

Further Study of China's housing price-to-income ratio

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Abstract –This paper mainly studied the Housing Price-to-Income Ratio in systems thought. This article analyzed the relationship among the House price, income and interest, and estimated the optimal Housing Price-to-Income Ratio function assurance on the basis of GDP maximization by nearly a decade's data, and discussed the current Housing Price-to-Income Ratio and explored the suitable mix policies about the national real estate control policies under the optimal GDP.

Keywords –system thought; Housing Price-to-Income Ratio; optimal GDP; high housing prices

1. Introduction

The problems caused by real estate industry could produce bad consequence to the economy. In 1920, the United States real estate appeared serious bubbles, and in 1929 the stock market of the United States crashed, and real estate bubble burst, then generated the nearly 10 years of great depression of United States economy and global economic crisis; In the 1990s, the Japanese real estate existed great bubbles and eventually burst, and hurt the real estate industry badly, then the Japanese economy had experienced a long recession. Followed the Japan, the Southeast Asia financial crisis broke out, and the housing bubble of Southeast Asian countries been destroyed, and led to a serious economic recession. In 2008, the subprime crises in housing mortgage loan derivatives led to the financial crisis to US, and then led to a new round of the United States financial crisis and also the global economic recession, and the United States' economy haven't recovery yet; the real estate market became short slab of the economic recovery. And in real estate market of China, the government has strongly aware of the real estate market has huge bubbles from 2010, and it will generate a bad consequence to China's economy if the government don't control real estate industry. The government had made a number of moves from 2010 to improve housing affordability, including loan and purchase limits-measures that have squeezed highly leveraged real-estate developers. China's real estate market has entered the comprehensive adjustment phase now, and the 'house prices' has been the hotspot problems of China's economic development. Above all, the real estate industry concern the national economic development, and also is an important part of GDP, the matching relationship between house prices and the income of the residents affect the people's daily life closely. So the GDP, Housing price to income ratio and people's daily life belong to on economic system which

can influence each other. In the second part is the literature review, the third part is the real estate system theory and model building, the fourth part is the empirical part, the fifth part is the conclusion and suggestions.

2. Literature Review

Scholars from China and foreign countries have made deep researches on the analysis of the real estate bubble, house prices and factors can influence the housing prices and the housing price to income ratio. Lv Jianglin (2010) made a measurement on the bubble of the city housing market; he investigated the relationship between purchase for investment and automated purchase, and vacancy rate, real estate loans ratio, rental and sale ratio, and real estate profit rate and other indexes of urban housing market to measure the real estate bubble. According to model of reasonable upper limit housing price-income ratio, and based on the factors such as average propensity to consume of current urban residents, inferred that the reasonable housing price to income ratio which city residents can afforded should between 4.63 and 6.78. He also thinks the urban housing market exist bubbles, and some cities' bubbles are very serious, and also have great financial risks. Shen Jiuyun (2006) defined the housing price-to-income ratio based on real estate prices and consumption, residents' disposable income, and thought that the housing price to income ratio has obvious regional feature, the housing price to income ratio have differences between regions and countries. The housing price to income ratio of our country has obvious relationship with the government's policy about real estate industry, housing and the land. And the housing price to income ratio is a general description of the connection between the family's income levels and real estate price levels, and cannot be used an judgment to the change of real estate

market, and also could not be as the basis of people to make a purchase to house.

Aihua-Li according to the index of housing price to income ratio, established housing purchasing power model from the town residents' consumption structure and the financing way, make an analysis about housing purchasing power of higher, high, medium, low, lower income family on the base of urban residents data of Beijing, obtains the different income family's acceptable the housing price to income ratio, the results show that low-income families short of purchasing power in the forward delivery housing market, so the author does not agree the low-income families' purchasing behavior and they should solve their housing problem through rent housing in a price that below the market rent price, and think the delivery housing should increase the proportion of middle and small family model, so as to improve the housing purchasing power of low-income family.

O.Magne and Rady (2006) studied the connection between down payment ability and house prices by life-cycle model. The model showed that the young man's down payment ability have positive correlation with house prices, and point that the fluctuation of income may generate the overreaction of house prices. Benito (2006) confirmed the down payment effect based on an empirical test of the British real estate market. But the researches on down payment mainly focused on the influence of house prices, and haven't on the quantitative analysis of real estate bubble.

