

FORECAST ON FUTURE LEVEL OF ECONOMY DEVELOPMENT OF CHINA

WANG Dian – hai, LI Zhen – fu

(School of Communication, Jilin University, Changchun 130025, P. R. China)

ABSTRACT: China is a country in the period of economy takeoff. We cannot use the common method to forecast its future economy level. This paper establishes an economic level forecast model of the countries whose economy is in the take off because of the stimulation of model country. The enlightenment of the model is from physics. If there are two substances, A and B, and a medium between them, according to physics, when substance A is hotter than B, B's temperature will inevitably rise and close to that of A. Thus, this system tends to be a state of balance. Three factors affect heat conduction between substance A and B. They are the difference of temperature between two substances, the conductivity of medium and the characteristics of themselves. The model is testified through two examples. And then we forecast the economic development level of China in long term. This paper raises a model to solve the problem of research approaches. However, since there are some limitations on data source, problems will appear. For example, in certain years, our forecast results do not suit the real situation. But in the long term, the tendency is accurate. Then this model can be amended in accordance with different situations.

KEY WORDS: forecast; economy takeoff; model country

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1 INTRODUCTION

At present, a public focus is put on the forecast of economic development level of China. Many experts and scholars have worked out various forecast models, such as relativity-analyzing model, tendency-output model, ambiguity-system model, dynamics of system model etc. However, there are two conspicuous problems. On one hand, for an economy takeoff country as China, these models cannot exactly describe its economic development tendency. For instance, tendency-output model is not suitable for the long-term forecast. On the other hand, it is hard to identify the parameters in the models and these parameters themselves are a very complex issue. A satisfied model, therefore, is difficult to be made. For a long-term forecast, the simpler and more convincing the model is, the better result the forecast turns out. In addition, the economic development of takeoff country is beyond a normal one, so simple and common methods cannot be conducted.

For this reason, we should seek a new method to evaluate the future economic development level of an economy takeoff country just like China.

2 PRINCIPLE OF THE MODEL DESIGNING

2.1 Enlightenment from Physics

If there are two substances, A and B, and a medium between them, according to physics, when substance A is hotter than B, B's temperature will inevitably rise and close to that of A. Thus, this system tends to be a state of balance (SHEN *et al.*, 1987). Three factors affect heat conduction between substance A and B. They are the difference of temperature between two substances, the conductivity of medium and the characteristics of themselves. This situation can be applied to economic development. A developing country is the same as substance B, and a developed country is the same as A, and there is an economic

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Biography: WANG Dian-hai(1962 –), male, a native of Da'an County of Jilin Province, professor, Ph. D. advisor. His research interests include communication planning and controlling. E-mail: wangdh@jlu.edu.cn.

difference between two countries (as temperature difference). If there is medium to conduct heat, in the meantime, the developing country is equipped with the conditions of development, it would develop at a higher speed and closer to the developed country. The developing countries under such situation are called the country in economy takeoff. Developed countries (model country) influence their speed of economic development and achievement in different stages. We can make a model to indicate the relationship between them (Fig. 1).

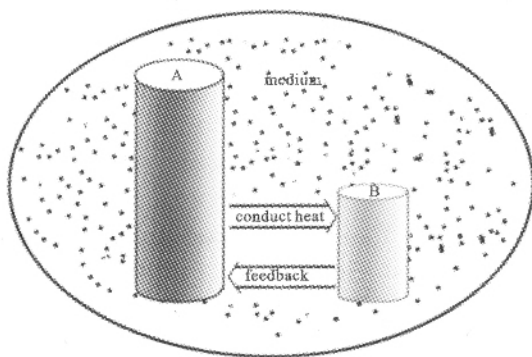


Fig. 1 Heat conduction between substance A and B

2.2 Character of the Country in Economy Takeoff

Economy takeoff isn't a new concept, which was put forward by western economists in the early 1960s. American economist Rostow divided human society into six stages. They are traditional society stage, prerequisite condition providing stage, takeoff stage, pushing-to-maturity stage, mass consumption stage, and living-quality pursuing stage. Economy takeoff is at the third stage (HU and LI, 1986).

Takeoff stage is the dividing line in modern society, a key stage in economy growth. The meaning of economy takeoff is to break through traditional standstill situation, and in short time, bring about radical changes in basic economy structure and the mode of production, and set free the various forces aiming at developing and improving. Once a country is in takeoff, its economy can step in the following stages (WANG and YANG, 1995).

