The Test on Rational Expectation of Inflation for Chinese Provincial Urban Residents: 1995-2014

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***Abstract*—Our objective is to investigate the rationality of inflation expectation on Chinese urban provincial residents' consumption during 1995-2014, in view of the changing of supply-demand structure from rationality. Two econometric models are used to get time series values of expected rates of inflation and further test the rationality of inflation anticipation with them. The result shows that there exist 27 provincial urban residents are rationality on inflation expectation among 29 provinces. Individuals' rationality indicates reducing the excess of ineffective supply should be a good way to alter the situation of prudent consuming behaviour and promote consumption growth.**

***Index Terms*—rationality; inflation expectation; chinese urban residents**

I. Introduction

In the recent years, particularly after 2012, China's economy has experienced obvious slow growth, and residents consume prudently. Uncertainties in the economy make people extremely worried about their future life, for example, consumption, pension and medicare. However, there exits another possible situation, people have rational expectations and would not like to change their consumption level obviously. If that is the case, we should consider the problem of imbalance between supply and demand in China, because rationality with consistent preferences means economic structural should be changed.

II. Two Econometric Models

There are four main methods often used to test inflation expectations: the first is based on the survey data of the central bank or other financial institutions targeting mainly at the residents' responses to future price changes [1,2]; second, to estimate using the bonds yield with different maturities in the financial market [3]; third, select some main variables affecting inflation or price changing to make regression analysis according to the macroeconomic theory and mathe- matical economics way [4]; the last is based on Auto-regressive Moving Average (ARMA (p,q)) Model considering the effect of lag inflation rates on current ones [5,6].

This paper combines the third and fourth methods mentioned above, select appropriate explanatory variable and consider the effect of lag inflation. According to economic theory, Okun's law and the Philips curve, economic growth measured by national revenue or output will bring inflation, hence we select income variable with lag one period y_{t-1} to be as the explanatory factor affecting price fluctuations, together lag j periods price index p_{t-j} are introduced into the MRMA model. Taking the natural logarithm sequence of each variable above, the panel econometric model Equation (1) of the following price expectations is established, here ε_t is time series of white noise.

$$\ln p_{i,t}^{e} = \alpha_i + \beta_i \ln y_{i,t-1} + \sum_{j=1}^{p} \omega_{i,j} \ln p_{i,t-j} + \varepsilon_{i,t} \quad (1)$$

Fitting time series values of the explained variable in Equation (1) are seen as households' expected inflation rates and we use them to make linear fitted analysis with actual inflation rates corresponding periods. Lucas (1972) points that rational expectation means an individual don't make systematic mistakes in shaping their expectations, i.e., the difference value between the expected and the actual price is zero on probability perspective [7].

According to Lucas (1972), actual inflation rate at time t can be expressed in terms of expected inflation rate and random error term at time t, $\pi_t = E_{t-1}(\pi_t) + \upsilon_t$. Here π_t is inflation rate at time t, υ_t is white noise at the same period. Therefore, a hypothesis of rational expectation consists of two parts: one is the hypothesis should be established, Equation (2), and test whether the condition $\delta = 1$ is satisfied or not statistically:

$$\pi_t = \delta E_{t-1}(\pi_t) + \upsilon_t \quad (2)$$

another, if the condition $\delta = 1$ holds, we should carry out the stationary test on the white noise υ_t.

III. An Empirical Analysis

A. Chinese Urban Residents' Expected Rate of Inflation

Provincial relative panel data during 1995-2014 of Chinese urban residents are used to make the empirical analysis. For income variable y in Equation (1) we choose per capita disposable income of urban residents, and select consumer price index series data to be as the price variable p adjusted base on period 1995 corresponding to this groups. We find that the variables $\ln p_{i,t}$, $\ln y_{i,t-1}$ and $\ln p_{i,t-1}$ are all first-order

stationary sequences at 5 percent significance level through unit root test of panel data. Under the rules of panel econometric model, the sum of the squared residuals of the three forms for model selection, slop coefficient variation, intercept changing and invariant parameter, are 0.108, 0.131 and 0.181. In addition, two F statistics are 3.411 and 1.654, and the probability value P of Hausman test is 0.0000, hence Equation (1) should be the fixed effect model with variant slop coefficient. The corresponding model parameter estimates on different provinces are reported in Table 1.

Table 1. The parameter estimates in Equation (1).

