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The Research on Influence Factors of Agricultural Products Logistics in Mainland China—The Empirical Analysis based on the Data During 2000-2014

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Abstract

Low efficiency of agricultural products logistics has become one of "bottlenecks" to restrict the further development of agricultural industrialization and rural economy in China. In this paper, upstream-downstream industries factors of agricultural products supply chain is innovatively absorbed into the influence factors framework. And then DEA-SBM model, regression analysis method and DEA-TOBIT model are applied to measure agricultural products logistics efficiency and analyze the three categories of influence factors. The research results show that During two periods of time, the TE level on a national scale was very low, which was basically in the state of inefficiency, which was mainly due to low PTE. Because the PTE is low and the development of agricultural products logistics of most of provincial administrative regions in Mainland China has reached the stage of constant or decreasing scale merit, the enlargement of agricultural production scale can improve the growth of TE level of agricultural products logistics to a certain extent, but the function is not remarkable. On the contrary, the negative relationship has been displayed between the expansion of farming industry scale and agricultural retail businesses and the TE level of agricultural products logistics. Because of the diversity in regional social and environmental factors, the impact of exogenous environmental factors on the TE level of three regions show a certain difference.

***Keywords**: Agricultural products logistics efficiency influence factor*

1. Introduction

The data in China Logistics Yearbook indicate that the total amount of agricultural products logistics of whole country had reached 330 million yuan by 2014. Agricultural products logistics has played an important role in the whole logistics system. However, low efficiency has become one of "bottlenecks" to restrict the further development of agricultural industrialization and rural economy in China. Taking the loss in transit of agricultural products for example, its rate had reached about 35% and logistics costs accounted for more than 80% of the sales price of agricultural products [1]. It's of great practical significance to study how to improve agricultural products logistics efficiency to get high output under the same input condition. The key to enhance the efficiency is to define the influence factors and analyze their mode of action to give pertinence promotion countermeasures. But now there are few relevant research findings.

Foreign scholars attach much importance to analyze influence factors of logistics efficiency at enterprise level and some involve in the researches at industrial and regional level. At enterprise level, Knemeyer & Murphy (2004) found that customer's trust and effective communication could directly affect logistics enterprise efficiency. And previous satisfaction, opportunity behavior and corporate reputation could be indirect factors because of their influence on the trust [2]. Wöhrle (2013) studied the pushing effect of enterprise's technology innovation and application ability on the logistics enterprise

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efficiency [3]. Min, DeMond & Joo (2013) pointed out that besides enterprise itself, external market was also key factor [4]. At industrial level, Tongzon & Wu (2005) used SFA method to make empirical study on some selected container ports and found that to a certain extent, the port privatization could improve the operation efficiency of the port [5]. Chudasama & Panya (2008) analyzed the influence of port scale, structure and state of operation on the port efficiency through the research on 12 main coastal ports in India [6]. At regional level, He & Cheng (2012) thought that market, transport facilities and information technology are external causes of impacting regional logistics efficiency and logistics center and operating costs are internal causes [7]. Among a small number of researches, foreign scholars tend to use qualitative methods. Hobbs & Young (2000) established a framework to analyze agricultural products logistics efficiency on the basis of supply chain theories [8]. Quinn & Murray (2005) put forward that the specificity and uncertainty of logistics assets were the key impact factors of agricultural products logistics efficiency level [9]. Muralidhar, Radhika & Bhave (2012) found that freight and agency fee were important factors that could hinder the improvement of logistics efficiency [10].

Being similar to foreign researchers, domestics scholars only attach importance to the researches on influence factors of logistics efficiency, not agricultural products logistics efficiency. The difference is that Chinese scholars explore it at macro level. Tian (2010) studied the degree of incidence of human capital, system, government intervention, degree of opening and industrial structure [11]. Tian (2011) analyzed the importance of regional economic development, regional informationalized level, degree of opening and quality of workers to regional logistics operating efficiency [12]. Yao & Zhuang (2013) considered that the core elements of impacting logistics efficiency included the ownership structure and environment of logistics industry, So it’s necessary to optimize structure and perfect environment to enhance efficiency [13]. Wang & Tan (2013) thought economic development level and geographical location were influence factors. In addition to this, domestic researchers prefer quantitative methods [14]. Xu & Li (2013) used SFA method to measure influence mode and degree of information service level, regional development level, institutional environment, industrial structure and foreign trade dependence [15]. In addition, some domestic scholars have researched the impact factors of industrial efficiency, which is helpful for defining influencing factors of logistics efficiency. For example, Zhou, Chen & Xu, *et. al.*, (2014) pointed out that industrial production technology level was the most important influence factor affecting efficiency level when measuring the Total Factor Productivity of Poyang Lake Ecological Economic Zone in China [16].

