

Reconstruction of Local Tax System and Improvement of Urban Housing Affordability: Evaluation Based on the Synthetic Control Method of Real Estate Tax Pilot

Yuan Liu

College of Economics and Finance, Hanyang University, Seoul, South Korea, 04763

Corresponding author: 2023095750@hanyang.ac.kr

Abstract

This article takes the real estate tax pilot policies implemented in Shanghai and Chongqing since 2011 as an example. The authors using the SCM, to compare the changes between the pilot cities and the synthetic control cities before and after policy implementation, to evaluate the impact of local tax system restructuring on urban housing affordability. Based on urban panel data from 2008 to 2023, it has been found through research that the actual housing price to income ratio in Shanghai has remained lower than the composite control level after the pilot of property tax, and the policy effect is negative and expanding year by year, indicating that the pilot policy has significantly improved the affordability of housing in Shanghai; And the policy effects of Chongqing in each year are mainly negative, although there are significant fluctuations, overall they also show an improving trend. At the same time, the placebo test results showed that there were no similar policy effects after advancing or replacing the treatment group, indicating the robustness of the baseline results. Based on the above results, the pilot policy of real estate tax has an improving effect on the affordability of urban housing. This study can provide empirical evidence for the new round of local tax system restructuring policies, and has reference value for optimizing the tax system structure and implementing tailored policies.

Key words

Real estate tax pilot program; Restructuring of local tax system; Urban housing affordability; SCM; House price to income ratio

1. Introduction

Over the past several years, under the sustained enforcement of macroeconomic changes and policies related to local tax system restructuring, China's real estate market has gradually entered a stage of adjustment. The housing prices have shifted from a rapid growth stage in the past to a fluctuating adjustment stage, with a slowdown in price growth rates. However, the central housing prices in some cities have not yet shown a downward trend, and the housing pressure caused by high housing prices is gradually receiving attention.

The continuous increase in the proportion of housing expenditure in residents' household income not only increases the cost of purchasing a house, but may also have an impact on the family's economic situation by squeezing out residents' consumption and other means[1]. At the same time, there is a mismatch between changes in housing prices and the growth of residents' income, which gradually highlights the issue of housing affordability.

To facilitate the steady and sound development of the real estate market, China launched a pilot reform of real estate tax in Shanghai and Chongqing in 2011[2]. On the one hand, real estate taxes may suppress speculative home buying demand by increasing the cost of housing ownership, thereby easing the pressure of rising housing prices and improving housing affordability. On the other hand, under the condition of imbalanced housing supply and demand, the tax burden may also be partially transferred to homebuyers, thereby increasing the housing burden on residents and having a negative impact on housing affordability.

The existing research on real estate tax policies mainly focuses on fluctuations in housing prices, regulation of the real estate market, and economic effects, with relatively less attention paid to housing affordability [3-5]. Housing affordability not only reflects residents' housing affordability, but is also closely related to residents' quality of life and urban sustainable development [6]. Some studies use the difference in differences method to evaluate policy effects, but their effectiveness highly depends on the parallel trend assumption between the treatment group and the corresponding control group. For example, in terms of the pilot policy of real estate tax, if only subjective selection of control cities

is used, it may make it difficult to establish the parallel trend hypothesis and may also affect the unbiasedness of the estimation results.

Previous research has shown that real estate taxes can help curb the rise in housing prices, but their effectiveness is influenced by various factors [7]. Based on this, this study takes the pilot policy of real estate tax as the research object, introduces the SCM, and constructs a 'synthetic control city' with similar characteristics to the pilot city to compare the differences in changes between the pilot city and the synthetic control city before and after policy implementation, and evaluate the net impact of local tax system reform on housing affordability.

2. Institutional Background and Theoretical Assumptions

2.1 The Institutional Evolution and Policy Characteristics of the Real Estate Tax Pilot Program

Back in 2003, the 16th CPC Central Committee's Third Plenum initially put forward a property tax levy reform plan. In order to further improve the regulation mechanism of the real estate market, a pilot policy of real estate tax was launched in Shanghai and Chongqing in 2011 [8]. In 2021, the Standing Committee of the National People's Congress authorized the launch of a new round of real estate tax pilot policies, and planned to expand the pilot cities from Shanghai and Chongqing to multiple cities. However, due to the impact of the economic downturn and the continued downturn in the real estate market, the expansion of pilot cities has not been effectively promoted. In January 2026, Shanghai issued a notice to extend the pilot policy of real estate tax until January 2031.

