Research on the Impact of Real Estate Tax Policy on Urban Economic Growth Based on Synthetic Control Method: A Case Study of Shanghai and Chongqing

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Abstract: The real estate tax is an effective means for the state to regulate the real estate market, and it is of great significance to study its policy effect for guiding the healthy development of the real estate market and high-quality economic growth. This paper focuses on the reform of real estate tax in Shanghai and Chongqing, selects balanced panel data of 35 medium-sized and large cities from 2006 to 2017 as research samples, adopts synthetic control analysis method to empirically analyze the impact of real estate tax pilot policy on urban economic growth, and carries out robustness test. It is found that the impact of real estate tax reform on economic growth is heterogeneous. The real estate tax reform in Shanghai significantly inhibits the urban economic growth, while the real estate tax reform in Chongqing has a strong policy strength, which promotes the urban economic growth. Therefore, this paper gives suggestions for future property tax reform, including expanding the scope of property tax collection, lifting household registration restrictions in the setting of duty-free area, and giving full support to real enterprise investment while implementing the property tax policy to promote urban economic growth.

Keywords: property tax; House prices; Economic growth; Synthetic control method

1   Introduction

After more than 20 years of vigorous development, China's real estate industry has provided an important driving force for economic growth, but the overheated real estate investment has led to the continuous rise of housing prices, which has also caused a series of negative impacts on China's economic activities. The State Council and local governments have introduced a number of regulatory policies to curb soaring housing price. among which the real estate tax has effectively controlled the growth of housing price [6] (Liu Youjin 2018).

There are not many empirical studies on the impact of real estate tax reform on economic growth, but many scholars have studied the impact of housing price fluctuation on economic growth and hold different views: First, housing price rise inhibits economic growth.Some scholars believe that the surge of housing price will lead to the rise of rent and land cost, which will lead to the misallocation of social resources and the adjustment of industrial structure. In order to escape from industry, enterprises choose to avoid reality and pursue imreality, which is

not conducive to economic growth [8](Mao Mengkai 2018). Scholar found in his study that the rise of housing price attracted too many resources into the real estate market, which would crowd out real investment, thus aggravating the hollowing out of private industry and negatively affecting economic growth[10] (Wu Haimin 2012). By establishing a dynamic model of life cycle, People found that when people expected that the rise of housing price was not sustainable, the rise of housing price would lead to the "mortgage slave effect", which inhibited consumption and ultimately hindered the sustainable development of economy[11] (Yan Se 2013). Scholors found in their study that the rise of housing price would lead to the rise of enterprise human cost, further lead to the decline of enterprise profit margin and damage economic growth. Second, rising housing prices promote economic growth [4](Chen Binkai 2018). Song Bo (2007) found that there is wealth effect in China's real estate, and the rise of housing price will lead to the increase of residents' consumption and ultimately have a positive impact on the macro economy[9]. basing on the DSGE model, found that moderate rise in housing price in the long run would promote economic growth[7] (Luo Yongmin 2012). Is there an inevitable relationship between the pilot of real estate tax and economic growth, and how does it affect the development of regional economy? Do different policies have different impacts on urban economic growth? In view of this, this paper selects panel data of 35 large and medium-sized cities from 2006 to 2017 to empirically study the impact of real estate tax policies on housing price fluctuations and urban economic growth in Shanghai and Chongqing by using synthetic control method.

2   Theoretical analysis and research hypothesis

2.1 Mechanism of Property Tax

What kind of impact the real estate tax reform will have on the urban economic growth mainly depends on its mechanism and transmission path. The most direct impact of the collection of property tax is reflected in the fluctuation of housing price. Chinese scholors show that the property tax policy can effectively control the rise of housing price, and housing price affects the flow of various production factors, investment choices of enterprises and consumption preferences of residents[5] (Liu Jiayan 2013). Therefore, this paper studies the mechanism of the impact of real estate tax on urban economic growth, mainly with the housing price as the transmission factor of enterprise investment and advanced skilled labor inflow two ways to carry out research.

