

The Impact of Property Tax on House Prices--Theoretical analysis based on the supply and demand model and the four-quadrant rule

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Abstract. This paper analyzes the impact of the real estate tax on house prices from theoretical models such as the long- and short-term supply and demand models and the four-quadrant analysis model, followed by a real estate tax country analysis. It is found that for most small and medium-sized cities, a real estate tax that imposes a tax on both the transfer and retention segments will lead to a significant decline in house prices in the medium to long term, but overall, house prices will still fluctuate up and down from the original trend. For cities with high house prices and large house price increases, a tax on only the transfer link will only drive The conclusion has some predictive value for the effect produced by the pilot real estate tax reform work, and at the same time, it has some guiding significance for the proposal of real estate tax reform in the paper.

Keywords: Real estate tax, house price, supply and demand model, four-quadrant rule.

1. Introduction

The real estate tax is about the livelihood of people and the fundamental of national taxation. With the continuous implementation of the policy and extensive research, academic circles have different views on how the real estate tax is heading.

Some scholars argue that the impact mainly comes from the tax-induced imbalance between supply and demand. Chen Ruohan and Hong Xiaohe (2020) [1] argue that taxes promote the rise of holding costs, and Chai Xiaojun (2016) [2] argues that buyers bear more tax burden when taxes are imposed. Other scholars argue that the impact mainly comes from the rational redistribution of social resources caused by taxes. Lin Yuan (2018) [3] says that the market cannot allocate resources rationally, and taxation helps to narrow the gap between the rich and the poor; Liu Xueying (2017) [4] says that real estate tax, as a variation of personal income tax, reflects the principle of "taxation by quantity and capacity".

Several countries and regions, such as the real estate tax collection experience of the US, UK, and China discussed by Zhang Zhijie (2020) [5], the comparison of real estate tax collection in the US, Japan, and Hong Kong discussed by Yue Shuang (2018) [6], the analysis of real estate tax experience in the US discussed by Chi Lihua (2014) [7] and Ding Coco (2015) [8], and the real estate tax reform in Japan discussed by Li Yingwei (2020) [9], have relatively mature real estate tax policies that It is worthwhile for China to learn from them.

At this stage, more detailed policies related to real estate tax are still being piloted in some cities in China, and the degree of impact is different for cities with different degrees of development. The research on the impact of the real estate tax on housing prices mainly focuses on its long-term impact, but less on the long-term and short-term differences, and it does not consider the equilibrium relationship within the real estate market, so this paper provides some reference ideas for the existing research [10,11].

2. Current status of the real estate tax and purpose of reform

At present, the structure of property tax levy in China has the problem of imbalance between the proportion of taxation in circulation and retention - the taxation in real estate retention is light, and

the taxation in real estate circulation is heavy. For the retention link, all personal non-operating properties are not within the scope of national tax collection, and the tax amount of the land retention link does not match with the actual value of the land; for the circulation link, since real estate has investment properties, levying real estate tax in the circulation link will raise the investment cost, making Chinese investors own more vacant properties and impeding the flow of real estate resources.

China's real estate tax currently suffers from unreasonable tax calculation basis, imperfect assessment system, limited pilot scope, lack of complete legal basis, and imperfect legislation

The main purposes of real estate tax reform are: to increase fiscal revenue and improve the local tax system; to regulate the property market and suppress property prices; to regulate the social distribution and narrow the gap between the rich and the poor; to strengthen housing management and improve the efficiency of housing tenure^{2.2}

3. Theoretical analysis

3.1. Short-term supply and demand model

Short-term supply-side impact of real estate taxation: In the housing market, the supply side mainly includes developers of new housing and investors in second homes. In terms of willingness to supply and ability to supply.

(1) For new housing developers: In the short run, the supply elasticity of new housing is small because it is affected by land, construction materials, and construction time. That is, the supply capacity of new housing developers is almost fixed, and the supply side cannot adjust the supply quantity in time in the short term. The supply curve is shown in Figure 1.

(2) For second-home investors: In the short term, the levy of the real estate tax will raise the holding cost of second-home investors, so that some second-home investors have a strong willingness to sell the properties in their hands to reduce their own holding cost, i.e., the supply willingness of second home investors is significantly higher. And a larger portion of second home investors have multiple properties in their hands, i.e., the supply capacity can be guaranteed to a certain extent. Based on this, the levy of the real estate tax will cause second home investors to increase the supply of second homes in the market, as shown in Figure 2.

