

# Can Purchase Restrictions Really Limit House Prices

Yanhua Shao

Jinan University, Guangzhou, China

Email: 1476810469@qq.com

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## Abstract

This article uses the data of residential commercial housing prices in 70 large and medium-sized cities from 2007 to 2017, and on the basis of controlling the covariates that can affect housing prices on the demand side and the supply side. The method of double difference is used to study the two rounds of purchase restriction policies, that is, in 2010, the first round of purchase restriction policies promulgated by local governments from 2011 and the second round of purchase restrictions promulgated in 2016 have their respective effects on residential commercial housing prices and price growth rates. The regression results of the benchmark fixed-effects model show that the implementation of the first round of purchase restriction policies in cities can significantly reduce the price of residential commercial houses, and the long-term effects of the purchase restriction policies are relatively weak. Because there may be a certain reverse causality between the implementation of the purchase restriction policy and the city's housing prices, this paper introduces the lag value of the explained variable as the instrumental variable of the purchase restriction policy, and uses the dynamic panel instrumental variable method to perform regression analysis. In addition, there may also be the problem of sample selection bias, that is, for the difference between the treatment group and the control group, this article first uses the propensity score matching method to determine the appropriate covariate, and then matches the treatment group to the appropriate control group, And finally perform double-difference regression analysis to reduce the bias of sample selectivity. In the analysis of heterogeneity, this paper divides the samples according to the different conditions of housing prices and housing price growth rates, and verifies whether there is a difference in the impact of the purchase restriction policy on the cities with excessively high housing prices, rapid housing prices, and high and rapid housing prices. At the same time, we will return to cities in the eastern, central and western regions to explore whether there are regional differences in the effect of the purchase restriction

policy. Finally, through a series of robustness tests, the robustness of the conclusions of this article is demonstrated.

### **Keywords**

Restricted Purchases, Residential Prices, Double-Differences, Disincentive Effects

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## **1. Introduction**

### **1.1. Research Background**

In response to the impact of the international financial crisis on the domestic economy, the central government issued a 4 trillion economic stimulus investment plan in 2008. Since then, the domestic economy has gradually recovered and the real estate industry has flourished. The accompanying housing prices continue to rise. The housing price-to-income ratio is much higher than the world average, and there are signs of a real estate bubble. As a result, more and more people are unable to achieve “home ownership” and decline in household consumption. At the same time, a large amount of funds poured into the real estate industry with a high rate of return on investment, leading to distortions in the distribution of economic resources. Therefore, the real economy was eroded, affecting the long-term healthy development of society economic.

Therefore, in order to control the excessive growth of housing prices, the central government promulgated the most stringent “New National Ten Measures” in the history of real estate control policies on April 17, 2010. Since then, local governments in most cities have successively introduced corresponding housing purchase restrictions, restricting consumers’ eligibility to purchase housing through household registration and social security purchase deadlines, thereby reducing the amount of demand in the housing market and maintaining The increase in housing purchases, with a view to achieving the policy effect of reducing housing prices while the supply of real estate developers remains roughly unchanged, and guiding the healthy and long-term development of the housing market.

### **1.2. Literature Review**

Judging from the existing literature on purchase restrictions, scholars mainly study the impact of purchase restrictions on residential commercial housing from both theoretical and empirical perspectives. In the theoretical part of the research, [Feng & He \(2012\)](#) conducted a general economic analysis on the impact of purchase restriction policies on the real estate market. It combines the characteristics of the real estate market to reconstruct the inverse demand function, and then quantitatively analyzes the impact of the purchase restriction policy on other consumer markets and the resulting changes in social welfare. [Liu et](#)

al. (2012) analyzed the effect of purchase restriction policies by constructing a housing market model and analyzed the effect of purchase restriction policies. They believed that the strength of the restraint effect of purchase restriction policies on housing prices was affected by multiple factors, such as the intertemporal adjustment of supply costs by developers, Investment demand, policy uncertain expectations and market expectation management, etc. Wang & Huang (2013) used the partial equilibrium model of the real estate market to dynamically analyze the effectiveness of the purchase restriction policy, study the impact of the purchase restriction policy on the long-term supply path of housing, and found that the effect of the purchase restriction policy in the short term is limited. However, long-term implementation is not conducive to the overall welfare of society.

Relative to the theoretical part, more scholars focus on empirical research on purchase restrictions. The empirical part of the research is divided into three categories according to the selected city sample sets. Most of the first category is based on the annual or monthly data of 70 large and medium-sized cities in China, such as Qiao (2012), Deng et al. (2014), Chen et al. (2019); the second category is based on the annual or monthly data of 283 prefecture-level cities, such as Yu & Zhang (2017); the third category is based on the monthly data of 36 medium and large cities, such as Han et al. (2014).

Regarding the effect of the purchase restriction policy on the price of residential commercial housing, the annual housing price (sales divided by the sales volume) or the monthly sales price index of newly built and second-hand residential commercial housing are often used as the explained variable. The choice of measurement benchmark model includes mixed estimation model, two-way fixed effect model, correlated random model, autocorrelation regression model, probit model with sample selection, etc. In terms of measurement methods, most scholars use the double-difference method and some scholars use the breakpoint regression method (Liao et al., 2018). For the endogenous problem caused by the possible reverse causality between the purchase restriction policy and the housing price, there are mainly instrumental variable method and dynamic panel instrumental variable method. In order to solve the problem of sample selection bias, some scholars use the propensity score matching method, and a few scholars use the synthetic control method to reconstruct the control group. Finally, from the perspective of research, most scholars have focused on exploring the inhibitory effects of purchase restriction policies on housing prices, and studying the effects of purchase restriction policies in the short and long term from a dynamic perspective. Some scholars have tried to study the effects of purchase restrictions on the housing market and the impact on social welfare from the perspective of other markets, such as the marriage market (Tang and Liang, 2016).

### 1.3. Innovation

The innovation of this paper is that, first, it comprehensively examines the im-

pact of the two rounds of purchase restriction policies on housing prices, and uses data from 70 large and medium-sized cities to empirically analyze the short-term and long-term effects of the policy. Secondly, it controls the impact of land fiscal and monetary policies on the housing market at the same time. It measures the dependence of local governments on land finance by introducing the transfer area and price of state-owned construction land, and the ratio of the land transfer price to the general budget expenditure of the local finance. Intensity, and then control the impact of land finance; it introduces variables such as the growth rate of broad currency issuance and deposit and loan interest rates to control the impact of monetary policy.

#### **1.4. Research Content**

Based on the above policy background and existing research and analysis, this article will start from a dynamic perspective and use the time difference between the two rounds of purchase restrictions to study the short-term and long-term strengths of the purchase restriction policy on housing prices. Then this article will study the impact of the purchase restriction policy on different housing price growth and the difference in the intensity of the impact of cities in different regions, and finally conduct a series of robustness tests.

The remainder of the paper is structured as follows: the second section presents the theoretical framework of the supply-demand balance in the housing market; the third section presents the research design and data; the fourth section presents the empirical results and analysis, including basic regression, endogeneity treatment, heterogeneity analysis, and a series of robustness tests; and the final section presents the conclusions and policy recommendations.

## **2. Theoretical Framework**

According to the aforementioned policy background, it can be seen that the purchase restriction policy is mainly to control the demand side of the housing market by restricting the qualifications of purchasers of residential commercial houses, thereby reducing the effective demand for house purchases, hoping to curb the rise in housing prices, and finally cool the real estate market. According to the supply and demand curve of the real estate market, only when the supply curve remains unchanged, the downward shift of the demand curve can make the housing price in the equilibrium of the market drop to point B. However, when the real estate developer also reduces the supply of housing, the supply curve will move upwards. At this time, the equilibrium point of supply and demand in the housing market is point C, and the price of housing at point C is equal to the price of housing at point A. The relationship depends on the relative elasticity between supply and demand.