House prices have an impact on business investment. On the one hand, when the housing price rises, a large amount of capital will be attracted to the real estate industry. Expanding the investment scale of real estate will also drive the increase of investment in real estate-related industries, such as household appliances, construction steel and other real economy investment, and drive the growth of real economy. On the other hand, the asset bubble caused by high housing price will restrain economic growth. The high profits of the real estate industry will induce the transfer of a large amount of capital from other industries to the real estate industry, and a large amount of capital will gather in the real estate industry, resulting in the waste and insufficiency of resources, aggravating the imbalance of China's industrial structure and affecting the sustainable and healthy development of economy. In addition, housing prices are directly related to the inflow of highly skilled labor. The real estate market is closely linked with the labor market, especially the inflow and outflow of skilled labor will affect the industrial

structure, not conducive to the development of high-tech industry and affect economic growth. On the one hand, economically developed cities with high housing prices mean more employment opportunities and rich remuneration, which will attract high-quality talents, facilitate the agglomeration of high-tech talents, promote the upgrading of industrial structure and promote the economic development of the city. On the other hand, due to the rapid rise of housing price, the migrant population will face the pressure of high housing price, which will prevent the inflow of talents, because the motivation of the high-skilled labor force to buy a house or settle down in the workplace is stronger than that of the low-skilled labor force.

2.2 Comparison of Real Estate Tax Policies between Shanghai and Chongqing

Shanghai and chongqing in early 2011 as the first pilot city real estate tax policy, although the two cities at the same time the property tax pilot, but only due to the geographical position, economic and the level of house prices there is a big difference, the two cities also differ in the emphasis of the policy making, Table 1 shows only the specific contents of the real estate tax reform.

Table 1: Concrete contents of real estate tax reform plans in Shanghai and Chongqing

Project	Chongqing	Shanghai
Expropriation scope	9 districts of Chongqing	18 administrative districts of Shanghai
Object of taxation	1. Single-family commercial residences Single-family commercial housing 2.A newly purchased high-end residence 3.No person (no household registration, no company, no job) newly purchased a second or above ordinary house	1.Newly purchased second or above houses (including second-hand houses) by Local residents 2.Houses purchased by families that are not residents of this city
Tax rate	0.5%, 1%, 1.2%	0.4%, or 0.6%
Tax bases	Tax is calculated based on taxable floor area * transaction unit price of floor area	Taxable floor area of newly purchased housing * Unit price of newly purchased housing *0.7
Tax reduction measures	Newly purchased high-end residential tax-free area for each family is 100 square meters; The tax-free area for each family of single-family commercial residence is 180 square meters; No personnel no tax-free area	Newly purchased housing tax free 60 square meters per person; Non-residents of the city newly purchased housing no tax free area

The property tax in Shanghai is mainly levied on newly added houses, and the existing houses are not included in the scope of the property tax, so the effect will be greatly reduced. Shanghai's lower tax rate is based on per capita living space and is based on an additional 70 percent discount on the value of a new purchase, with an even lower effective tax rate. Shanghai's restrictions on the migrant population are more obvious, per capita 60 square meters of

concessions can only be enjoyed by Shanghai's registered population. The real estate tax policy in Shanghai is relatively weak, which has limited ability to regulate the real estate market and can not significantly restrain the rise of housing price, which is not conducive to the overall economic development of the city. The real estate tax in Chongqing is levied on both existing and incremental houses, and the tax exemption is carried out for families. The tax object and duty-free area are treated equally, which is conducive to the inflow of labor force. The real estate tax rate is divided into three levels, and the gradient tax rate is more reasonable. The real estate tax reform of Chongqing is stronger than that of Shanghai, which has curbed the rise of housing price and has a good regulation effect, which is conducive to the healthy development of the real estate market. Chongqing's real estate tax policy can attract more talents to work and settle down, accelerate the pace of industrial innovation of high-tech enterprises, and have a positive impact on economic growth. Therefore, based on the above research, the following hypotheses are proposed:

H1: The property tax policy of Shanghai inhibits the economic growth of the city.

H2: The real estate tax policy in Chongqing promotes the economic growth of the city.

3 Research design

3.1 Model Construction

Differential difference method (DID) is a common policy evaluation method, but DID is susceptible to subjective factors in the selection of the control group. If there is no parallel trend between the treatment group and the control group before the policy intervention, the evaluation results are often biased, and the influence brought by the policy is eventually overestimated or underestimated. Abadie & Gardeazabal (2003) proposed a new policy effect evaluation method -- Synthetic control Method (SCM), which can overcome the above defects of DID and objectively evaluate the effect of policy implementation [2].The basic idea is to construct a "counterfactual" control group by weighted average of multiple control groups in a data-driven way, and the sum of the weight coefficients of the synthesized object is 1.Synthetic control method reduces the error based on artificial subjective choice, ensures the objective rationality of synthetic object and avoids the endogenous problem of policy.