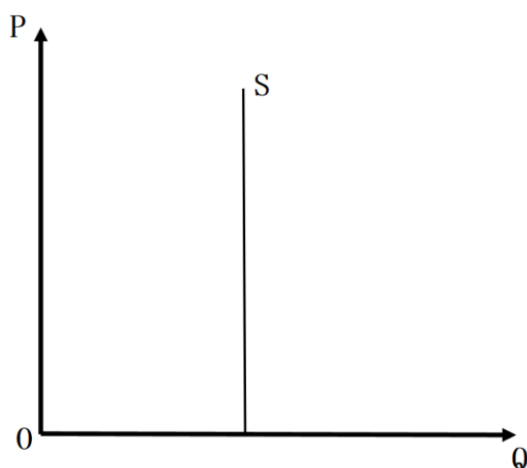


Figure 1. Supply curve of the new housing market in the short term

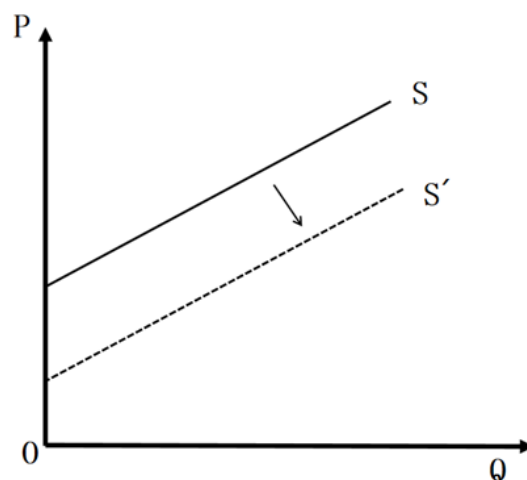


Figure 2. Supply curve of the secondary housing transaction market in the short term

Short-term impact of the real estate tax on the demand side: For the demand side, it mainly affects the housing market in terms of consumers' willingness to pay and ability to pay; and the real estate tax mainly affects the willingness to pay of the demand side.

In China's housing market environment, most demand-side demand for housing is rigid, i.e., the first-time purchase of a home for residential purposes. Before the real estate tax, the demand side only pays for home purchases, while after the real estate tax is imposed, the cost-effectiveness of

home purchase decreases, causing some consumers to choose not to purchase a home in the short term or to rent a home instead of purchasing a home. The demand curve shifts left (from D to D'), as in Figure 3.

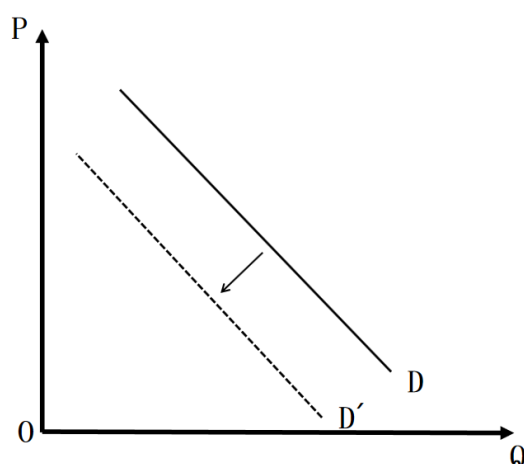


Figure 3. Demand curves for the housing market (new housing market and secondary housing market) in the short term

The impact of imposing a real estate tax on housing prices in the short term is based on both supply and demand.

(1) For the new housing market: In the short run, the imposition of real estate taxes does not produce a significant change in supply, and the supply curve remains almost unchanged. And consumers' willingness to purchase homes decreases, as shown in Figure 4, and house price decreases from P_0 to P_1 .

(2) For the secondary home market: In the short run, house prices decrease (from P_0 to P_1) as the cost of holding second homes increases and investors in second homes choose to sell a large number of second homes, the supply of second homes increases, and consumers are less willing to purchase homes, as shown in Figure 5.