LuYong (2007) used the housing prices, consumption and salary data of Hong Kong, analyzed the connection between the housing prices and consumption through the error correction model, and the result shows that there is a long-term equilibrium and short-term dynamic relationships between consumption and real estate prices in Hong Kong. People have the housing property don't think their own real estate will fall when the house prices rising, so this has certain stimulation to consumption; At the same time the housing prices rising also can increase the expected economic pressure of the residents who have the purchasing demand to house, so can inhibit the consumption. And if the real estate prices fluctuate frequently, it will disturb the people's expectation to the real estate value and investment, it couldn't generate obvious affection on consumption.

The literature above almost draw a conclusion from the house prices, real estate bubble's existence and the range of the housing price to income ratio can bear, but the lack of overall Angle to study the real estate industry. Bruno and Alois (2000) points out that factors happiness concerned include income factors and factors about conditions of economy and society, so GDP concerns the nation's happiness. The author thinks that GDP, real estate prices, and consumption of real estate constitute an economic system, and every single factor depends on other factors, and their goal is maximization GDP.

Therefore this paper tries to constructive Housing Price-to-Income Ratio function assurance on the basis of GDP

maximization. And to deal with the relationship between economic growth and the high housing prices, the policies to house prices should also consider the housing price to income ratio, loan interest rate and loan structure.

3. The system of real estate and Theoretical analysis

The variables that influence the real estate market construct a system that can influence every other variable in this system; it will be one-sidedness if we just consider the single or few variables to research the real estate dynamic development. Consumption, loan interest rates, loan structure, and real estate prices concern to national living standard and happiness; and interest rates affect national economic behavior; Real estate prices affect residents' consumption and GDP; and GDP is regarded as the best standard to measure an economic entity. We set the maximize GDP as the target, and estimate the optimal Housing Price-to-Income Ratio function through consumption and investment function, loan structure, and then discuss the current housing price to income ratio and government's policies, so as to improve the real estate market reasonably.

In the economic system, GDP is target function, the residents' income divided into consumption and savings, and the residents' consumption is divided into general consumption and house's investment. And we assume people pay their loan according to the theory of equal repayment, and also assume the function relationship exists between the multiplier of residents' consumption to GDP and the multiplier of residents' investment to GDP. The target function as follows:

$$\max GDP_t = \alpha * C_t + \beta * CI_t \quad (1)$$

The GDP is the sum of the individual's consumption and individual's investment after their multiplier to GDP. In this model, assume C_t is the individual's total capital for consumption in period t , and CI_t is the individual's total capital for the house investment in period t , α and β are multipliers of consumption and house investment to GDP, and the target is to make the GDP maximization. And in (2), Y_t is individual's disposable income in period t . Here I made an assumption that Y_t has multivariate linear relationship with C_t and CI_t , and also made an assumption that individuals have no new savings, because they will chose to reduce mortgage loan time if they have. w is the proportion of payments of disposable income monthly in (4) and (6), n is loan period in (6), r is loans annual interest rate in (6), P is total housing prices in (6), x is down payment proportion in (6), and (4) is according to the theory of equal repayment. (5) is savings function and ρ is marginal propensity to save.

$$\begin{cases}
 C + \alpha C_t + \beta * CI_t + \xi \leq Y_t & (2) \\
 \alpha = f(\beta) & (3) \\
 C_t = wY_t & (4) \\
 S_t = \rho Y_t + \zeta & (5) \\
 s.t. \begin{cases}
 (1-x) \times P \times \left(1 + \frac{r}{12}\right)^{12n} \\
 = \frac{wY_t \times \left[\left(1 + \frac{r}{12}\right)^{12n} - 1\right]}{\frac{r}{12}} & (6)
 \end{cases}
 \end{cases}$$

4. Empirical and Discussion

This paper’s data are quarterly data of GDP and Consumption and Investment range from the first quarter of 2003 to the first quarter of 2012, and then made a multivariate linear regression to estimate parameters. The data is from the national bureau of statistics source.

Table 1. The results of multivariate linear regression

Parameter	c	α	β
value	10954.401	1.621	0.481
t	3.589	7.861	4.860

The analysis shows, the multiplier of the investment for the national economy is smaller than the multiplier of the consumption for the national economy, so our economy should focus on internal demand more, and internal demand is the new driver of our country’s economic growth.