In the context of the housing tax pilot reform policies of Shanghai and Chongqing, suppose there are K+1sample citys, T_0 represents the year of implementing the housing tax pilot policy.$1 \leq T_0 < T$, k=1 represents the cities that will carry out the pilot reform of property tax in T_0, is the processing group; The control group was represented by the cities that had not implemented the property tax pilot policy.k =2 to k=K+1 represent the cities that have not implemented the property tax pilot policy and are the control group. For city i=1,...,K+1 and t=1,...,T, period T, use$B_{it}^N$to represent the economic growth level of city i in period t without implementing the property tax pilot policy, and use$B_{it}^N$to represent the economic growth level of the city i that implemented the property tax pilot policy in period t. The setting model is as follows:

$$B_{it} = B_{it}^{N} + C_{it}\alpha_{it} \qquad (1)$$

Where C_{it} represents the dummy variable of whether the real estate tax pilot is implemented in city i at the moment t. If the real estate tax pilot is not implemented, the value of variable C_{it} is 0; otherwise, there is $C_{it}=1$. When $t \geq T_0$, the change value of economic growth level of region i is:

$$\alpha_{it} = B_{it}^{I} - B_{it}^{N} = B_{it} - B_{it}^{N} \qquad (2)$$

Bit is the economic growth level of the city after the implementation of the real estate tax pilot. For Shanghai and Chongqing in the reform area, Bit can be observed through macro data, but B_{it}^{N} cannot be directly observed, and then. You can't figure it out, so you build a model to estimate:

$$B_{it}^{N} = \sigma_{t} + \theta_{t}M_{i} + \lambda_{t}\mu_{i} + \varepsilon_{it} \qquad (3)$$

Where σ_t as the time fixed effects, and M_i is not affected by other real estate tax policy influence the level of economic growth can be observed in the control variable, θ_t for the unknown parameter vector, λ_t is unobservable mutual influence urban economic growth of the other factors, for the unknown parameter vector μ_i, ε_{it} stands for an observation of the temporary shocks and averages.

To solve B_{it}^{N}, first set a (K×1) dimensional control vector weight $W = (\omega_2, \omega_3, \ldots, \omega_{K+1})$, for any k=2,3,...,K+1, satisfy $W_k \geq 0$ and $\omega_2 + \omega_3 + \ldots + \omega_{K+1} = 1$. The value of each given weight vector W represents a specific synthetic control combination, and the result variable value of each control group city can be weighted to obtain:

It is assumed that the optimal weight vector $W^* = (\omega_2^*, \omega_3^*, \ldots, \omega_{K+1}^*)$ can make the observation results of synthetic control objects in Shanghai and Chongqing be the same as the actual observation results in Shanghai and Chongqing before the real estate tax policy pilot, namely:

$$\sum_{k=2}^{K+1}\omega_{k}B_{it} = \delta_{t} + \theta_{t}\sum_{k=2}^{K+1}\omega_{k}M_{k} + $$
$$\lambda t\sum_{k=2}^{K+1}\omega_{k}\mu_{k} + \sum_{k=2}^{K+1}\omega_{k}\varepsilon_{kt} \qquad (4)$$

If $\sum_{t=1}^{T_0}\lambda_{t}^{'}\lambda_{t}$ is a non-singular matrix, it can be further obtained:

$$B_{it}^N - \sum_{k=2}^{K+1} \omega_k^* B_{kt} = \sum_{k=2}^{K+1} \omega_k^* \sum_{f=1}^{T_0} \lambda_t \left(\sum_{n=1}^{T_0} \lambda_n' \lambda_n \right)^{-1}$$

$$\lambda_f' \left(\varepsilon_{kf} - \varepsilon_{1f} \right) - \sum_{k=2}^{K+1} \omega_k^* \left(\varepsilon_{kt} - \varepsilon_{1t} \right) \tag{5}$$