In Rostow's viewpoint, there are three qualifications for takeoff: higher accumulation ratio, establishment of leading industries, and reform on regulations (HU and LI, 1986). It is easily accepted to regard China as one of the countries in economy takeoff. China has formed the qualifications in past twenty years, that is, the high accumulation ratio, the reasonable adjust-

ment of industrial structure, and the continuous reforms on political system and economic structure meeting the demand of economic development. Meanwhile, the open policies as well as a series of relevant policies have provided a medium between China and the model country (developed country).

2.3 Role of the Model Country

Model country refers to the most advanced countries in the world, which stay in leading position in international economic progress, and can be dominant in many aspects. They will stimulate and bring along the country in economy takeoff by means of its capital, technology, management experience, consumption concept and tendency. The major roles of model countries can be summarized as follows:

2.3.1 Capital transfer

Takeoff countries always need much capital to develop national economy, while model countries or other developed countries have plenty of standby capital to invest. As a result, the capital will flow to the country in takeoff from model countries.

2.3.2 Technology transfer

Economic takeoff means that its industrial structure is in an adjusting period, and advanced practical technology is in need. It will be very slow if they are invented or created at home. It has been proved that advanced foreign technology is helpful to speed up economy takeoff for developing countries.

2.3.3 Shift of consumption concept and tendency

The national consumption concept and tendency in developed countries will change with the new products that come from new technology. The change is very slow. While the consumers in economic takeoff country will be guided by model countries. This strong consumption tendency will enlarge market demands, stimulate production and speed up economic development of the country in economy takeoff.

2.3.4 Shift of management experiences and methods

In general, the model countries have accumulated a complete set of successful experiences and methods in modern management and social economy operation. The economy takeoff countries can make full use of those practical and advanced experiences and methods to promote its own economic level.

Of course, model countries also influence the takeoff countries in other aspects, for example, culture, moral, tradition, etc. With various comprehensive effects, the takeoff countries will develop at a higher speed for a long time.

3 THE ESTABLISHMENT OF MODEL

The basic principle is: the developing speed of takeoff countries is in a direct proportion to the difference between the takeoff and model country, that is, imputing the difference of the two kinds of national economy into synthetically stimulus factor. Therefore, the following model is established:

$$\frac{dI}{dt}/I = a(I_m - I) + \beta \quad (1)$$

where I is a certain economic index of takeoff country, for instance, average gross national income or average gross national products; I_m , a certain economic index of model country (the same index as I); T , time; a , proportion coefficient; β , constant.

For a long-term, model country maintains steady economic development at the speed of b . Provided that it develops at a smooth speed, I_m can be indicated by the following formula:

$$I_m = I_m^0 e^{bt} \quad (2)$$

where I_m^0 is the base period value of I_m , and b is its increase speed.

From the two formulas above, we can found the following formula:

$$\frac{dI}{dt}/I = a(I_m^0 e^{bt} - I) + \beta \quad (3)$$

Formula (3) is a differential equation. From formula (1), we can see that I_m roughly equals to I , when t is very large. To this point, the economy takeoff country has approached or reached the economic level of model country. So that β roughly equals to b . In formula (3), we can find following formula through solution to the differential equation:

$$I = \frac{I_m^0 e^{r+bt}}{CI_m^0 + e^r} \quad (4)$$

where r is $ab^{-1}e^{bt}I_m^0$, and C is indeterminate coefficient.

When $t = 0$:

$$C = \left(\frac{I_m^0}{I^0} - 1\right) \frac{e^{ab-1} I_m^0}{I_m^0} = \left(\frac{1}{I^0} - \frac{1}{I_m^0}\right) e^{ab-1} I_m^0 \quad (5)$$

From formula (1), if $t = 0$, and V^0 is the I' (base period) increase speed of economy takeoff, we can establish the following equation:

$$a = (V^0 - b)/(I_m^0 - I^0) \quad (6)$$

The model formed with formula (4) and formula (6) is an economic level forecast model of the countries whose economy are in the takeoff because of the stimulation of model country. In this model, V^0 , b , I^0 and I_m^0 are original data, which can easily be collected. When the economic level in a certain period of time is to forecast for country in takeoff, we can just put these

data into formula (6), formula (5) and formula (4).