It is obvious that existing researches are of two characteristics features. One is that the researches on influence factors of agricultural products logistics are not sufficient. As what mentioned before, most of literatures focus on using qualitative or quantitative methods to explore influence factors of logistics efficiency. Because of lack of pertinence, those conclusions don’t exactly apply to agricultural products logistics. And it’s difficult to provide corresponding strategies to promote agricultural products logistics efficiency in China. The other is the research horizon is limited. Chinese scholars prefer quantitative method and employ SFA method and DEA-TOBIT model to measure the influence way and degree of various factors. These factors encompass input-output factor, local economic development level, institutional environment, informationalized level, industrial structure and foreign trade dependence. However, besides above- mentioned factors, whether there are some other factors have an impact?

In view of the insufficient in existing researches, this paper defines the influence factors of agricultural products logistics efficiency as the object of study, and focus on exploring new factors to build more integrated and more comprehensive influence factor framework, based on which the impact of various factors is measured. Different from ordinary studies, the paper firstly establishes a framework from the angle of theories, and then makes empirical analysis within the framework, which can ensure the organization of subsequent analysis. The framework built in this paper provides helpful reference for follow-up research and the empirical research in the paper can make valuable reference for relevant government sectors and agricultural products logistics practitioners to set policies and strategies.

Therefore, based on existing research findings, from perspective of self characteristics of agricultural products logistics and management of agricultural products supply chain, this article structures a framework containing direct acting factors, upstream-downstream industries factors of agricultural products supply chain and exogenous environment factors. And then it employs DEA-SBM model to measure agricultural products logistics efficiency of 28 provincial administrative regions in Mainland China from 2000 to 2014 to evaluate the function of direct acting factors. After that, regression analysis method and DEA-TOBIT model are applied to analyze the effect of upstream-downstream industries factors of agricultural products supply chain and exogenous environment factors.

2. The Framework Construction of Influence Factors of Agricultural Products Logistics Efficiency

Agricultural products logistics is an activity in which agricultural output objects whose value have been kept and increased are sent to consumers after processing, packaging, storing, transporting and distributing. As a logistics system, the efficiency level of agricultural products logistics is certainly influenced by different factors inside and outside the system. Obviously, it is not accurate to study influence factors from one aspect.

2.1. Direct Acting Factors

In modern efficiency theories, Debreu (1951) and Koopmans (1951) respectively provide their own achievements [17-18]. Depending on their achievements, Farrell (1957) put forward new efficiency theory[19]. According to Farrell, Economic Efficiency (EE) of one Decision Making Unit (DMU) can be decomposed into Technical Efficiency (TE) and Allocative Efficiency (AE). Thereinto, TE refers to, under the condition of production technology and market price keeping unchanged, the DMU's ability to achieve minimizing input under a certain output or maximizing output under invariant input levels according to fixed proportion of factor input. Thereout, the TE level can reflect the DMU's ability to make use of resources. Allocation efficiency is defined as the ability to configure each resource to the most appropriate use under a certain market price and existing production specifications. Further, TE is able to be decomposed into the product of Pure Technical Efficiency (PTE) and Scale Efficiency (SE). PTE stands for the DMU's management ability of utilizing available technology and resource to give play to its utility. If PTE value is 1, technology and resource have been fully used and maximum output or minimum input has been achieved. SE measures the scale effectiveness of this DMU. When SE value is 1, the DMU has attained ideal input scale, that is the increase of a certain proportion of input can lead to the rise of the same proportion of output. If SE increases by degrees (SE value < 1), it indicates that the scale is relatively small. By this time, input scale should be enlarged, because to multiply input is going to cause output increasing at higher multiples. And if SE decreases by degrees (SE value < 1), it declares that the scale is too large and multiply input will lead to output increasing at lower multiple. So, input scale should be shrinked.

According to Farrell, TE value is the ratio of optimal input and actual input or the ratio of actual output and optimal output. Input and output level are regarded as direct acting factors of the efficiency because they can mirror the operation condition of agricultural products logistics and directly impact the efficiency level.

When studying the relationship between input and output, Cobb - Douglas production function is one of the production functions which has been widely used, which is shown as formula (1).

$$Q(\mathrm{K},\mathrm{L}) = \mathrm{AK}^{\alpha} L^{\beta}, 0 < \alpha, \beta < 1 \tag{1}$$

In this formula, Q, A, K and L respectively stand for output value, technological level, vested capital level and devoted workforce level. Meanwhile, α is the elastic coefficient of capital output and β is the elastic coefficient of workforce output. From it, it is known that under fixed technical merit level, the main input factors which can impact output are capital and labor force.