Province	β_i	$\omega_{i,1}$	**Province**	β_i	$\omega_{i,1}$
Beijing	0.053 (0.059)	0.730 (0.000)	Henan	0.094 (0.000)	0.631 (0.000)
Tianjin	0.072 (0.001)	0.737 (0.000)	Hubei	0.105 (0.000)	0.585 (0.000)
Hebei	0.096 (0.000)	0.566 (0.000)	Hunan	0.100 (0.003)	0.594 (0.000)
Shanxi	0.062 (0.002)	0.713 (0.000)	Guangdong	0.093 (0.000)	0.659 (0.000)
Neimengu	0.049 (0.009)	0.802 (0.000)	Guangxi	0.127 (0.000)	0.545 (0.000)
Liaoning	0.030 (0.010)	0.897 (0.000)	Hainan	0.063 (0.001)	0.761 (0.000)
Jinlin	0.057 (0.000)	0.783 (0.000)	Sichuan	0.145 (0.000)	0.487 (0.002)
Heilongjiang	0.056 (0.003)	0.761 (0.000)	Guizhou	0.080 (0.000)	0.688 (0.000)
Shanghai	0.060 (0.038)	0.768 (0.000)	Yunnan	0.110 (0.000)	0.679 (0.000)
Jiangsu	0.059 (0.001)	0.751 (0.000)	Shanxi	0.068 (0.000)	0.751 (0.000)
Zhejiang	0.054 (0.006)	0.797 (0.000)	Gansu	0.069 (0.000)	0.810 (0.000)
Anhui	0.106 (0.000)	0.530 (0.001)	Qinghai	0.087 (0.001)	0.783 (0.000)
Fujian	0.071 (0.002)	0.715 (0.000)	Ningxia	0.078 (0.001)	0.712 (0.000)
Jiangxi	0.067 (0.014)	0.700 (0.000)	Xinjiang	0.107 (0.000)	0.565 (0.000)
Shandong	0.055 (0.027)	0.723 (0.000)			
$\overline{R}^2$	0.98			F-statistic	295.28

Note: The data in parentheses are the corresponding parameters' probability values of T-statistic.

Logarithmic variables are used in the Equation (1), the slope coefficient of each variable is elastic. Parameter β_i reflects the impact of income growth on price fluctuation and $\omega_{i,1}$ is the effect on current price changing from one lag price level. Table 1 shows that income policies have positive effects on individuals' inflation expectations even for different sections. The estimate of parameter β of Sichuan is the biggest and its counterparts' value of Liaoning is the lowest. From the three major regions in China, the east, the middle and the west, average values of regression coefficient reflecting the impact of income are 0.068, 0.081 and 0.092. In general, the resluts in Table 1 show a reverse trend between residents' inflation expectations and the region economic development, residents in stronger economy regions have lower inflation expectations, while those in weaker regions easily possess higher inflation expectations. That maybe partly because urban residents in strong economy areas are accustomed to higher income and consumption level, hence they are less sensitive to general commodity prices. While, consumers' expenditure in weak economy regions depend more on income change making them more sensitive to inflation. From analysis, although the income policy can obviously promote the growth of residents' consumption in the weak economy areas, it will also bring serious individuals' inflation expectations, further restrain the consumption growth. From each value of parameter $\omega_{i,1}$, it's easy to find that the effect of lag price change on current expected inflation rate is obviously larger than income change. It shows that the variation of residents' inflation expectations are more subjected to the historical price itself. The regression coefficients $\omega_{i,1}$ of most provinces are among 0.6-0.8. The average sensitivity coefficients of the expected inflation rate corresponding to the three major regions above from the delayed price are 0.737, 0.622 and 0.682 respectively.

B. Test on Rationality of Inflation Expectation for Urban Residents

Taking the fitting values of the explained variable of Equation (1) as the expected inflation values of urban residents, and use them to make linear fit analysis with actual inflation rates to test whether individuals have rational expectation of inflation or not according to Lucas (1972) rule. For Equation (2), we use price index represent inflation rate, and take natural logarithm of each variable, the estimates of slop coefficient δ of 29 sections are listed in Table 2.

Table 2. The Estimate Results of Parameter δ.