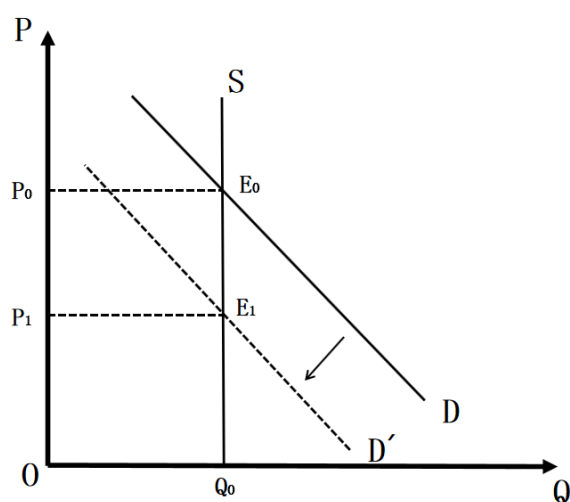


Figure 4. Equilibrium changes in the new housing market in the short-term

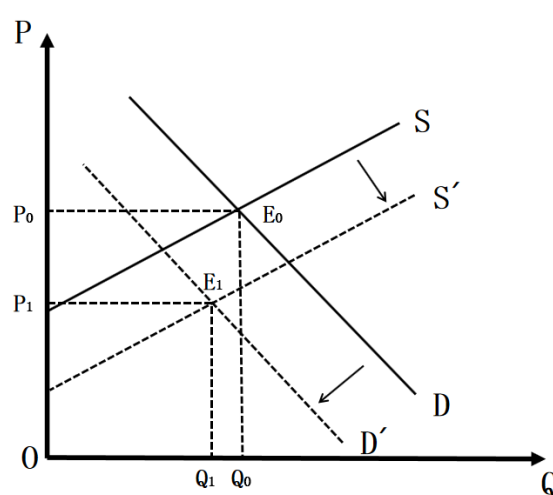


Figure 5. Equilibrium changes in the secondary housing transaction market in the short term

3.2. Long-term supply and demand model – a general model of tax pass-through

The supply side of the real estate market consists of real estate developers, i.e., the supply side of new housing, and investors in second homes. Since the price elasticity of the supply and demand sides is different, which leads to different tax burdens after taxation, part of the tax may be passed on from the supply side to the price paid by the demand side. Based on the analysis of the tax pass-through

problem based on the supply and demand price curves, it can be concluded that the levy of the real estate tax will lead to an increase in house prices in the long run.

The difficulty of tax pass-through is assumed to be positively proportional to the price elasticity of demand and inversely proportional to the price elasticity of supply. When the market is in equilibrium, there is an equilibrium point of supply and demand E_0 , an equilibrium transaction price P_0 , and an equilibrium quantity Q_0 . After the real estate tax is levied, the cost of purchasing a house rises, and the new equilibrium point of supply and demand is E_1 , the new transaction price is P_1 , and the equilibrium quantity is Q_1 . The difference between P_2 and P_1 is the actual amount of tax levied T , as shown in Figure 6.

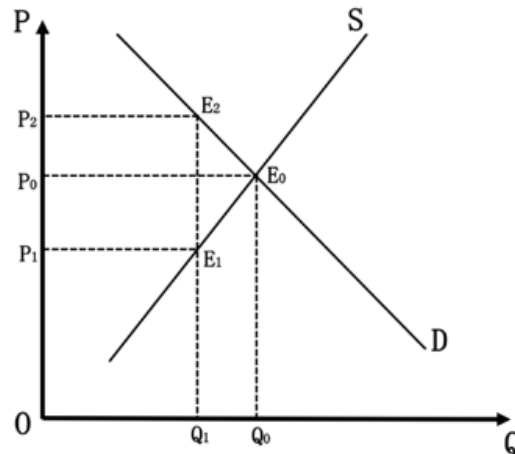


Figure 6. Impact of taxation on housing market equilibrium in the long run

After taxation, the actual number of transactions is Q_1 and the seller's actual price is P_1 , which is the real price of the house transaction, but due to the presence of taxation, it causes price changes between buyers and sellers, and the buyer has to pay a higher price than the original price P_2 . The price elasticity of supply and price elasticity of demand can be expressed as follows, respectively

$$E_d = \frac{dQ_D}{dP} \cdot \frac{P}{Q_D} \quad (1)$$

$$E_s = \frac{dQ_S}{dP} \cdot \frac{P}{Q_S} \quad (2)$$

An increase in taxation increases the tax burden on both supply and demand. The degree of tax burden depends on E_s and E_D .