As an important exploration of China's real estate tax reform, there are certain differences between the two pilot cities in terms of tax targets, tax calculation methods, and tax rate settings. Shanghai pilot mainly targets the taxation of newly added housing, and uses the per capita housing area as a partial tax exemption basis, with a relatively low overall tax rate. In contrast, Chongqing mainly levies taxes on high-end residential and single

family commercial housing, with relatively high tax rates and stronger regulatory guidance.

2.2 Cost Effect Hypothesis and Expected Effect Hypothesis

The implementation of real estate tax may affect the real estate market by increasing the cost of housing ownership. On the one hand, the real estate tax will increase the holding cost of investment oriented housing purchases, thereby suppressing speculative housing demand and easing the pressure of rising housing prices, which may improve the affordability of housing. On the other hand, the pilot policy of real estate tax may also affect the real estate market by influencing market expectations and reducing some investment demand. Therefore, the pilot policy of real estate tax may have a certain impact on the affordability of urban housing through cost-effectiveness and expected effects. Therefore:

H1: Real estate tax will increase the cost of housing ownership, curb speculative demand, and help improve housing affordability.

H2: Real estate tax will lower market expectations for future housing price increases, reduce investment demand, and help improve housing affordability.

2.3 Hypothesis of Tax Burden Shifting

During the implementation of real estate tax, tax costs may be passed on to homebuyers or tenants through housing prices or rent, thereby affecting residents' housing expenses. In the case of unequal supply and demand forces, the transfer of tax costs to homebuyers may worsen the mechanism of affordability and weaken the effectiveness of policies. Therefore:

H3: When the supply elasticity in the market is insufficient, the tax burden may shift to homebuyers, which may weaken the effectiveness of policies.

3. Research Design

3.1 Setting up the Measurement Model

This article uses the SCM to evaluate the impact of this policy on housing affordability. Select relevant data

from 12 non pilot cities and construct 'virtual city' data with similar characteristics to the pilot cities through the optimal weighted combination. And evaluate the actual impact of the real estate tax pilot policy on housing affordability by comparing the development differences between the pilot cities and the composite control cities after policy implementation.

The benchmark regression model is set as follows:

Building a synthetic city: $\hat{Y}_{it}^N = \sum_{j=2}^{J+1} \omega_j Y_{jt}$

Policy effects: $\alpha_{it} = Y_{it} - \hat{Y}_{it}^N$

Optimal weight: $\min_i \|X_1 - X_0 \omega\|_1^2$

inside,

$\hat{Y}_{it}^N$: Housing affordability level of composite city in year t

ω_j : The weights of each city of control group when synthesizing

Y_{jt} : The housing affordability level of each city in the control group in year t

Y_{it} : Housing affordability level of pilot cities in year t

α_{it} : The treatment effect generated by the policy in year t (i.e. Subtract the actual value from the synthesized value)

X_1 : Predictive variable vector for pilot cities

X_0 : Predictive variable matrix for each city in the control group

ω : weight vector

Constraints:

Weight of each city ≥ 0 , And, the sum of all weights = 1

3.2 Variable Measurement and Explanation

(1) Dependent variable: urban housing affordability, which is measured in this article using the Housing Price to Income Ratio.

(2) Core explanatory variable: pilot policy of real estate tax. This article uses the SCM to evaluate policy effects

(3) Predictor variables: including GDP, log of year-end resident population, urbanization rate, and real estate investment level (real estate development investment amount residential).