4 VERIFICATION OF THE MODEL

4.1 Japan

First, the data from 1960 to 1980 in Japan are chosen to testify this model, because the beginning of 1960s was the time when Japanese economy started to boom (WANG and YANG, 1995). In the 1960s, Japanese Average Notional Income was 417US\$/person (I^0), and average increase speed was 11% (V^0). Provided that the United States was a model country, its Average National Income was 2 502US\$/person (I_m^0) at the same time. Its average increase speed was 2.5% (b) from 1960 to 1980 (THE WORLD BANK, 1993).

The data mentioned above are put into formula (6), formula (5), and formula (4), and thus $t = 20$ (1960 - 1980). Then the forecast value of Japanese Average National Income is $I = 3 045$ US\$/person in 1980 (in 1960's price); and it was 7 737 US\$/person (in 1980's price), which is resulted from changing in dollar exchange rate. And its real income was 7 672US\$/person, 55US\$/person lower than the forecast value, in which error rate was 0.72%. In a word, this model is valid in forecasting the economic situation of the takeoff countries.

4.2 China

In 1990, Chinese Average National Income was 420US\$/person (I^0), and average increase rate was about 10% (V^0) from 1990 to 1997 (here take the unchanged price into account). Provided that the United States was a model country, whose Average National Income was 22 660US\$/person (I_m^0) in 1990, and its increase rate was 1.7% (b) from 1990 to 1997 (THE WORLD BANK, 2000).

The data mentioned above are put into formula (6), formula (5), and formula (4), and $t = 7$. Then the forecast value of Chinese Average National Income (I) was 873US\$/person in 1997. But its real income was 860US\$/person (THE WORLD BANK, 2000), 13 US\$/person lower than the forecast value, in which error rate was 1.26%, and it is very accurate.

5 FORECAST TO ECONOMIC PROSPECT IN CHINA

China is an economic takeoff country, whose economic prospect can be forecast by means of the men-

tioned model.

In this model, the economic growth speed of the model country is vital to that of economy takeoff country. While the economic growth speeds of the model country is not an unchanged value to some extent in a long period of time. Thus under different speeds of the model country, the economy developing of the contrast country in economy takeoff are foretold.

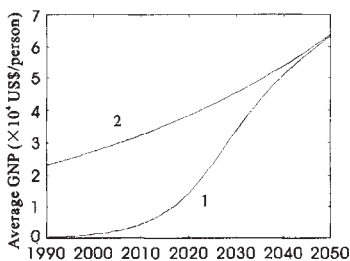
In Fig. 2A, we take the year 1990 as the base year, $I^0 = 420\text{US\$}/\text{person}$. The base period(V^0) equals 10% (unchanged price), and the United States is still supposed to be model country, whose I_m^0 equals 22 660US\$/person, $b = 1.7\%$. Put the data into the model, then Chinese average GNP in 2005, 2010, 2020, 2030, are respectively 2 441.57US\$/person, 4 456.7US\$/person, 14 330.5US\$/person and 33 645.2 US\$/person(here indicator I is the average GNP, and take the unchanged price in 1990 into account). About 2060, the economy takeoff country will come up with the model country.

In Fig. 2B, we take the year 1990 as the base year, $I^0 = 420\text{US\$}/\text{person}$. The base period(V^0) equals 10% (unchanged price), and the United States is still supposed to be model country, whose I_m^0 equals 22 660 US\$/person, $b = 2.0\%$. Put the data into the model, then Chinese average GNP in 2005, 2010, 2020, 2030, are respectively 2 889US\$/person, 5 659US\$/person,

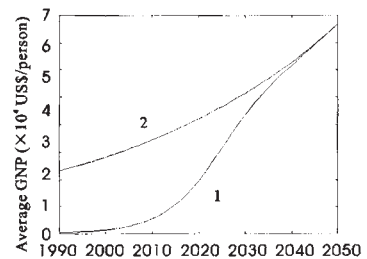
19 724US\$/person and 43 595US\$/person (here indicator I is the average GNP, and take the unchanged price in 1990 into account). About 2055, the economy takeoff country will come up with the model country.

In Fig. 2C, we take the year 1990 as the base year, $I^0 = 420\text{US\$}/\text{person}$. The base period(V^0) equals 10% (unchanged price), and the United States is still supposed to be model country, whose I_m^0 equals 22 660 US\$/person, $b = 2.5\%$. Put the data into the model, then Chinese average GNP in 2005, 2010, 2020, 2030, are respectively 3 050US\$/person, 6 230US\$/person, 24 360US\$/person and 56 030US\$/person (here indicator I is the average GNP, and take the unchanged price in 1990 into account). About 2050, the economy takeoff country will come up with the model country.