Assuming a constant total tax amount T , when $\frac{E_s}{E_D} < 1$, the tax is borne more by the supply side (area in yellow), as in Figure 7.

When $\frac{E_s}{E_D} > 1$, the tax is borne more by the demand side (area in blue), as in Figure 8.

In the extreme case, $E_s = 1$ i. e. the supply is perfectly elastic, when the supply side is unaffected by the tax and the demand side bears the full tax (blue part of the area), as in Figure 9.

When $E_D = 1$, the demand is fully elastic, the demand side is not affected by the tax and the supply side bears all the tax (yellow area), as in Figure 10.

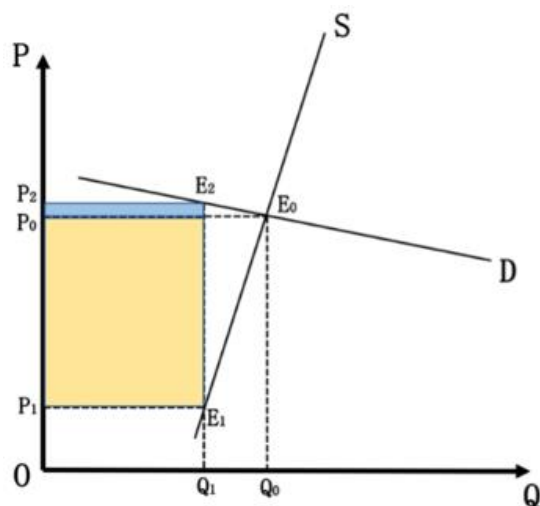


Figure 7. Tax burden sharing between supply and demand when $\frac{E_S}{E_D} < 1$,

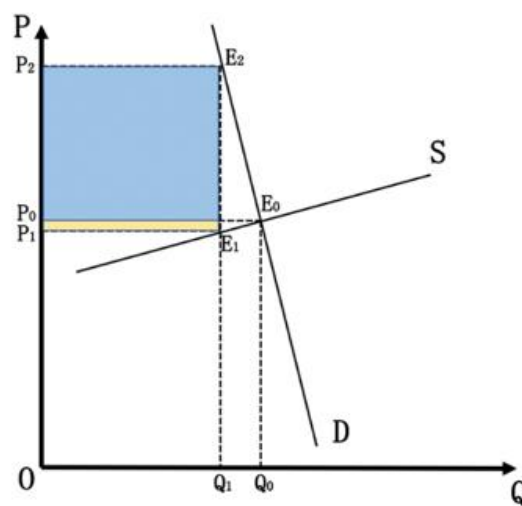


Figure 8. Tax burden sharing between supply and demand when $\frac{E_S}{E_D} > 1$,