On the demand side, the housing market is dominated by rigid consumer demand for housing, demand for improvements, and investment and even speculative participants. Among them, the rigid demanders of housing have weak de-

mand elasticity, and their participation in the housing market is influenced by the restriction on the eligibility to buy a house in the restrictive purchase policy and their own economic status, such as disposable income. The demand elasticity of improvement and investment demand is higher, but it is influenced not only by the restrictions related to the purchase restriction policy, but also by their expectations on whether the purchase restriction policy will be implemented in the long term. If they expect that the restriction policy will not be implemented for a long time, they can adjust their inter-period demand behavior relatively more elastic. For speculative participants, they are influenced not only by the restrictions of the restriction policy and the expected duration of the restriction policy, but also by the macroeconomic situation, such as monetary policy. The main purpose of the purchase restriction policy is to reduce investment demand and suppress speculative demand by restricting the eligibility of purchases, thus reducing the quantity of demand in the housing market and suppressing the rise in housing prices. Thus, changes in the demand curve in the housing market are mainly influenced by the expectations of market participants other than rigid demanders, as well as by financial and monetary policies.

On the supply side, in the short term, it takes a long time for real estate developers to participate in supply and demand transactions in the housing market, from land acquisition to construction inspection and acceptance, as well as to go through the relevant administrative procedures. Therefore, in the short term, it is more difficult for real estate developers on the supply side of the housing market to change their supply behavior of providing incremental housing. The supply behavior of the stock of housing is influenced by the financing capacity of real estate openers, because the capital debt ratio of real estate enterprises is basically above 50%, so the flow of capital chain is extremely critical to the development of their enterprises. The financing capacity of real estate developers is not only determined by the strength of the enterprise itself, but also influenced by the macroeconomic situation, such as the deposit and loan interest rates of financial institutions and other factors. However, due to the real estate industry has a high rate of return on investment as well as low risk, most of the funds in the society flow into the real estate industry. Therefore, in the short term, the supply behavior of real estate developers is closely related to the financing of companies.

In the long run, real estate developers can adjust their production and business strategies according to their expectations of the purchase restriction policy, thus influencing the quantity of housing supply in different periods. If real estate developers expect that the government's purchase restriction policy will not be implemented for a long period of time, they can reduce the supply in the housing market to maximize their profits in the long run under the premise that the financial chain will not be broken. Conversely, if a real estate developer expects the government's purchase restriction policy to be a long-term administrative measure to regulate the housing market, it will probably not reduce the supply of

housing, and the price at point B of the housing market equilibrium will fall, thus achieving the desired policy effect.

At the same time, the government can also influence the housing supply behavior of real estate developers in the primary land market by adjusting the amount and price of construction land to be sold, and adjust the relevant taxes and fees of housing transactions through tax policies to guide real estate developers to make rational decisions select. Therefore, in general, the housing supply behavior of real estate developers is affected by their intertemporal supply costs and the anticipation of whether the purchase restriction policy will be implemented for a long time.

Based on the above analysis, it can be seen that the cost of intertemporal adjustment of housing supply behavior of real estate developers in the short term is relatively high. The supply curve in the housing market can be seen as almost constant or weakly changing. Therefore, the purchase restriction policy can reduce the number of demand ends of the housing market by controlling the qualifications of buying houses, and the demand curve will move downward, so that the price of the housing market will fall when the housing market is in equilibrium, and the desired policy effect can be achieved. However, in the long run, the cost of real estate developers' intertemporal adjustment of housing supply behavior is relatively low. At the same time, after a long-term learning effect, real estate developers and housing market participants can form expectations of the purchase restriction policy through continuous learning. Judgment and other circumvention methods have been obtained in the practice of the purchase restriction policy, such as "false divorce" to avoid the influence of the purchase restriction policy. Therefore, the long-term effect of the purchase restriction policy on the housing market may not be as strong as the short-term effect (Figure 1).

### 3. Study Design and Presentation of Data

#### 3.1. Research Design

In order to test the impact of purchase restrictions on housing prices, this paper takes 70 domestic cities as samples. Among them, the large and medium-sized cities that have successively issued relevant purchase restriction policies after the

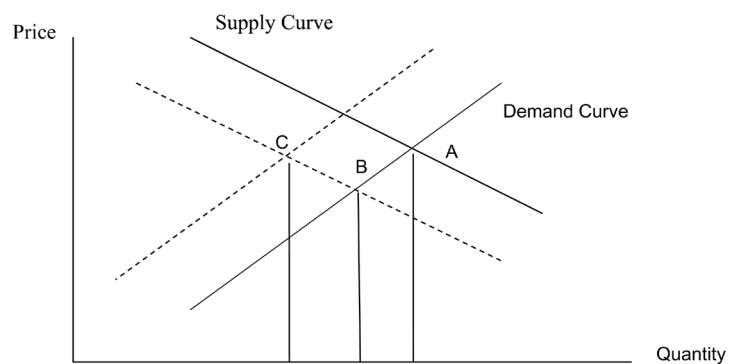


Figure 1. Theoretical equilibrium analysis.

“National Ten Articles of Implementation Rules” promulgated by Beijing on April 30, 2010 are the processing group, and the medium and large cities that have not issued the relevant purchase restriction policies are the control group. The cities that have introduced relevant purchase restriction policies are all provincial capitals and first- and second-tier cities, that is, basically all of them are one of 70 major cities. At the same time, referring to previous studies by scholars, most of them are based on samples of 70 domestic cities. Therefore, this paper selects 70 large and medium-sized cities in China as the sample for the study, and uses the DID method for causal identification to estimate the impact of the purchase restriction policy on the price of residential commercial housing. The model is set as follows:

$$Rhp_{it} = \alpha_0 + \alpha_1 Xg_{it} + \sum \text{Control}_{it} + \mu_i + \delta_t + \varepsilon_{it}$$

In the above formula,  $Rhp_{it}$  indicates the price of residential commercial housing in each city  $i$  in different year  $t$ . It is obtained by dividing the sales of residential commercial housing by the sales area.  $Xg_{it}$  indicates whether the relevant purchase restriction policy is implemented in city  $i$  in year  $t$ , if it is implemented, it will be 1, and if it is not implemented, it will be 0.  $\text{Control}_{it}$  indicates a series of measurable control variables that affect the price of residential commercial housing in each city  $i$  in year  $t$ . Since whether a city has a restrictive purchase policy or not is closely related to the price of residential commercial housing in the city, it is important to include as many covariates that affect the price as possible to control for estimation bias caused by self-selection of the sample. Also according to the analysis of the theoretical model, the effect of the restrictive purchase policy on residential goods is also influenced by the supply side of the housing market.

According to the different subjects that affect housing prices, it can be roughly divided into four categories. The first category is from the perspective of consumers' effective demand, including population size, per capita disposable income, and housing price-to-income ratio (housing-to-income ratio [80 \* (residential commercial housing sales/residential commercial housing sales area)/(average working staff) Wage \* 2]), resident price consumption index. The second category is the variables of the economic development status at the city level, including per capita GDP, general public budget expenditures of local finance, fixed asset investment, economic openness (foreign direct investment divided by GDP), real estate development investment level (The amount of real estate development investment divided by the investment in fixed assets), the proportion of urban construction land in the municipal districts in the urban area, and the year-end deposit balance and loan balance of financial institutions. The third category is the country's overall macroeconomic variables, used to control the impact of other real estate control policies and macroeconomic development in different years. These include the deposit and loan interest rates of financial institutions, the rate of change in the issuance of broad money, the rate of change in gross domestic product, the consumer expectations index, the con-



sumer confidence index, and the consumer satisfaction index. The fourth category is from the perspective of the supply side, including the area of state-owned construction land transfer, the price of construction land transfer (the transfer price of state-owned construction land/the transfer area of state-owned construction land), the degree of local policy dependence on land finance (total land transfer Income divided by local government general public budget expenditure).

### 3.2. Data Presentation

This article takes 70 medium and large cities in China as the research object. The original data comes from historical statistical yearbooks and relevant statistical websites. The data on the sales and sales volume of residential commercial houses come from the “China City Statistical Yearbook” from 2007 to 2018 and the official website of CEIC Data. The data on urban purchase restrictions comes from relevant policy documents published on the official websites of local governments in various cities. The number of land transfers and the total income from land transfers comes from the 2007-2017 China Land and Resources Statistical Yearbook. The data for other control variables comes from the “China Regional Economic Statistical Yearbook”, “China City Statistical Yearbook” and the official website of the National Bureau of Statistics.

