Chapter 4

Empirical Results

4.1 Posterior Parameters

Table 4.1 and 4.2 show the posterior mean and the 10th and 90th probability intervals for the structural parameters obtained using the Metropolis-Hastings algorithm.

Table 4.1 Prior and Posterior Distribution of the Structural Parameters

	Prior Distribution			Posterior Distribution			
Parameter	Distr.	Mean	St.Dev	Mean	CI(low)	Median	CI(high)
ε	Beta	0.61	0.075	0.5743	0.5501	0.5730	0.5958
$\acute{\varepsilon}$	Beta	0.61	0.075	0.9367	0.9084	0.9359	0.9633
α	Beta	0.65	0.05	0.2719	0.2421	0.2671	0.2920
θ_{π}	Beta	0.85	0.05	0.6851	0.6628	0.6845	0.7061
θ_{wc}	Beta	0.6	0.05	0.5597	0.5216	0.5578	0.5939
θ_{wh}	Beta	0.6	0.05	0.5768	0.5582	0.5820	0.6058
ι_{π}	Beta	0.5	0.2	0.8793	0.7968	0.8753	0.9537
ι_{wc}	Beta	0.5	0.2	0.6392	0.5603	0.6311	0.7019

Table 4.1 Prior and Posterior Distribution of the Structural Parameters (Continued)

	Prior Distribution			Posterior Distribution			
ι_{wh}	Beta	0.5	0.2	0.5635	0.3735	0.5806	0.7877
r_R	Beta	0.75	0.1	0.6207	0.5676	0.6178	0.6680
η	Gamma	0.5	0.1	0.3513	0.3184	0.3514	0.3844
$\acute{\eta}$	Gamma	0.5	0.1	0.6616	0.5210	0.6625	0.8040
ξ	Normal	1	0.1	-0.0030	-0.0320	-0.0029	0.0262
$\acute{\xi}$	Normal	1	0.1	1.2838	1.1731	1.2761	1.3791
r_Y	Normal	0	0.05	0.0226	0.0036	0.0264	0.0491
r_π	Normal	1.68	0.05	1.2506	1.1965	1.2540	1.3115

Table 4.2 Prior and Posterior Distribution of the Shock Processes

	Prior Distribution			Posterior Distribution			
Parameter	Distr.	Mean	St.Dev	Mean	CI(low)	Median	CI(high)
ρ_{ah}	Beta	0.8	0.1	0.9494	0.9350	0.9500	0.9650
ρ_{ac}	Beta	0.8	0.1	0.9902	0.9837	0.9904	0.9971
ρ_{ak}	Beta	0.8	0.1	0.5746	0.5186	0.5765	0.6343
ρ_z	Beta	0.8	0.1	0.8256	0.7508	0.8201	0.8893
ρ_j	Beta	0.8	0.1	0.4593	0.4074	0.4580	0.5085
ρ_τ	Beta	0.8	0.1	0.9694	0.9553	0.9698	0.9843

Table 4.2 Prior and Posterior Distribution of the Shock Processes (Continued)

	Prior Distribution			Posterior Distribution			
ρ_g	Beta	0.8	0.1	0.7820	0.7186	0.7849	0.8512
ρ_e	Beta	0.8	0.1	0.8535	0.7798	0.8555	0.9311
ρ_h	Beta	0.8	0.1	0.9987	0.9978	0.9988	0.9997
σ_z	Uniform	3	1.7	0.2810	0.2337	0.2826	0.3315
σ_j	Uniform	3	1.7	5.7046	5.3310	5.6378	5.9445
σ_τ	Uniform	3	1.7	0.4482	0.3551	0.4478	0.5405
σ_{ac}	Uniform	3	1.7	0.0764	0.0555	0.0759	0.0962
σ_{ak}	Uniform	3	1.7	0.2050	0.1551	0.2042	0.2532
σ_{ah}	Uniform	3	1.7	2.6702	2.1343	2.7130	3.2916
σ_p	Uniform	3	1.7	0.0578	0.0555	0.0581	0.0607
σ_e	Uniform	3	1.7	4.4937	3.6990	4.6122	5.5253
σ_R	Uniform	3	1.7	0.0570	0.0555	0.0572	0.0589
σ_{pl}	Uniform	3	1.7	5.5456	5.2799	5.6121	5.9443
σ_g	Uniform	3	1.7	0.5211	0.0556	0.5516	1.0476
σ_h	Uniform	3	1.7	1.8212	1.5389	1.8259	2.1128

From the table, we can see that some of the results are significantly different to prior findings, this mean that the posterior result is mainly determined by the data. The labor income share of patient households is estimated at 0.2719, a value which is

lower than our prior mean. The value of the habit in consumption is larger for impatient households ($\acute{\varepsilon} = 0.9367$, as opposed to $\varepsilon = 0.5743$ for the patient ones). For the labor supply elasticity parameters, the posterior means are 0.3513 and 0.6616, respectively for patient lenders and impatient borrowers.