3.3 Data Sources and Descriptive Statistics

Table 1 Descriptive Statistics

Variables	Definition	N	Mean	Sd	Min	Max
PIR_Shanghai	House price-to-income ratio (Shanghai)	16	42.133	6.570	30.673	52.871
PIR_Synth_Shanghai	House price-to-income ratio (Synthetic Shanghai)	96	42.513	16.085	21.527	96.346
PIR_Chongqing	House price-to-income ratio (Chongqing)	16	21.351	2.357	17.435	25.202
PIR_Synth_Chongqing	House price-to-income ratio (Synthetic Chongqing)	96	23.125	4.662	13.895	35.799
GDP_Shanghai	Including Gross domestic product (Shanghai)	16	122574.125	40394.586	69154	190321
GDP_Synth_Shanghai	Including Gross domestic product (Synthetic Shanghai)	96	114803.986	38283.187	45241.64	200278
GDP_Chongqing	Including Gross domestic product (Chongqing)	16	56549.625	23976.436	20865	94147
GDP_Synth_Chongqing	Including Gross domestic product (Synthetic Chongqing)	96	85258.242	35500.283	27736	190605
ln_Population_Shanghai	Log of year-end resident population (Shanghai)	16	7.38	6.03	7.331	7.396
ln_Population_Synth_Shanghai	Log of year-end resident population (Synthetic Shanghai)	96	7.147	6.641	6.88	7.342
ln_Population_Chongqing	Log of year-end resident population (Chongqing)	16	7.487	6.124	7.453	7.507
ln_Population_Synth_Chongqing	Log of year-end resident population (Synthetic Chongqing)	96	7.049	6.567	6.7	7.33
Urbanization_Shanghai	Urbanization rate (Shanghai)	16	0.888	0.007	0.876	0.896
Urbanization_Synth_Shanghai	Urbanization rate (Synthetic Shanghai)	96	0.854	0.077	0.693	1

Variables	Definition	N	Mean	Sd	Min	Max
Urbanization_Chongqing	Urbanization rate (Chongqing)	16	0.617	0.071	0.5	0.717
Urbanization_Synth_Chongqing	Urbanization rate (Synthetic Chongqing)	96	0.73	0.067	0.432	0.856
Real estate investment amount_Shanghai	Real estate development investment amount residential(Shanghai)	16	194300750000	70109353155.862	87546000000	346679000000
Real estate investment amount_Synth_Shanghai	Real estate development investment amount residential(Synthetic Shanghai)	96	140302979166.667	69024336364.866	28978000000	282959000000
Real estate investment amount_Chongqing	Real estate development investment amount residential(Chongqing)	16	217134187500	84947764176.36	61953000000	328811000000
Real estate investment amount_Synth_Chongqing	Real estate development investment amount residential(Synthetic Chongqing)	96	121780125000	59467261835.71	34179000000	270029000000

Table 1 presents the descriptive statistical results of the main variables for the pilot cities Shanghai and Chongqing with their respective composite control cities. As for Shanghai, the actual average PIR is 42.133, and the synthesized PIR for Shanghai is 42.513, which is highly similar in value. Moreover, the standard deviation of the composite value is 16.085, which is greater than the actual value of 6.57, reflecting the significant differences in internal housing prices in some cities of the composite control group. This is in line with the demand for heterogeneity in the control group using the composite control method. In terms of controlling variables, the actual and composite values of per capita GDP, urbanization rate, and population logarithm in Shanghai are in a similar state, indicating a relatively good fitting effect. As for Chongqing, the actual average

PIR is 21.351, and the synthesized PIR for Chongqing is 23.125. The difference between the two is small, indicating that the fitting effect of the PIR between the pilot city Chongqing and its synthesized control city is good. In terms of controlling variables, the composite value of urbanization rate and population logarithm is closer to the actual value. However, there is a certain gap between the actual and composite values of per capita GDP and investment in residential real estate development, which may be related to the macroeconomic fluctuations of each city during the sample period and the different implementation of real estate regulation policies. Overall, the actual and composite values of the two pilot cities have maintained a high degree of consistency in the core variables, providing a reliable data foundation for the subsequent evaluation of policy effects.