At the same time, based on the aforementioned policy background, we know that the cities of the processing group successively announced the implementation of the purchase restriction policy from 2010 to 2011, and at the same time successively announced the cancellation of the purchase restriction policy in 2014, and then implemented the purchase restriction policy again in 2016. Therefore, this article divides the sample period into two stages. The first stage is the period of the first round of purchase restrictions from 2007 to 2013. This stage is also the key analysis period of this article. The second stage is the period of the second round of purchase restrictions from 2014 to 2017. Since the relevant statistical yearbook for 2019 has not yet been released, the research period for the second round of purchase restrictions is a bit short. At the same time, the second round of purchase restrictions may be subject to the first round the follow-up impact of the purchase restriction policy, so the policy effect of the second round of purchase restriction may be less obvious, so this article uses the second round of purchase restriction as an auxiliary analysis. In order to expand existing research and analyze the impact of purchase restriction policies more comprehensively, this article also compares and analyzes the impact of purchase restrictions on residential commercial houses from 2007 to 2017 as a full sample period. Finally, regarding the research object, among the 70 large and medium-sized cities, due to the administrative changes in Xiangyang and Dali, the statistical caliber of the relevant variables is not unified over the years. Therefore, the sample of this article removes these two cities, leaving only 68 Two large cities as the research object.



### 3.3. Descriptive Analysis of Variables

Before proceeding to the empirical regression analysis, this paper presents descriptive statistics for the variables mentioned above, as shown in **Table 1**. Since residential commodity prices are highly location-specific and highly correlated with the control variables, all benchmark regressions in this paper are the results of the inclusion of the control variables.

**Table 1.** Descriptive statistics of model variables.

Meaning	Variable	N	mean	sd	min	max
Residential commercial housing prices	Rhp	746	6382	4866	1299	48,622
Commercial housing prices	Chp	748	6592	4735	1520	47,936
Purchase restriction policy	Xg	748	0.23	0.42	0	1
Population	pop	748	627.6	436.3	53.52	3392
Gross production	gdp	748	405.3	442.1	12.23	3063
Fiscal expenditure	tge	748	60.71	88.9	1.88	754.8
Foreign investment	fdi	748	2.18	3.37	0	30.83
Investment in fixed assets	inv	748	254.6	245.1	10.97	2623
Investment in real estate	rei	748	62.44	74.38	1.85	423.6
Residential investment	invhousing	748	41.28	45.27	1.24	263.3
Proportion of built-up land	prop	748	13.13	10.78	1.25	97.18
Loan balance	lb	748	682.5	1030	9.32	7993
Interest rates on loans	lr	748	5.56	0.94	4.35	7.47
Total retail sales	trs	748	193.1	288.3	2.94	4803
Disposable income	perdi	748	25,647	9925	8480	62,596
Average wage of worker	wage	748	47,257	19,578	15,870	180,000
Rate of change in M2	m2gr	748	15.54	5.14	8.11	28.42
GDP rate of change	ggr	748	8.81	2.14	6.7	14.23
price index	cpi	748	102.9	2.04	97.3	119.3
Consumer confidence index	cci	748	106	6.33	100.4	122.6
Consumer satisfaction index	cei	748	109.2	6.3	100.6	125.9
Index of consumer expectations	csi	748	101.6	6.08	93.18	117.6
Area of land granted for construction	landarea	673	1399	1160	51.42	8277
Construction land sale price	landprice	674	2465	20,307	123.7	530,000
GDP per capita	pergdp	748	65,433	60,639	3454	520,000
Economic openness	open	748	4.5	3.54	0.02	21.75
Level of real estate development	reiinv	748	22.57	11.33	3.18	66.1
Dependence on land finance	depend	674	41.92	30.63	2.58	218.2
Residential house price to income ratio	rchpir	748	5.46	2.45	1.05	20.71

## 4. Empirical Results and Analysis

### 4.1. Baseline Regressions

This part first performs simple least square regression on the sample data of the three stages. Then, according to the results of Hausmann's test, an individual fixed-effect model is selected for regression analysis. Finally, time fixed effects are added to perform a two-way fixed effects regression analysis. The specific analysis results are as follows.

The first three columns of **Table 2** report the regression results of the hybrid OLS. The results in the first column show that the regression coefficient of the purchase restriction policy on the housing price of the entire sample period is significantly negative. The results in the second column show that the regression coefficient of the first round of purchase restrictions on the price of residential commercial housing is significantly negative. At the same time, it is noted that the absolute value of the regression coefficient of the second column of purchase restrictions is larger than that of the first column, which means that the implementation of the first round of purchase restrictions can clearly achieve the effect of restraining the increase in housing prices, thereby cooling the real estate market. Although the regression coefficient of the purchase restriction in the third column is negative, it does not reach the significance of measurement, and the absolute value of the regression coefficient is also the smallest, indicating that the effect of the second round of purchase restriction is obviously not as good as the effect of the first round of purchase restriction. The regression results indicate to a certain extent that the administrative measures of the purchase restriction policy are effective in the short term. In the long-term, people may gradually fail due to the learning process and the use of certain methods to avoid the influence of purchase restrictions on their qualifications.

The last three columns of **Table 2** report the regression results of individual fixed effects. The results of the regression coefficients of the purchase restriction policies in the last three columns are similar to the results of the first three columns, which means that the regression coefficients of the purchase restriction policies during the entire sample period and the first round of purchase restrictions are significantly negative. However, the absolute value and standard error of the regression coefficient are obviously smaller than those of the first three columns, indicating that there is indeed an individual effect for each city. That is, there may be missing variables that do not change over time. Considering the fixed effect of time, this paper adds the dummy variable of the year for regression. The regression results are basically consistent with the fixed effects results. At the same time, since the added year dummy variable still has more serious multiple correlations, it is omitted in the report results of data regression. Therefore, this article does not report and analyze the two-way fixed effects.

Therefore, this paper takes the regression result of fixed effects as the benchmark regression result. From the regression coefficient of the purchase restriction in the fifth column, it can be seen that the implementation of the first round

**Table 2.** The regression results of OLS and fixed effects.

	least squares			fixed effect		
	2007-2017	2007-2013	2014-2017	2007-2017	2007-2013	2014-2017
xg	-1190.99*** (327.99)	-1323.12*** (412.00)	-289.10 (506.67)	-370.25* (210.87)	-914.19** (395.86)	200.58 (380.37)
pop	0.34 (0.45)	-0.10 (0.51)	-0.09 (0.58)	-10.57** (4.23)	-10.34** (3.91)	-2.08 (3.30)
pergdp	0.02*** (0.00)	0.03*** (0.00)	0.01** (0.00)	-0.08*** (0.03)	-0.10*** (0.03)	-0.01 (0.02)
tge	-3.96 (3.41)	14.18*** (5.14)	0.75 (3.97)	-21.17*** (5.92)	-48.94*** (13.72)	-26.58*** (8.71)
open	81.31** (37.67)	34.38 (45.88)	47.80 (36.93)	37.95 (43.49)	105.71 (73.82)	-7.41 (31.40)
inv	-0.42 (1.12)	-1.77 (1.99)	0.39 (0.97)	7.97*** (2.38)	16.73*** (4.27)	2.48** (1.11)
reiinv	70.21*** (12.63)	76.14*** (17.13)	57.19*** (9.62)	22.29 (25.57)	43.65 (34.51)	16.21 (19.08)
prop	9.73 (10.28)	19.83* (11.61)	-35.78*** (11.48)	-7.85 (12.51)	-56.62*** (16.02)	-30.91 (19.71)
db	0.57*** (0.18)	0.27 (0.24)	0.31 (0.30)	-0.36 (0.32)	-0.20 (0.87)	0.16 (0.61)
dr	1411.99*** (341.72)	-855.01 (1321.38)	0.00 (.)	1103.73*** (233.91)	1077.40* (618.66)	686.08*** (156.41)
trs	-0.27 (0.53)	-0.23 (0.54)	1.35 (1.38)	-0.04 (0.10)	-0.10 (0.16)	-5.74 (4.02)
perdi	0.07** (0.03)	0.07* (0.04)	0.06*** (0.02)	0.09 (0.08)	0.19 (0.16)	0.01 (0.03)
rchpir	847.15*** (67.17)	941.89*** (83.18)	605.21*** (70.42)	-40.27 (140.10)	53.11 (193.70)	363.44* (188.73)
m2gr	239.14*** (54.32)	51.34 (146.23)	-1121.42*** (166.70)	83.88 (53.47)	112.42 (119.60)	114.37 (71.57)
ggr	539.66*** (161.93)	842.71*** (289.35)	0.00 (.)	-60.58 (71.01)	25.45 (157.70)	0.00 (.)
cpi	-279.37*** (80.75)	-155.37* (85.35)	-393.61* (206.63)	-7.48 (30.73)	30.38 (28.06)	-54.01 (176.56)
cci	-455.87*** (64.82)	-157.30 (150.85)	-647.83*** (87.34)	-117.61** (53.45)	-142.57 (126.05)	0.00 (.)
cei	382.80*** (58.87)	324.90*** (66.08)	0.00 (.)	102.21** (47.64)	133.71* (77.30)	0.00 (.)