In line with the KLEMS productivity measurement method put forward by Strassner, Medeiros & Smith (2005) [20], Total input consists of two parts: the initial input and intermediate input. The initial input includes capital and labor force and the intermediate input contains resource, material and service. Thus, total input is composed of capital, labor force and intermediate input. But intermediate input involves too many variables, which will probably lead to too complicated measurement model to get optimal solution. So, this paper selects capital and labor force as input factors.

On the basis of existing research literatures, the factor that can representative the output of agricultural products logistics is defined as rotation volume of freight transport or value added. The former is to measure the output level of agricultural products logistics from the angle of matter form and the latter is to measure it from the value form point. In theory, both of them are adequate to stand for the output of regional agricultural products logistics. In fact, the value added can not be obtained from statistical materials now available. In addition, China has been carrying on stable low freight rate policy for promoting economical and social development. The deviation between price and real value is large, so it would be possible to underestimate the actual output of agricultural products transportation industry if value added were be taken as the measurement index of output. Therefore, the paper chooses rotation volume of freight transport to representative output level.

2.2. The Upstream-Downstream Industries Factor of Agricultural Products Supply Chain

The larger the scale of regional agricultural production is, the more products are going to be produced. After keeping a small part to meet farmers' own demand, a large quantity of goods will enter circulation domain and flow to the downstream of agricultural products supply chain. The larger the turnover of agricultural products is, the greater the logistics volume will be. So, the larger scale of agricultural products logistics is necessary to adapt to the change.

With the improvement of living standard, urban residents desire to consume more agricultural products, which prompt retailer to enlarge scale of operation and build more agricultural products market. It means that more products flow to retailers from producers at upstream via wholesalers, which needs high-level logistics service. In a similar way, the development of agricultural product processing industry will also increase the demand for agricultural products logistics services.

Demand determines supply. The development of agriculture, agricultural products retail business and processing industry enlarges the demand for logistics service and stimulates the expansion of logistics scale. It may improve the technical efficiency level of agricultural products logistics and also could have the opposite effect. Farrell (1957) pointed out that TE can be decomposed into the product of PTE and SE. When the development of regional agricultural products logistics is still at increasing stage of scale merit, the expansion of scale is conducive to the enhancement of scale efficiency and TE level. Meanwhile, the introduction of more resources is going to cause more fierce interior competition. To cope with strong competition and consolidate and extend market share, logistics enterprises have to positively improve their state of operation and advance the utilization of own resources, which is in favor of the promotion of PTE level and the overall PTE of the region. However, if the regional agricultural products logistics has reached the constant or decreasing stage of scale merit, the redundancy will be unavoidable with the resources pouring in. it is certain to lead to SE level and TE level decrease. Thus it can be seen that the development of agriculture, agricultural products retail industry and processing industry has a certain impact on logistics TE level, but the direction of impact is uncertain.

2.3. Exogenous Environmental Influencing Factor

From the systematic point, agricultural products logistics is an economic system that is composed of regional agricultural products logistics industry (including transportation industry, warehousing industry, circulation and distribution industry and so on) and other related organizations (encompassing governmental agencies, trade associations, financial enterprises, intermediary agencies *etc.)*, taking geographic area within limits as the carrier, and taking advanced city within the region as the center and taking the development level of regional economy and society as the basis. It comprehensively employs various transportation modes relying on all kinds of logistics infrastructures to achieve the flow of agricultural primary commodities from production sites to the places where consumers live in and processing enterprises are to be located. Hence, the efficiency level of agricultural products logistics is not only influenced by its own operation and the upstream-downstream industry of agricultural products supply chain, but also affected by external macro-environment of this region, containing the support or the block of regional economic and social development and relative organizations at all level. Regional macro-environment should be considered as a kind of factor that can influence the TE level. Commonly, it is called exogenous environmental influencing factor.

There are many researches on influence factors of logistics efficiency in China, in which the following in Table l, are typical.

Table 1. Part of Selection Results of Logistics Efficiency Influence Factors

Author	Influence Factor Selection
Yu & Wu (2010)[21]	economic development level, marketization degree, regional advantages, foreign trade level and the rate of multipurpose utilization of logistics resources
Tan (2013) [22]	location factor, the rate of multipurpose utilization of logistics resources, marketization degree, economic development level and logistics professionals
Zhao (2014) [23]	logistics resource investment, regional economic development, urbanization level, regional professionalization condition and logistics informationalized level
Chen & Li (2015) [24]	economic development level, marketization degree, regional advantages, foreign trade level and the rate of multipurpose utilization of logistics resources
Yuan & Lei (2015) [25]	logistics professionalization degree, the rate of multipurpose utilization of logistics resources, human capital level, urbanization level, economic power, industrial structure and degree of opening.
Yu (2015) [26]	economic development level, logistics professionals, the rate of multipurpose utilization of logistics resources and regional advantages
Ni, He & Yang (2015) [27]	economic development level, the rate of utilization of logistics infrastructure, informationalized level, professionals and energy consumption

Taking existing literatures and the features of agricultural products logistics, the paper set exogenous environmental influencing factors as follows.

