Dynamic Decomposition of the Urban Poverty Variation in Beijing

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Abstract: Poverty is a long-standing problem with the development of human society. We study on the dynamic effect of the urban poverty in Beijing in order to recognize the status of the poverty in Beijing, make further to eliminate poverty, and eventually to achieve the purpose of common prosperity. In this paper, we study on the dynamic effects of the urban poverty in Beijing, caused by the poverty line change and income growth respectively, and draw some conclusions.

Introduction

The poverty is one of the most serious challenges in China. After the eighteenth Congress of the Communist Party of China, the problem of poverty, become the priority among priorities in the reform of income distribution. Beijing, as China's political economic and cultural center, in 2012, its urban residents has reached 17840000 people, occupying 86% of the total population in Beijing. Therefore, it becomes particularly important to measure the poverty line and study on the poverty change in Beijing urban.

Measurement of poverty line

Due to some historical and political reasons, the poverty standard has a bigger gap between the China and the world. So, in this paper we get a new poverty line based on the "Martin method". The Martin poverty line includes lower and upper bounds. Using the regression model, we can calculate the non food spending (expressed as "NF") of the people whose per capita disposable income just can reach the food poverty line (expressed as "Z_F"). Then following the equation: $Z_L=Z_F+NF$, we can get the lower bound of the poverty line (expressed as "Z_L"). Meanwhile, we can also calculate the non food spending (expressed as "N^*F^*") of the people whose food expenditure exactly equal to the food poverty line. Then following the equation: $Z_U=Z_F+ N^*F^*$, we can get the upper bound of the poverty line (expressed as "Z_U"). Fig. 1 is the sketch diagram of the poverty line based on the "Martin method".

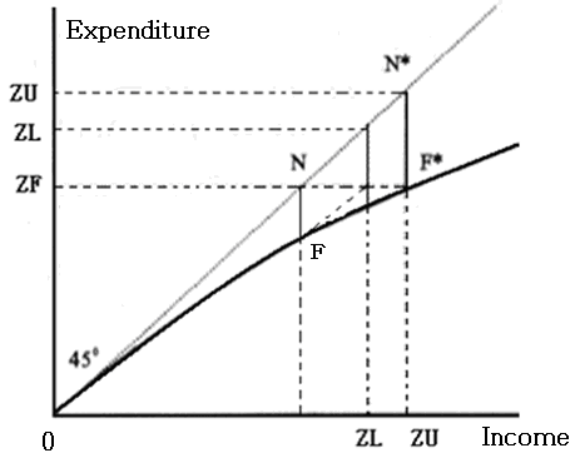

Fig. 1 Sketch Diagram of Martin Poverty Line

Based on the data provided by the National Bureau, we can establish the following regression model:

$$F = 0.2566Y+1006.9 \quad (1)$$

Where, Y is the per capita disposable income of the 20% urban low-income households in Beijing, F is the corresponding per capita food consumption expenditure

In this paper, for simplicity, the food poverty line equals to the per capita food consumption expenditure of the 20% urban low income households in Beijing. So, according to the "Martin method", we can calculate the lower and upper bounds of the poverty line in Beijing, shown in the following table.

Table 1 The Lower and Upper Bounds of the Poverty Line in Beijing [Unit: Yuan]

Year	Z_F	Z_L	Z_U	Year	Z_F	Z_L	Z_U
1998	2297.6	2998.7	5030.0	2006	3467.0	5037.5	9587.3
1999	2302.8	3007.7	5050.1	2007	3726.0	5489.0	10596.6
2000	2385.2	3151.4	5371.4	2008	3780.0	5583.2	10807.1
2001	2528.3	3400.9	5929.1	2009	4048.0	6050.4	11851.5
2002	2623.6	3567.1	6300.5	2010	4514.0	6862.8	13667.6
2003	2732.2	3756.4	6723.7	2011	4609.0	7028.4	14037.8
2004	2866.9	3991.3	7248.6	2012	5405.0	8416.2	17139.9
2005	3218.2	4603.7	8617.7				