**Continued**

csi	229.70*** (68.53)	17.66 (155.32)	0.00 (.)	84.04** (39.00)	93.12 (90.66)	0.00 (.)
landarea	0.03 (0.16)	-0.11 (0.19)	-0.40* (0.24)	-0.06 (0.16)	0.05 (0.16)	-0.28 (0.23)
landpricee	-0.00 (0.01)	-0.00 (0.01)	-0.08 (0.08)	-0.00*** (0.00)	-0.00*** (0.00)	-0.14* (0.08)
depend	-1.98 (4.90)	4.82 (5.89)	5.14 (6.29)	4.34 (4.29)	0.88 (4.00)	-5.31 (5.07)
_cons	-3611.89 (11,591.42)	-1.4e+04 (13,798.46)	1.2e+05*** (25,503.29)	5456.65 (6350.40)	-3737.54 (10,453.85)	11,320.09 (18,403.09)
N	671	468	203	671	468	203
F	82.4274	73.0975	60.1451	89.4494	2598.7334	20.0719
r2_a	0.7278	0.7725	0.8405	0.6955	0.6397	0.6907

Note: Standard errors of the regression coefficients are in parentheses. \*, \*\*, \*\*\* denote significance at the 10 percent, 5 percent and 1 percent levels, respectively.

of purchase restriction policies in cities can significantly reduce the price of residential commercial houses by 914 yuan.

In terms of control variables, first of all, it is worth noting that the regression coefficient of fixed asset investment is significantly positive. This also shows that the better the infrastructure of a city, the higher the housing price. The price of a house actually includes the value of the comfort of the city. Secondly, the regression coefficient of the general budget expenditure of local finance is significantly negative. This may be because the general budgetary expenditures of the local finance include the relevant expenditures of the local government to provide affordable housing for urban low-income families with housing difficulties. The regression results also verify to a certain extent that increasing the supply of affordable housing can achieve the effect of reducing the price of residential commercial housing on the demand side. Finally, the regression coefficient of the consumer expectation index is significantly positive. This index comprehensively reflects and quantifies consumers' evaluation of the current economic situation and their subjective feelings about economic prospects, income levels, income expectations, and consumer psychology. Residential commercial houses have both the attributes of consumer goods and investment goods. Therefore, when consumers are optimistic about the economic situation, the corresponding investment expenditures on residential commercial housing will increase. This also shows that the real estate market cycle and the economic cycle are closely related.

## 4.2. Endogenous Treatment

Whether the city implements the purchase restriction policy is actually related to

a certain extent with the price of residential commercial housing. Cities where purchase restriction policies are often introduced are cities where housing prices are too high or rising too fast, which means that the sample has a problem of selective bias. Therefore, there may be potential reverse causality between the purchase restriction policy and the price of residential commercial housing. In addition, during the period when the purchase restriction policy is implemented, there may be the influence of other real estate control policies, which means that there may also be the problem of missing variables. Both of the above factors may lead to the existence of endogenous problems. In order to better solve the problem of endogeneity and learn from the practices of existing literature, this article will introduce the price of residential commercial houses lagging one period as an instrumental variable. The measurement method of dynamic panel is used for regression analysis of instrumental variables, and the measurement method of double difference propensity score matching is used to reduce the selectivity bias of the sample.

#### 4.2.1. Tool Variable Method for Dynamic Panels

According to the research results of the previous literature, the lag value of the explained variable is introduced as an instrumental variable in the panel model. Due to the correlation between the explanatory variable and the disturbance term after the deviation, the regression results of the general panel instrumental variable method have the problem of “dynamic panel bias”. There are usually three solutions to deal with dynamic panel data, namely differential GMM, horizontal GMM and system GMM. In these three methods, the system GMM combines the advantages of the first two, combining the difference equation and the level equation as a system equation to perform GMM estimation, thereby improving the estimation efficiency. The precondition for the application of the system GMM method is that there is no autocorrelation in the disturbance term. It can be seen from **Table 3**, the Arellano-Bond test results show that although the difference of the disturbance term has first-order autocorrelation, there is no second-order autocorrelation. Therefore, it meets the precondition that the disturbance item has no autocorrelation, that is, the system GMM method can be used to estimate the dynamic panel data.

The regression results of the system GMM dynamic panel are shown in **Table 4**. Comparing the results of the benchmark regression, after introducing the lag period of the explained variable residential housing prices as an instrumental variable, the regression coefficient of the purchase restriction policy is still significantly negative. Only the absolute value and standard error have been reduced,

**Table 3.** The Arellano-bond test results.

Order	z	Prob
1	-2.5283	0.0115
2	-0.03213	0.9744
3	-0.03447	0.9725

**Table 4.** The regression results of the system GMM dynamic panel.

	2007-2017	2007-2013	2014-2017
L.rhp	0.55*** (0.04)	0.46*** (0.06)	0.70*** (0.12)
L2.rhp	-0.00 (0.03)	0.03 (0.04)	0.13* (0.07)
xg	-217.86* (122.88)	-964.75*** (333.12)	90.81 (275.94)
tge	-11.10*** (3.39)	-6.27 (5.54)	-13.79** (6.36)
pop	4.24*** (0.96)	2.08* (1.23)	1.28 (2.88)
pergdp	0.03*** (0.00)	0.02*** (0.01)	0.00 (0.01)
open	31.00 (36.53)	101.27* (59.84)	1.79 (56.11)
inv	0.46 (0.77)	2.11 (1.75)	-0.39 (1.22)
reiinv	16.56 (10.76)	35.62** (15.29)	-25.45 (23.09)
prop	-19.30* (10.24)	-19.90 (15.26)	-12.58 (15.83)
db	-0.29 (0.20)	0.37 (0.31)	-0.67* (0.35)
dr	666.23*** (103.58)	-182.82 (491.60)	
trs	-0.05 (0.19)	-0.04 (0.21)	-0.01 (0.26)
perdi	0.02 (0.02)	0.00 (0.06)	0.01 (0.03)
rchpir	263.60*** (49.74)	289.18*** (62.53)	361.08*** (104.69)
m2gr	92.49*** (16.74)	10.29 (38.50)	-61.09 (168.90)
ggr	-4.46 (79.75)	401.10 (348.21)	
cpi	-21.13 (29.61)	5.85 (33.62)	122.34 (145.35)
cei	-56.70*** (21.28)	143.52 (131.40)	10.23 (111.78)
landarea	0.12 (0.10)	0.09 (0.12)	0.21 (0.22)
depend	-0.87 (2.50)	1.28 (3.12)	-1.28 (4.80)
_cons	1459.93 (3424.63)	-21,115.22 (15,998.43)	-13,302.70 (21,684.84)
N	539	336	203

Note: Standard errors of the regression coefficients are in parentheses. \*, \*\*, \*\*\* denote significance at the 10 percent, 5 percent and 1 percent levels, respectively.

indicating that the systematic GMM method can improve the efficiency of estimation. The effect of the purchase restriction policy estimated in the benchmark regression may include the impact of other omitted factors on housing prices. The estimated coefficient of the purchase restriction policy in the first column of **Table 4** is approximately significantly negative 218, which means that the implementation of the purchase restriction in cities during the entire study period can reduce the price of residential commercial houses by 218 yuan. Comparing the results in the first column, the absolute value and significance level of the estimated coefficient of the first round of purchase restrictions in the second column are significantly greater. At the 1% significance level, the implementation of the first round of purchase restrictions in cities can significantly reduce the housing prices of 965 units. Although the estimated coefficient of the second round of the purchase restriction policy in the third column of results is positive at this time, it is not statistically significant. Therefore, the overall regression result is consistent with the basic logic.