2.3.1. Regional Economic Development Level: The regional economic development level is in the process of improvement, the level of demand for logistics services also increases accordingly. Driven by economic interests, the government and the private economy entities will inevitably intensify investment in the logistics industry, strengthen the logistics infrastructure to construct and procure logistics facilities and equipment with higher technical content. At the same time, the region at high economic level can offer high salary to attract more professionals and managers, which is helpful to improve the quality of human resources. All this are in favor of the development of logistics industry. As a branch of logistics, the development of agricultural products logistics is certain to obtain strong support.

2.3.2. Institutional Environment: The institution is the core factor of influencing efficiency that plays an essential role in the process of economic increase. Reasonable system design can directly or indirectly guide the optimal configuration of resources to improve efficiency and realize economic increase. In all institutions, property ownership, that is system of ownership is the most fundamental. Xiao (1997) state briefly that under the condition of market competition, the gap in efficiency between state-owned enterprises and non state-owned enterprises results from the unclear property right structure, which causes it’s difficult for state-owned businesses to design effective managerial and supervisory mechanism and it’s also hard to implement existing mechanism [28].

2.3.3. Informationalized Level: Compared to industrial products logistics, agricultural products logistics faces more difficulties. It requires more detailed logistics planning and more timely and accurate information support. In the implementation of logistics plans, every link including transportation, stock, handling, packaging and distribution should join tightly and support each other. It’s necessary to guarantee that the information generated in each link is able to transmit rapidly and feedback exactly among every subject of agricultural products logistics. So, there is a close relation between efficient operation of logistics and informaationalized level within the region.

2.3.4. Degree of Opening: To the TE, the impact of degree of opening maybe positive enhancement or negative inhibition (Wei & Shen, 2007) [29]. On the one hand, with the expansion of opening degree, the introduction of overseas-funded agricultural products logistics businesses has brought about technology spillover effect. The transfer and reproduction of advanced logistics technology and managerial mechanism can benefit the promotion of TE level. On the other hand, the enter of foreign-owned enterprises may result in leading surface of production moving outside to enlarge the distance between local enterprises and leading surface, which may pull down the overall TE level of agricultural products logistics. (Tu & Xiao, 2006) [30]. Therefore, the impact of degree of opening on TE level need further test.

2.3.5. The Condition of Industrial Structure: Regional condition of industrial structure has a certain impact on agricultural products logistics efficiency. In the region, while not directly involved in the specific activities of agricultural products logistics, financial enterprises, intermediary companies and information service businesses in third industry can provide important support. Generally speaking, the more advanced the third industry in the industrial structure is, the faster the TE level will improve.

In conclusion, the influence factor framework of agricultural products logistics efficiency is shown in Figure 1.

