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Determinants of Commercial Housing Prices in China: A Provincial Panel Data Analysis

Hansheng Zhang

Department of Economics and Data Analytics Program, Denison University, Granville, USA
zhang_h2@denison.edu

Abstract. Sustained increases in commercial housing prices have become a central concern for household welfare and regional development in China. This research analyzes commercial housing prices in China using provincial panel data covering 30 Chinese regions from 2016 to 2023. The analysis considers several potential determinants, including per capita disposable income, per capita GDP, urban population density, real estate development investment, and undergraduate enrollment. The regression results indicate that income level, population concentration, and real estate development activity are positively associated with commercial housing prices, among which income shows the strongest effect, suggesting that household purchasing power plays a central role in housing price formation. However, after accounting for the effects of other factors, per capita GDP and undergraduate enrollment show negative relationships with housing prices, implying that economic development and educational resources may influence housing markets through indirect channels. Therefore, housing policies should pay greater attention to regional differences by improving affordable housing provision and guiding real estate investment.

Keywords: Commercial Housing Prices, Provincial Panel Data, Purchasing Power, Real Estate Investment

1. Introduction

1.1. Institutional context and motivation

Since the 1998 housing market liberalization, real estate has constituted a pivotal pillar of China's macroeconomic stability. Fluctuations in housing prices critically impact household wealth accumulation, local government land-based finance, and broader social welfare. For ordinary families, housing expenditure usually accounts for a large proportion of life-long income. Therefore, fluctuations in commercial housing prices directly affect residents' ability to pay housing costs, consumption capacity, living conditions, and long-term welfare.

Housing affordability has become a particularly important issue for Chinese cities. The analysis of China's housing affordability shows that during the sample period, the overall affordability remained relatively stable [1]. This discovery shows that the development of the real estate market in China is unbalanced. In cities with strong economic development, large net population inflows,

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abundant employment opportunities, and well-developed public facilities, commercial housing prices often remain high for a long time.

At the same time, the housing price problem is also related to income inequality and housing vacancy. By investigating the relationship among Income inequality, housing affordability, and purchased housing vacancy rate in China, it is found that income inequality is positively correlated with the ratio of residents' house price to income and the vacancy rate of purchased houses [2]. This shows that rising house prices may not only put pressure on the ability to pay but also lead to inefficient allocation of housing resources. When high-income groups have greater investment capacity and low-income families face a higher threshold for buying houses, the real estate market may face high housing prices and high vacancy rates simultaneously.

1.2. Literature review

Extensive scholarly attention has focused on the determinants of China's housing prices. Li et al. document substantial inter-city heterogeneity in affordability, linking price dynamics to heterogeneous purchasing power across urban hierarchies [1]. Complementing this, Zhang et al. identify a positive association between the relationship between income inequality of residents and price-income ratio, exacerbating resource misallocation and vacancy rates [2].

Regarding the factors influencing housing prices, Liu and Ma used provincial panel data to examine these factors in China. The results show that land prices, real estate developers' loans, residents' savings, and labor market conditions have played important roles in housing price changes [3]. Other studies have also pointed out that factors such as land supply, the credit environment, urbanization, and population inflow will affect housing demand and developers' pricing behavior [4]. The recent empirical research continues to examine the changes of housing prices in China from the perspective of regional differences and market fundamentals. Jiang and Qiu analyzed the determinants of housing prices in various provinces and cities in China. The results show that residents' income and land-related factors are important factors to explain the commercial housing prices [5]. Garriga and others investigated the housing market in China from the perspective of urban and rural population migration and structural transformation, and noted that population migration and urban development are closely linked to housing market changes [6]. Generally speaking, the existing literature shows that the price of commercial housing in China is influenced by demand-side factors such as income and urbanization, and supply-side factors such as land cost and real estate investment. These findings provide a theoretical basis for adopting a multiple linear regression model in this research.

1.3. Research gap

Although the existing research provides an important explanation for the housing price problem in China, there are still some gaps in the literature. First of all, many studies focus on a single factor and rarely examine the comprehensive influence of multiple factors within a unified empirical framework. Secondly, some studies focus on national trends or specific big cities, but fail to compare the differences among provinces in China fully. Thirdly, the existing studies tend to pay more attention to the traditional economic and land-related variables, while there is relatively little discussion on the role of educational resources and population concentration.