#### 4.2.2. Double Differential Propensity Score Matching Method

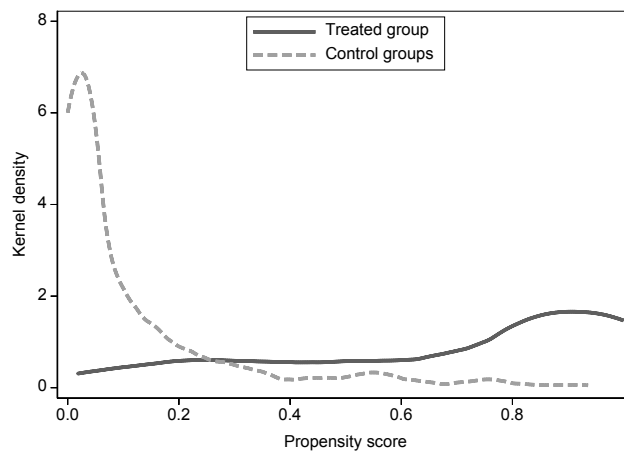
From the foregoing analysis, it can be seen that the cities that choose to implement the purchase restriction policy generally belong to the cities with higher housing prices or excessively rapid housing prices. Housing prices are closely related to the economic and social development of the city itself. Therefore, this brings about sample selection bias and leads to biased policy evaluation results. At the same time, due to the large differences in urban factors that may exist between the cities in the treatment group and the cities in the control group, it may also affect the parallel trend assumption of double difference. In order to better solve these two problems and reduce the sample difference between the treatment group and the control group, this paper uses the propensity score matching method. This article will find in the control group the  $j$  individual that is as similar as possible to the  $i$  individual in the treatment group based on the measurable variables of the sample. Since the number of control groups is relatively small, the matching method with replacement is adopted in this article.

Before using the propensity score matching method to match the control group to the corresponding control group, the appropriate matching covariate should be determined. In this paper, the `psetimate` command provided by `stata` is used to select the best matching covariates of the three stages, so that the model can achieve better fitting results. Therefore, the best matching covariates for the full sample period and the second round of purchase restrictions are construction land transfer price (`landprice`), loan interest rate (`dr`), per capita disposable income (`perdi`), fixed asset investment (`inv`), total population (`pop`), real estate development degree (`reinv`), economic openness (`open`), construction land transfer area (`landarea`), construction land proportion (`prop`), housing price to income ratio (`rchpir`). The best matching covariates for the first round of purchase restrictions are per capita disposable income (`perdi`), real estate development level (`reinv`), fixed asset investment (`inv`), population (`pop`), economic

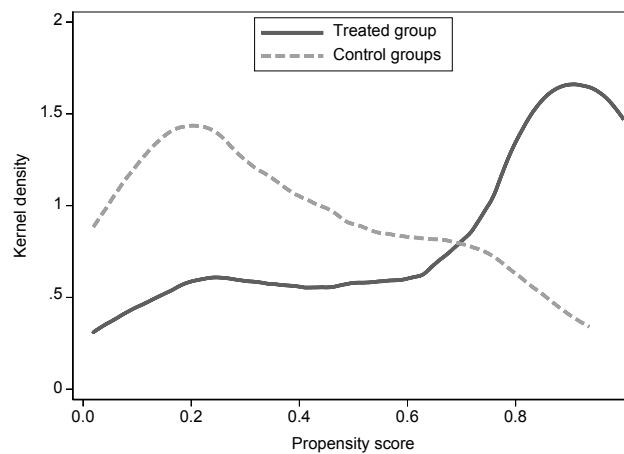


openness (open), construction land transfer price (landprice), Per capita gross national product (pergdp), local fiscal general budget expenditure (tge).

Propensity score matching is performed after determining the best matching covariate. First, this paper conducts the balance hypothesis test of the covariates to determine whether the matching results better balance the data. That is to test whether the covariates of the matched experimental group and control group are still significantly different. The results show that there is no significant difference in the matching covariates of the two groups after matching, and then the model estimation can be continued. **Table 5** shows the results of the hypothesis test on the balance of matching covariates during the first round of purchase restriction. It can be seen that the matched covariates are not significantly different at the 1% significance level, and the standard deviation of other covariates except for the variable pop is significantly reduced. The results of the measurement analysis in **Table 5** and the propensity score graphs of the experimental group and the control group before and after the matching of the experimental group and the control group in **Figure 2** and **Figure 3** can verify the establishment of the balance hypothesis test.



**Figure 2.** Before matching.



**Figure 3.** After matching.

**Table 5.** The results of the balance hypothesis tests.

Variable	Unmatched	Mean		t-test		V(T)/V(C)
	Matched	Treated	Control	t	p > t	
perdi	U	28,103	18,224	17.23	0.00	1.92*
	M	28,103	26,273	2.58	0.01	2.60*
reiinv	U	29.183	19.393	10.49	0.00	1.370
	M	29.183	30.892	-1.07	0.29	0.44*
inv	U	313.79	138.48	11.55	0.00	2.09*
	M	313.79	319.52	-0.27	0.79	1.52*
pop	U	648.52	606.54	0.95	0.34	0.48*
	M	648.52	764.63	-2.52	0.01	0.59*
open	U	5.027	4.391	1.81	0.07	1.250
	M	5.027	4.457	1.64	0.10	6.48*
landprice	U	6149.3	853.7	2.16	0.03	4427.88*
	M	6149.3	2207.2	0.99	0.32	993.03*
pergdp	U	91248	42097	9.89	0.00	3.73*
	M	91248	87656	0.53	0.59	5.10*
tge	U	79.489	30.236	8.40	0.00	4.31*
	M	79.489	109.59	-2.68	0.01	0.800

If the corner is marked with an asterisk, it means that the variance of the two covariates still has a certain difference.

The specific regression results of the double-difference propensity score matching method are shown in **Table 6**, and the regression results are roughly similar to the benchmark regression results. Among them, the estimated coefficient of the term purchase policy for the full sample is negative 404 at the 10% significance level, and the absolute value of the regression coefficient is slightly larger than the result of the benchmark regression. The estimated coefficient of the purchase restriction policy in the first round of purchase restriction stage is negative 1204 at the 1% significance level. Compared with the results of the benchmark regression, the absolute value of the regression coefficient is also slightly larger, and the estimated coefficient is also more significant. The estimated coefficient of the purchase restriction policy in the second round of purchase restriction is also similar to the result of the benchmark regression. Although the regression coefficient is positive, it is not statistically significant. Therefore, overall, after reducing the selection bias of the sample, the estimated effect of the purchase restriction policy is also more significant.

### 4.3. Heterogeneity Analysis

#### 4.3.1. Excessive and Rapid House Price Increases

It is known from the above analysis that the purchase restriction policy can restrain the rise of the price level of commercial housing to a certain extent. In or-

**Table 6.** The regression results of the PSM-DID.

	2007-2017	2007-2013	2014-2017
xg	-404.41* (249.40)	-1204.00*** (399.33)	424.71 (516.94)
pop	-11.50*** (3.09)	-11.91*** (3.78)	-4.40 (5.70)
pergdp	-0.10*** (0.01)	-0.11*** (0.01)	-0.00 (0.02)
tge	-23.39*** (6.62)	-53.84*** (8.99)	-32.94*** (11.65)
open	32.18 (56.14)	100.77 (96.45)	-9.72 (79.32)
inv	10.29*** (1.66)	19.04*** (2.60)	2.43 (2.43)
reiinv	34.77 (21.52)	46.36 (28.36)	15.55 (37.14)
prop	-3.27 (15.05)	-44.70 (27.58)	-38.74 (30.86)
db	-0.26 (0.48)	-0.08 (0.41)	0.72 (0.68)
dr	1383.80*** (322.55)	1408.70 (928.60)	557.72 (631.56)
trs	0.64 (2.28)	0.02 (0.47)	-5.89 (4.19)
perdi	0.10** (0.04)	0.20** (0.08)	-0.13 (0.12)
rchpir	108.31 (91.74)	96.19 (125.89)	398.10** (160.20)
m2gr	57.23 (66.83)	98.07 (114.13)	12.09 (247.30)
ggr	-55.43 (141.48)	-46.26 (230.61)	0.00 (...)
cpi	-27.78 (81.32)	24.73 (82.86)	3.41 (304.78)
cci	-279.65*** (96.68)	-180.01 (133.04)	0.00 (...)
cei	245.58*** (78.37)	157.86** (74.73)	0.00 (...)
csi	139.35** (63.61)	105.38 (111.44)	0.00 (...)
landarea	-0.23 (0.17)	-0.03 (0.20)	-0.89* (0.47)
landprice	-0.00 (0.00)	-0.01 (0.00)	-0.14 (0.09)
depend	9.17** (3.99)	2.83 (5.06)	-8.54 (8.59)
_cons	4362.94 (11,005.64)	-1613.98 (13,233.42)	15,015.18 (32,275.48)

