2014

ISSN : 0974 - 7435 Volume 10 Issue 21

BioTechnology

An Indian Journal

FULL PAPER

BTAIJ, 10(21), 2014 [12729-12735]

Analysis of the effects on macro economy after levying domestic house property tax based on dsge model

Bo Jin

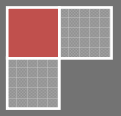
Economics & Management School of Taiyuan University of Science and Technology, Taiyuan, 030024, (CHINA)

ABSTRACT

The real estate market is covered a wide range. Its fluctuations impacted the industries can affect the whole national economy trend. In recent years, China's real estate bubble is becoming serious increasingly. Housing prices rises too fast. China's relevant government departments puts forward levying house property tax to solve these problem. In order to study the effects of property tax, this research uses a dynamic stochastic general equilibrium model (DSGE model) to analyze housing data information and introduce the property tax's impact on various economic indicators. Some conclusions are as follows. The collection of real estate stock's property taxes can reduce housing prices for a long time. But it has negative effects on macro economy. If the property tax rate increases, the total output, consumption, housing stock, house prices and land prices will reduce. The real estate tax of government will reduce too. Government revenues will be reduced. Besides, through the simulation of the data of Shanghai property tax pilot. It shows that the variables of money demand, science and technology have more positive long-term effects on macro economy. Consumption demand variables and housing demand variables have a short-term positive impact on macro economy. While the labor supply variables' impact has a negative effect on macro economy.

KEYWORDS

Housing price; DSGE model; Levying property taxes; Macroeconomic operation.



INTRODUCTION

At present there are large numbers of scholars had pointed out that the Chinese real estate market exists a serious bubble. The price of real estate market is too high. If the real estate bubble bursts, it will have a serious blow to China economic system. In response to the harm of rising housing prices, Chinese government attempts to implement a property tax and reforms property tax system. However, the implementation of property taxes can really solve the problem of the real estate industry or not and has a positive impact on the macroeconomic operation or not, different scholars have different views. Kuang Weida[1], Luo Yongmin and Wu Wenzhong[2] and other scholars believe that the property tax can solve the present stage of China's real estate market problems effectively. Some scholars such as Zhu Runxi[3] and Gong Gangmin[4] believe that the property tax has many unreasonable place and it is difficult to execute. It can't solve the problems of housing.

Now, Chinese academic circles study the impact of property taxes adjustments to China's macro economy mainly through regression analysis method. Some scholars study the relationship between levying property taxes and real estate prices[5],population migration[6], public service[7] and other economic indicators. These previous researches provide a theoretical basis and inspiration for studying the relationship between property taxes and macro economy. But these studies also exist many deficiencies. First of all, the collection and the reformation of the real estate tax are mainly for personal property. And there is a considerable part of the studies depends on the tax data of commercial property. The conclusion based on these data is certainly difficult to reflect the true impact of reformation on macroeconomic development. In addition, studying the relationship between a single economic index and property taxes can't truly reflect the relationship between property taxes and the economic development of the whole country. Sometimes there might be neglected the important variables and turned out the opposite conclusions. Finally, the micro economy will change their investment behavior correspondingly when it faces the reformation of property taxes. The analysis of policy and the empirical studies based on regression analysis will fail because of these changes. It appears the situation of "Lucas critique".

To solve these problems, this research uses dynamic stochastic general equilibrium model (DSGE) to study the present effects of reformation and real estate tax levying on macro economy. The biggest advantage of economic analysis model is to avoid the mistake of inconsistence between Lucas criticizes and dynamic. It is higher than other economic models in reliability to evaluate macro economy and policy. It is useful to help scholars understand the impact on macro economy by levying and reforming property taxes.

ESTABLISHING AND SOLVING OF THE MODEL

Tan Zhengxun and Wang Cong are the mainly scholars to study the relationship between the real estate tax and macro economy based on model of DSGE in China. According to the relationship between the fluctuation of housing price and the national financial steadying, and the Kuang Weida's research about the relationship between property taxes and housing prices, this research analyzes and simulates the existing data through establishing a closed DSGE model type. Then we can know the relationship between macro economy and property taxes' reformation and levying.

