number of residential buildings started two years prior, residential land price index, and interest rates), this study uses STATA software to analyze real estate data from China, Japan, and the U.S. A multiple linear regression model is established as the follow equation:

$$Y = \beta_0 + \beta_1 * X_1 + \beta_2 * X_2 + \beta_3 * X_3 + \beta_4 * X_4 + \beta_5 * X_5 + e$$

## 4. Empirical Analysis of Factors Affecting the Actual Real Estate Price Index

Table 5 : Regression Results Of China

| $Y$ | Coef. | Std. Err. | t | P > \| t\| | [95% Conf. Interval] |
|---|---|---|---|---|---|
| $X_1$ | 0.0324028 | 0.0494545 | 0.66 | 0.531 | [-0.0816, 0.1464] |
| $X_2$ | -3.910428 | 1.255865 | -3.11 | 0.014 | [-6.8065, -1.0144] |
| $X_3$ | 0.0000000628 | 0.000000454 | 0.14 | 0.894 | [0.00000111, 1.11E-06] |
| $X_4$ | 0.4464531 | 0.0831197 | 5.37 | 0.001 | [0.2548, 0.6381] |
| $X_5$ | 1.378517 | 1.579984 | 0.87 | 0.408 | [-2.2649, 5.0219] |
| _cons | 596.4454 | 176.378 | 3.38 | 0.01 | [189.7171, 1003.174] |
| R-squared | | | 0.9319 | Adj R-squared | 0.8893 |

Table 6 : Regression Results Of Japan

| $Y$ | Coef. | Std. Err. | t | P > \| t\| | [95% Conf. Interval] |
|---|---|---|---|---|---|
| $X_1$ | -0.3963098 | 0.3619084 | -1.1 | 0.287 | [-1.1512, 0.3586] |
| $X_2$ | 1.086888 | 0.7286918 | 1.49 | 0.151 | [-0.4331, 2.6069] |
| $X_3$ | 0.0000707 | 0.0000711 | 0.99 | 0.332 | [-0.0000776, 0.0002191] |
| $X_4$ | 0.559382 | 0.0246391 | 22.7 | 0.000 | [0.5080, 0.6108] |
| $X_5$ | 0.0395681 | 0.8903325 | 0.04 | 0.965 | [-1.8176, 1.8968] |
| _cons | -306.107 | 225.5493 | -1.36 | 0.190 | [-776.5946, 164.3807] |
| R-squared | | | 0.9912 | Adj R-squared | 0.9890 |

Table 7: Regression Results Of United States

| $Y$ | Coef. | Std. Err. | t | P > \| t\| | [95% Conf. Interval] |
|---|---|---|---|---|---|
| $X_1$ | 2.597015 | 1.210561 | 2.15 | 0.069 | [-0.2655, 5.4595] |
| $X_2$ | -20.25804 | 5.572227 | -3.64 | 0.008 | [-33.4343, -7.0818] |
| $X_3$ | 0.00000839 | -0.66 | 0.532 | -0.0000253 | [-0.0000253, 0.0000143] |
| $X_4$ | 0.9768664 | 0.2057637 | 4.75 | 0.002 | [0.4903, 1.4634] |
| $X_5$ | -6.012484 | 20.21503 | -0.3 | 0.775 | [-53.8134, 41.7885] |
| $X_6$ | 3.791168 | 16.9029 | 0.22 | 0.829 | [-36.1778, 43.7602] |
| _cons | 446.7338 | 139.3782 | 3.21 | 0.015 | [117.1567, 776.311] |
| R-squared | | | 0.9788 | Adj R-squared | 0.9607 |

## 4.1 Model Fit Analysis

The R-squared and adjusted R-squared values indicate the model's explanatory power:

• China (2010–2023): R-squared = 0.9319, Adjusted R-squared = 0.8893, indicating strong explanatory power (93.19% of housing price variations explained).

• Japan (1985–2010): R-squared = 0.9912, Adjusted R-squared = 0.9890, suggesting an extremely high fit.

• U.S. (2000–2013): R-squared = 0.9788, Adjusted R-squared = 0.9607, demonstrating strong explanatory power.