Note: Standard errors of the regression coefficients are in parentheses. \*, \*\*, \*\*\* denote significance at the 10 percent, 5 percent and 1 percent levels, respectively.

der to further explore the impact of the purchase restriction policy on the price of residential commercial housing, this paper takes the rate of change of residential commercial housing price as the explained variable in the benchmark model for regression analysis. The specific estimation results are shown in **Table 7**.

It can be seen from the first two columns of **Table 7** that the purchase restriction policy can achieve the effect of restraining the price increase of residential commercial houses at least at a significant level of 5%. The estimated coefficient of the purchase restriction policy in the first column shows that the implementation of the purchase restriction policy in cities during the entire sample period can significantly reduce the growth rate of housing prices by 6% units. From the estimated coefficient of the first round of the purchase restriction policy in the second column, it can be seen that the implementation of the purchase restriction policy can significantly reduce the housing price growth rate of 3% units. The estimated coefficient of the second round of the purchase restriction policy in the third column is negative, indicating that the purchase restriction policy has a certain inhibitory effect on the growth rate of house prices.

From the above analysis, we can see that the implementation of the purchase restriction policy in cities can reduce the growth rate of residential commercial housing prices. The purchase restriction policy is proposed to curb the rise of high house prices. On the basis of the existing research, this paper further studies and analyzes whether there is a difference in the intensity of the impact of the purchase restriction policy on the level of housing prices and the growth rate of housing prices.

Therefore, this article will group the samples based on the level of housing prices in cities before 2010 and the growth rate of housing prices. Among them, cities where the price of residential commercial houses are higher than the overall average are those with excessively high housing prices, while cities where the growth rate of residential commercial housing prices is higher than the overall growth rate are cities with excessively rapid housing prices. Since the effect of the second round of purchase restriction policies is not obvious, this section only conducts regression analysis on the data during the full sample period and the first round of purchase restrictions. The specific regression results are shown in **Table 8**.

From the regression results of the first three columns in **Table 8**, the implementation of the first-round purchase restriction policy can significantly reduce the level of high housing prices and restrain the excessive growth of housing prices, thereby achieving a good administrative effect. Comparing the estimated coefficient of the purchase restriction policy in the benchmark regression, it can be found that the absolute value of the estimated coefficient of the purchase restriction policy in the third column is the largest. It shows that before 2010, the price of residential commercial housing was at a relatively high level and the effect of restricting purchases in cities with excessively rapid growth was the best. That is, the implementation of purchase restrictions in this type of city could reduce housing prices by 3823 units. At the same time, comparing the estimated coefficients of the purchase restriction policies in the first two columns, it can be

**Table 7.** The rate of change of housing prices regression results.

Rhpgr	2007-2017	2007-2013	2014-2017
xg	-0.06*** (0.02)	-0.03** (0.02)	-0.02 (0.04)
pop	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)
pergdp	-0.00*** (0.00)	-0.00** (0.00)	-0.00* (0.00)
tge	-0.00 (0.00)	-0.00** (0.00)	-0.00 (0.00)
open	0.00* (0.00)	0.01** (0.00)	0.00 (0.01)
inv	-0.00*** (0.00)	-0.00 (0.00)	-0.00 (0.00)
reiinv	-0.00*** (0.00)	-0.00** (0.00)	-0.01 (0.01)
prop	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)
db	0.00*** (0.00)	0.00 (0.00)	0.00 (0.00)
dr	-0.03* (0.01)	-0.21*** (0.05)	0.04 (0.03)
trs	-0.00 (0.00)	-0.00 (0.00)	0.00 (0.00)
perdi	-0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
rchpir	-0.01 (0.01)	0.01 (0.01)	0.01 (0.02)
m2gr	-0.02*** (0.00)	-0.03*** (0.01)	0.01 (0.01)
ggr	0.00 (0.01)	0.04*** (0.01)	0.00 (.)
cpi	-0.00 (0.00)	0.00 (0.00)	0.01 (0.03)
cci	0.01*** (0.00)	0.03*** (0.01)	0.00 (.)
cei	0.00 (0.00)	-0.00 (0.00)	0.00 (.)
csi	-0.02*** (0.00)	-0.03*** (0.01)	0.00 (.)
landarea	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
landprice	-0.00*** (0.00)	-0.00*** (0.00)	-0.00 (0.00)
depend	0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)
_cons	1.50*** (0.50)	1.55** (0.77)	-0.85 (3.44)

Note: Standard errors of the regression coefficients are in parentheses. \*, \*\*, \*\*\* denote significance at the 10 percent, 5 percent and 1 percent levels, respectively.

**Table 8.** The regression results of cities with different types of housing prices.

	2007-2013			2007-2017		
	High	Fast	High & Fast	High	Fast	High & Fast
xg	-2364.82** (978.91)	-1641.72* (882.06)	-3822.88* (1903.67)	-91.37 (464.70)	-1066.80* (556.43)	-1022.48 (1014.08)
pop	-54.85** (23.81)	-48.71** (22.13)	-64.92 (42.65)	-11.58 (10.06)	-38.89** (18.91)	-32.41 (33.02)
pergdp	-0.13*** (0.02)	-0.11*** (0.03)	-0.11** (0.04)	-0.13*** (0.02)	-0.09*** (0.03)	-0.15*** (0.03)
tge	-21.46 (15.70)	-31.41** (14.81)	-3.99 (23.09)	-21.20* (12.01)	-21.56* (11.40)	-25.44 (20.12)
open	290.69** (122.28)	163.93 (142.84)	-133.30 (493.24)	-69.90 (84.76)	39.17 (83.99)	179.34 (178.91)
inv	15.64*** (5.13)	6.30 (5.97)	13.44 (8.94)	17.23*** (4.35)	7.35 (4.55)	10.61 (9.60)
reiiinv	40.04 (104.18)	-29.16 (40.67)	31.36 (168.67)	123.28 (75.15)	12.69 (36.73)	69.46 (135.58)
prop	-49.54 (85.70)	-32.78** (13.95)	-72.29 (176.44)	-53.53 (33.20)	5.21 (9.94)	-85.14 (95.14)
db	-3.74*** (1.09)	-2.43* (1.19)	-4.89* (2.18)	-0.36 (0.94)	0.25 (0.74)	0.67 (1.41)
dr	-508.75 (1123.87)	569.36 (730.57)	-923.60 (3346.27)	2150.31*** (559.92)	1006.88*** (268.21)	1480.85 (1077.74)
trs	25.40*** (5.12)	17.11*** (5.74)	33.95** (12.47)	1.54 (4.54)	-1.37 (2.69)	-3.73 (5.58)
perdi	0.41** (0.18)	0.42** (0.19)	0.64** (0.22)	0.22* (0.11)	0.11 (0.08)	0.23 (0.16)
rchpir	145.16 (234.92)	69.52 (269.34)	86.01 (297.89)	96.42 (192.60)	148.28 (164.47)	383.92 (269.96)
m2gr	157.09 (249.05)	85.90 (173.59)	445.04 (490.91)	238.44 (189.48)	-0.29 (74.90)	-211.17 (371.93)
ggr	180.25 (499.62)	344.52 (236.47)	763.51 (1226.02)	274.72 (333.19)	25.26 (179.93)	342.90 (622.03)
cpi	699.46** (327.81)	6.30 (134.00)	938.40 (800.77)	-258.33 (255.55)	-147.31 (129.78)	-687.78 (406.45)
cci	223.1 (272.97)	-208.55 (180.37)	51.38 (829.11)	-506.49** (207.56)	-204.40* (100.87)	-609.44* (309.41)
cei	-1.10 (186.00)	190.31 (119.99)	56.19 (467.93)	483.11** (191.19)	197.14* (101.56)	628.97** (243.92)