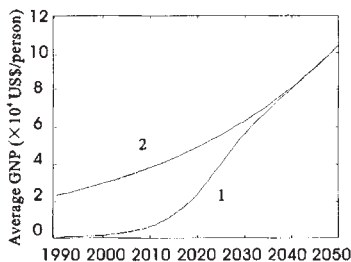
In Fig. 2D, we take the year 1990 as the base year, $I^0 = 420\text{US\$}/\text{person}$. The base period(V^0) equals 10% (unchanged price), and the United States is still supposed to be model country, whose I_m^0 equals 22 660US\$/person, $b = 3.0\%$. Put the data into the model, then Chinese average GNP in 2005, 2010, 2020, 2030, are respectively 3 210US\$/person, 6 850US\$/person, 29 940US\$/person and 71 250 US\$/person(here indicator I is the average GNP, and take the unchanged price in 1990 into account) . About 2045, the economy takeoff country will come up with the model country.



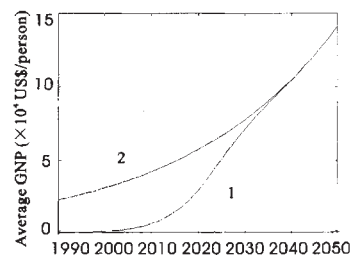
A. the United States' increase speed is 1.7%



B. the United States' increase speed is 2%



C. the United States' increase speed is 2.5%



D. the United States' increase speed is 3%

Fig. 2 The Comparison of economy development forecasts between China and the United States

(Curve 1 is the variance of Chinese Average GNP, and Curve 2 is the variance of American Average GNP)

6 ANALYSIS ON THE RESULTS

All the mentioned forecast results are valid.

(1) By means of calculation, we can find that the faster the economy of the model country develops, the faster the economy of takeoff country develops and speeds up. When $b = 1.7\%$ the economy takeoff country will come up with model country in 2060. When $b = 2.0\%$ the economy takeoff country will come up with model country in 2055. When $b = 2.5\%$ the economy takeoff country will come up with model country in 2050. When $b = 3.0\%$ the economy takeoff country will come up with model country in 2045.

(2) In view of the economic growth, it seems impossible that a nation keeps high lasting speed of economic increase. However, Chinese GNP lags far behind that of developed countries, so at this speed, China can hardly shake off poverty within 50 years. Therefore, China must maintain such a high speed to achieve the goal that it matches to medium level among developed countries in the mid-21st century.

(3) Even due to the forecast result ($b = 1.7\%$), Chinese GNP in 2030 is only equivalent to 73% that of the United States. China can be just counted as an average developed country. This goal can be achieved.

(4) China can take Japan, Germany, Republic of Korea, and Singapore as examples, which have turned from the underdeveloped countries to higher level ones in less than 30 years. It is likely that China spends 30 to 50 years achieving this aim in the economic development.

(5) All the mentioned GNP are counted by means of U. S. dollars, whose average increase speed is high, counting in the changing factors of the exchange rate.

For instance, Japanese exchange rate to US\$ had increased about three times and that of Germany had increased about two times in the period of takeoff. In this stage, China will have a similar economic situation in exchange rate to U. S. dollars.

7 CONCLUSION

The economic growth forecast is meaningful to economy takeoff countries. This paper raises a model to solve the problem of research approaches. However, since there are some limitations on data source, problems will appear. For example, in certain years, our forecast results do not suit the real situation. But in the long term, the tendency is accurate. Then this model can be amended in accordance with different situations.

REFERENCES:

- Hu Dai-guang, Li Yi-ning, 1986. *The Main Genre of the Contemporary Capitalist Economics*[M]. Beijing: The Commercial Press, 88 - 92. (in Chinese)
- Shen Xiao-feng, Hu Gang, Jiang Lu, 1987. *The Theory of the Dissipation Structures* [M]. Shanghai: Shanghai People Press, 229 - 230. (in Chinese)
- The World Bank, 1993. *World Developing Report in 1992*[R]. Beijing: The Financial and Economic Press of China, 8 - 22. (in Chinese)
- The World Bank, 2000. *World Developing Report in 1999* [R]. Beijing: The Financial and Economic Press of China, 8 - 22. (in Chinese)
- Wang Dian-hai, Yang Zhao-sheng, 1995. A research of the economy developing forecast models of the country in economy flying start under the stimulations of the model countries[A]. In: *Technological Economics*[C], 34 - 38. (in Chinese)