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# Analysis and Prediction of Residents' Income Gap in Poverty-stricken Areas of Yunnan Province

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**Abstract** Taking Ludian County in Zhaotong City of Yunnan Province for example, according to the data on residents' income gap in Ludian County during the period 2002–2011, we analyze the residents' income gap in Ludian County, and offer the forecast value of residents' income gap in Ludian County during the period 2012–2015, using Compertz curve model and Eviews software for fitting. The forecast value shows that the residents' income gap will continue to widen in Ludian County. Finally we put forth the recommendations for bridging the residents' income gap in Ludian County, in order to provide a reference for settling the problems concerning residents' income gap in other state-level poverty-stricken counties of Yunnan Province.

**Key words** Ludian County, State-level poverty-stricken counties, Residents' income gap, Compertz curve model, Analysis and prediction

In recent years, many scholars have been not just concerned about urban-rural income gap; they become more and more aware of the widening income gap between farmers in the context of gradually expanding urban-rural income gap. It will ineluctably aggravate the issues concerning agriculture, rural areas and farmers. When researching the income gap between farmers, some scholar have found that with the state's increasing support to the state-level poverty-stricken counties and mobility of labor in the poverty-stricken counties in recent years, the residents' income gap in these counties is widening. The poverty-stricken counties are regarded as the sensitive areas in the issues concerning agriculture, rural areas and farmers, and the issues concerning the residents' income gap in poverty-stricken counties have also captured a great deal of attention.

There are 73 state-level poverty-stricken counties in Yunnan Province, and in terms of the poverty-stricken counties and poor population, Yunnan Province ranks first. So compared with other provinces, the widening residents' income gap in the poverty-stricken counties will exert the greatest impact on the income gap between farmers in Yunnan Province<sup>[1]</sup>. In this paper, we take Ludian County in Zhaotong City for example to explore the trend of the income gap in the poverty-stricken areas in Yunnan Province, use Compertz curve model to predict this trend, and put forth the recommendations.

## 1 Research methods and data sources

**1.1 Overview of the study area** Ludian County is located in the northeast of Yunnan Province, with its northeast bordering on Zhaoyang District of Zhaotong City, southeast adjacent to Weining County of Guizhou Province, where there are numerous mountains, and the majority of the poor people are distributed in

the mountainous areas with harsh natural environment, backward transport facilities and sluggish development of science, education and sanitation; even some ethnic groups are in the state of poverty, and the poverty alleviation cost is very high.

Due to the shortage of natural resources, most of the labor forces abandon farming and choose to work in the city; the young, old, sick left can barely keep on their sustenance by the annual income. This phenomenon causes the families with more labor to have a great advantage in the income. Due to education backwardness technical shortage, even for the migrant workers, their income is not satisfactory while for the skilled labor forces, their income is much higher as a result of small possibility of being replaced. The local government only pays attention to supporting the enterprises with large size, but neglects the development of small and medium-sized enterprises, so that there are few resources available for small and medium-sized enterprises, thereby hindering the development of small and medium-sized enterprises.

**1.2 Research methods** The original formula of Compertz curve model is  $Y_t = La^{b^t}$ , and we take logarithm of both sides to get  $\ln Y_t = \ln L + b^t \ln a$ . If selecting the curve trend model with growth limit, we can not use LS command estimation parameter but use the three sum value method when the growth limit can not be determined in advance. The specific method of three sum value method is as follows: If the model has three unknown parameters, the data are divided into three equal parts; if the data can not be divided into three equal parts, a few of the earliest data can be given up<sup>[1]</sup>.