All three models show high goodness-of-fit, confirming that the selected explanatory variables effectively explain real estate price fluctuations.

## 4.2 Significance of Variables

### 4.2.1 Regression results for China

Based on the above regression results, in the regression model for China, the p-values of variables $X_2$ and $X_4$ are 0.014 and 0.001 respectively, both of which are below the 0.05 significance threshold, indicating statistical significance within the model. The corresponding regression coefficients are -3.9104 for $X_2$ and 0.4465 for $X_4$, suggesting that population density ($X_2$) exerts a significant negative impact on the housing price index, while the land price index on the supply side ($X_4$) has a significant positive effect.

In contrast, the p-values for variables $X_1$, $X_3$, and $X_5$ are 0.531, 0.894, and 0.408 respectively, all exceeding 0.1, implying that these variables are not statistically significant within the model.

### 4.2.2 Regression results for Japan

In the case of Japan, variable $X_4$ similarly demonstrates a high level of statistical significance, with a p-value of 0.000 and a regression coefficient of 0.5594, indicating a significant positive effect on the housing price index. This result is consistent with the findings from the Chinese model. However, variable $X_2$ has a regression coefficient of 1.0869 and a p-value of 0.151, which does not meet the 0.05 significance level. Moreover, the sign of the coefficient differs from that observed in the Chinese model.

The remaining variables $X_1$, $X_3$, and $X_5$ also exhibit p-values above 0.05 and are thus statistically insignificant.

### 4.2.3 Regression results for the United States

Regarding the United States, variable $X_2$ exhibits a regression coefficient of -20.2580 with a p-value of 0.008, indicating a statistically significant negative impact on the housing price index. This aligns with the findings from the Chinese model, in which $X_2$ also shows a significant negative effect. In addition, the regression coefficient of variable $X_4$ is 0.9769 with a p-value of 0.002, again revealing a significant positive effect on housing prices. Variable $X_1$ has a p-value of 0.069, which falls below the 0.1 threshold, indicating weak statistical significance.

The remaining variables—$X_3$, $X_5$ (average 30-year fixed mortgage rate), and $X_6$ (average 15-year fixed mortgage rate)—have p-values of -0.000, 0.775, and 0.829 respectively, none of which meet conventional significance levels.

### 4.2.4 Comparative analysis

Based on the regression results of the three models, variables $X_2$ and $X_4$ demonstrate significant effects on housing

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prices. All three models confirm a positive relationship between $X_4$ (residential land price index) and the housing price index, which is consistent with the research hypothesis. However, regarding variable $X_2$ (population density), the sign of the regression coefficient varies across models. In the Japan-based model, $X_2$ shows a significant positive impact on housing prices, in alignment with the hypothesis. Conversely, the models for China and the United States indicate a negative relationship between population density and housing prices, contradicting the initial hypothesis.

Given the statistical insignificance of the remaining explanatory variables, separate regressions were conducted for variables $X_1$, $X_3$, and $X_5$ to eliminate the possibility of multicollinearity, as shown in Tables 8, 9, and 10.

Table 8 : Regression Results Of $X_1$ $X_3$ $X_5$ Of China

| $Y$ | Coef. | Std. Err. | t | P > \| t\| | [95% Conf. Interval] |
|---|---|---|---|---|---|
| $X_1$ | 0.1147829 | 0.0295334 | 3.89 | 0.002 | [0.0504351 , 0.1791307] |
| $X_3$ | -0.000000385 | 0.00000138 | -0.28 | 0.785 | [-0.00000339 , 0.00000262] |
| $X_5$ | -3.727852 | 1.656996 | -2.25 | 0.044 | [-7.338136 , -0.1175676] |
| R-squared ($X_1$) | | | 0.5573 | Adj R-squared ($X_1$) | 0.5204 |
| R-squared ($X_3$) | | | 0.0065 | Adj R-squared ($X_3$) | -0.0763 |
| R-squared ($X_5$) | | | 0.2967 | Adj R-squared ($X_5$) | 0.2380 |