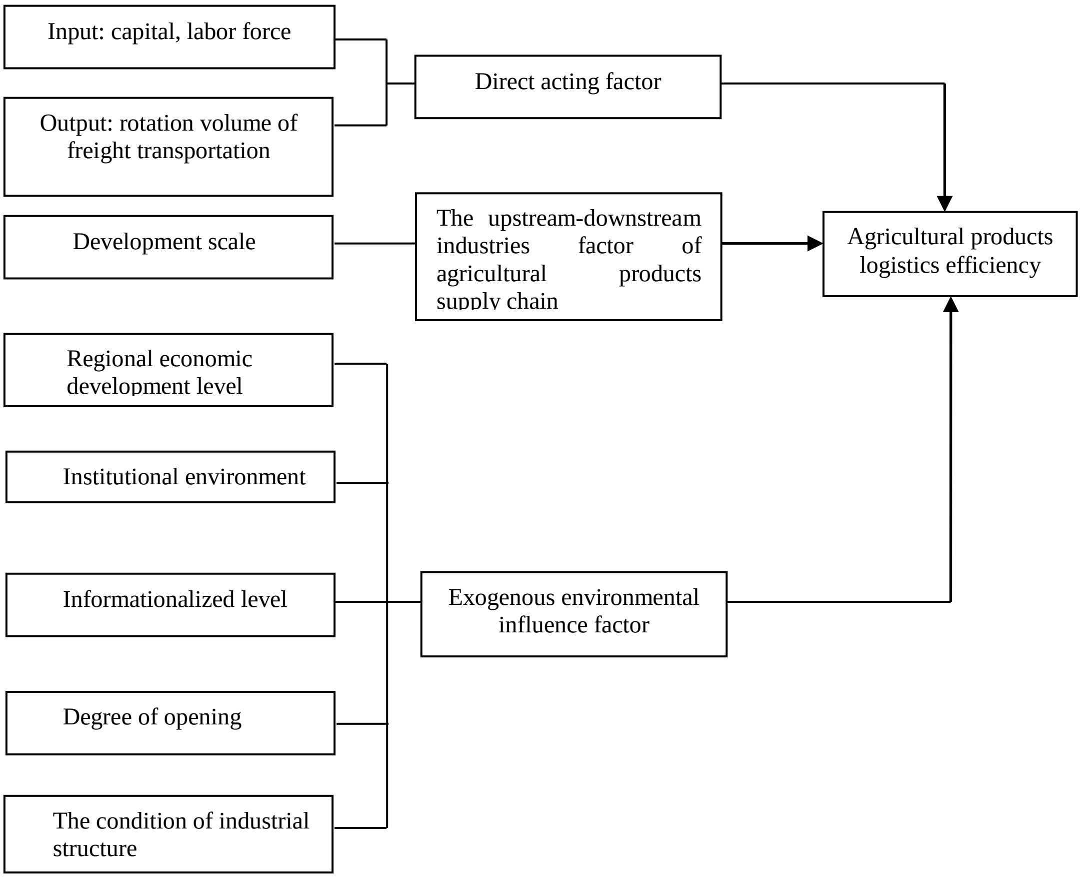

Figure 1. The Influence Factor Framework

3. The Function Analysis of Agricultural Products Logistics Efficiency

3.1. The Function Analysis of Direct Acting Factor

3.1.1. Model Setting: DEA is one of the most representative nonparametric methods. Both widely-used CCR model and BCC model in DEA method allow the existence of "weak effectivity", that is, the DMU is thought to be valid in technology even if there is redundant input or insufficient output. It means to abandon amount of input isn't going to influence the efficiency of this DMU, which doesn't conform to the cognition of technology validity in general meaning. Therefore, this paper selects non-radial, non-angular SBM model put forward by Tony (2001) [31]. SBM model directly put slack variable into objective function. And the influence of slack input and slack output are taken into consideration of efficiency calculation, which has made up for the flaw in CCR model and BCC model.

It's assumed that there are n DMUs, m kinds of input and k kinds of output. Under CRS, The SBM model is shown as formula (2).

$$\min \rho = \frac{1-\frac{1}{m}\sum_{i=1}^{m} s_i^- / x_{i0}}{1-\frac{1}{k}\sum_{r=1}^{k} s_r^+ / \mathrm{y}_{r0}}$$
$$s.t.\begin{cases} x_0 = X\lambda + s^- \\ y_0 = Y\lambda - s^+ \\ \lambda \geq 0, s^+ \geq 0, s^- \geq 0 \end{cases} \tag{2}$$

In this formula, s- and s+ respectively representative excessive input and insufficient output, ρ representatives the efficiency value evaluated by the model. The features of SBM model are as follows: (1) ρ isn't affected by the measuring units of input and output data. (2) ρ is of preferable monotonicity, whose value decreases with the increase of slack input and output. (3) The value of ρ is between 0 and 1, which can equal to 1. (4) ρ is 1 when both slack input and output are 0, which means this DMU is valid in SBM model. So, there is no "weak effectivity" in SBM model. If constraint condition ∑λj*=1 (j=1,2， …， n）is added into formula (1), the SBM model under VRS can be obtained.

3.1.2. Index Setting and Data and Sample Selection: This part consists of two aspects.

1. input and output indexes

According to Cobb–Douglas production function, under vested technical condition, the main influence factors of output are capital and labor force. To embody the continuity of the function of early capital, in this paper the capital stock of logistics industry is selected to be the index, and it's accounted by means of "perpetual inventory method". The formula of this method is shown as follows.

$$K_{it} = K_{it-1}(1-\delta) + \mathrm{I}_{it} \tag{3}$$

In this formula, K_{it} and K_{it-1} respectively representative the capital stock of regional agricultural product logistics of province i during the period of t and t-1. δ is rate of depreciation. And I_{it} is the capital input of province i during the period of t.