Province	δ_i	t_{ADF}	**Province**	δ_i	t_{ADF}
Beijing	1.00 (0.000)	-3.3909 (0.0880)	Henan	1.00 (0.000)	-6.399 (0.0007)
Tianjin	1.00 (0.000)	-5.2632 (0.0042)	Hubei	1.00 (0.000)	-4.9289 (0.0072)
Hebei	1.00 (0.000)	-5.2084 (0.0046)	Hunan	1.00 (0.000)	-4.4613 (0.0172)
Shanxi	1.00 (0.000)	-3.588 (0.0660)	Guangdong	1.00 (0.000)	-3.7325 (0.0523)
Neimenggu	1.00 (0.000)	-4.0307 (0.0320)	Guangxi	1.00 (0.000)	-4.0413 (0.0315)
Liaoning	1.00 (0.000)	-4.1547 (0.0261)	Hainan	1.00 (0.000)	-3.7838 (0.0481)
Jinlin	1.00 (0.000)	-3.4806 (0.0811)	Sichuan	1.00 (0.000)	*-1.4047 (0.8082)*
Heilongjiang	1.00 (0.000)	-5.1502 (0.0050)	Guizhou	1.00 (0.000)	-4.7410 (0.0098)
Shanghai	1.00 (0.000)	-3.3811 (0.0917)	Yunnan	1.00 (0.000)	-3.6300 (0.0595)
Jiangsu	1.00 (0.000)	-3.5584 (0.0720)	Shanxi	1.00 (0.000)	-3.7758 (0.0487)
Zhejiang	1.00 (0.000)	-3.6388 (0.0635)	Gansu	1.00 (0.000)	-3.8675 (0.0398)
Anhui	1.00 (0.000)	-4.2975 (0.0223)	Qinghai	1.00 (0.000)	-2.7037 (0.2476)
Fujian	1.00 (0.000)	-3.9876 (0.0344)	Ningxia	1.00 (0.000)	-4.6061 (0.0123)
Jiangxi	1.00 (0.000)	-4.4956 (0.0163)	Xinjiang	1.00 (0.000)	-4.1304 (0.0254)
Shandong	1.00 (0.000)	-4.999 (0.0064)			

Data in parentheses in Table 2 are the corresponding parameter T-Statistical values, and the original assumption is H_0: $\delta = 1$. The statistical values of unit root test on residual sequences are listed on the columns t_{ADF} in Table 2 and their corresponding probability values are enclosed by parentheses in the same grids. Table 2 shows that provincial values of parameter δ are all approximated to 1, and their T-statistical values are zero, so the original assumption H_0 should be accepted. But from unit root test on residual sequences, we find that residual sequences of most sections are stationary expect Sichuan and Qinghai. Therefore, on the whole, Chinese urban residents have rational inflation expectations from the year 1995 to 2014.

IV. CONCLUSION

This paper make the rationality test on inflation expectation for Chinese urban residents during 1995-2014. We introduce income variable to be as the major factor into ARMA model which is related price level and further gain expected rate values of inflation with Chinese provincial panel data. Then use them to make linear fit analysis with actual inflation rates according to Lucas (1972) to examine whether Chinese urban residents have rational inflation anticipation or not. Through research, we find Chinese urban inhabitants possess rational expectation of inflation during this peroid. Rational inflation expectation indicates that urban residents have a strong sense of identity, ability to integrate various economic signals, and are enable to understand and resist uncertainties in the economy. Their consumption decisions are more flexible, their preferences can be consistent easily, and thus their consuming behaviours are more likely to realize rationality.

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REFERENCES

[1] B. Zhang, "The Nature of inflation expectation and its impact on inflation in China," Journal of Financial Research, pp. 40-54, September 2009.
[2] J. H. Zhang, Li Chang, "What factors affect inflation expectations?" Journal of Financial Research, pp. 19-34, December 2011.
[3] Y. D. Yao, Hai-ming Tan, "Inflation expectations in China's financial markets," Journal of Financial Research, pp. 61-70, June 2011.
[4] Y. Li, J. R. Lin, "An Analysis of the Unsymmetry of Inflation, Inflation Expectations and Monetary Policy in China," Journal of Financial Research, pp. 16-29, December 2010.
[5] M. Li, T. Wen, "Inflation expectations and macroeconomic stability: 1995-2008," Nakai Economic Studies, pp. 30-53, June 2009.
[6] L. J. Sun, H. Zhu, "Inflation expectations and Monetary Policy: an empirical study based on China's 2001-2010 data," East China Economic Management, pp. 32-34, April 2010.
[7] Lucas, Robert Jr, "Expectations and the Neutrality of Money," Journal of Economic Theory, pp. 103-124, February 1972.