The above formula is infinitely close to 0 under general conditions. When $t \in (T_0, T]$, $\sum_{k=2}^{K=1} \omega_k^* B_{it}$ can be used as an unbiased estimate of B_{it}^N, and the effect of the real estate tax policy implemented by the treatment group can be expressed as:

$$\hat{\alpha}_{1t} = B_{1t} - \sum_{k=2}^{K+1} \omega_k^* B_{kt} \tag{6}$$

3.2 Data Sources and Descriptive Analysis

This paper studies the impact of real estate tax reform on urban economic growth, selects the per capita GDP of each city as an evaluation index of economic growth, and performs logarithmic processing on sample data in order to eliminate the impact of time series heteroscedasticity. In this paper, the following other predictors of urban economic growth are selected: urbanization level (urb), medical and health level (med), fiscal decentralization (fin), degree of marketization (market), urban innovation level (tec) and industrial structure (str). In terms of measurement, the urbanization level is expressed by the ratio of the non-agricultural population of each city to the total population of the region. The medical and health level is represented by the number of beds in medical institutions; iscal decentralization is expressed by the ratio of revenue and expenditure in the general budget of local finance. The degree of marketization is expressed by the ratio of added value of tertiary industry to GNP. The level of urban innovation is expressed by the number of patent applications; The industrial structure is expressed by the ratio of the output value of the secondary industry and the tertiary industry.

This paper selects 35 large and medium-sized cities determined by the National Bureau of Statistics as sample cities. The time span was from 2006 to 2017, with Shanghai and Chongqing as the treatment group and the other 33 cities as the control group for synthetic control. Data of all variables are derived from China Statistical Yearbook, provincial statistical yearbook and EPS database over the years. The descriptive statistical results of each variable are shown in Table 2.

Table 2: Descriptive statistics of variables

Variable	Obs	Mean	Sd	Min	Max
lngdp	420	10.70	1.519	2.290	12.150
urb	420	0.703	0.129	0.440	1.000
med	420	10.41	0.657	8.748	12.090
fin	420	0.750	0.171	0.261	1.541
market	420	0.512	0.090	0.349	0.806
tec	420	1.231	1.688	0.006	10.680
str	420	0.908	0.290	0.235	1.622

4   Empirical analysis

Shown in Table 3 for Shanghai and Chongqing as treatment group respectively predicted variables affect the level of urban economic growth under the fitting values and the ratio, the urban economic growth level in 2006, the value of 2008 and 2010 as prediction variables, fitting and synthetic value difference is small, are close to clearly indicates that the city can well fit the actual situation of the city.

Table 3: Prediction variables fitting table

Preditor variable	The actual Shanghai	Synthesis of Shanghai	The actual Chongqing	Synthesis of Chongqing
urb	0.887	0.879	0.556	0.650
med	11.581	10.808	11.617	10.376
fin	0.897	0.880	0.557	0.744
market	0.605	0.624	0.426	0.447
tec	4.485	3.813	1.893	1.802
str	0.659	0.631	1.157	1.225
Lngdp (2006)	10.915	10.911	9.541	9.561
Lngdp (2008)	11.144	11.139	9.945	9.937
Lngdp (2010)	11.282	11.281	10.243	10.241

Based on the synthetic control method, 34 cities excluding Chongqing are used to synthesize Shanghai, with the weights of Beijing (0.297), Guangzhou (0.229), Hangzhou (0.109), Shenzhen (0.326), Xi 'an (0.007), Zhengzhou (0.032), and the weights of other cities are 0. This shows that the weighted average of these six cities can well fit the economic growth of Shanghai before 2011, and its weighted average can be used as the control group of Shanghai. FIG1 reflects the trend of real and composite Shanghai's economic growth levels from 2006 to 2017, with the vertical dashed line showing the pilot time of the property tax policy in 2011. It can be observed from the figure that before 2011, the trajectory of the dashed line representing synthetic Shanghai is basically consistent with that of the solid line representing actual Shanghai, indicating that synthetic Shanghai well fits the actual economic growth level of Shanghai before the implementation of the property tax policy. After the implementation of the real estate tax policy in 2011, the actual value and the synthetic value gradually showed an obvious trend of separation. Although both showed sustained economic growth, the synthetic value was generally greater than the actual value, indicating that the reform of real estate tax had a significant inhibitory effect on the economic growth level of Shanghai. Hypothesis H1 is verified, that is, the real estate tax pilot policy in Shanghai has a restraining effect on urban economic growth.