To address these gaps, this research places several provincial-level factors into the same empirical framework instead of focusing on a single determinant. Per capita disposable income is used to capture household purchasing power, while GDP per capita reflects the broader level of regional

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economic development. Urban population density is included to represent population concentration, and real estate development investment is used to measure market activity in the housing sector. Undergraduate enrollment is also considered because it reflects the distribution of higher-education resources. By combining these indicators, this study provides a more complete analysis of the factors associated with commercial housing prices in China.

1.4. Analytical framework

The empirical framework is organized around a provincial panel covering 30 Chinese provincial administrative regions from 2016 to 2023. In the model, the average selling price of commercial housing is treated as the outcome variable. The explanatory variables are chosen to reflect several channels through which housing prices may change, including household income conditions, the broader level of regional development, the concentration of urban population, investment activity in the real estate sector, and the distribution of higher-education resources. In practical terms, these dimensions are represented by per capita disposable income, GDP per capita, urban population density, real estate development investment, and the number of undergraduate students.

This study conducts descriptive statistics, correlation analysis, multicollinearity tests, and regression analysis to examine the relationship between these variables and commercial housing prices. Through this framework, this study aims to identify the main factors associated with commercial housing prices in China and provide empirical support for understanding the formation mechanism of housing prices.

2. Materials and methods

2.1. Econometric specification

To examine why commercial housing prices differ across Chinese provinces, this research applies a regression-based empirical approach. Housing prices are influenced by more than one economic or social condition, so the model considers several explanatory variables at the same time. This design makes it possible to observe the relationship between each factor and housing prices while keeping the other factors constant.

The outcome variable is the average selling price of commercial housing. The explanatory variables include per capita disposable income, GDP per capita, urban population density, real estate development investment, and undergraduate enrollment. All variables are taken from secondary statistical data, and the regression analysis is used to identify which factors are most closely connected with changes in commercial housing prices in China.

2.2. Data sources and sample selection

The empirical dataset is compiled from official statistical publications and public statistical databases. The main data sources are the National Bureau of Statistics, the China Statistical Yearbook, the China Real Estate Statistical Yearbook, and provincial statistical yearbooks. The observation period runs from 2016 to 2023.

The final sample consists of 30 provincial administrative regions in China. Xizang, Hong Kong, Macau, and Taiwan Province are not included because of data availability and statistical comparability. The dataset contains information on commercial housing prices, residents' disposable

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income, regional economic output, urban population density, real estate development investment, and undergraduate enrollment.

2.3. Variable measurement

Table 1 summarizes the operational definitions and measurement protocols for all variables employed in the regression analysis.

Table 1. Variable definitions

Variable Type	Symbol	Variable Name	Measurement
Dependent variable	lnPrice	Average selling price of commercial housing	yuan/m²,
Independent variable	lnIncome	Per capita disposable income	yuan/person,
Independent variable	lnGDPpc	GDP per capita	yuan/person,
Independent variable	lnPopDensity	Urban population density	persons/km²,
Independent variable	lnInvest	Real estate development investment	100 million yuan,
Independent variable	lnStudents	Number of undergraduate students	10,000 persons,

2.4. Model specification and analytical procedure

In this study, a multiple linear regression model is used to analyze the factors influencing commercial housing prices. The model is specified as follows:

$$\mathrm{lnPrice_it} = \beta 0 + \beta 1\mathrm{lnIncome_it} + \beta 2\mathrm{lnGDPpc_it} + \beta 3\mathrm{lnPopDensity_it} \quad (1)$$

$$+\beta 4\mathrm{lnInvest_it} + \beta 5\mathrm{lnStudents_it} + \varepsilon \mathrm{_it}$$

In Equation (1), the subscript i denotes each province, and t denotes the year. lnPrice refers to the natural logarithm of the average selling price of commercial housing. The variables lnIncome, lnGDPpc, lnPopDensity, lnInvest, and lnStudents represent the logged values of per capita disposable income, GDP per capita, urban population density, real estate development investment, and undergraduate enrollment, respectively. After defining the variables, this study uses descriptive statistics, correlation analysis, multicollinearity testing, and regression analysis to examine the relationship between the selected factors and commercial housing prices.