Table 2 Predictor Balance Test

Predictor variable	Shanghai (Actual)	Shanghai (Synthetic)	Chongqing (Actual)	Chongqing (Synthetic)
GDP	7.3638	6.4440	2.4098	4.4885
ln_Population	3.3459	2.9253	3.4565	2.8961
Urbanization rate	0.888	0.707	0.515	0.631
Real estate investment amount	10079900	5475600	8333500	4299600

This research plan uses urban panel data for empirical analysis, with a preliminary sample time interval set from 2008 to 2023. In 2009, in response to the financial crisis, the central bank implemented a large-scale interest rate cut, lowering the one-year loan benchmark interest rate to 5.31%. The annual increase in loans was 9.59 trillion yuan, driving up the sales price of newly-built commercial residential buildings in China by about 24.7%. In 2015-2016, the central bank continuously lowered interest rates and reserve requirements ratios, as well as monetized shantytown renovation, leading to another surge in housing prices in most cities [9]. Shanghai's housing prices have long been among the top in the country, and speculative demand is high. However, the prices of high-end residential properties in Chongqing are too high and there is a serious phenomenon of speculation. Therefore, the pilot policy of real estate tax

was implemented in 2011. Table 2 shows the results of the predictor balance test. Among them, this article uses Beijing, Tianjin, Shenzhen, Guangzhou, Hangzhou, and Nanjing to construct a composite control city for Shanghai, while uses Chengdu, Xi'an, Changsha, Suzhou, Hefei, and Zhengzhou to construct a composite control city for Chongqing. The data mainly come from the CSMAR database, the NBS official site, the websites of city statistical bureaus, China's Statistical Yearbook, the Urban Statistical Yearbook of China.

