

# THE RESEARCH ON THE INTERACTION EFFECTS OF RURAL LOGISTICS AND ECONOMIC DEVELOPMENT

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**Keywords:** Rural logistics, Economic development, Interaction effects.

**Abstract:** There are interaction effects between rural logistics and economic development. The effect rural logistics has on the economic development presents as an S-shaped curve. So the interaction effects between rural logistics and economic development vary at different stage. It's necessary to analyse the interaction effects to make the appropriate policies to promote the development of rural logistics. A model is constructed to analyse the interaction effects. Then the contribution that rural logistics makes to economic development in China is discussed. The interaction effects at present imply a result that the rural logistics elasticity coefficient of economic development is less than 1. Finally, some policies to develop rural logistics are proposed.

## 1 INTRODUCTION

As a large agricultural country, the important role of rural logistics in the development of the national economy is self-evident. The research on rural logistics is also carried out extensively. Lu Jiang pointed out that logistics about agricultural products should be attached importance to, which provides logistics security for building new socialist countryside. The backward logistics equipment and poor operation models are important factors which lead to keep farmers' income at low level even with the increasing production. The application of new logistics concepts and technologies is a very important method to build new socialist countryside (Lu jiang, 2006). With the summary of the development characteristics of modern logistics in developed countries, Wei Jigang put forward that when concerned with the development of the logistics in urban and rural, agriculture logistics and rural logistics should be paid more attention to than urban logistics (Wei Jigang, 2006).

Although rural logistics is so important, the overall development of rural logistics is in low level and low speed. There are some obstacles in rural logistics, such as poor logistics infrastructure, high transaction costs, backward logistics technologies and low rate of the application of modern information technologies. Relative to the development level of overall economic, the

development of rural logistics is not satisfactory. So many experts and scholars proposed countermeasures and suggestions for the development of rural logistics (Deng Shuhong and Wei Feng, 2009). It is one of the most familiar advices that the government should attach great importance to the promotion of logistics infrastructure in rural areas. The starting point of these proposals implies that the development of rural logistics should be supported by other economic departments. However, there are some limits in these studies. Because the rural logistics is a part of national economy, there is a relationship between them and the development scale of rural logistics must match with the scale of the overall economy. Therefore, empirical study is needed to educe the relationship between the rural logistics and economic development before the actual logistics planning in rural areas. When the development of rural logistics is in small scale stage and isn't conducive to economic development, it's necessary to increase investments to promote rural logistics. When the scale of rural logistics is large enough, policies should mainly be assigned to focus on how to change the logistics development into an important force for economic growth through the optimization of rural logistics. In total, it is crucial to find the appropriate scale of rural logistics and policies should be put forward based on the principle of mutual benefit for both of the development of

rural logistics and national economy.

Therefore, this paper analyzes the role of rural logistics in the regional economics growth from the quantitative point of view. Based on the result, the matched scale of rural logistics and how to make appropriate rural logistics policy are discussed, which may do good to rural logistics planning.

## 2 MODEL OF THE EFFECTS OF RURAL LOGISTICS ON ECONOMIC GROWTH

There are many characteristics of rural logistics, so it is necessary to adopt some of the sophisticated theories and methods of modern logistics, especially the quantitative research methods. Empirical research methods have been maturely used in the study of regional logistics. Wang Jun used the GDP to represent the level of economic development, while the level of development of the logistics industry represented by the goods turnover (Wang Jun, 2004). Then he revealed the relationship between logistics industrial and economic development by using the econometric approach. Tan Qingmei et al used cargo turnover and volume of passenger transportation as a unified index to reflect the regional logistics capability, and analyzed the relationship between logistics and economy in Jiangsu Province by using regression approach (Tan Qingmei and Wang Zilong, 2005). In quantitative research about regional logistics and regional economic growth, passenger and freight traffic volume or passenger and freight traffic turnover are always used to describe the development level of logistics, and GDP is used to describe the economic growth. To research the relationship between regional economic and logistics, researchers mostly use these econometric models: (1) regression model; (2) the logic of economic growth trends (Logistic) model; (3) co-integration analysis; (4) panel data analysis (Song Shanmei and Xie Huiqiang, 2009). In the paper, the interaction effects between the rural logistics development and economic development are analyzed with empirical research method, which is maturely used to study regional logistics..

### 2.1 Data Resources

In this paper, the level of economic development is represented by GDP (Wang Jun, 2004; Tan Qingmei, 2005), while the level of rural logistics is represented by freight traffic volume of agricultural

products. Wu Zhihui et al indicated that it's reasonable to use freight traffic volume to represent the level of logistics development (Wu Zhihui and Yu Qiaoyun, 2008). She pointed out that both of the freight traffic volume and freight traffic turnover speed have important influences on the development of regional logistics. Then she analyzed the influence that logistics had on the economic growth of the three economic zones. The agricultural products from farmers are eventually put into the circulation through the logistics channels, so the total freight volume of agricultural products is calculated by the sum of the weight of farmers' selling agricultural products, animal products and aquatic products.