The above data can be shown in Fig. 2:

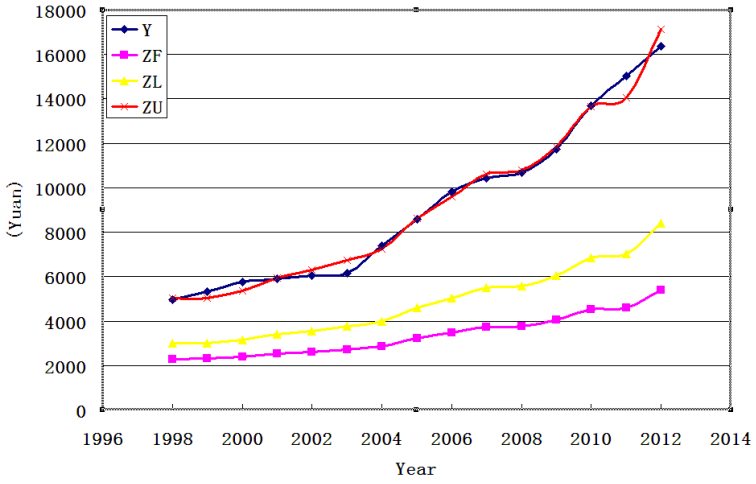

Fig. 2 The Poverty Line and Per Capita Disposable Income of the 20% low-income households in Beijing

By means of the literature research, the existing national standard of poverty line is still lower. We need to choose a more reasonable method to adjust the poverty line, which can guarantee the normal life of residents. In view of this, this paper will use the upper bound of the Martin poverty line for further research.

Calculation of the Poverty Rate

The poverty rate refers to the ratio of the poverty population to the total population. For the convenience of calculation, we assume that the per capita disposable income of Beijing urban residents obey normal distribution. The probability density function is as follows.

$$f(x) = \frac{1}{\sigma\sqrt{2\pi}} \exp\left(-\frac{(x-\mu)^2}{2\sigma^2}\right) \quad (2)$$

Where, μ is the location parameter, σ is the scale parameter.

In order to measure the poverty rate, first of all, we should estimate the two parameters. The per capita disposable income can be used as the estimator of the parameter, μ, shown in the 3rd 7th column3 in Table 2. According to the five-packet data, we can get 5 estimators of the parameter, σ. For simplicity, we use the mean as the estimator of σ, shown in the 2nd and 6th columns in Table 2. Based on the estimated parameters and the poverty line we have calculated above, we can get the poverty rate of the Beijing urban (expressed as "R"), according to the formula, $P = F\left(\frac{X-\mu}{\sigma}\right)$. The result is shown in the 4th and 8th columns in Table 2.

Table 2 The Calculation of the Poverty Rate in 1998-2012

Year	σ	μ	R	Year	σ	μ	R
1998	5254	8723	24%	2006	14906	20463	23%
1999	5501	9354	22%	2007	16918	22395	24%
2000	6731	10601	22%	2008	20575	24969	25%
2001	7687	11653	23%	2009	21867	26999	24%
2002	9624	12775	25%	2010	21882	29372	24%
2003	12047	14887	25%	2011	26360	33490	23%
2004	12766	16139	24%	2012	27125	36180	24%
2005	14086	18182	25%				

As can be seen in table 2, during 1998-2012, the poverty line in Beijing urban can maintained smooth growth. The annual change of the poverty rate was not so large, and hence was of relativity and stability.

Dynamic Decomposition of the Poverty Rate

Further, we study on the factors to influence the poverty rate. We can divide the factors into two kinds of dynamic effect, that is, the income growth effect and poverty line change effect.