4. Regression Results and Robustness Testing

4.1 Benchmark Regression Results

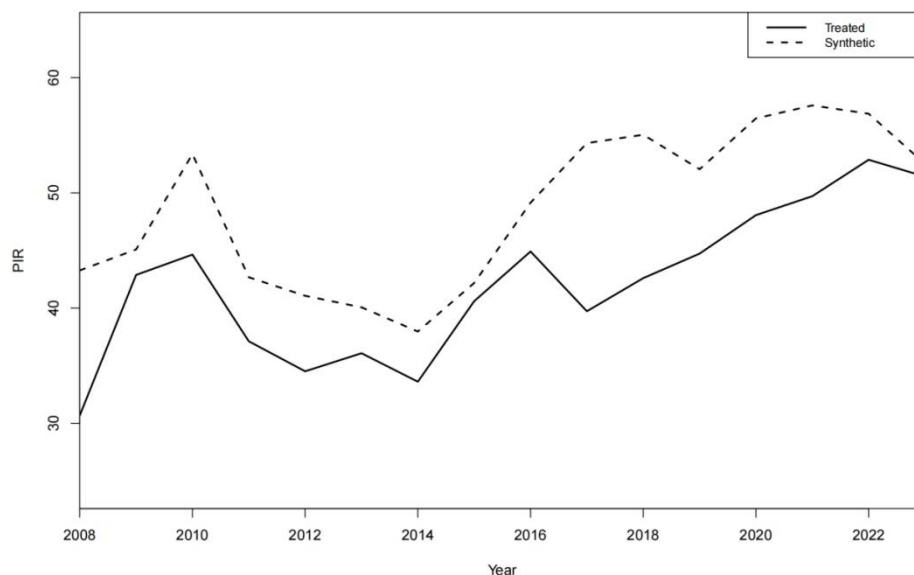


Figure 1 Shanghai: Actual vs Synthetic PIR

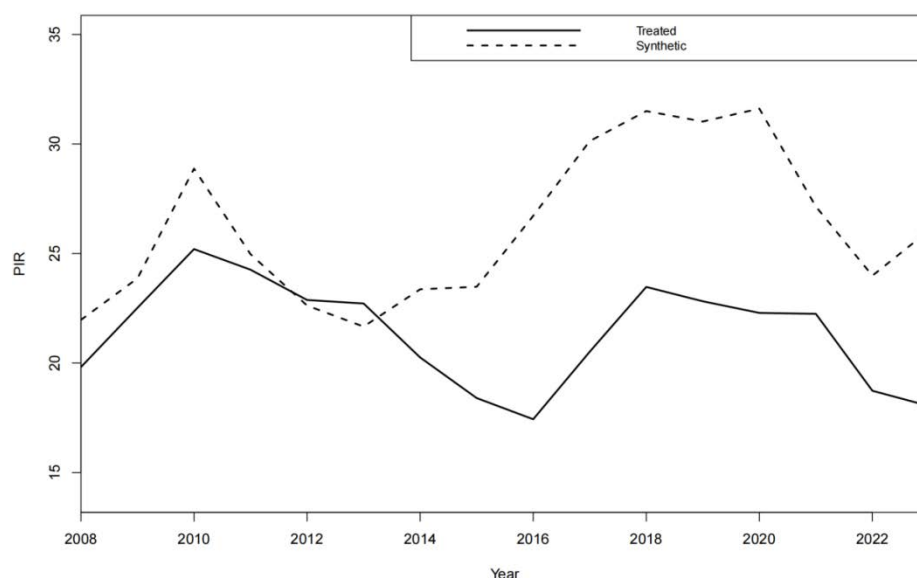


Figure 2 Chongqing: Actual vs Synthetic PIR

Figure 1 and Figure 2 respectively show the changing trends of PIR in the pilot cities of Shanghai, Chongqing, and the composite control city. Before the implementation of the policy (i.e. 2008-2010), the actual values and composite values of the pilot cities and the composite control cities showed a similar trend, indicating that the composite control method fits well. Moreover, after the pilot policy was introduced in 2011, the

actual value in Shanghai was lower than the composite value, and the gap between the actual value and the composite value continued to widen after 2017. Moreover, the actual value in Chongqing is also lower than the composite value. This implies that the pilot policy of real estate tax has improved the affordability of housing in the two cities.

Table 3 Policy Effects

year	Shanghai	Chongqing
2009	-2.210469218	-1.346267999
2010	-8.728348411	-3.671216657
2011	-5.554399126	-0.707356421
2012	-6.553150994	0.252768
2013	-3.983697126	1.05479798
2014	-4.353741671	-3.11109441
2015	-1.581228824	-5.080940939
2016	-4.232336263	-9.283583896
2017	-14.59156439	-9.615613073
2018	-12.44328222	-8.028697608
2019	-7.322984194	-8.204935473
2020	-8.395637596	-9.325470913

year	Shanghai	Chongqing
2021	-7.876688185	-4.896756385
2022	-3.994911134	-5.253538994
2023	-1.102852602	-8.011764913

Table 3 shows the policy effects of two pilot cities. Among them, the policy effect values of Shanghai in each year were negative, indicating that the actual PIR was lower than the composite control level after the implementation of pilot policies, which improved housing affordability. Meanwhile, the policy effect values of Chongqing in each year are mainly negative, indicating

that the policies have also improved the affordability of housing in Chongqing. Overall, the pilot policy of real estate tax has an improving effect on residents' housing affordability.