This study puts the levied property taxes above the dynamic stochastic general equilibrium theory. It has been established the DSGE model including several economic sectors in the basic framework of the economy. And it corrects parameters to a certain extent. There are six important sectors. They are the households sector, the real estate sector, the corporate sector, financial institutions, government sectors and the central bank sector. By establishing and solving the model, we can know effect of property tax on the macroeconomic indicators more accurately. The establishment of model's framework is as follows.

The households sector

Considering the households is the infinite continuum, its behavior can describe by the following optimization problem.

$$MaxE\sum_{t=0}^{\infty}\beta^{t}U(C_t,N_t,\frac{M_t}{P_t},H_t) \tag{1}$$

Accordingly, the utility functions are as follows:

$$U()=Z_t^c\frac{C_t^{1-\sigma_c}}{1-\sigma_c}+Z_t^m\frac{(M_t/P_t)C_t^{1-\sigma_m}}{1-\sigma_m}-Z_t^n\frac{N_t^{1+\sigma_n}}{1+\sigma_n}+Z_t^h\frac{H_t^{1-\sigma_h}}{1-\sigma_h} \tag{2}$$

E is mathematical expectation, β is households discount factor, $0<\beta\leq 1$, C_t、N_t、M_t、H_t represent household consumption, labor, nominal money, numbers of housing; σ_c、σ_m、σ_h represent resident consumption demand, demand for money, elasticity of housing demand. σ_n is the reciprocal of the labor supply elasticity. Z_t^c、Z_t^m、Z_t^n、Z_t^h are their own impulses. In the period of T, households have the following budgetary constraints:

$$\tau_h P_t^h H_t + D_{t+1} + P_t^c C_1 + M = W_1 N_1 + R_{t-1} D_1 + M_{t-1} + P_t^c Tr_t \quad \textbf{(3)}$$

Under the budgetary constraint (3), the first-order optimality conditions of achieving maximum household effects (1) is:

$$z_t^c C_t^{-\sigma_c} - \lambda_t P_t^c = 0 \quad \textbf{(4)}$$

$$z_t^m \frac{1}{P_t^c} (\frac{M_t}{P_t^c})^{-\sigma_m} - \lambda_t + \beta \lambda_{t+1} = 0 \quad \textbf{(5)}$$

$$-z_t^n N_t^{\sigma_n} + \lambda_t W_1 = 0 \quad \textbf{(6)}$$

$$z_t^h H_t^{-\sigma_n} - \lambda_t \tau_h P_t^h = 0 \quad \textbf{(7)}$$

$$-\lambda_t + -\lambda_{t+1} R_t = 0 \quad \textbf{(8)}$$

The real estate sector

The function of real estate sector's production is:

$$I_t^h = A_t (L_{t-1}^h)^{\vartheta} (Y_t^h)^{\upsilon} (N_t^h)^{1-\vartheta-\upsilon} \quad \textbf{(9)}$$

Among them, ϑ、υ are the output elasticity of capital's factors of production and land. In the period of T, the real estate developers have the following budgetary constraints:

$$P_t^h H_t + B_t^h = P_t^l L_t^h + P_t^c Y_t^h + W_1 N_t^h + R_{t-1}^h B_{t-1}^h + P_t^c C_t^h \quad \textbf{(10)}$$

L_t^h, P_t^l represent the land of real estate development and land price. N_t^h is the labor employed by real estate. R_t^h is the financial institutions' lending rates to the real estate.

From the above, we can know the first-order optimality conditions in the real estate sector is:

$$\frac{1}{C_t^h} + \lambda_t^2 P_t^c = 0 \quad \textbf{(11)}$$

$$-\lambda_t^1 - \lambda_t^2 + \gamma \lambda_{t+1}^2 R_t^h B_t^h = 0 \quad \textbf{(12)}$$

$$\gamma \lambda_{t+1}^1 \psi P_{t+2}^h A_{t+1} (L_t^h)^{\vartheta-1} (Y_t^h)^{\upsilon} (N_t^h)^{1-\vartheta-\upsilon} + \lambda_t^2 P_t^1 = 0 \quad \textbf{(13)}$$