### 2.2 Gompertz Model

Gompertz model was designed to forecast the population growth by the life insurance expert, B.Gompertz in UK in 1820. Then the model was used in market forecasting by the American scholar, R.Prescott (Gu Jibao, 2010). And later it was widely used for description and prediction in biological and industrial growth. The function is as follow.

$$Y = e^{(b_0 + b_1/X)} \quad (1)$$

Where,  $Y$  is the dependent variable and  $X$  is the independent variable.  $b_0$  and  $b_1$  are unknown constant. Its function curve is shown in Figure 1.

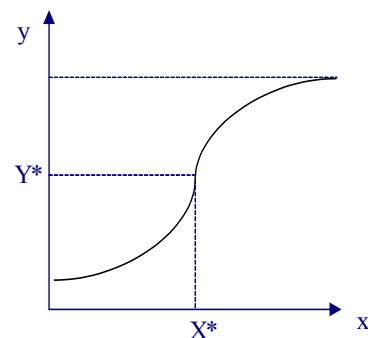


Figure 1: Function curve of Gompertz model.

As shown in Figure 1, the curve of Gompertz model is a typical S-shaped curve. Note that in the left side of the turning point  $(X^*, Y^*)$ , the curve is concave because  $y'(x) > 0, y''(x) > 0$ , while in the right side of the turning point the curve is convex as  $y'(x) > 0, y''(x) < 0$ . When  $x \rightarrow \infty$ , the curve is close to a horizontal asymptote.

The contribution that rural logistics makes to regional economic development can also be described by the Gompertz model. The effect trend

of freight traffic volume of agricultural products (x) to GDP(y) is also presented as the S-shaped curve. The development of rural logistics lags behind the regional economic growth in the early stage, and its contribution to economic growth is not obvious with a flat trend. While the rural logistics is developed to a certain degree, its contribution to the regional economy may stand out with a rapid rise trend. After the scale of rural logistics and the level of logistics management are developed to a certain extent, the contribution which the rural logistics makes to the regional economy may accordingly reach the maximum and then gradually become stable.

**2.3 Empirical Research**

Firstly, China's GDP during 1990-2008 and the total freight traffic volume of agricultural products per year are given in Table 1.

Table 1: China's GDP and freight traffic volume of agricultural products.

Year	GDP(billion Yuan)	Freight traffic volume of agricultural products(thousands tons)
1990	1866.78	258003.57
1991	2178.15	270083.18
1992	2692.35	265372.87
1993	3533.59	265465.00
1994	4819.79	289315.60
1995	6079.37	282718.29
1996	7117.66	332219.04
1997	7897.30	367373.87
1998	8440.23	361125.16
1999	8967.71	385832.92
2000	9921.46	424534.22
2001	10965.52	425891.41
2002	12033.27	443147.41
2003	13582.28	456802.34
2004	15987.83	453026.16
2005	18321.74	544953.21
2006	21192.35	557975.40
2007	25730.56	550679.94
2008	30067.00	577907.39

Based on the model constructed before, now we use the GDP (y) which indicated the level of economic development as the dependent variable, and freight traffic volume of agricultural products (x) as the independent variables, indicating the level of logistics development in rural areas. Here we adopt the SPSS17.0 to fit the S-shaped curve and get the S-shaped curve equation as follow:

$$y = e^{(11.891 - \frac{1048593.36}{x})} \quad (2)$$

Where the correlation coefficient R2=0.941,P=0.000 achieve the significant level, indicating that the positive effect China's rural logistics have on economic development indeed presents as the S-shaped curve. The fitting image is shown in Figure 2.

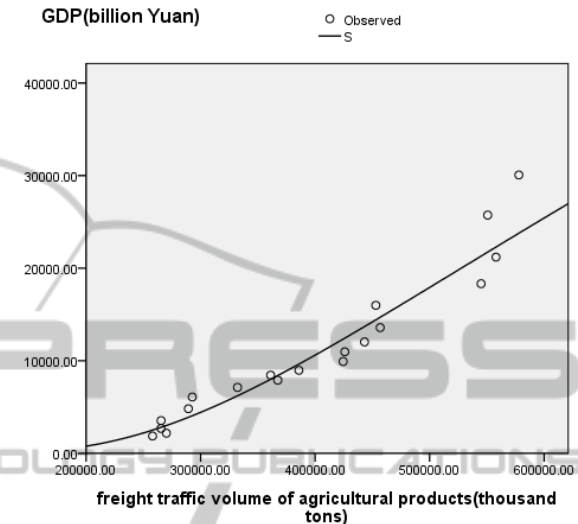


Figure 2: Fitting curves of GDP and freight traffic volume of agricultural products.

**3 THE SCALE AND DEVELOPMENT STRATEGIES IN RURAL AREAS OF LOGISTICS TO MATCH WITH ECONOMIC DEVELOPMENT LEVEL**

Having analyzed the positive effect that the rural logistics have on China's economic, it's necessary to adopt effective policies to promote the development of rural logistics. In practice, because the level of logistics development in rural areas can not always match with the level of economic development, the degree of the contribution that rural logistics makes to economic development may not the same. That's why appropriate policies that made by government should based on the regional economic environment, i.e. the development level of rural logistics should match with the development level of economic. Before making the logistics policy, no matter the infrastructure construction or investment scale and intensity, it's necessary to identify the interaction effects between them.