4.2 Robustness Testing

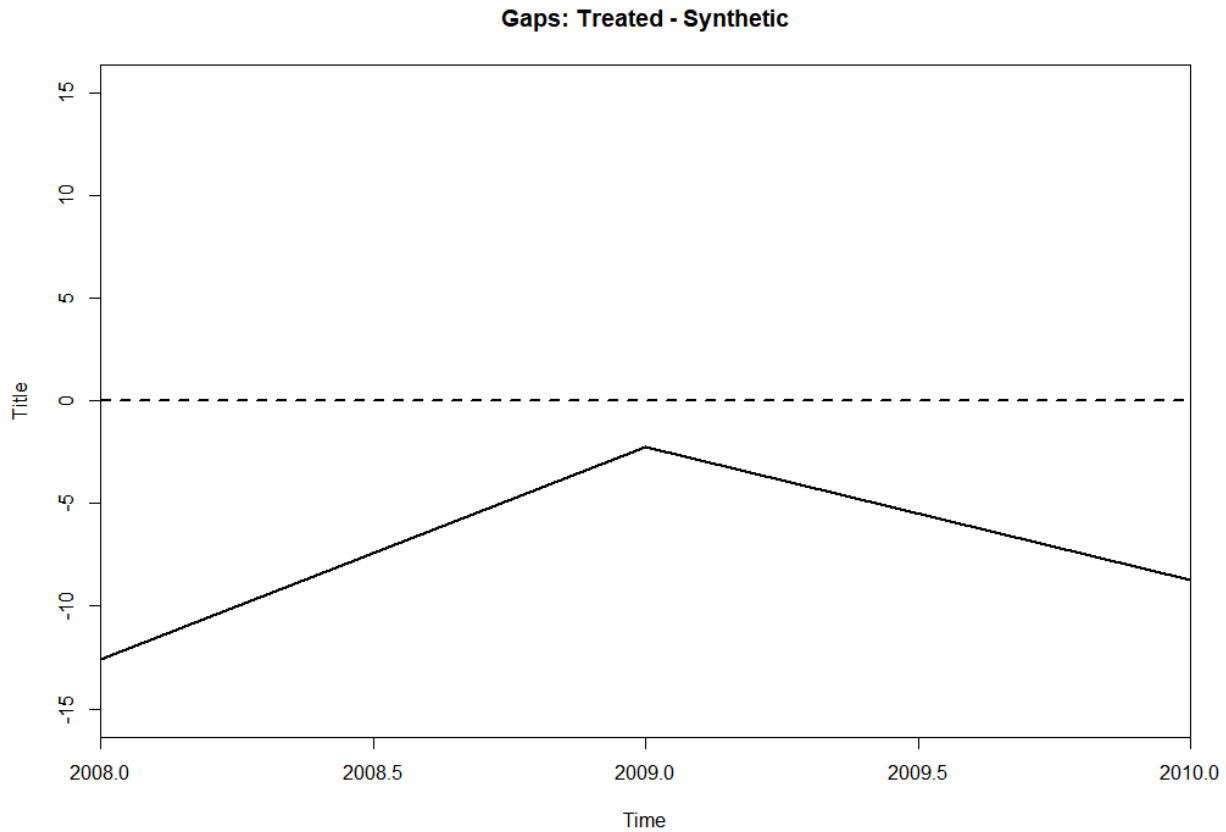


Figure 3 Time Placebo Test (Pseudo-treatment in 2009)

This article advanced the implementation of the policy to 2009 and conduct a time placebo test. Figure 3 shows a positive trend in the difference between 2009-2010, indicating that the policy effect is not driven by other time factors, and the benchmark results are robust.