This paper uses the method put forward by Hall & Jones (1999) to estimate the capital stock of base year [32]. It is to calculate the capital stock of logistics industry of each province in the base year 1981 with the amount of fixed investments of the whole country divided by the sum of geometric average growth rate of fixed investments and rate of depreciation from 1981 to 2014. Taking the method put forward by Zhang, Wu & Zhang (2004) for reference, with the assumption of relative efficiency of capital goods geometrically diminishing, the rate of depreciation δ in formula (3) is calculated by means of balance depreciation method, which is on behalf of geometric diminishing returns, which is shown in formula (4) [33].

$$d_\tau = (1-\delta)^\tau, \tau = 0,1,\cdots \tag{4}$$

In this formula, dτ is relative efficiency of capital goods, which is the marginal production efficiency of former capital goods relative to new capital goods. δ is rate of depreciation and τ is working life. The distribution of rate of depreciation in each year is unchanged in the diminishing geometric mode of relative efficiency. The result studied by Huang, Ren & Liu (2002) displays statutory ratio of remaining value can be substitute for relative efficiency of capital goods[34]. Based on this finding, the statutory ratio of remaining value is set to be 4% (the value range of it is commonly from 3% to 5%, the value in the paper is the median). Fix-asset investment of whole society consists of construction and installation investment, equipment and instrument investment and other expenses. The service life of each part of investment is apparently different and the result calculated by formula (4) is also different from each other. In view of this, the service lives of three kinds of fixed assets are assumed to be 40 years, 16 years and 25 years. And respective ratio of depreciation is worked out to be made weighted summation.

In the paper, fixed investments of whole society in current year is taken as capital input to logistics industry that very year , and amount of investment of each year is calculated taking the constant price in 1981 as the base.

In terms of labor input, because communication and transportation, storage and mall business are the main body of logistics industry, the number of practitioners in these three parts is regarded as that in agricultural product logistics industry in this paper.

In the paper, the volume of the circular flow of regional agricultural products is set to be output index. Setting a hundred million ton kilogram as unit of measurement, it is an ideal output variable since it can not be affected by fluctuation in prices and be on behalf of volume of freight traffic and freight distance at the same time.

2. Data and sample selection

The sample of this paper includes every provincial administrative region in Mainland China. But there is serious lack of relative data, Tibet and Hainan province are not taken into consideration. Chongqing is combined with Sichuan province because it’s not upgraded to be municipality directly under the central government until 1997. So, 28 provinces are studied in the paper. Meanwhile, With reference to the regional division method, 28 provinces in mainland China are classified into east region (Beijing, Shanghai, Tianjin, Hebei, Liaoning, Shandong, Jiangsu, Zhejiang, Fujian and Guangdong), central region (Shanxi, Jilin, Heilongjiang, Henan, Hubei, Hunan, Jiangxi and Anhui) and west region (Inner Mongolia, Shanxi, Yunnan, Guizhou, Sichuan, Guangxi, Gansu, Qinghai, Ningxia and Xinjiang).

In order to ensure the authenticity and veracity, the data used in the paper are mainly from China Statistical Yearbook and China Statistical Yearbook of Fixed-asset Investment. It should be pointed out that after 2008, the statistical caliber on highway and waterway transportation has been changed, which has made a certain influence on original data of volume of the circular flow of regional agricultural product logistics. Therefore, the follow-up study in this paper is divided into two periods, which are from 2000 to 2007 and from 2008 to 2014.

3.1.3. The Measurement Results of TE Level: With the help of software MAXDEA pro 6.3, SBM-CRS model is employed in the paper to calculate the TE value of 28 provinces in Mainland China from 2000 to 2007 and from 2008 to 2014. The results are shown in Table 2.

Table 2. The TE and Results of Decomposing of Agricultural Products Logistics in Mainland China from 2000-2014

		00	01	02	03	04	05	06	07	08	09	10	11	12	13	14
Eastern mean	TE	0.40	0.41	0.29	0.28	0.28	0.29	0.31	0.29	0.32	0.36	0.38	0.38	0.4	0.42	0.44
	PTE	0.47	0.50	0.46	0.44	0.42	0.49	0.50	0.52	0.48	0.50	0.52	0.53	0.56	0.59	0.62
	SE	0.91	0.89	0.80	0.81	0.84	0.76	0.78	0.74	0.80	0.84	0.84	0.83	0.84	0.85	0.86
Central mean	TE	0.27	0.26	0.19	0.16	0.15	0.14	0.15	0.13	0.28	0.32	0.34	0.34	0.37	0.4	0.43
	PTE	0.29	0.28	0.21	0.18	0.15	0.16	0.17	0.16	0.33	0.37	0.39	0.4	0.5	0.6	0.7
	SE	0.95	0.95	0.94	0.94	0.99	0.94	0.94	0.93	0.82	0.88	0.87	0.86	0.79	0.72	0.65
Western mean	TE	0.27	0.26	0.17	0.15	0.12	0.12	0.15	0.13	0.20	0.25	0.25	0.22	0.26	0.3	0.34
	PT	0.4	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.4