### 3.1 The Interaction Effects between Rural Logistics Development and Economic Development

There are interaction effects between the level of rural logistics development and economic development, including pushing effect and pulling effect. When studying the regional logistics, the interaction effects are always described by regional economic logistics flexibility (Tan Qingmei and Wang Zilong, 2005). In this paper, the method is adopted and improved to explore the interaction effects between rural logistics and rural economic development. In economics, elasticity is used to describe the degree that an economic variable changes under the other economic variables' influence. Based on the definition of elasticity in economics, the function that can be used to calculate the rural logistics elasticity of economic development is given as follow:

$$E_L = \frac{dy/y}{dx/x} = \frac{dy}{dx} \cdot \frac{x}{y} \quad (3)$$

Where  $x$  indicate the level of rural logistics development, and  $y$  indicate the level of economic development. When  $E_L > 1$ , that for every 1% increase of rural logistics industry will bring the increase rate of economic growth more than 1%, indicating the rural logistics performs pulling effect on the overall economy. Similarly, the rural logistics performs pushing effect on the overall economy when  $E_L < 1$ . If  $E_L = 1$ , that means the development of rural logistics capabilities keep the same pace with the development level of economic.

The rural logistics elasticity of economic development can be calculated based on the function given above:

$$E_L = \frac{dy}{dx} \cdot \frac{x}{y} = \frac{1048593.36}{x} \quad (4)$$

Further obtained, when  $E_L = 1$ , indicating that the development of rural logistics can keep up with the development of our national economy when the freight traffic volume of agricultural products is equal to 1048593.36 thousand tons. And the interaction effects of rural logistics and our national economy is relative perfect at this stage. When  $x < 1048593.36$  thousand tons, however, supports from the national economy are urgent needed for the development of rural logistics. That means the development of rural logistics will mainly reckon on

the country increasing its investment strengthen in the area. When  $x > 1048593.36$  thousand tons, the development level of China's rural logistics over the development level of overall economic with the pulling effect on the economy. At this stage, the modes of rural logistics development need to transfer: from extensive to intensive and from relying on state investment to strengthen the logistics management.

### 3.2 Policy Recommendations for the Development of Rural Logistics

Until the end of 2008, China's freight traffic volume of agricultural products reached 577907.4 thousand tons, which is still far below the level of 1048593.36 thousand tons. As analyzed above, the key point for developing rural logistics at this stage is that our country should strengthen policy guidance and strengthen investments. Specific policies advices are proposed as follows:

(1) Strengthen the construction of logistics infrastructure in rural areas. Logistics infrastructure plays a decisive role at the early stage of the development of rural logistics. At present, logistics infrastructure in rural areas lags far behind the development of regional economy. That is an important factor which limits the development of rural logistics. So the first priority is strengthening the investments for the construction of rural logistics infrastructure facilities.

(2) Improve the informationization level in rural areas. Promoting the informationization process in rural areas is an important part of the construction of new countryside in China. Through the project, information such as the agricultural market supply and demand, trade, prices, can timely and accurately delivery to farmers. That will reduce the uncertainty and blindness in agricultural production and selling. At the same time, through the development of online trading platform like e-commerce, transaction costs can be reduced while the logistics efficiency and service level improved.

(3) Develop the rural logistics technologies and strengthen the training of professionals. With the development of modern logistics, many advanced logistics technologies achieved rapid development and improvement. But the circulation of agricultural products in China is still facing problems such like a low rate of primary processing and a high rate of loss. As data shows, the circulation decay loss rate of vegetables, meat, aquatic products even reached 20-30%, 12%, 15%, and annual loss of fruits and vegetables only even reached more than 100 billion Yuan. Therefore, we should vigorously develop

professionals that master the knowledge of logistics. And more attention should be paid to the research and practice of rural logistics technologies. These measures may avoid the loss of agricultural products in the logistics chain, which lead to keep farmers' income at low level even with the increasing production.

(4) Develop rural finance. The development of rural finance affects the development of agricultural and the rural logistics. Financial support is especially needed at the initial stage of the development of rural logistics. At present China's rural financial services and products are relatively simple, that makes it have little efforts to support the development of rural area economy. So it's necessary to develop rural finance to ensure the financial support in agricultural production and logistics development.

#### 4 CONCLUSIONS

A regression model is constructed to analyse the interaction effects between rural logistics development and economic development. Then China is taken as an example of empirical research. The research has some practical significance. On one hand, through the regression model of rural logistics and economic development, quantified analysis of the relationship between them will be available. The result will benefit the forecast of the scale of rural logistics and economy. On the other hand, because the interaction effects vary at different stage, policy makers can find which state it is at present through the interaction effects analysis combined with the regional economic realities. That is helpful for making appropriate policies for rural logistics development and rural logistics plans. Finally, according to the interaction effects in China at present, policy recommendations that meet the current needs for the development of rural logistics are proposed.

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