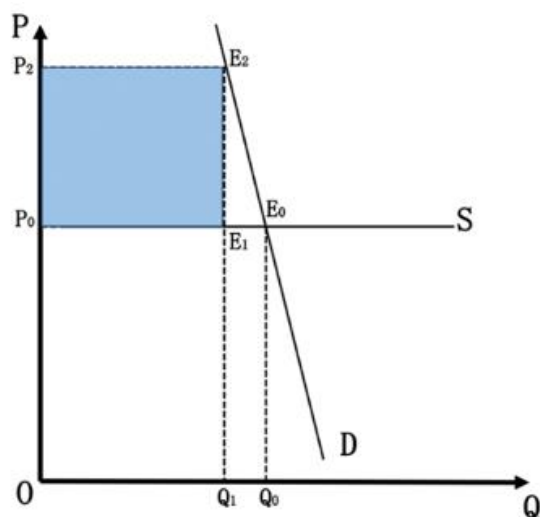


Figure 9. The demand side bears all taxes when $E_S=1$

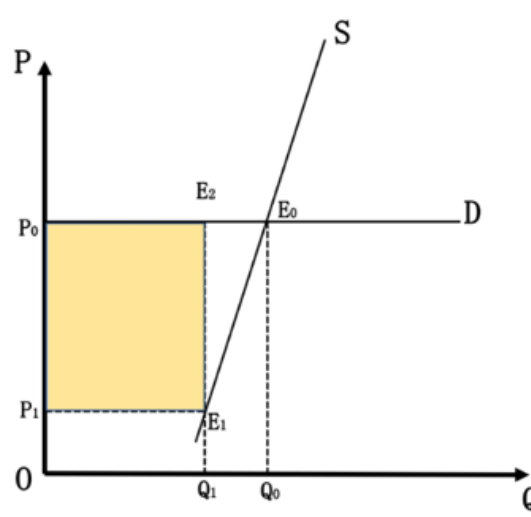


Figure 10. The supply side bears all taxes when $E_D=1$

It is assumed that in the long run, the housing demand curve slopes to the upper right. For the housing supply curve, the housing supply curve is steeper in the long run relative to the short run, although the supply side can adjust its supply behavior by adjusting its production factor inputs, due to the scarcity of land resources used for property development, in the long run, the long-term housing supply capacity is limited. When the price decreases to a certain level A_1 , the cost of sale is greater than its transaction price, and the housing supplier cannot achieve the expected return and thus prefers to hold the house or land in its own hands instead of selling it to the outside world. So the long-run housing supply curve can be expressed as $LS_1 A_1$. D_1 is the homebuyer demand curve and Q_1 is the equilibrium quantity.

After taxing buyers in the long run, their demand changes the same as in the short run, and the demand curve moves from D_1 to D_2 because of the higher purchase cost. Since the supply curve is horizontal at this time, the equilibrium price is constant at A_1 , i.e., taxing buyers alone, in the long run, does not cause price changes.

After the tax is imposed on the seller in the long run, according to the principle of tax burden shifting, the buyer needs to pay a higher price to make up for part of the tax compared to before, so the demand curve moves from D_1 to D_3 , at which time the equilibrium price rises to A_2 and the supply curve becomes $LS_2 A_2$, as in Figure 11.

Price fluctuations in the second-hand housing transaction market are directly influenced by the tax policy of the tenure segment. From the supply point of view, the short-term sale of second-hand houses reduces the future supply of second-hand houses, the supply curve shifts from S to S' , and the price of second-hand houses rises. From the demand point of view, in the short term, buyers with rigid demand will not change significantly because they are in a wait-and-see situation to buy housing considering the uncertainties of tax policies. In the medium and long term, due to the continued stable operation of tax policy, some buyers with a wait-and-see attitude in the short term will choose to purchase housing, and the potential demand for housing will decrease and the actual demand will increase, and the equilibrium price will be rise as P' . In addition, new housing and second homes are substitutes, and a rise in the price of second homes will cause those homebuyers who originally wanted to buy second homes to shift their demand into the new housing market, causing the price of new housing to rise, as shown in Figure 12.

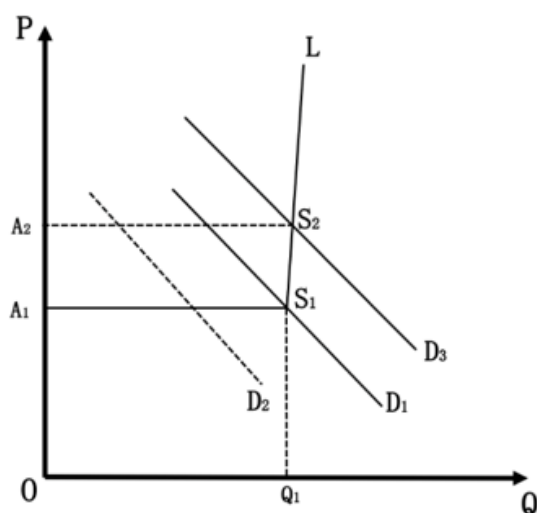


Figure 11. Impact of a separate tax on buyers and sellers on the equilibrium of the new housing market in the long run

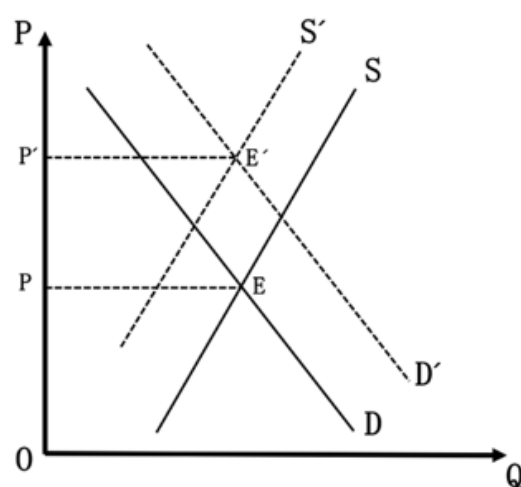


Figure 12. Impact of the tax on the equilibrium of the secondary housing transaction market in the long run

3.3. Four-quadrant analysis model

The model provides an overall analysis of the real estate market based on the flow phase and the retention phase of the market, combining rents and new development and construction volumes that affect the supply and demand of both.