The estimated mean for the interest rate smoothing parameter is 0.6207, which is similar to the prior mean (0.7). The value of the parameters describing the response to output growth and inflation are 0.0226 and 1.2506, which shows a small response to GDP growth and tightly response to inflation.

The shock of housing tax is quite persistent, with autocorrelation coefficients 0.9987. Meanwhile, the shocks of land cost and government investment are not persistent, and their autocorrelation coefficients are equal to 0.8535 and 0.7820. Turning to the estimated standard deviations, it can be concluded that the most volatile shock considered in the model is the land policy shock (4.4937), while the least volatile is the interest rate (0.0570).

About the nominal rigidities parameter, the estimate of θ_π is 0.6851, which implies that prices in the consumption goods sector are re-optimized infrequently. The wage stickiness in the consumption goods sector ($\theta_{wc} = 0.5597$) is lower than in the housing sector ($\theta_{wh} = 0.5768$), which means that the wage in the consumption goods sector adjusts frequently. Meanwhile, the wage indexation is larger in housing sector ($\iota_{wc} = 0.6392$ and $\iota_{wh} = 0.5635$).

4.2 Impulse Response Analysis

4.2.1 Affordable housing policy shock

The impulse response of affordable housing policy shock is presented in Figure 4.1. The government expenditure is separated into consumption spending in non-housing sector and production spending for housing sector as input of housing production. The affordable housing policy is considered as an increase in government's investment in housing sector. Following the government investment shock, the housing firms can produce more houses for given cost. This leads to an increase in housing supplied (0.1 percent). With a higher supply of housing, the housing prices decline immediately after the shock and last more than 20 periods.

In the consumption goods sector, the reduction of housing prices causes a substitution effect, so households will purchase more housing, which causes total consumption to fall. The consumption firms produce intermediate input for housing sector, thus the consumption goods production follows the same fluctuation and trend with housing sector on a small scale. Inflation increases because of the extra spending in housing sector, and the employment in both sectors rises in line with the output respectively. Due to the increase in government investment, the demand of housing capital falls, which cause total investment to decrease. In addition, the sustained decrease in house prices induces a negative valuation effect on the housing collateral, making borrowing less attractive. As a result, the loan faces a negative effect which reduces the interest rate.
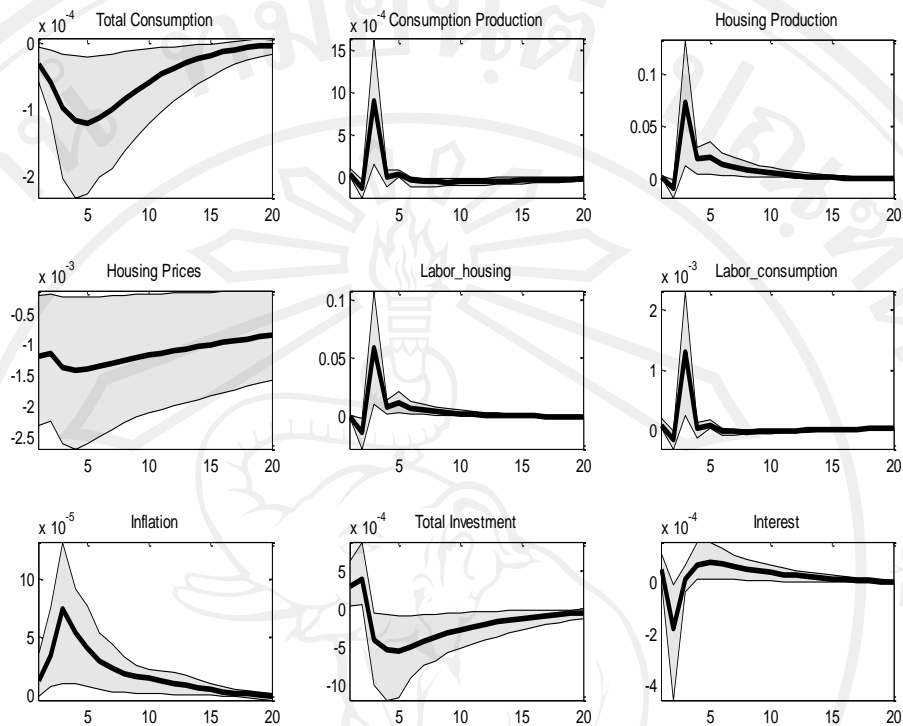
**Figure 4.1** Response to government investment shock