3. Result

3.1. Descriptive statistics and correlation analysis

Before conducting the regression analysis, the main variables are summarized through four basic indicators: mean, standard deviation, minimum, and maximum. These statistics provide an initial

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view of the scale and dispersion of the variables used in the empirical model (Table 2).

Table 2. Descriptive statistics

Variable	Mean	SD	Min	Max
Price	9496.27	6277.75	4241	40302
Income	30964.29	12083.48	14670	84834
GDPpc	71359.86	32153.12	28583	207193
PopDensity	3055.3	1063.47	1136	5515
Invest	4139.33	3532.35	201.35	17465.85
Students	60.11	32.93	3.61	142.87

After observations with missing values are removed, the dataset contains 236 province-year records from 30 provincial administrative regions in China during 2016–2023. The summary statistics show the overall distribution of the selected variables and provide a basic description of regional differences in housing prices, income, economic development, population density, real estate investment, and higher education resources.

Commercial housing prices differ greatly across provinces. The mean value is 9,496.27 yuan/m², while the lowest and highest values are 4,241.00 yuan/m² and 40,302.00 yuan/m², respectively. The large gap between the minimum and maximum values indicates that housing prices are highly uneven across regions. The standard deviation of 6,277.75 also suggests clear regional variation in China's commercial housing market.

As for explanatory variables, the average per capita disposable income is 30,964.29 yuan, and the average per capita GDP is 71,359.86 yuan. These data indicate significant differences in residents' purchasing power and in the level of regional economic development among provinces. The average urban population density is 3,055.30 people/km2, which shows that some areas have a high degree of population concentration and are facing greater pressure on housing demand. The average investment in real estate development is 413.933 billion yuan, indicating that real estate market activity varies significantly across regions. In addition, the average number of undergraduate students is 60.11 (10,000), reflecting differences in the distribution of higher education resources and the attractiveness of regions to youth groups.

3.2. Correlation diagnostics

Table 3 reports the correlation matrix of the logarithmic variables used in the regression model.

Table 3. Correlation matrix

Variable	lnPrice	lnIncome	lnGDPpc	lnPopDensity	lnInvest	lnStudents
lnPrice	1	0.849	0.804	-0.013	0.394	0.096
lnIncome	0.849	1	0.95	-0.065	0.427	0.248
lnGDPpc	0.804	0.95	1	-0.071	0.46	0.233
lnPopDensity	-0.013	-0.065	-0.071	1	-0.026	0.129
lnInvest	0.394	0.427	0.46	-0.026	1	0.8

DOI: 10.54254/2754-1169/2026.38657

Table 3. (continued)

lnStudents	0.096	0.248	0.233	0.129	0.8	1

Table 3 lists the correlation coefficient matrix of the main variables. Correlation analysis aims to examine the preliminary relationships between commercial housing prices and selected explanatory variables prior to regression analysis.

3.3. Baseline regression results

Table 4 presents the regression results of the multiple linear regression model, with lnPrice as the dependent variable.

Table 4. Regression results of the multiple linear regression model

Variable	Coefficient	Std. Error	t-value	p-value	Significance
Constant	-3.896	0.541	-7.201	$p < 0.001$	***
lnIncome	1.445	0.133	10.873	$p < 0.001$	***
lnGDPpc	-0.341	0.117	-2.924	$p = 0.004$	**
lnPopDensity	0.141	0.039	3.598	$p < 0.001$	***
lnInvest	0.233	0.029	8.174	$p < 0.001$	***
lnStudents	-0.289	0.032	-9.133	$p < 0.001$	***

Note: Dependent variable: lnPrice. Number of observations = 236. R-squared = 0.7975. Adjusted R-squared = 0.7931. F-statistic = 181.1. Model p-value < 0.001. *** p < 0.001, ** p < 0.01, * p < 0.05.

The estimates in Table 4 are obtained from the baseline log-linear regression. In this model, lnPrice measures the average selling price of commercial housing after logarithmic transformation. The covariates also enter the model in logarithmic form, including per capita disposable income, GDP per capita, urban population density, real estate development investment, and undergraduate enrollment. After incomplete province-year records are excluded, 236 observations remain for the regression analysis.