Rents are a measure of the level of income of housing in the retention phase. Rents can be considered as the cash flow generated by current and future housing. Changes in rents affect the demand for housing in the flow phase of real estate.

The amount of new construction and development affects two phases of real estate: the turnover phase and the retention phase. The supply of housing in the flow phase of real estate increases with the amount of new construction and development, while the price decreases in both phases.

In Figure 13, the property stock S , rent R , price P , and new construction C are used as axes in four directions. Two quadrants, I and IV, represent the homeownership phase, and two, II and III, represent the housing turnover phase.

On the corresponding axes, the values are taken to be positive, and the values from the origin, which extend outward, become larger in turn.

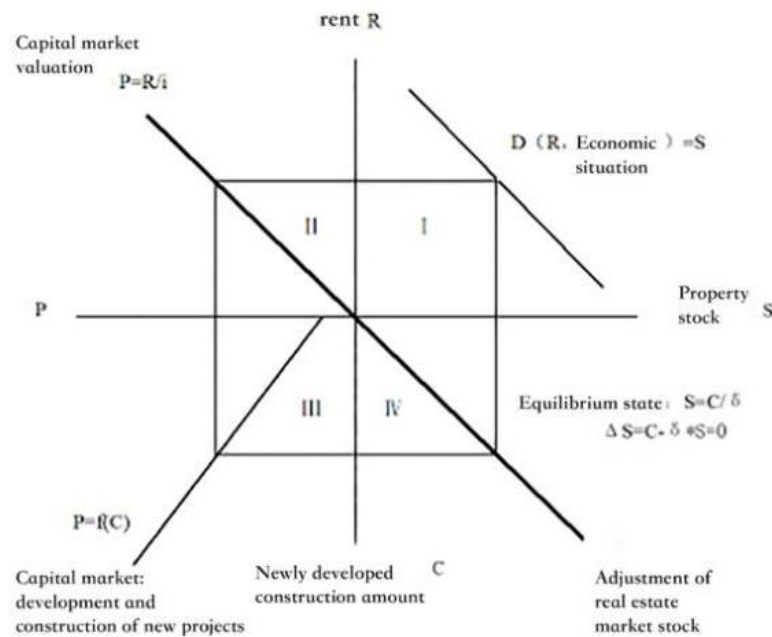


Figure 13. Relationship between the real estate property market and capital market