Table 9 : Regression Results Of $X_1$ $X_3$ $X_5$ Of Japan

| $Y$ | Coef. | Std. Err. | t | P > \| t\| | [95% Conf. Interval] |
|---|---|---|---|---|---|
| $X_1$ | -0.9353652 | 0.5411724 | -1.73 | 0.097 | [-2.05229 , .1815596] |
| $X_3$ | 0.001285 | 0.000163 | 7.88 | 0.000 | [0.0009486 , 0.0016215] |
| $X_5$ | 6.95563 | 2.087399 | 3.33 | 0.003 | [2.647451 , 11.26381] |
| R-squared ($X_1$) | | | 0.1107 | Adj R-squared ($X_1$) | 0.0736 |
| R-squared ($X_3$) | | | 0.7214 | Adj R-squared ($X_3$) | 0.7098 |
| R-squared ($X_5$) | | | 0.3163 | Adj R-squared ($X_5$) | 0.2878 |

Table 1 0 : Regression Results Of $X_3$ $X_5$ $X_6$ Of United States

| $Y$ | Coef. | Std. Err. | t | P > \| t\| | [95% Conf. Interval] |
|---|---|---|---|---|---|
| $X_3$ | 0.0000262 | 0.00000726 | 3.61 | 0.004 | [0.0000104 , 0.000042] |
| $X_5$ | 4.752211 | 4.378379 | 1.09 | 0.299 | [-4.787457 , 14.29188] |
| $X_6$ | 4.676739 | 3.881612 | 1.20 | 0.251 | [-3.780567 , 13.13404] |
| R-squared ($X_3$) | | | 0.5205 | Adj R-squared ($X_3$) | 0.4905 |
| R-squared ($X_5$) | | | 0.0894 | Adj R-squared ($X_5$) | 0.0135 |
| R-squared ($X_6$) | | | 0.1079 | Adj R-squared ($X_6$) | 0.0336 |

By conducting separate regressions for the previously insignificant explanatory variables, the results presented above were obtained. Examination of the R-squared and adjusted R-squared values indicates that the explanatory power of the models constructed with these variables remains relatively weak.

It is noteworthy that variable $X_1$ in both the Chinese and Japanese models yielded p-values of 0.002 and 0.097, respectively, both of which are below the 0.1 significance threshold. This aligns with the results from the U.S. model and suggests that real per capita GDP exhibits a weak correlation with housing prices. Additionally, the regression coefficients for this variable are positive in the models for China and the United States, which is consistent with the research hypothesis. Regarding variable $X_5$ (and $X_6$), the interest rate variables in the Chinese and Japanese models produced p-values of 0.044 and 0.003, respectively, both of which are statistically significant at the 0.05 level. However, in the U.S. model, neither the average 30-year fixed mortgage rate ($X_5$) nor the 15-year counterpart ($X_6$) passed the significance test. Moreover, the regression coefficients for variable $X_3$ are all close to zero across the models, suggesting that the number of residential buildings started two years prior has only a negligible impact on housing prices.

### 4.3 Interpretation of Regression Model Results

In summary, the empirical results support theoretical hypotheses 1 and 4 proposed in Section 2.2, namely, that there is a positive relationship between real per capita GDP, the residential land price index, and the real housing price index. However, hypothesis 2 is not supported: the regression models reveal a negative correlation between population density and real housing prices, contrary to the hypothesized positive relationship.

Among the explanatory variables $X_1$, $X_2$, and X4, variable $X_4$ demonstrates the strongest explanatory power, followed by $X_2$ and then $X_1$. This implies that the residential land price index has the greatest influence on housing prices, followed by population density, and lastly, real per capita GDP.

## 5. Conclusion

In conclusion, the above findings indicate that both supply-side and demand-side factors exert substantial influence on housing prices. However, the lack of empirical support for hypothesis 2 may be attributable to lagging effects stemming from country-specific economic structures and stages of urbanization. These factors may have contributed to the observed negative correlation between population density and real housing prices, as opposed to the anticipated positive relationship.

Similarly, the lack of support for hypothesis 5 may also be due to varying degrees of lagged responses in the housing markets of different countries to interest rate adjustments.

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