According to the three sum value parameter formula of modified exponential curve, Compertz curve is calculated as follows:

$$\ln a = \left( \sum_2 \ln y_t - \sum_1 \ln y_t \right) \frac{b-1}{(b^n-1)^2}$$

$$b = n \sqrt{\frac{\sum_3 \ln y_t - \sum_2 \ln y_t}{\sum_2 \ln y_t - \sum_1 \ln y_t}}$$

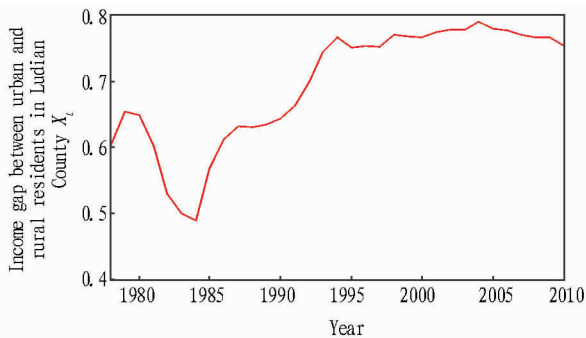
$$\ln L = \frac{1}{n} \left( \sum_1 \ln y_t - \frac{b^n-1}{b-1} \ln a \right)$$

**1.3 Data sources** According to Ludian County Statistics Bulletin and Yunnan Statistical Yearbook, we calculate the per capita disposable income of urban residents and per capita net income of rural residents in Ludian County (Table 1). Using the per capita disposable income of urban residents to subtract per capita net income of rural residents, we get the income gap, denoted as  $x_t$ , 2002  $\leq t \leq$  2011. The trend of income gap between urban and rural residents in Ludian County is shown in Fig. 1.

**Table 1 Income gap between urban and rural residents in Ludian County of Zhaotong City**

Year	Per capita disposable income of urban residents//yuan	Per capita net income of rural residents//yuan	Income gap $x_t$
2002	5 484	993	4 491
2003	5 780	1 055	4 725
2004	6 280	1 181	5 099
2005	7 140	1 286	5 854
2006	7 769	1 464	6 305
2007	8 615	1 688	6 927
2008	9 886	1 990	7 896
2009	11 328	2 336	8 992
2010	12 375	2 572	9 803
2011	13 527	3 046	10 481

Note: Data are derived from *Ludian County Statistics Bulletin*.



**Fig. 1 The trend of income gap between urban and rural residents in Ludian County**

Fig. 1 and Table 1 show that during the period 2002 – 2011, both urban residents' income and rural residents' income in Ludian County increased, but the gap between the two tended to widen ceaselessly.

## 2 Results and analysis

Compertz curve model is the model with the growth limit, but currently its growth limit can not be determined, so we use the three sum value method. According to the relevant stipulation of three sum value method, we remove the data in 2012, divide the remaining data into three equal portions, and calculate the sum of all phases of data logarithm (Table 2).

According to the three sum value parameter formula of modified exponential curve, it can be calculated as follows:

$$a = 1.807\ 117\ 1$$

$$b = 1.032\ 965\ 748$$

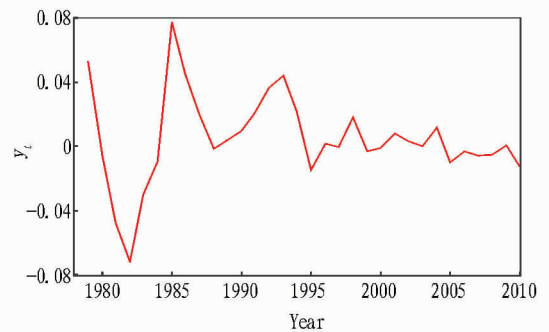
$$L = 281.771\ 696\ 3$$

Using Eviews software, the initial value is assigned to the a-

bove calculation results ab L, and we get the forecast value and the forecast map by entering  $\hat{Y}_t = La^{bt}$  into the command bar of the equation.

**Table 2 Logarithm in each phase**

Year	The first phase ( $\ln y_t$ )
2003	8.460 623
2004	8.536 8
2005	8.674 88
$\Sigma_1 \ln y_t$	25.672 3
The second phase ( $\ln y_t$ )	
2006	8.749 098
2007	8.843 182
2008	8.974 112
$\Sigma_2 \ln y_t$	26.566 39
The third phase ( $\ln y_t$ )	
2009	9.104 091
2010	9.190 444
2011	9.257 319
$\Sigma_3 \ln y_t$	27.551 85



**Fig. 2 The prediction of the trend of income gap between urban and rural residents in Ludian County**

Fig. 2 shows that during the period 2012 – 2015, the income gap between urban and rural residents in Ludian County will widen constantly. The forecast value is 10 785.57 in 2011, 12 103.96 in 2012, 13 633 in 2013, 15 412.93 in 2014, and 17 492.82 in 2015. From the forecast results, we can find that the urban-rural income gap will continue to widen in Ludian County.