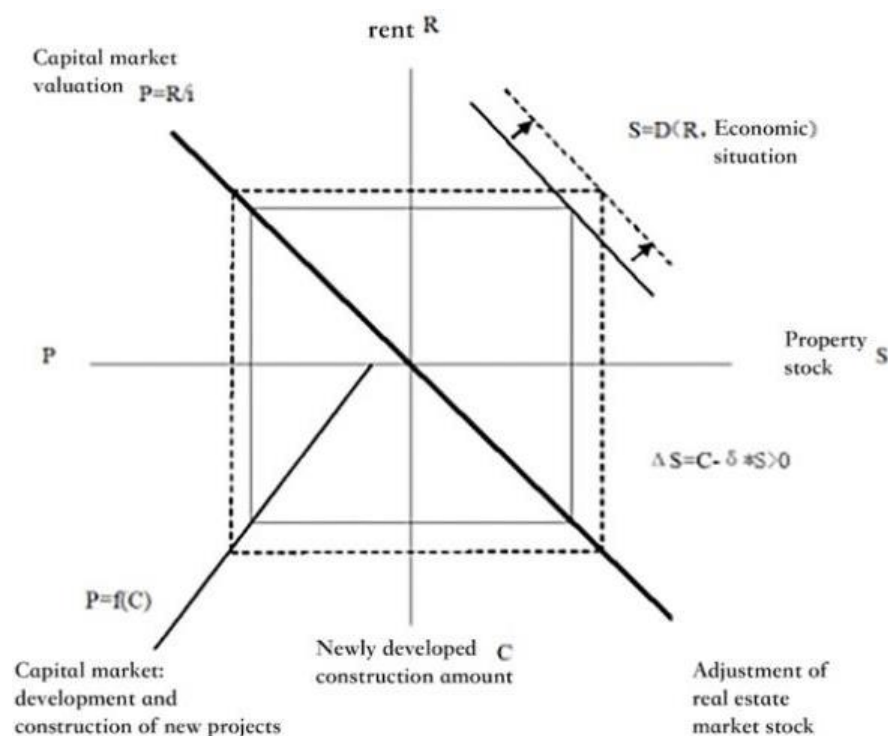


Figure 14. Property and capital markets: Demand D changes - R rises

Quadrant I cover the two variables of property stock S (per square meter) and rent R . The property stock is the property supply. The curve represents the demand for property D . It shows that the demand for property D is equal to the stock of property S at a specified level of interest rates and economic conditions, which confirms the rent level R . This curve shows that in the real estate property market, the stock of property is linearly and negatively correlated with the rent.

The property stock S is determined by the capital market, so the corresponding property supply and demand equilibrium point on the curve can be found by drawing a line perpendicular to the horizontal coordinate axis on the corresponding property stock S . The corresponding rent R can be found by drawing a line perpendicular to the vertical coordinate axis from that point.

Quadrant II contains two variables, rent R and price P . The ratio of rent to price is a certain value and the capitalization rate of real estate capital. This is an exogenous variable that can be expressed

as the capitalization rate at which investors are willing to hold real estate, and this ratio is determined by the return on investment of various assets in the capital market. This quadrant shows the relationship between rents and prices. The curve shows that rents are linearly and positively related to property prices in the capital market.

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The corresponding equilibrium point of the rent price on the curve can be found by drawing a line perpendicular to the vertical axis of the rent R . The corresponding price P can be found by drawing a line perpendicular to the horizontal axis from that point.

You can find the corresponding price equilibrium point on the curve by drawing a line perpendicular to the horizontal coordinate axis on the price P , and find the corresponding new development construction volume C by drawing a line perpendicular to the vertical coordinate axis from that point.

Quadrant IV contains two variables: the volume of new development construction C (square meters) and the amount of housing stock available S (per square meter). At this point, the new development and construction volume C is converted to the long-term housing stock in the process from the flow phase to the retention phase. The new development and construction volume less depreciation loss of the property stock gives the long-term stock. Denoting the depreciation rate by δ , $\Delta S = C - \delta S$. In the equilibrium state, the depreciation rate equals the new completion rate. Therefore, $\Delta S = 0$ and $S = C/\delta$. This quadrant reflects how newly developed properties are converted into property stock.

A line perpendicular to the vertical axis can be drawn on the amount of newly developed construction C to find the corresponding equilibrium point on the curve for the old and new transformation, and a line perpendicular to the horizontal axis can be drawn from that point to find the corresponding property stock S .

So far, from the analysis of the four quadrants, it is known that the four quadrants will form a relatively stable rectangle when equilibrium is reached between the variables. The factors relatively constrain each other to relative equilibrium, and when one of the factors changes, the remaining factors will also change until a new equilibrium level is reached.

When the economy grows, the demand for real estate market D increases, and the transmission path is expressed as follows: rent R rises $\rightarrow$ property price P rises $\rightarrow$ new development and construction volume C rises $\rightarrow$ property stock S rises $\rightarrow$ property demand D and property stock S are equal $\rightarrow$ demand is satisfied, as in Figure 14.

The transmission path is expressed as follows: interest rates fall $\rightarrow$ real estate property prices P rise $\rightarrow$ new development and construction volume C increases $\rightarrow$ market stock S (supply) increases $\rightarrow$ rent R falls and demand rises $\rightarrow$ equilibrium is reached, as shown in Figure 15.