	E	0	8	7	5	2	2	5	3	1	6	6	2	5	8	1
	SE	0.83	0.82	0.86	0.85	0.88	0.88	0.86	0.88	0.86	0.85	0.85	0.87	0.88	0.89	0.9
National mean	TE	0.32	0.31	0.22	0.20	0.19	0.19	0.20	0.19	0.27	0.31	0.32	0.31	0.34	0.37	0.4
	PTE	0.39	0.39	0.32	0.30	0.27	0.30	0.32	0.31	0.38	0.41	0.42	0.42	0.45	0.48	0.51
	SE	0.89	0.88	0.86	0.86	0.90	0.85	0.86	0.84	0.83	0.86	0.86	0.86	0.85	0.84	0.83

Note: For the limitation of length, this paper does not display relevant value of each province. The following are the same. In addition, TE is technical efficiency, PTE is pure technical efficiency and SE is scale efficiency.

Following conclusions can be drawn from the results above.

1. During two periods of time, the TE level on a national scale was very low, which was basically in the state of inefficiency, which was mainly due to low PTE. It indicated that the existing input of agricultural products logistics hadn't been fully used to realize sufficient logistics output.

2. From the contrast among the regions, the TE level presented the diminishing state from the east, the central region to the west during two periods of time. Taking advantage of enhanced development of economy and society within the east, the regional logistics industry enjoys favorable external environment , which provides abundant capital and high-quality labor force for the industrial development. The logistics industry of agricultural products in the eastern region has started earlier and accumulated rich experience in the long development process, which has fostered more logistics operation competence. Meanwhile, high degree of opening to the outside world, advanced import and export trade and introduction of plenty of overseas-funded enterprises have pulled up the TE level of this region to some extent. In comparison, the TE level of the central and the west regions was lower because of a late start of logistics industry and the gap in resource, experience and competence. But during the second period of time, with the improvement of external environment of the central and the west regions and the deepening of cooperation and exchange among enterprises in different regions, the gap among three regions had been narrowed.

3. Figure 2 indicates that from 2000 to 2007, the TE level presented the downward trend throughout the country. But from 2008 to 2014, it appeared to be upward. The continuous improvement embodied that the governments at all levels increasingly attached importance to the development of logistics industry in recent years and introduced series of supportive policies. In the meantime, the logistics industry in every region were making progress to higher level to meet the needs of market. The TE level showed up the trend of continuous improvement.

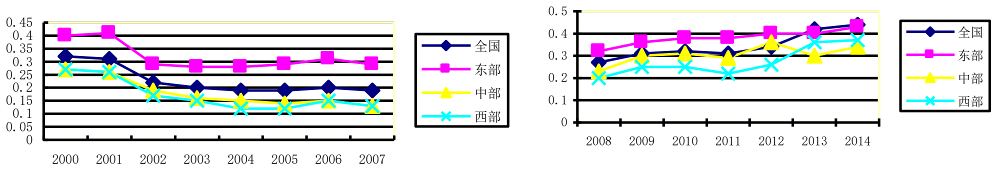

Figure 2. The Mean Value of TE of Agricultural Products Logistics of Three Regions and Whole Country

3.2. The Function Analysis of Upstream-Downstream Industries Factor of Agricultural Products Supply Chain

3.2.1. Index Setting and Data Selection: The paper has selected the gross output value of agriculture as representative index of agricultural development scale and net value of fixed assets as the index of farming industry. To ensure the comparability of index value and bring into correspondence with the data processing method in chapter 3, this paper converts the gross output value of agriculture and net value of fixed assets in the base year of 1981. Meanwhile, having not found the data of retail business in various statistical materials, the paper estimates the scale of the regional agricultural products retail based on the result of the per capita consumption expenditure multiplied by regional total population at the end of year (it is named agricultural products consumer spending in the paper.) and converts the result relying on consumer price index in the base year of 1981. The data used in the research process are all from China Statistical Yearbook and Compilation of Statistical Data for Sixty Years in New China, which are able to guarantee the authenticity and reliability of the data.

3.2.2. The Measurement of Impact: After finishing the stationary test, the paper analyzes how to select the model of panel data and then use it to measure the impact of upstream-downstream industries of agricultural products supply chain on the TE level of agricultural products logistics.

1. The stationary test for the data

To analyze the impact of upstream-downstream industries of agricultural products logistics on the TE level, this paper makes the regression analysis, taking the logistics TE level of each province (XL) as explained variable and the gross output value of agriculture (NY), net value of fixed assets (JGX) and consumer spending of agricultural products (XS) as explaining variable.

Because there maybe exists heteroscedasticity in the collected data, above index values have experienced natural logarithm processing.

For avoiding the spurious regression caused by unstable data, the stationary test for the data is made in the first place. The time span of the data is from 2000 to 2014 and involves in 28 provincial administrative region. Hence, it belongs to panel data.