4.2.2 Land policy shock

The effects of land policy shock are shown in Figure 4.2. The land policy in China is different from other country, because the land income which getting by selling land through auction is an important source of government revenues. So a change in land cost will impact not only the production cost of housing firms, but also the government's budgets and fiscal policy. In 2010, to control the worse situation of the housing market, the new land policy which aims to reduce the cost of land is implemented.

A negative shock to land cost will generate a sharp and persistent growth in

housing supply. The housing production rises 0.4 percent in 5 periods and remain significantly above the baseline for about 20 periods. The housing prices reduce slowly, because households cannot immediately match the increase of housing supply. When housing prices drop, households will purchase more housing instead of consuming final goods and leisure. Thus, the consumption of households will drop as well. Meanwhile, due to the prosperity of the real estate market, the housing firms need more housing capital which produced in the consumption goods sector to expand production, so the consumption firms face a small positive effect.

The employment in both sectors follows a similar fluctuation with the production respectively. The effect of this shock on total investment and interest are very similar to those of a positive government investment shock. Since both policies manage the real estate market through decreasing the cost of housing firms. Besides, Inflation falls due to the weak consumption of households.
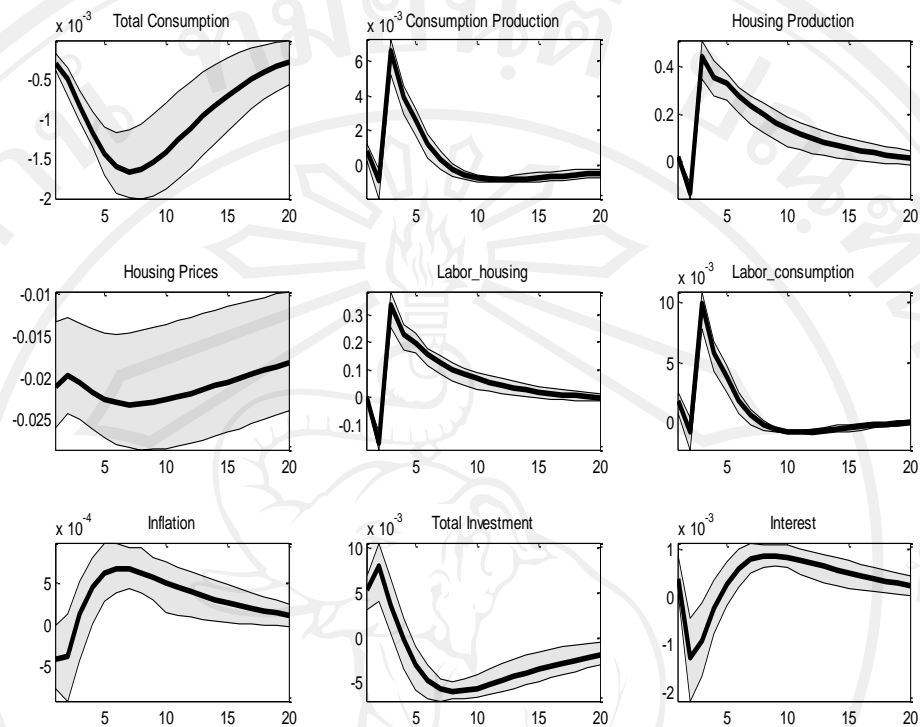
Figure 4.2 Response to land policy shock
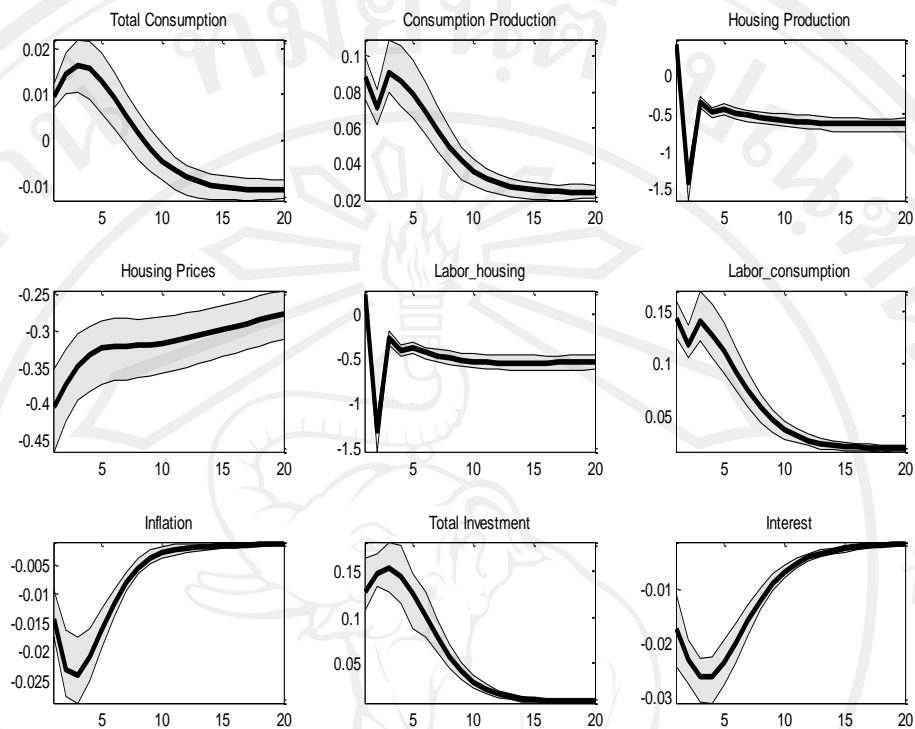
4.2.3 Property tax policy shock