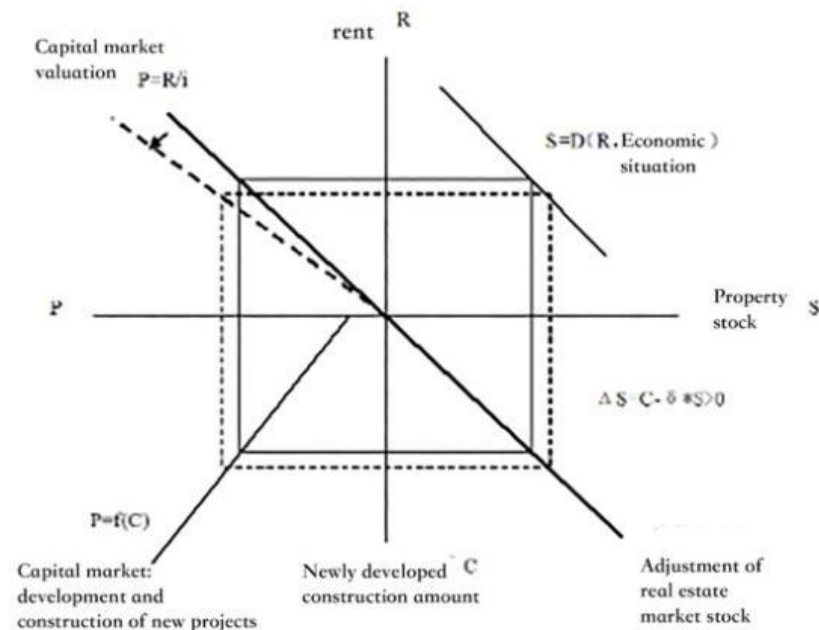


Figure 15. Real estate property and capital markets: a change in asset demand

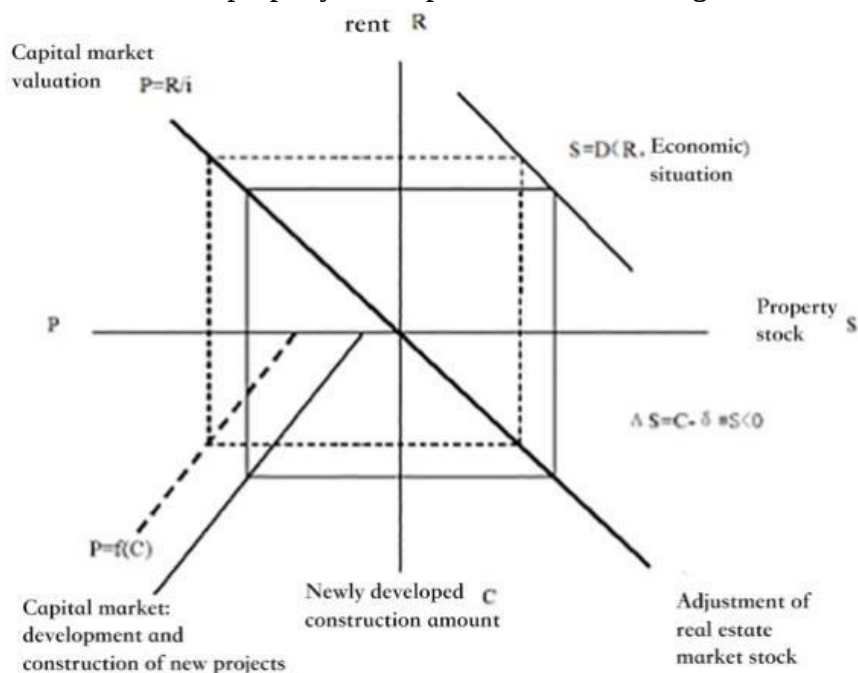


Figure 16. Real estate properties and capital markets: changes in development costs

The transmission path is expressed as follows: it is known that the transmission path is as follows: development costs rise and the price cost curve shifts outward $\rightarrow$ new development and construction volume C falls $\rightarrow$ the value added of property stock ΔS falls $\rightarrow$ property supply S . The transmission path is expressed as follows: the development cost rises and the price cost curve shifts outward $\rightarrow$ the increase in property stock ΔS falls $\rightarrow$ the supply of property S falls $\rightarrow$ the rent R rises $\rightarrow$ the price P rises $\rightarrow$ the equilibrium is reached, as in Figure 16.

4. Conclusions

For most small and medium-sized cities, a real estate tax that taxes both the transfer and retention segments would lead to a significant decrease in house prices in the medium to long term, but overall, house prices would fluctuate up and down from the original trend. For cities with high property prices

and large increases in property prices, a tax on only the transshipment segment would only lead to a long-term increase in property prices.

Suggestions for the reform of the real estate taxation system: (1) Clarify the purpose of levying real estate tax. (2) Improve relevant laws and regulations. (3) Expanding the tax base, reducing tax types, and simplifying the taxation system. (4) Improving the price assessment system based on real estate prices

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