With the development of economy, the income level growth will inevitably reduce poverty occurrence. In order to verify this case, we keep the poverty line (X=5030) in 1998 unchanged, and recalculate poverty rate in 1998-2012 (expressed as "R'"), shown in the 2nd and 7th columns in Table 3.

Table 3 Decomposition of the Beijing Urban Poverty Rate in 1998-2012

Year	R'	$Rn - Ro$	$R'n - Ro$	$Rn - R'n$	Year	R'	$Rn - Ro$	$R'n - Ro$	$Rn - R'n$
1998	24%	0%	0%	0%	2006	15%	-1%	-9%	8%
1999	22%	-2%	-2%	0%	2007	15%	0%	-9%	9%
2000	20%	-2%	-4%	2%	2008	17%	1%	-7%	8%
2001	19%	-1%	-5%	4%	2009	16%	0%	-8%	8%
2002	21%	1%	-3%	4%	2010	13%	-1%	-11%	11%
2003	21%	1%	-3%	4%	2011	14%	-1%	-10%	9%
2004	19%	0%	-5%	5%	2012	13%	0%	-11%	11%
2005	18%	1%	-6%	7%					

Shown as in table 2 and 3, during the past 15 years, Beijing urban poverty rate has remained at around 22-25%, but, if the poverty line is fixed in 1998, the poverty rate is reduced from 24% to 13%. The major factor leading to this decline is income growth effect (expressed as "$R'n - Ro$"), displaying in the 4th and 9th columns in Table 3. It is easy to see, companied with the income growth, the poverty reduction is very significant, which can show the effect in tackling poverty in Beijing.

On the other hand, we can make further to analyze the poverty line change effect. ($Rn - R'n$) can be considered as the poverty line change effect, shown in the 5th and 10th columns in Table 3.Visibly, because the poverty line continues to increase, the poverty rate rise is notable. But this

rise does not mean the deterioration in poverty.

Through the above analysis, we can say that the main factors to influence the poverty rate change in Beijing urban dynamically are two effects, the income growth effect and poverty line change effect. The relationship of the three variables can be expressed as follows:

$$Rn - Ro = (R'n - Ro) + (Rn - R'n) \tag{3}$$

It also can be seen in fig. 3:

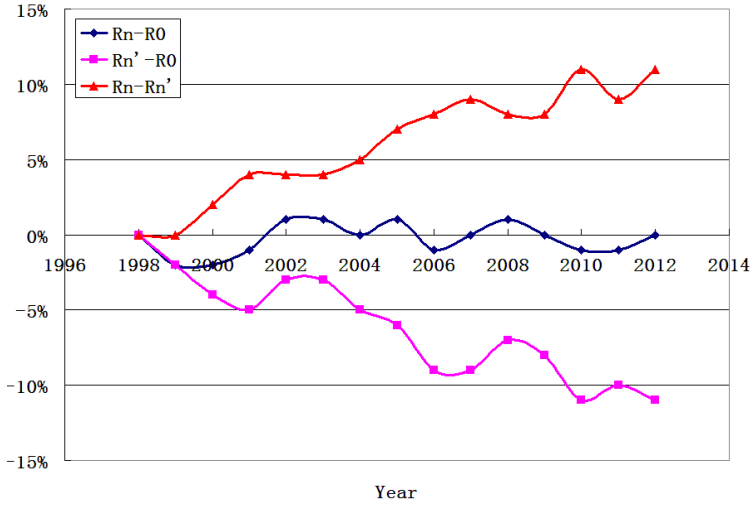

Fig. 3 Decomposition of the Poverty Rate

Conclusions

To sum up, according to the Martin method, we calculate a new poverty line, which give the concept the relative significance. So the urban poverty in Beijing has remained a stable trend during 1998-2012. But the change can be decomposed into two effects, namely, income growth effect and poverty changes effect. The former makes the poverty rate continue to decline, reflecting the effect of poor treatment, while the latter contributes to the rise in poverty rate constantly. But the rise is of the policy reason, not meaning the aggravation in poverty.

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