In order to make to maximize GDP, we assume that α and β has function relation, and estimate α and β by the first quarter of 2003 to the third quarter of 2006, and delayed two quarters to make the curve fitting by SPSS, and the results showed that the quadratic curve has a higher fitting(R = 0.659),and the fitting curve as follows(t=3.87,2.64,4.23):

$$\alpha = 0.292 + 0.656\beta - 1.080\beta^2 + \xi \quad (7)$$

Table 2. The value of α and β for fitting curves

α	2.084	2.097	1.987	2.059	2.099	2.208	2.279	2.209	2.242	2.146	1.982
t	14.034	15.056	12.573	13.401	13.018	10.186	9.942	9.942	8.208	7.780	8.661
β	0.637	0.614	0.721	0.647	0.616	0.480	0.405	0.405	0.339	0.349	0.423
t	4.951	5.176	5.729	5.330	5.148	3.068	2.601	2.601	1.923	1.983	2.923

Table 3. Fitting curves’ R-square

Function	Linear	Logarithmic	Inverse	Quadratic	Cubic	Compound	Power	S	Growth	Exponential
R-square	0.413	0.398	0.380	0.659	0.437	0.407	0.392	0.373	0.407	0.407

From (4) and (5), so $C_t = \frac{(1-x)P\left(1 + \frac{r}{12}\right)^{12n} \frac{r}{12}}{\left(1 + \frac{r}{12}\right)^{12n} - 1}$ (8)

And the target function is

$$\max GDP_t = -1.080C_t\beta^2 + [(1-\rho)Y_t - 0.344C_t]\beta + 0.292C_t \quad (9)$$

According to GDP maximization, $\beta = \frac{(1-\rho)Y_t - 0.344C_t}{0.016C_t}$ (10)

And the housing price to income ratio is $\frac{P}{12Y_t} = \frac{r(1-\rho)(1-x)\left(1 + \frac{r}{12}\right)^{12n}}{(0.016\beta + 0.034)\left[\left(1 + \frac{r}{12}\right)^{12n} - 1\right]}$ (11)

So the housing price to income ratio concerns to the proportion of payments of disposable income and down payment proportion and loans annual interest rate and loan period, and also concerns to the multiplier of the consumption and investment for GDP.

According to the current actual situation, the loan interest rate is 7.05%, if the loan period is 15 years, and down payment proportion is 30%, the multiplier of investment to GDP is 0.481 from our estimated early, and assume that individual's marginal savings tendency is zero, then get the reasonable the housing price to income ratio is 7.35.

And the reasonable housing price to income ratio city residents can afforded range from 4.63 to 6.78 from Jianglin-Lv's research. From (6) and (11) we can infer the range of (12).

$$\frac{r\left(1+\frac{r}{12}\right)^{12n}}{\left[\left(1+\frac{r}{12}\right)^{12n}-1\right]} \quad (12)$$

And we can infer that (12) is the proportion of year's payment to the total loan from (13). So the proportion of year's payment to the total loan in the reasonable housing price to income ratio can afforded should be between 0.074 and 0.092.

$$\frac{r\left(1+\frac{r}{12}\right)^{12n}}{\left[\left(1+\frac{r}{12}\right)^{12n}-1\right]} = \frac{12wY_t}{(1-x)P} \quad (13)$$

5. Conclusion and Suggestion

The current our country residents' income is not matching with house prices, the People's Daily reported the housing price-income ratio as high as 15 times or above in first-tier city and the reasonable housing price to income ratio 7.35. The proportion of year's payment to the total loan in the reasonable housing price to income ratio can afforded should be between 0.074 and 0.092. In 2011, the average wage of Shanghai was 51986RMB, so year's payment to the total loan in the reasonable housing price to income ratio can afforded should be between 584, 112RMB and 852,229RMB, and the total loan of purchasing house should be between 834,446RMB and 1, 217,471RMB from the proportion of down payment. So the source of repayment pressure is high house prices and the house prices do not match with income.

Therefore, the current housing price-income ratio higher than reasonable the housing price to income ratio and the income of the residents is not matching the house price. In the basis of empirical conclusions we think the government should take positive policies

to knock the house prices down, and adjust the income- distribution system, and also to match the income to house prices.

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Vitae

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