$$\lambda_t^1 \psi P_{t+1}^h A_t (L_{t-1}^h)^{\vartheta} \upsilon (Y_t^h)^{\upsilon-1} (N_t^h)^{1-\vartheta-\upsilon} + \lambda_t^2 P_t^c = 0 \quad \textbf{(14)}$$

$$\gamma \lambda_t^1 \psi P_{t+1}^h A_t (L_t^h)^{\vartheta} (Y_t^h)^{\upsilon} (1-\vartheta-\upsilon) (N_t^h)^{-\vartheta-\upsilon} + \lambda_t^2 w_t = 0 \quad \textbf{(15)}$$

$$\psi \lambda_t^1 P_{t+1}^h - \psi \lambda_{t+1}^1 P_{t+2}^h (1-\delta) H_t - \lambda_t^2 P_t^h = 0 \quad \textbf{(16)}$$

The corporate sector

Enterprises i produce composite capital goods and consumer goods such as steel and concrete by capital $K(i)_t^e$ and labor $N(i)_t^e$. The production function is as follows.

$$Y_t(i) = A_t (K_t(i))^{\alpha} (N_t(i)^e)^{1-\alpha} \quad \textbf{(17)}$$

α represents factors of production and output elasticity of capital of the enterprise sector. A_t represents the technical level of enterprise production. Through the calculation of the business department cost, we can know the optimal solution of the pricing problem as follows

$$P_t^{h*}(i)=\frac{\theta}{\theta-1}\frac{E_t\sum_{i=0}^{\infty}(\beta\rho)^i P_t^h\frac{W_t}{(1-\alpha)A_t}\left[\frac{r_t(1-\alpha)}{W_t\alpha}\right]^{\alpha}Y_t^h(i)}{E_t\sum_{i=0}^{\infty}(\beta\rho)^i Y_t^h(i)} \quad (18)$$

$$P_t^{c*}(i)=\frac{\theta}{\theta-1}\frac{E_t\sum_{i=0}^{\infty}(\beta\rho)^i P_t^c\frac{W_t}{(1-\alpha)A_t}\left[\frac{r_t(1-\alpha)}{W_t\alpha}\right]^{\alpha}Y_t^c(i)}{E_t\sum_{i=0}^{\infty}(\beta\rho)^i Y_t^c(i)} \quad (19)$$

According to formula (12), (13) awakened linear logarithmic transformation. It can be obtained:

$$\hat{P}_t^h-\hat{P}_{t-1}^h\approx\beta\left[E_1\hat{P}_{t+1}^h-\hat{P}_t^h\right]+\frac{(1-\rho)(1-\beta\rho)}{\rho}\left[(1-\alpha)\hat{w}_t-\hat{A}_t+\alpha\hat{r}_t\right] \quad (20)$$

$$\hat{P}_t^c-\hat{P}_{t-1}^c\approx\beta\left[E_1\hat{P}_{t+1}^c-\hat{P}_t^c\right]+\frac{(1-\rho)(1-\beta\rho)}{\rho}\left[(1-\alpha)\hat{w}_t-\hat{A}_t+\alpha\hat{r}_t\right] \quad (21)$$

Financial institutions

Banks and other financial institutions take deposits from households as their main source of income. It uses to provide loans to real estate developers. Maximize expected discounted profit for financial institutions is:

$$MaxE\sum_{t=0}^{\infty}\varphi^t\pi_t \quad (22)$$

RE_t represents the financial institutions' liquidity from the central bank. $S(B_t)$ is loan loss reserve. Under the constraint of this function, the first-order optimality conditions of achieving maximum expected discounted profit for financial institutions is:

$$R_t=E_t\{\frac{P_{t+1}^c}{\varphi P_t^c}\} \quad (23)$$

$$P_t^h=(1+\frac{S'(B_t)}{R_t})R_t \quad (24)$$

Government sectors

Government meets its fiscal expenditure through property tax revenue, land revenue, enterprise and bank profit transfer income:

$$\tau_h P_t^h H_t+P_t^l L_t^h+P_t^c Tr_t=P_t^c G_t \quad (25)$$

The supply of land revenue conform to the random distribution. Random distribution function is as follows.