## Continued

csi	21.16 (175.69)	55.15 (133.56)	260.27 (436.46)	282.79* (135.60)	50.21 (55.39)	82.07 (279.50)
landarea	-0.15 (0.29)	0.30 (0.30)	0.84 (0.68)	-0.32 (0.35)	0.27 (0.32)	0.22 (0.83)
landprice	-0.01*** (0.00)	-0.01** (0.00)	-0.00 (0.00)	-0.00* (0.00)	-0.00 (0.00)	-0.00 (0.00)
depend	2.62 (5.51)	0.65 (6.55)	-3.40 (11.30)	12.12** (4.96)	4.20 (5.90)	17.76* (8.15)
_cons	-55,294.99 (45,097.59)	23,588.77 (21,543.15)	-97,116.52 (72,206.12)	7240.59 (36,764.75)	39,669.16*** (13,476.46)	93,853.40 (52,986.32)
N	139	206	70	198	295	99
F	.	9491.4242	.	.	190.1081	.
r2_a	0.7873	0.7121	0.7895	0.7720	0.7259	0.8140

Note: Standard errors of the regression coefficients are in parentheses. \*, \*\*, \*\*\* denote significance at the 10 percent, 5 percent and 1 percent levels, respectively.

seen that before 2010, cities with excessively high housing prices implemented purchase restriction policies than cities with excessive housing prices, which can achieve a better effect of restraining housing prices more significantly.

Comparing the estimated coefficients of the purchase restriction policies in the last three columns of **Table 8**, only if the cities with excessively fast housing prices implement the purchase restriction policy can they achieve a significant effect of restraining housing price increases in the long run. Comparing the absolute value and significance of the estimated coefficients of the purchase restriction policies in the first three columns and the last three columns of **Table 8** can again verify to a certain extent that the use of administrative measures to implement purchase restrictions can achieve better results in the short term. But the long-term effect is obviously not ideal.

#### 4.3.2. East Midwest Region

Since housing prices have strong location attributes, they are also related to the geographical environment and economic conditions of the region. Therefore, this paper divides the research sample into three sub-samples according to the region to which the city belongs, the eastern region, the western region, and the central region. Then this article evaluates the effect of the purchase restriction policies implemented by these three types of cities on the prices of residential commercial houses. Because the estimated coefficients of the purchase restriction policy during the whole sample period and the second round of purchase restriction stage after grouping are not statistically significant. Therefore, this article only analyzes the regression results of the first round of purchase restrictions. The specific regression results are shown in **Table 9**.



**Table 9.** The regression results of cities in different regions.

	Eastern	Middle	Western
xg	-1326.66** (628.32)	28.66 (185.43)	-522.95** (171.90)
pop	-49.98*** (16.74)	-2.00* (1.07)	-0.59 (4.38)
pergdp	-0.13*** (0.02)	0.01 (0.01)	0.02 (0.01)
tge	-7.92 (11.60)	13.40 (18.26)	-12.19* (5.94)
open	65.41 (61.07)	201.44** (79.35)	114.93 (67.04)
inv	13.77*** (4.34)	-9.67** (3.95)	0.59 (2.10)
reiinv	63.50 (66.45)	-28.29** (11.59)	0.78 (11.57)
prop	-51.48*** (17.46)	-64.42*** (13.16)	36.02 (56.71)
db	-4.85*** (0.91)	0.01 (0.43)	-4.20** (1.88)
dr	371.96 (654.65)	-3.72 (382.29)	798.25** (346.90)
trs	31.16*** (5.05)	-0.11*** (0.04)	23.40 (13.24)
perdi	0.15 (0.16)	0.09** (0.04)	-0.08 (0.05)
rchpir	63.20 (215.17)	-49.60 (83.91)	61.50 (109.71)
m2gr	43.34 (149.90)	49.35 (48.40)	59.03 (45.56)
ggr	198.89 (227.37)	219.49* (108.63)	-100.54 (134.84)
cpi	55.46* (30.32)	27.78 (71.39)	-15.57 (54.43)
cci	-94.24 (155.53)	-34.21 (69.02)	-23.22 (59.74)
cei	99.25 (117.57)	38.88 (46.93)	7.94 (52.25)

**Continued**

csi	43.20 (113.06)	28.37 (46.12)	56.77 (42.28)
landarea	-0.03 (0.14)	-0.13 (0.19)	0.12 (0.14)
landprice	-0.00*** (0.00)	-0.47* (0.26)	-0.15 (0.24)
depend	4.30 (4.59)	8.63 (7.53)	-3.11 (3.83)
_cons	25,521.78 (18,220.50)	-3114.27 (7786.06)	1102.01 (9191.45)
N	243	141	84
F	891.6110		
r2_a	0.7692	0.8344	0.7433

Note: Standard errors of the regression coefficients are in parentheses. \*, \*\*, \*\*\* denote significance at the 10 percent, 5 percent and 1 percent levels, respectively.

Comparing the estimated coefficients of the purchase restriction policy in the three regions in **Table 9**, we can find that the absolute value of the regression coefficient in the eastern region is the largest, and it is larger than the value of the benchmark model. That is to say, it shows that the implementation of the purchase restriction policy in eastern cities can achieve the effect of restraining the price of residential commercial houses more significantly than the central and western cities. At the same time, the implementation of purchase restrictions in western cities can also significantly curb the rise in housing prices, but the degree of restraint is relatively weak.

From the results of econometric regression, it can be seen that the purchase restriction policy in central cities seems to have no corresponding effect. The reason may be that housing prices are closely related to the development of the city's economy and other aspects. The development status of the eastern cities is the best due to the advantages of geographical location. At the same time, the prices of residential commercial houses in most eastern cities were at a higher level before 2010 and their growth rates were faster. In the western cities, due to policy trends in recent years, the speed of development in all aspects has also been accelerating, resulting in faster housing prices.

#### 4.4. Robustness Test

From the above analysis, it can be seen that the implementation of the purchase restriction policy in the city can achieve a restraining effect on the price of residential commercial housing. Among them, the purchase restriction policy implemented in the first stage has the best effect. In order to reflect the robustness of the conclusion of this article, this article will exclude other factors that may

have an impact on the conclusion in turn. This article will conduct robustness tests from the four perspectives of eliminating the expected impact of purchase restrictions, replacing control variables, measuring explanatory variables, and measuring standard errors.

At the same time, the main text only reports and analyzes the regression results of the robustness of the first round of purchase restriction policies. The regression results and analysis process of the other two stages are similar, so this article will not repeat them.

#### **4.4.1. Excluding the Expected Impact of Purchase Restrictions**

As in the first round of purchase restrictions, each city has successively implemented purchase restrictions during the period 2010-2011. The spillover effect of the purchase restriction policy has affected the housing prices in cities where purchase restrictions have not been implemented. Therefore, it is possible that the expected purchase restriction has an effect on the price of residential commercial housing rather than the effect of the purchase restriction policy itself. Based on this, this paper removes the period samples during which cities have successively implemented the purchase restriction policy, that is, only uses the clean sample period before and after the implementation of the purchase restriction policy to regress to estimate the effect of the purchase restriction policy. From the absolute value and significance level of the estimated coefficient of the purchase restriction policy in the first column of **Table 10**, it can be seen that in the clean sample period, the purchase restriction policy can still significantly reduce the price of residential commercial housing by 731 units. This fully validates the conclusion of this article on the effectiveness of the first round of purchase restrictions.

#### **4.4.2. Replacement of Control Variables**

To further enhance the robustness of the conclusions of this article, this article will avoid the deviation of the estimation results caused by the difference in the measurement angle of the control variables. In view of the availability of data, this paper uses the degree of residential development (residential investment divided by fixed asset investment) instead of measuring the degree of real estate development (real estate development investment divided by fixed asset investment). In this paper, the total amount of deposits and deposit interest rates of financial institutions are used instead to measure total loans and loan interest rates, thereby introducing new control variables into the benchmark regression model. The specific regression results are shown in the second column of **Table 10**. It can be seen that the estimated coefficient of the purchase restriction policy is still significantly negative, and the absolute value of the estimated coefficient is basically the same as the result of the benchmark regression. It again verifies the robustness of the conclusion of this article.