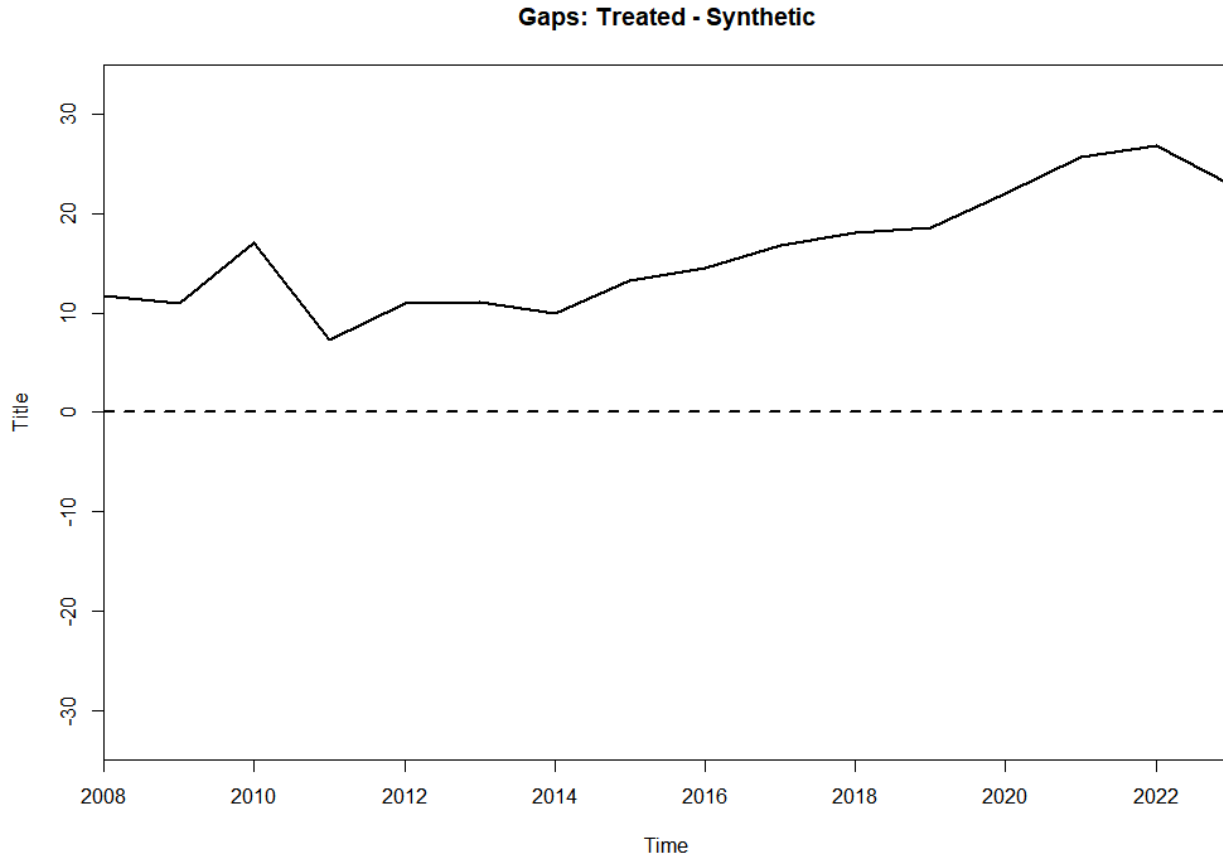


Figure 4 Spatial Placebo Test (Beijing)

This article used Beijing as a pseudo treatment group for spatial placebo testing. Figure 4 shows that after the implementation of the policy in 2011, there was no sustained negative trend similar to that of Shanghai and Chongqing, indicating that the effectiveness of the policy was not caused by random factors, and the benchmark results were robust.

5. Mechanism Testing and Heterogeneity Analysis

5.1 Mechanism Testing

The results of benchmark regression show that the real estate tax pilot policy launched in Shanghai and Chongqing in 2011 has improved housing affordability, which is consistent with the theoretical expectations of the cost effect hypothesis(H1) and the expected effect hypothesis (H2). Real estate tax may improve housing

affordability by increasing housing holding costs and lowering market expectations. However, the weaker policy effect in Chongqing compared to Shanghai may be due to differences in tax system structure design and the hypothesis of tax burden shifting (H3).

5.2 Heterogeneity Analysis

There are significant differences in tax system settings between Shanghai and Chongqing. Shanghai mainly imposes taxes on newly added housing and uses per capita housing area as a partial exemption basis. Chongqing mainly imposes taxes on high-end residential and single family commercial housing, with relatively high tax rates. The differences in tax system settings may be an important reason for the more significant policy effects in Shanghai compared to Chongqing [10]. Due to the wider coverage of the pilot program in Shanghai and the relatively limited effect of tax burden transfer, the policy effect is more significant. The pilot program in Chongqing only targets taxes on high-end

residential and single family commercial housing, and due to the tax burden transfer effect, the policy effect in Chongqing is significant but fluctuates greatly.

6. Policy Recommendations

In order to promote the improvement effect of local tax system restructuring policies on housing affordability. This article proposes the following policy recommendations:

Firstly, local tax system restructuring policies should be tailored to each city, fully considering the market characteristics of each region and improving the local tax system [11]. There are significant differences in supply and demand structure, housing price levels, and other aspects among different cities. In the future, expanding pilot projects should give local governments a certain degree of autonomy to avoid policy effects deviating from expectations due to a one size fits all approach. Secondly, tax burden shifting should be prevented to protect the housing rights and interests of low - and middle-income groups. The verification of the hypothesis of tax burden shifting indicates that in a market where supply exceeds demand, the tax burden may shift to homebuyers. Therefore, it is recommended to increase corresponding subsidies and improve the housing security system to ensure that the reform goals are not eroded. In addition, corresponding policies should be further improved to promote the stable and healthy development of the housing market. Tax reform also needs to be linked to land supply, credit policies to avoid excessive pressure on a single policy.