The goodness-of-fit statistics suggest that the model captures a large share of the variation in commercial housing prices. The R-squared is 0.7975, while the adjusted R-squared is 0.7931, meaning that the selected variables account for about 79.31% of the observed variation in housing prices. The joint significance test also supports the validity of the model, with an F-statistic of 181.1 and a p-value below 0.001.

Among the explanatory variables, income has the largest positive coefficient. The coefficient for lnIncome is 1.445 and is significant at the 0.1% level. Since both the dependent variable and income are expressed in logarithmic form, this coefficient can be read as an elasticity. Holding the other variables constant, a 1% rise in per capita disposable income is linked to an approximately 1.445% increase in commercial housing prices. This finding confirms the important role of household purchasing power in the growth of housing prices.

Urban population density also enters the model with a positive and significant coefficient. The coefficient for lnPopDensity is 0.141 and is significant at the 0.1% level. This means that, after controlling for other factors, a 1% increase in urban population density corresponds to an approximately 0.141% increase in commercial housing prices. The result suggests that population

DOI: 10.54254/2754-1169/2026.38657

concentration strengthens housing demand and adds upward pressure to the commercial housing market.

The coefficient for real estate development investment is positive. lnInvest has a coefficient of 0.233 and is significant at the 0.1% level. Since the variables are in logarithmic form, this result means that a 1% rise in real estate development investment is associated with about a 0.233% increase in commercial housing prices, assuming other factors remain unchanged. This finding indicates that stronger investment activity in the real estate sector is often accompanied by a more active housing market and higher commercial housing prices.

GDP per capita shows the opposite pattern. The coefficient of lnGDPpc is -0.341 and is statistically significant at the 1% level. This result does not mean that regional economic development directly reduces commercial housing prices. A more reasonable interpretation is that, after residents' income, population density, real estate investment, and education resources are included in the model, GDP per capita captures a different independent effect. This may be because GDP per capita is closely related to other economic indicators in the model, especially residents' income.

The coefficient of lnStudents is also negative and statistically significant. Its coefficient is -0.289 and is significant at the 0.1% level. This indicates that the number of undergraduate students does not directly increase commercial housing prices after other variables are controlled. A possible explanation is that undergraduate students reflect educational resources and regional attractiveness, but they usually have limited direct purchasing power in the commercial housing market. Therefore, the influence of higher education resources on housing prices may be indirect rather than immediate.

Overall, the regression results show that residents' income, urban population density, and real estate development investment are the main positive factors associated with commercial housing prices in China. At the same time, the negative coefficients of GDP per capita and undergraduate students suggest that regional economic development and education resources have more complex effects after other variables are controlled. These results indicate that commercial housing prices are shaped by purchasing power, population concentration, real estate market activity, and broader regional structural factors.

3.4. Robustness and heterogeneity considerations

3.4.1. Housing affordability pressure driven by income growth

The regression results show that per capita disposable income has a significant positive impact on the price of commercial housing. This shows that the purchasing power of residents is an important factor in promoting the rise of housing prices. In areas with higher income levels, families usually have stronger purchasing power for commercial housing, which may further increase housing demand and push up housing prices. However, this result also reveals the potential housing affordability problem. If house prices rise faster than income growth, income growth may not be able to reduce the housing burden. For young families, first-time homebuyers, and low-income groups, higher market prices may weaken their ability to enter the housing market. Therefore, the positive relationship between income and housing prices shows that although income growth can enhance purchasing power, it may also exacerbate the housing burden in the face of insufficient housing supply and price controls.

DOI: 10.54254/2754-1169/2026.38657

3.4.2. Housing price pressure from population concentration and real estate investment

The positive coefficient for urban population density suggests that commercial housing prices tend to be higher in more densely populated areas after other factors are controlled. This relationship is reasonable because densely populated regions usually have more employment opportunities, better public services, and more convenient living resources. These conditions attract residents and increase the demand for commercial housing. At the same time, land supply in highly concentrated areas is often limited, so stronger demand can more easily create upward pressure on housing prices.

Real estate development investment also shows a positive association with commercial housing prices. A higher level of investment usually reflects active market conditions and developers' expectations of future housing demand. However, rapid or excessive investment may also strengthen market expectations and increase price volatility. Therefore, commercial housing prices are influenced not only by residents' housing demand but also by investment behavior and market activity in the real estate sector.