$$\hat{L}_t^h=\eta_1 L_{t-1}^h+\eta_y\hat{Y}_t+\varepsilon_{1t}\quad \varepsilon_{1t}\sim N(0,\sigma_1^2) \quad (26)$$

Central bank

This study assumes that central banks use monetary policy with the following rules:

$$\ln(R_t/\bar{R})=\rho_r\ln(R_{t-1}/\bar{R})+\rho_\pi\ln(\pi_{t-1}/\bar{\pi})+\rho_y\ln(Y_{t-1}/\bar{Y})+\rho_m\ln(V_t/\bar{V}) \quad (27)$$

Market cleaning

$$Y_t=C_t^c+C_t^h+Y_t^h+G_t \quad (28)$$

THE ESTIMATION OF PARAMETER AND THE SIMULATION OF IMPULSE RESPONSE FUNCTION

Calibration and estimation of parameters

Before taking the value of parameter in DSGE models, this study calibrated the static parameters in the model first. Calibration use the 1-year deposit rate that widely used in academic circles at present. Effectiveness of household discount factor (β) is 0.99. Elasticity of consumer demand (σ_c) is 0.32. Elasticity of money demand (σ_m) is 0.41. According to the Matk Gertker[9]'s study in 2006, σ_h can be taken as 0.031. By using Zhang Jun[10]'s method, the capital output flexibility (υ) of China's real estate is 0.6. With Liu Zongming's study, we can know the transfer price of land through the ratio of land transfer amount to transfer area. Then the land transfer price is divided by real estate sales prices as a production function of land index. ϑ is 0.27. In addition, the loan to value ratio (ψ) is 0.58. The real estate discount factor (γ) is 0.88.

Assuming the DSGE establishment of model in this study is impact by five exogenous variables. They are consumer demand, demand for money, housing demand, technology and labor supply. They follow the distribution of inverted Gamma. Then the Bayesian estimation of dynamic parameters is impacted by these five kinds of exogenous variables of the model, as shown in TABLE 1

TABLE 1 : Bayesian estimation of dynamic parameters

Parameter	Estimated Value	Standard deviation	Parameter	Estimated Value	Standard deviation
ρ_{zc}	0.214	0.064	σ_{zc}	0.913	0.032
ρ_{zm}	0.396	0.015	σ_{zm}	0.425	0.035
ρ_{zl}	0.753	0.052	σ_{zl}	0.275	0.069
ρ_{zh}	0.482	0.047	σ_{zh}	0.115	0.022
ρ_{za}	0.761	0.061	σ_{za}	0.116	0.031

Analysis of pulse simulation

According to property tax data in Shanghai, we can know changes in the macroeconomic indicators with the impacted by consumer demand, demand for money, housing demand, technology and labor supply. Figures 1 to 5 are analysis of pulse simulation for the five external variables:

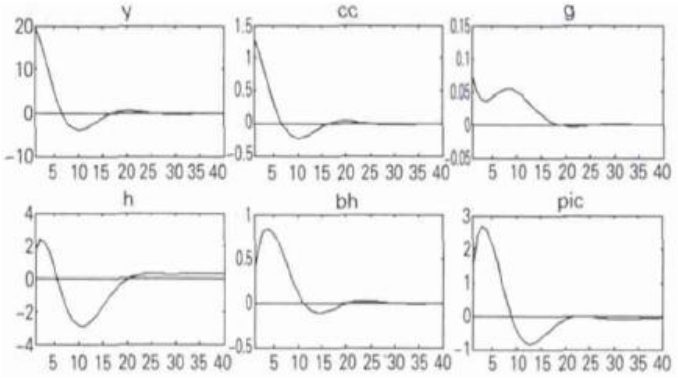


Figure 1 : Changes of pulse in impact of consumer demand variables

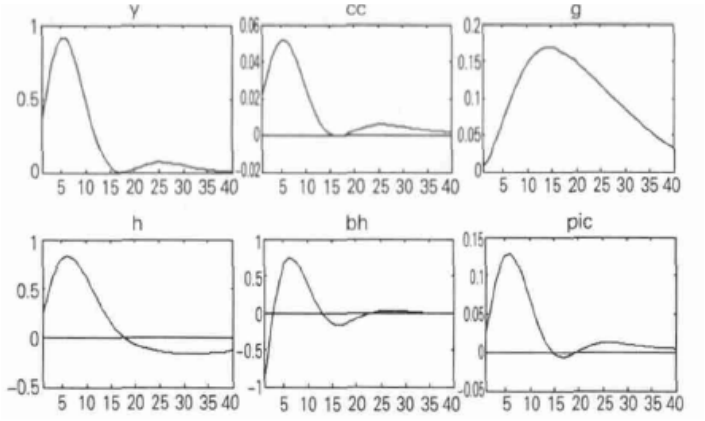


Figure 2 : Changes of pulse in impact of demand for money

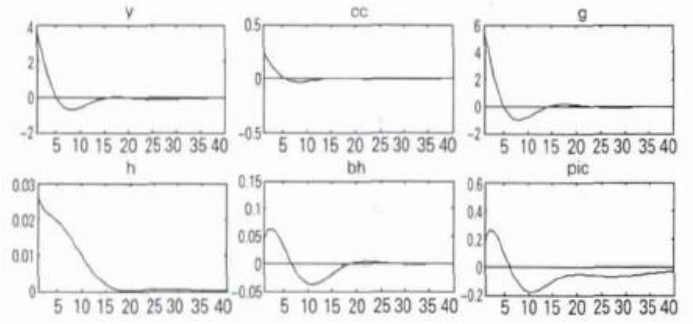


Figure 3 : Changes of pulse in impact of housing demand

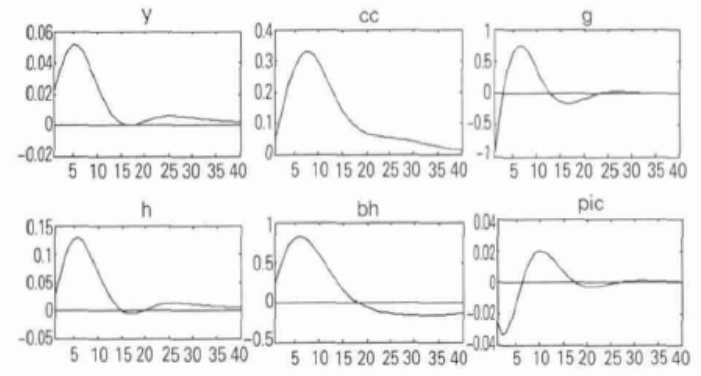


Figure 4 : Changes of pulse in impact of technology demand

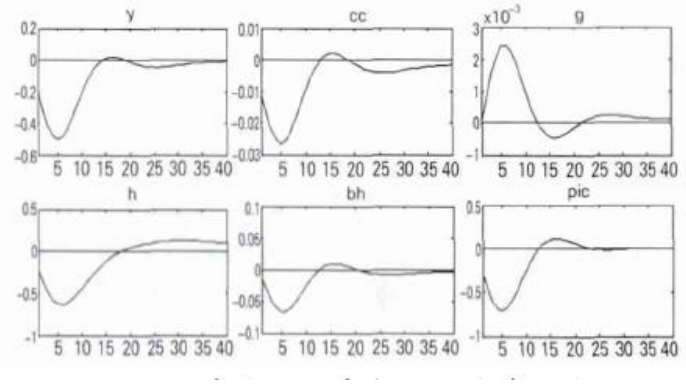


Figure 5 : Changes of pulse in impact of labor supply demand

From Figure 1 we can see that commodity prices will improve if consumer demand increases. So it may cause and exacerbate inflation. Rising commodity prices shows the price of production in the real estate market including r steel, concrete and other building materials will rise. The cost of housing markets will increases. In addition, increased consumer demand also shows the needs of the residents of the housing, thus stimulating price rises further. Because of the stimulation of rising construction costs and consumer demand, real estate agents will also raise the needs of capital chain for a large number of production and increase the loan of housing mortgage. Eventually under the interaction of multiple factors, the Government's real estate tax increases. Government revenue increases. Government spending also increases.

From Figure 2 we can see that the rise of money demand variables stimulates the increase the cash balances in consumer’s hands to enhance consumer demand. From the picture of impulse response, it can be seen that the housing stock increases rapid in the early. So the impact of housing stock to money demand is more sensitive. In the promotion of real estate market demand and price, from Figure 1, we can know that government spending will increase further.