#### **4.4.3. Metrics of Explanatory Variables**

Since the total sales of residential commercial houses and the sales area are

**Table 10.** The regression result of robustness test.

	(1)	(2)	(3)	(4)	(5)
xg	-731.03*	-926.91**	-919.28**	-914.19**	-370.25*
	(423.52)	(375.34)	(373.24)	(395.86)	(195.94)
pop	-13.72***	-10.11**	-8.63**	-10.34**	-10.57**
	(3.87)	(4.08)	(4.10)	(3.91)	(4.18)
pergdp	-0.10***	-0.10***	-0.09***	-0.10***	-0.08***
	(0.01)	(0.03)	(0.03)	(0.03)	(0.02)
tge	-51.69***	-53.33***	-47.73***	-48.94***	-21.17***
	(7.69)	(8.78)	(12.99)	(13.72)	(5.57)
open	78.02	110.68	76.89	105.71	37.95
	(67.69)	(71.13)	(60.03)	(73.82)	(49.73)
inv	18.09***	16.43***	15.44***	16.73***	7.97***
	(2.18)	(4.13)	(4.18)	(4.27)	(2.33)
reiinv	31.68		41.95	43.65	22.29
	(28.04)		(32.90)	(34.51)	(25.36)
prop	-75.37**	-55.62***	-59.05***	-56.62***	-7.85
	(30.85)	(16.06)	(17.34)	(16.02)	(11.81)
db	-0.01		0.21	-0.20	-0.36
	(0.38)		(0.83)	(0.87)	(0.30)
dr	-1367.32		1534.45***	1077.40*	1103.73***
	(1516.12)		(528.66)	(618.66)	(178.30)
trs	-0.11	-0.16	-0.09	-0.10	-0.04
	(0.36)	(0.10)	(0.16)	(0.16)	(0.09)
perdi	0.15**	0.18	0.22	0.19	0.09
	(0.08)	(0.17)	(0.14)	(0.16)	(0.08)
rchpir	71.45	41.19		53.11	-40.27
	(143.13)	(189.81)		(193.70)	(137.99)
m2gr	-102.74	112.14	189.18*	112.42	83.88*
	(75.59)	(128.67)	(99.04)	(119.60)	(47.48)
ggr	71.60	-31.15	11.60	25.45	-60.58
	(219.78)	(154.03)	(148.97)	(157.70)	(80.68)
cpi	56.35	28.15	31.43	30.38	-7.48
	(56.38)	(28.48)	(26.33)	(28.06)	(36.51)
cci	258.52	-146.96	-212.78*	-142.57	-117.61**
	(271.21)	(137.30)	(108.35)	(126.05)	(47.80)
cei	0.00	127.68	152.02**	133.71*	102.21**
	(.)	(79.95)	(70.88)	(77.30)	(47.16)

## Continued

csi	0.00 (.)	98.98 (98.20)	158.38** (76.07)	93.12 (90.66)	84.04** (33.20)
landarea	-0.00 (0.20)	0.10 (0.16)	0.06 (0.15)	0.05 (0.16)	-0.06 (0.16)
landprice	-0.01* (0.00)	-0.00*** (0.00)	-0.00*** (0.00)	-0.00*** (0.00)	-0.00*** (0.00)
depend	0.44 (5.52)	-0.40 (3.91)	1.04 (3.97)	0.88 (4.00)	4.34 (4.05)
invhousinginv		58.13 (37.28)			
lb		0.30 (0.88)			
lr		1089.73* (642.63)			
chpir			29.72 (46.74)		
_cons	-10,677.60 (23,235.43)	-5902.01 (12,177.06)	-9173.82 (9239.72)	-3737.54 (10,453.85)	5456.65 (6519.72)
N	332	468	470	468	671
F	28.8745	1695.0345	1190.2278	2598.7334	386.9673
r2_a	0.5971	0.6406	0.6072	0.6397	0.6955

Note: Standard errors of the regression coefficients are in parentheses. \*, \*\*, \*\*\* denote significance at the 10 percent, 5 percent and 1 percent levels, respectively.

slightly smaller than those of commercial houses, the price trends of the two are basically the same. Therefore, this article uses the price of commercial housing to replace the price of residential commercial housing. It can avoid the bias of the estimation results caused by the deviation of the explained variable alone to a certain extent. Comparing the estimation results of the purchase restriction policy in the benchmark regression, it is found that the estimated coefficient and the significance level of the purchase restriction policy in the third column of **Table 10** are basically consistent with it. It can once again show the robustness of the conclusion.

#### 4.4.4. Clustering Criterion Errors

Since the data in this article are short-panel data, the robust standard error is used in the benchmark regression. In order to avoid the error of the estimation results caused by the difference of the standard errors in the econometric regression method, this paper will use two kinds of clustering standard errors, the standard errors of the clustering to the city level and the standard errors of the province level respectively to regression estimation of the benchmark model.

The specific regression results are shown in the last two columns of **Table 10**. From the estimated results in the fourth column, it can be seen that the estimated coefficient and significance of the purchase restriction policy are the same as the results of the benchmark regression. It is worth noting the estimated results in the last column. Although the absolute value of the estimated coefficient of the purchase restriction policy clustered to the standard error of the province level is much smaller than that of the benchmark regression, the difference between the two values may be due to the large difference in the development status of different cities in the province. However, even so, the estimated coefficient of the purchase restriction policy clustered to the standard error of the province level is still significantly negative, indicating that the conclusion of this article is still robust.

## 5. Conclusion and Insights

This paper takes 70 large and medium-sized cities as the research object, and uses the relevant data from 2007 to 2017 to empirically study the effect of the purchase restriction policy on the price of residential commercial housing. Using the instrumental variable method of the dynamic panel and the propensity score matching method of double difference to deal with the endogenous problem to a certain extent. The research in this paper finds that the first round of purchase restriction policies can significantly inhibit the increase in the level of housing prices and the growth rate of housing prices, and has a good policy effect. At the same time, it is also found that the restraining effect of the purchase restriction policy on housing prices is heterogeneous. Among them, it has the strongest degree of influence on cities and eastern cities where the level of housing prices and growth rates were at a relatively high level before 2010. However, the long-term inhibition strength of this effect is significantly weaker than the short-term inhibition strength. At the same time, the research in this article shows that the effect of the second round of purchase restriction policies is far less than that of the first round of purchase restrictions.

Therefore, combined with the conclusions of this article, there can be practical enlightenment on the housing market in the following aspects. First of all, the purchase restriction policy is a policy that reduces the amount of demand in the housing market by controlling consumers' eligibility to purchase houses. On the premise that the supply of real estate developers remains largely unchanged, it can achieve the effect of restraining housing prices in the short term. Due to the impact of market participants' expectations of policy uncertainty, it must be implemented for a long time to achieve the desired effect. However, the long-term implementation of the purchase restriction policy will cause the loss of social welfare, and will also adversely affect other markets such as the rental market and the stock market. Secondly, housing itself not only has consumption attributes, but also has strong investment attributes. The real estate industry, due to its high rate of return on investment and low risk, has a strong attraction to

social funds, which leads to distortions in the distribution of economic resources. This is not conducive to the development of the real economy. The development of the real economy is closely related to the increase in people's income, which ultimately leads to a decrease in the actual purchasing power of residents for housing. More and more people are likely to be unable to achieve "home ownership". Therefore, the government should introduce corresponding measures to guide the flow of social funds to the real economy and increase the intensity of financial institutions' support for non-real estate industries. Finally, the housing market is ultimately a market where supply and demand are balanced. If it is only one-sided to suppress the quantity of demand, without any adjustment on the supply side, there is no way to achieve long-term and healthy development of the housing market. Therefore, on the supply side, the government should increase the supply of housing by improving the construction of the land market, increasing the area of land for construction, reducing the dislocation of land, and increasing the supply of affordable housing. In addition, the government should also supplement fiscal and tax policies and land policies to achieve long-term and healthy development of the housing market.

### Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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