3.4.3. Effects of economic development and educational resources

In the regression model, both GDP per capita and the number of undergraduates show statistically significant negative coefficients. These results need to be interpreted carefully. This does not mean that economic development or educational resources will directly lead to a decline in housing prices; on the contrary, after controlling for variables such as income, population density, and real estate development investment, their respective effects are no longer so intuitive. As for per capita GDP, its negative coefficient may be related to its close relationship with residents' income. In many provinces, per capita GDP and disposable income tend to change in the same direction. When these two variables are included in the model simultaneously, disposable income can more clearly reflect families' direct purchasing power, while per capita GDP reflects the level of economic development at a more macro level. Therefore, per capita GDP does not show an independent positive effect in the regression results. Regarding the number of undergraduates, the negative coefficient also needs to be understood in the context of housing demand. Although colleges and universities can enhance the attractiveness of cities, undergraduates are usually not the main buyers in the commercial housing market. Most students have limited income and no direct demand to buy houses during their school days; their influence on housing prices may lag behind, mainly through employment, settlement decisions, and population retention.

In short, based on the above research results, income, population concentration, and real estate development investment directly affect commercial housing prices; at the same time, the impact of economic development and educational resources on housing prices is more indirect. Therefore, the rise in house prices cannot be attributed to a single factor; instead, it is the result of several reasons, such as increased purchasing power, population relocation, and investment in the market and region.

4. Discussion: interpretation and implications of findings

4.1. Direct demand-side drivers: income, density, and investment

The regression results indicate that per capita disposable income, urban population density, and real estate development investment are positively related to commercial housing prices. Among these three variables, per capita disposable income has the strongest effect, showing that residents' purchasing power plays a central role in housing price growth. When household income increases,

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families have a greater ability to purchase commercial housing, which can further expand housing demand and place upward pressure on prices.

This finding is consistent with the recent research results, that is, national and regional basic factors influence regional housing prices, and these effects may vary from region to region [7]. In this study, income is the most direct demand-side factor, because it reflects the actual ability of residents to enter the housing market. However, the higher income elasticity also indicates that the rising rate of house prices may outpace income growth, thereby exacerbating pressure on housing affordability. Since the ratio of house price to income is an important indicator to measure the affordability of housing, the relationship between house price and residents' income should be paid more attention by policymakers [8].

Urban population density provides another explanation for higher commercial housing prices. Areas with higher density usually concentrate employment opportunities, public services, and daily living facilities, which makes them more attractive to residents. As more people move into these areas, housing demand becomes stronger, and price pressure may increase. Real estate development investment also points to the role of market activity. A higher level of investment reflects developers' expectations and the active operation of the real estate sector, so housing prices are shaped not only by household demand but also by investment behavior. This interpretation is consistent with recent research showing that land finance, infrastructure investment, and housing prices are connected in China's housing market [9]. It also supports the view that housing demand includes both consumption demand and investment demand, meaning that commercial housing prices are influenced by residential needs as well as investment incentives [10].

4.2. The GDP paradox: economic structure vs. housing demand

One noteworthy result is the negative coefficient of per capita GDP in the regression model. This does not mean that economic development itself lowers commercial housing prices. Rather, after other explanatory variables are included, the link between regional economic growth and housing prices becomes less direct and more difficult to interpret.

Per capita GDP is a broad indicator of regional economic development, while per capita disposable income reflects household purchasing power more directly. When these two variables are included in the same regression model, disposable income may more clearly reflect the direct demand-side effect. The residual effect of per capita GDP may reflect differences in industrial structure, investment in production, infrastructure construction, and regional economic composition.

To understand the mechanism behind the negative coefficient, it is useful to decompose the components of regional GDP. In some provinces, per capita GDP may be mainly driven by manufacturing, infrastructure, or production-oriented industries. These industrial activities can improve the regional economic output, but they do not necessarily generate demand for commercial housing purchase immediately. In addition, some industrial investment may be located outside the core residential areas, so its impact on commercial housing prices may be weaker than family income and population concentration. Therefore, the negative coefficient of per capita GDP reflects the possible decoupling effect between economic growth and housing price growth. This shows that after controlling for purchasing power and real estate investment, higher economic output does not necessarily mean stronger demand for commercial housing.