7. Conclusion

This study uses the real estate tax pilot implemented in Shanghai and Chongqing in 2011 as a quasi-natural experiment, and uses the SCM to evaluate the impact of local tax system restructuring policies on housing affordability. The research results indicate that the affordability of housing has been significantly improved by the pilot policy of real estate tax. This article has the following limitations. Firstly, due to the limited number of cities in the control group, it may affect the efficiency of weight allocation in the SCM. Moreover, during the implementation of the real estate tax pilot policy, oth-

er regulatory policies related to the real estate market were also implemented. Although the composite control method can separate macroeconomic shocks caused by monetary policy, economic cycles, and other factors, it is difficult to eliminate the interference brought by the superposition of policies during the same period.

Based on the empirical results of the real estate tax pilot policies launched in Shanghai and Chongqing in 2011, this article provides an empirical basis for the new round of local tax system reform. Moreover, it has reference value for optimizing the tax system structure and urban governance. With further expansion of research scope in future research plans. Incorporate data from more years and conduct more in-depth research on the effects of local tax system restructuring policies over a longer period of time. Furthermore, further evaluate the differential impact of real estate tax policies on housing affordability across different income groups and regions.

References

- [1] Guo,J., Liu,Y.Urban differences and dynamic changes in housing pressure: Measurement and Analysis[J]. Statistics and Decision making,2023,39(6):149-154. DOI:10.13546/j.cnki.tjyc.2023.06.027.
- [2] Wei Qi.Analysis of Real Estate Tax Regulation Policies in China: Taking the Shanghai Chongqing Real Estate Tax Pilot as an Example[J].China's management informatization,2022,25(5):160-163.
- [3] Lai Wenjie, Xie Jinghua, Yang Yang.Analysis of the Mechanism of Real Estate Tax on Housing Prices [J].Cooperative Economy and Technology,2023,(22):186-187.DOI:10.13665/j.cnki.hzjjykj.2023.22.005.
- [4] Chen Dongfang.The regulation and impact of real estate tax on the real estate market[J].Technology and Enterprise,2016,(8):178.DOI:10.13751/j.cnki.kjyqy.2016.08.149.
- [5] Li Jiao.Research on the Economic Effects of Consolidated Collection of Real Estate Taxes in China[D].Chongqing University,2015.
- [6] Guo Yukun.Research on the Relationship between Sustainable Development and Affordable Housing[J]. business research,2012,(5):176-181.DOI:10.13902/j.cnki.syyj.2012.05.003.
- [7] Shangfa H ,Jiaying W ,Degui Z .Has the Newly Imposed Property Tax Controlled Housing Prices? An Analysis of China's 2009–2020 Interprovincial Panel Data[J].

- Sustainability,2022,14(22):14872-14872.DOI:10.3390/SU142214872.
- [8] Fan Huixia.Value orientation and institutional support of real estate tax reform in the new era: a discussion on the name change and policy evolution of real estate tax[J].Research on Tax Economy,2019,24(1):1-7. DOI:10.16340/j.cnki.ssjjyj.2019.01.001.
- [9] CUI X Y ,WEI C S ,RAN T .HAS MONETARY POLICY CAUSED HOUSING PRICES TO RISE OR FALL IN CHINA?[J].The Singapore Economic Review,2018,1-18.DOI:10.1142/s0217590818500145.
- [10] Hua Q, Qian S, Min L, et al. (2026). Pathways to healthy real estate development driven by land finance transformation and economic structure optimization. Journal of Systems Science and Mathematical Sciences, 1-24 [2026-05-29]. J/OL. <https://link.cnki.net/urlid/11.2019.O1.20250704.1351.004>.
- [11] Wang Sen.The selection of local main tax types and the construction of local tax system in China[J]. Contemporary Economy,2020,(1):63-67.