Figure 4.3 shows the effects of a positive property tax shock. After the housing tax shock, households need to spend more money on holding houses, so they will purchase less real estate, thus causing housing demand to decrease. In the face of lower housing demand, housing firms respond by reducing real estate production as well as decreasing employment and capital utilization. The decreased housing demand also leads to lower housing prices, as the housing prices drop 0.4 percent immediately and last more than 20 periods. Overall, the housing sector suffers a significant

negative effect.

The consumption goods sector is different from the housing sector and faces a positive effect. The main reason is that the reduction of housing prices causes a substitution effect, thus households will consume more final goods, which causing production in consumption goods sector to rise immediately. Then as housing sector become weak and need less intermediate goods, and more labor and capital will be supplied to non-housing sector.

As we mentioned, the housing tax income is an important source of government revenue, so with a high housing tax, the government can spend more on the consumption goods sector, which cause the total consumption of household to reduce after a few periods.
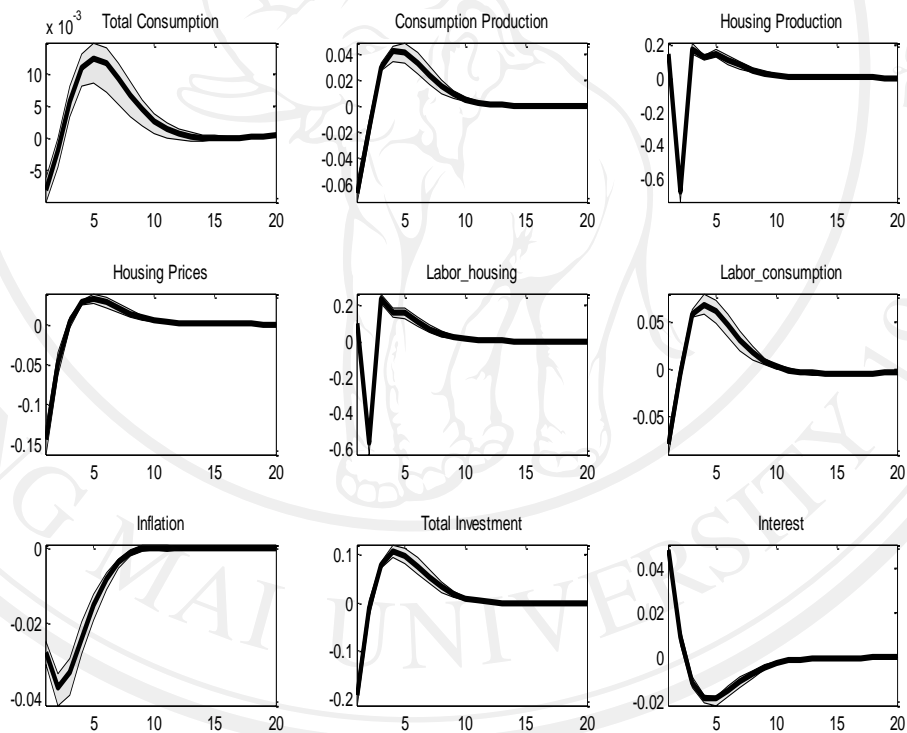
Figure 4.3 Response to property tax shock