DOI: 10.54254/2754-1169/2026.38657

4.3. Higher education and deferred housing demand

The coefficient of the number of undergraduates is also negative, and it has statistical significance. This result shows that educational resources will not directly translate into higher commercial housing prices in the short term. Although universities can enhance a region's attractiveness, undergraduates are usually not the primary buyers in the commercial housing market.

Most undergraduates have limited income and have not accumulated enough savings to buy houses. Their housing needs are mainly reflected in dormitories, shared apartments, and rented houses, rather than commercial housing transactions. Therefore, the huge student group may increase the demand for renting, but it will not immediately increase the demand for buying houses.

There may be a time lag in the impact of higher education resources on housing prices. After graduation, some students may stay in their original cities for employment, seek income growth, and settle down for a long time. Only at this stage can educational resources be gradually transformed into housing demand. Therefore, the negative coefficient of the number of undergraduates does not mean that educational resources will reduce the regional attractiveness, but that the relationship between educational resources and housing prices is indirect and lagging.

4.4. Policy implications and regional differentiation

The findings point to the need for more region-specific housing regulation in China. Instead of applying the same policy standard to all provinces, policy design should be adjusted according to local differences in income growth, population concentration, real estate investment, and educational resources. In provinces where rising income and population inflows create strong pressure on housing prices, affordable housing programs should be further strengthened. More targeted support should also be provided to young households, first-time buyers, and low-income groups, since these groups are more likely to face difficulties in entering the commercial housing market.

Secondly, investment in real estate development should be carefully guided. Because there is a significant positive correlation between investment and commercial housing prices, excessive dependence on real estate investment may strengthen market expectations and aggravate price fluctuations. Local governments should avoid over-reliance on real estate development as a tool for economic growth, and real estate investment should be consistent with actual population concentration and actual housing demand.

Third, areas rich in higher-education resources should pay greater attention to rental and transitional housing support. Because undergraduates and fresh graduates usually have weak purchasing power in the short term, measures such as talent apartments, affordable rental housing, and housing subsidies are helpful to transform educational resources into long-term population retention.

In a word, the price of commercial housing in China is influenced by direct market forces and deeper structural factors. Income, population concentration, and real estate investment directly drive up housing prices, while per capita GDP and educational resources affect housing prices more indirectly and in more complex ways. Therefore, housing policy should strike a balance among market demand, affordability, investment risk, and regional development differences.

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5. Conclusion

5.1. Key findings

Using provincial panel data from 2016 to 2023, this study examines the factors associated with commercial housing prices in China. The analysis is based on a multiple linear regression model, with per capita disposable income, GDP per capita, urban population density, real estate development investment, and undergraduate enrollment included as explanatory variables.

The results indicate that residents' income, urban population density, and real estate development investment are positively related to commercial housing prices. Among these factors, per capita disposable income shows the strongest effect, suggesting that household purchasing power is the main force behind housing price growth. Urban population density increases price pressure by strengthening housing demand, while real estate development investment reflects housing market activity and market expectations.

At the same time, GDP per capita and undergraduate enrollment have negative coefficients after other factors are controlled. This result suggests that regional economic development and educational resources do not affect housing prices only through direct purchasing power. Instead, their effects may be related to broader economic structure, rental demand, population retention, and other indirect channels.

5.2. Policy implications

The results provide practical value for understanding housing price regulation in China. Housing policies should not follow one uniform standard across all regions. Instead, policy design needs to take account of differences in income levels, population concentration, real estate investment, and educational resources.

For provinces with rapid income growth and strong population inflows, the supply of affordable housing should be further improved. More support should also be provided to young families and first-time homebuyers. In regions where real estate development investment is highly active, local governments need to control excessive reliance on the real estate sector and reduce the risk of unstable market fluctuations.

5.3. Limitations and future research

Two main limitations should be acknowledged. First, this study mainly uses provincial-level secondary data, so it cannot fully reflect household-level housing purchase behavior. Second, the model focuses on selected economic and social variables, while some factors, such as mortgage policy, land prices, housing supply structure, and local government regulation, are not fully included.

Future research can use more detailed city-level or household-level data to improve the accuracy of the analysis. In addition, surveys or interviews can be combined with quantitative methods to further examine how households make housing purchase decisions and how different regional conditions affect the formation of commercial housing prices in China.

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