From Figure 3 we can see that the impact of housing demand variables is a positive correlation among the total output, consumption and government expenditure in a short time. And it is a positive correlation to housing stock in a long time. Rising demand for housing stock improves real estate producers’ enthusiasm. Then it increases the producers of housing mortgage loans. In addition, the increased demand for production materials pushes prices for building materials market. Moreover, the increased demand for housing increases property tax revenues of the Government. In three areas of interaction, government expenditure increases by the increased demand for housing.

From Figure 4 we can see that the progress of science and technology can improve output and consumption. The function of consumption is long-term and sustainable. In the model of the research, advances in science and technology contains improvement of the real estate. Under the influence of scientific and technological progress, the real estate industry should be improved in productivity. Because the housing supply is substantial increase and housing demand is without great fluctuation, at the beginning of the real estate market will present a situation of supply exceeding demand. And housing prices will fall. However, the demand of real estate market is very strong. So the demand for housing will be increased quickly to a corresponding level in a long time. House prices will rise.

From Figure 5 we can see that the impact of changes in labor supply variables has a negative effect on aggregate output and consumption. Labor supply shocks explain the overall decline in the income of residents. The money in the hands of residents is reduced. The consumption and the desire for consumption reduce. It affect the total output of the whole country reduced. The consumption demand of residents including housing demand reduces the amount of goods. At the same time it also affects the price of commodities including house prices. So the real estate developers have no power of the production. Housing mortgage loans are reduce. The government spending is affected and reduced.

CONCLUSION

This research is based on dynamic stochastic general equilibrium models. It uses the property tax as a variable. Through built economic function of family, real estate business, enterprises, financial institutions, governments and central banks, we can get the optimal solution and constraint conditions. By using past data, it can simulate the impact of property tax on macro economy. Through the model we can draw the following conclusions: The collection of real estate stock's property taxes can reduce housing prices for a long time. But it has negative effects on macro economy. If the property tax rate increases, the total output, consumption, housing stock, house prices and land prices will reduce. The real estate tax of government will reduce too. Government revenues will be reduced. Besides, through the simulation of the data of Shanghai property tax pilot. It shows that the variables of money demand, science and technology have more positive long-term effects on macro economy. Consumption demand variables and housing demand variables have a short-term positive impact on macro economy. While the labor supply variables' impact has a negative effect on macro economy.

REFERENCES

[1] Kuang Weida; Housing Characteristics, Property tax and house prices [J], Economic Research Journal, **(4)**, 28-33 **(2009)**.

[2] Luo Yongmin, Wu Wenzhong; House property tax reform and macroeconomic effects----- Simulation and analysis of the data based on DSGE model [J], Journal of Financial Research, **(5)**, 25-34 **(2011)**.

[3] Zhu Runxi; Cause and location of levying property tax [J], Taxation Research, **(5)**, 18-22 **(2005)**.

[4] F.C.Lai, J.F.McDonald, D.F.Merriman; "Housing appreciation (Depreciation) and owners' welfare", Journal of Housing Economics, **19(1)**, 66 -73 **(2010)**.

[5] H.Shan; "Property taxes and elderly mobility", Journal of Urban Economics, **67(2)**, 194-205 **(2010)**.

[6] W.E.Oates; "Property taxation and local public spending: The renter effect", Journal of Urban Economics, **57(3)**, 419 - 431 **(2005)**.

[7] Tan Zhengxun, Wang Cong; Research on China's credit expansion and price fluctuation in financial stability effects [J], Journal of Financial Research, **(8)**, 57-59 **(2011)**.

[8] Mark Gertler, Antonella Trigari; Unemployment fluctuations with staggered nash wage bargaining[R], NBER Working Paper NO.12498, August, **(2006)**.

[9] Zhang Jun, Growth; Capital formation and technological choice why has China's economic growth rate been declining? [J], China Economic Quarterly, **(2)**, 301-338 **(2002)**.

[10] Liu Zongming; Fiscal decentralization, Surging house prices and consumption suppression [J], Finance & Economics, **(2)**, 12-19 **(2012)**.