The weight coefficients of Changsha (0.143), Hefei (0.638), Nanning (0.161) and Xi 'an (0.058) were obtained by similar synthetic control for Chongqing. FIG2 reflects the changes in the economic growth level of actual Chongqing and synthetic Chongqing from 2006 to 2017. Like Shanghai, before the implementation of the property tax policy, the economic growth path of Chongqing is highly consistent with that of its synthetic cities, with a good fit. However, after 2011, the two curves show a trend of deviation and the gap is getting wider. Compared with

synthetic cities, Chongqing has achieved greater economic growth, which indicates that the implementation of real estate tax policy has played a role in promoting the economic growth of Chongqing. Hypothesis H2 is verified. But before the formal property tax pilot reform in Chongqing a year, two curves have been deviation, Chongqing has reported to the State Council may be related to the beginning of 2010 property tax related solutions, "special housing consumption tax" plan has been approved, then controversial rapidly in Chongqing, raised market expectations for the property tax, So the real impact of the property tax is supposed to have begun as early as 2010.
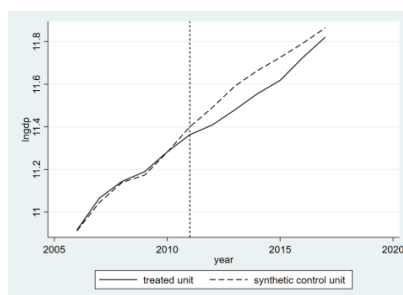
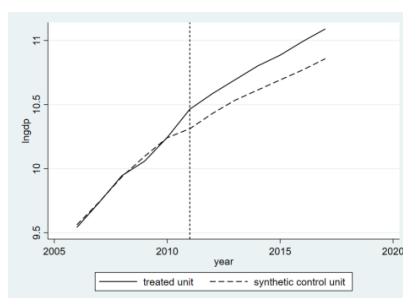FIG.1 Actual and synthetic Shanghai

FIG.2 Actual and synthetic Chongqing

5 Robustness test

Although the above empirical findings show that there is a significant difference between the actual urban economic growth level and the synthetic urban economic growth level after the implementation of the policy, is this difference necessarily caused by the property tax reform, or is it driven by other factors? In order to eliminate the interference of chance factors, the robustness of the above empirical results was tested by ranking test and placebo test.

5.1 Sorting Test

The core idea of ranking test is as follows: assume that in the control group, not the implementation of the property tax has to implement the policy of city, in the same way using synthetic control method constructs the corresponding urban synthetic control object, get the level of economic growth of the cities and synthesis of gap, aligning the treatment effect of all these cities, if processing group of individual effect in the whole of the end of the sort, It is

considered that the effect of real estate tax policy on the economic growth level of Shanghai and Chongqing is statistically significant, which proves the robustness of the estimated results. In this paper, learning from previous practice[3] (Abadie 2010), the control cities whose RMSPE value was more than 1.5 times that of the cities where the policy was implemented before the real estate tax reform were removed, and the remaining cities were sorted and the treatment effects were arranged. FIG3 and FIG4 gives out the greater than 1.5 times the area of Shanghai and Chongqing in Shanghai, Chongqing and other cities after the difference between the value distribution, found that real estate tax reform in 2011, a former Shanghai, Chongqing and other cities are relatively small changes in the gap, better fitting of sex, but after policy implementation pilot the gap between city and other cities began to increase, Moreover, the distribution curves of Shanghai and Chongqing are located outside other cities, which indicates that the probability of significant economic growth similar to that of Shanghai and Chongqing is extremely low by randomly selecting a control city for the sample test, indicating that the real estate tax pilot has significantly inhibited the economic growth of Shanghai and promoted the economic growth level of   Chongqing.
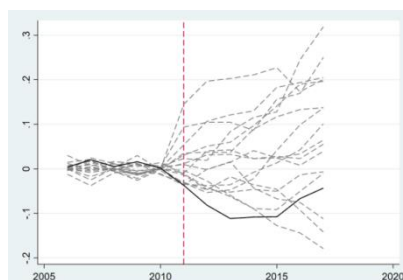

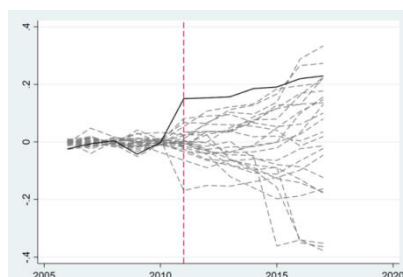FIG. 3 Distribution of economic growth difference between Shanghai and other cities

FIG.4 Distribution of economic growth difference between Chongqing and other cities