## 3 Recommendations

The income gap between labor forces and the old, weak, sick and disabled, income gap between skilled workers and unskilled workers, development gap between large enterprises and small and medium-sized enterprises and some other reasons, have contributed to the widening income gap between urban and rural residents in Ludian County. Ludian County is the state-level poverty-stricken county, where the residents' income level is not high, and if the income gap continues to expand, it is likely to lead to many social problems, so narrowing the income gap brooks no delay.

**3.1 Increasing investment in agricultural technology, adjusting the agricultural structure and developing characteristic agriculture** Due to regional differences in production conditions, it is necessary to select appropriate agricultural technology and accelerate the pace of transformation of agricultural technology

to agricultural production. Some native foods in Ludian County are well known, such as cherries, apples, cattle Thelephora, walnuts, green peppers and maltose, but the blocked market channels and poor transportation conditions hinder the development of its agricultural industry.

The government can conduct collective cultivation planning of the related characteristic industries, and organize unified sales, to form economies of scale, increase the bargaining power of farmers, and increase the income of farmers who do not work outside the home.

### 3.2 Increasing support to small and medium-sized enterprises while laying emphasis on supporting large enterprises

There were 35 industrial enterprises in Ludian County in 2011, including 12 large-scale enterprises and 23 small-scale enterprises. The industrial enterprises above designated size achieved total output value of 1.52152 billion yuan, an increase of 28.0% over the previous year; the industrial enterprises below designated size achieved total output value of 74.87 million yuan, an increase of 0.9%<sup>[4]</sup>.

Although the output value of small and medium-sized enterprises grows, but compared with the enterprises above designated size, the growth rate is too low; the number of small and medium-sized enterprises is nearly twice that of the enterprises above designated size. If the small and medium-sized enterprises grow rapidly, it will ease the employment pressure in Ludian County and increase farmers' income.

Therefore, Ludian government should increase efforts to support small and medium-sized enterprises, and relax the loans policy for small and medium-sized enterprises, to create a good environment for the development of small and medium-sized enterprises.

### 3.3 Improving the quality of labor, increasing investment in education and providing equal opportunities for education

The education should be oriented for farmers, and teach farmers according to their aptitude. It is necessary to enhance technical training for farmers and improve farmers' ability to obtain market information and participate in market competition, to make education truly benefit farmers<sup>[5]</sup>.

Therefore, the government should increase financial support for education, give extra help to vocational training for farmers and educational subsidies to poor families under the premise of ensu-

ring rural basic educational funding, to stimulate farmers' motivation to learn and participate in technical training.

### 3.4 Reforming the existing household registration system and improving the social security and labor protection for farmers

The longing term existence of urban-rural dual economic structure and the household registration system firmly controlling the population migration in the course of ordinary labor migration have become the biggest obstacle. Therefore, it is necessary to gradually get rid of barriers to urban-rural dual economic structure, so that rural residents obtain more employment opportunities and participate in the right to distribution of economic outcomes. In the areas where conditions permit, it is necessary to establish and promote rural subsistence security system, actively and steadily push forward the basic medical service and educational assistance, and gradually institutionalize and standardize the poverty reduction in rural areas.

In addition, there is a need to popularize labor-related legal knowledge for farmers, to increase farmers' rights-defending awareness. Other poverty-stricken counties in Yunnan Province should draw a lesson from Ludian County to increase investment in agricultural technology and develop specialized agricultural economy; increase non-farm employment opportunities for farmers, increase the technical content of the labor, and improve the quality of the labor. It is necessary to lay more emphasis on the development of small and medium-sized enterprises, to provide more resources for small and medium-sized enterprises and improve social security system for farmers.

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