4.2.4 Monetary policy shock

We consider a monetary policy shock as a change in the loan interest rate. A positive shock in the loan interest rate will increase the cost of borrowing money, which will generate a downward pressure on borrowers' budgets. Affected by the limited budget, the demand of borrowers is less in both goods. As a result, both sectors suffer a negative effect on production and employment. But the negative impact on the non-housing sector is less than on housing sector. The main reason for this situation is that borrowers are the main purchasers of housing, which can explain

the housing sector is larger impacted by the weak demand of borrowers.

Housing prices fall due to the weak demand of borrowers and the interest rate also decreases affected by the weak housing collateral. Total investment follows the similar fluctuation with consumption production and total consumption falls first because of the weak demand of borrowers. And then increases affected by decreasing interest rates. With low consumption, the inflation also faces a negative effect.

Figure 4.4 Response to a monetary shock

Overall, the property tax policy is better at declining housing prices to a normal level, but it will hit the housing sector. The monetary policy has a similar

effect with property tax policy, except the negative effect on consumption goods firms. The land policy can stabilize the real estate market well, but its effect of controlling housing prices is weak. Compared with land policy, the affordable housing policy has a positive effect on inflation.

4.3 Policy Applications

The affordable housing policy can support the housing sector better, but its effect of controlling housing prices is small. Besides, the affordable housing policy also has a positive effect on inflation. Considered the high inflation in China, the government should decrease the use of this policy to against the deterioration of underlying inflation risks.

The monetary policy is good at controlling housing prices, but it has a negative effect on not only the housing sector, but also the other sectors. If the purpose of the government is only about controlling the housing sector, the power of this policy is so strong and it might not be worth it financially. So the government should not use this policy frequently.

The land policy is similar to the affordable housing policy with the exception that it has a better effect on stabilizing real estate market and a negative effect on inflation. Meanwhile, as we have mentioned before, the land income is an important source of government revenues. So when the land cost is decreased by the land policy, the land income will also fall, which generates a downward pressure on the

government's budget. The choice of using land policy which leads land cost to decrease is dependent on the weight of the stabilization of the real estate market. Now stability in the real estate market is a prime concern in China's economy, so we suggest that the government should use land policy to stabilize the housing market.

The property tax policy has a better effect on controlling housing prices, but it will hit the housing sector. If compared with monetary policy, housing tax policy has a positive effect on the consumption goods sector. So the government should use housing tax policy as a main way to reduce housing prices. Meanwhile, the property tax policy is designed to use housing tax income to replace land income and become a new stable source of government revenues. After the implementation of new land policy, the government's budget is limited. So to change the situation of austerity budgets, the housing tax policy is introduced to China. But because we know nothing about this policy's degree and horizon, so this policy is still in the pilot phase and has only been tested in two cities. According to the result of this study, we suggested that the government should use property tax income to replace land income. The reason is that compared with giving land cost a positive shock to increase the government revenues, the housing tax policy can not only provide enough revenues for government, but also can eliminate the housing bubbles by giving both housing prices and housing production a negative effect.

Finally, we suggest that the government should use both housing tax policy (or monetary policy) and land policy (or affordable housing policy) to control the real

estate market at the same time. Because the land policy which focus on housing supply can offset the negative effect of property tax policy on the housing sector. Meanwhile, the ability of housing tax policy on controlling housing prices is not impacted. So the government can achieve the goal that reduces the housing prices and keeps the real estate market stable.