5.2 Placebo Test

Using the method of ABADIE (2015) for reference, a city without a property tax policy was selected to conduct the placebo test [1]. assumes that the urban real estate tax reform in 2011, the use of synthetic control build out of the city's synthetic objects, comparing the difference between the city the city and its synthesis and its changing trend is consistent with Shanghai or Chongqing, if consistent criterion shows that the change of the urban economic growth level may be caused by other factors. Taking the economic growth level of Shanghai as an example, Shenzhen, the city with the highest weight in Shanghai, is selected to show that Shenzhen has

the highest similarity with Shanghai among all the cities. FIG5 is the result of the placebo test for Shenzhen. Similarly, for the placebo test of Chongqing, Hefei with the highest weight was selected for the experiment, and the results are shown in FIG6. Shenzhen's economic growth level after 2011, the composite value is greater than the real value, and the situation is completely opposite to that of Shanghai. Compared with Chongqing, Hefei does not present the same change state as Chongqing. Therefore, the placebo test proves that the property tax pilot reform is a factor affecting the urban economic growth in Shanghai and Chongqing, rather than other common accidental factors.
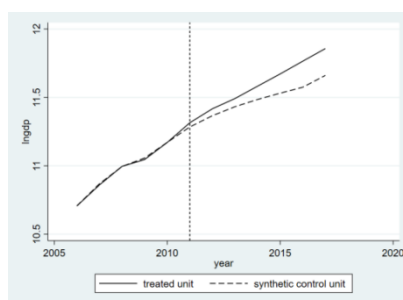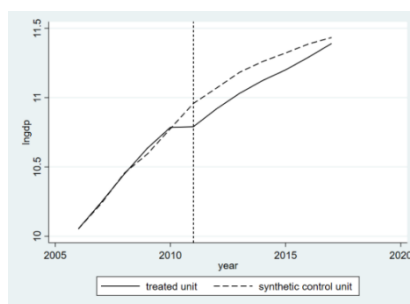

FIG.5 Actual and synthetic Shenzhen

FIG.6 Actual and synthetic Hefei

6　Conclusions and implications

This paper adopts synthetic control method to empirically study the impact of different real estate tax pilot policies in Shanghai and Chongqing on urban economic growth. It is found that the implementation of the real estate tax pilot policy has a restraining effect on the economic growth of Shanghai, but promotes the economic growth level of Chongqing. The research shows that the real estate tax reform of Shanghai is weak, only levied on incremental housing property tax, property tax policy is not attractive to advanced skilled labor force, is not conducive to the development of high-tech industry, inhibit economic growth. The real estate tax policy of Chongqing includes part of the stock houses into the tax scope, and the multi-tax rate setting is more reasonable, which effectively restrains the rise of housing price in Chongqing and promotes the development of real economy. The tax exemption policy attracts the inflow of advanced skilled labor force, and the talent concentration promotes industrial upgrading and

economic growth. In the future, when other cities carry out real estate tax reform in China and draw lessons from the practical experience of Shanghai and Chongqing, it is necessary to formulate real estate tax policies scientifically and rationally to promote economic growth. Based on this, this paper puts forward the following suggestions:

First, expand the property tax collection object range. Shanghai and Chongqing both levy property tax on incremental housing. Although Existing housing is included in the scope of taxation in Chongqing, it is only part of the existing housing stock, such as single-family commercial housing, and the proportion of taxable housing in the city is very low. Residents who own several houses are not regulated by the policy, and the effect of restraining the rise of urban housing price is not obvious, which is not conducive to economic development. China has a large population and faces great resistance. Other cities can learn from the real estate tax reform experience of Chongqing, and first include high-end residences in the collection scope, and further include people with multiple ordinary residences in the collection scope of stock houses, so as to reduce the resistance of deepening the real estate tax reform.

Second, restrictions on household registration shall be lifted for the establishment of duty-free area. Shanghai is right the 2nd that family of this city dweller buys reach above residence to bring into collect limits, give per capita area of 60 square metre duty-free, to the home of 3 commonly for, purchase bridal chamber need not collect tax basically. For non-local household registration residents need to purchase a new taxable area for the tax base. There is no household registration restriction in the establishment of duty-free area in Chongqing. We should learn from the real estate tax reform experience in Chongqing, and lift the household registration restriction on the establishment of tax exemption standard, attract talents to settle down, develop high-tech enterprises, and drive the growth of urban economy.

Third, while implementing the real estate tax policy, the government should introduce auxiliary policies to encourage substantial investment by real enterprises. Local governments should specifically introduce a series of corresponding policies in bank credit, fiscal subsidies and other aspects for real enterprises to fully support the investment of real enterprises and promote high-quality economic development.

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