In this paper, Eviews 7.0 software is applied to make stationary test for collected panel data. At the same time, LLC test method, Im-Pesaran-Skin test method, Fisher-ADF test method, Fisher-PP test method and Hadri Z-stat are also utilized to assure the reliability of the result. The result is shown in Table 3.

Table 3. The Unit Root Test of Panel Data

		LLC	Im-Pesaran-Skin	Fisher-ADF	Fisher-PP	Conclusion
LNXL	t	-14.8335	-12.0922	236.109	277.522	stable
	p	0.0000	0.0000	0.0000	0.0000	
LNNY	t	-13.4205	-8.27055	169.066	195.616	stable
	p	0.0000	0.0000	0.0000	0.0000	
LNJGY	t	-11.4457	-8.38795	167.956	213.265	stable
	p	0.0000	0.0000	0.0000	0.0000	
LNXS	t	-7.32039	-4.73967	115.566	131.760	stable
	p	0.0000	0.0000	0.0000	0.0000	

According to the table, the test results indicates that LNXL, LNNY, LNJGY and LNXS have refused the null hypothesis that there are roots of unity. That is, cross section sequence is stable.

2. Regression analysis procedure

A panel data model composed of N individuals, T observation periods and K explaining variables is shown as formula (5). In the formula, y_i is the explained variable vector of T×1 dimension and x_i is the explaining variable matrix of T×k dimension . Each component of y_i and x_i is individuals' time series of economic index. α_I and β_i respectively stand for the intercept term and the coefficient vector of k×1dimension, whose value will change with transformation of individual. μ_i is the disturbance vector of T×1 dimension, which is to meet the hypothesis that mean value is 0 and variance is σ^2_μ.

$$y_i = \alpha_i + x_i \beta_i + \mu_i$$
$$i = 1, 2, \cdots, N \tag{5}$$

Based on different value of intercept term and coefficient, model (6.2) can be divided into three kinds： $\alpha_i=\alpha_j$, $\beta_i=\beta_j$, constant coefficient model; $\alpha_i\neq\alpha_j$, $\beta_i=\beta_j$, variable-intercept model; $\alpha_i\neq\alpha_j$, $\beta_i\neq\beta_j$, variable parameter model. Hence, before setting panel data regression model, it's primary to test whether α_i and β_i keep unchangeable to all individual sample points or during all observation periods, that is to determine which form should be chosen to avoid the deviation when setting model to improve the validity of parameter estimation.

Model form can be decided through testing following two hypotheses.

H_1： $\beta_1=\beta_2=\ldots=\beta_N$

H_2: $\alpha_1=\alpha_2=\ldots=\alpha_N$; $\beta_1=\beta_2=\ldots=\beta_N$ (6)

If H_2 is accepted, model form can be chosen to be constant coefficient model. If H_2 is refused, H_1 should be further tested: if H_1 is accepted, variable-intercept model has been chosen and if H_1 is refused, variable parameter model has been chosen. The test for above hypotheses can be judged by the values of statistic $F_1$and F_2.

The calculation formulas of $F_1$and F_2 are shown as (7) and (8).

$$F_1 = \frac{(S_2 - S_1)/[(N-1)k]}{S_1/(NT - N(k+1))} \sim F[(N-1)k, N(T-k-1)] \tag{7}$$

$$F_2 = \frac{(S_3 - S_1)/[(N-1)(k+1)]}{S_1/(NT - N(k+1))} \sim F[(N-1)(k+1), N(T-k-1)] \tag{8}$$

In the formula, S_1 is the residual sum of squares of variable parameter model regression. S_2 is the residual sum of squares of variable-intercept model regression and S_3 is the residual sum of squares of constant coefficient model regression.

Under the hypothesis H_2, F_2 obeys the F distribution under corresponding degree of freedom, and if the value of F_2 is greater than or equal to the critical value under given confidence coefficient, H_2 is refused and then H_1 is going to be tested. If the value of F_2 is less than the critical value under given confidence coefficient, H_2 is accepted and the model form is set to be constant coefficient model.

Under the hypothesis H_1, F_1 also submits to the F distribution under corresponding degree of freedom, and if the value of F_1 is greater than or equal to the critical value under given confidence coefficient, H_1 will be refused and the model form is set to be variable parameter model. If the value of F_1 is less than the critical value under given confidence coefficient, then H_1 is accepted and the form is determined to be variable-intercept model.

Before start of above-mentioned analysis, in order to avoid the influence of multicollinearity, multicollinearity test has been done to check LNXL, LNNY, LNJGY and LNXS. The results are as follows.

Table 4. Multicollinearity Test

		LNXL	LNNY	LNJGY	LNXS
LNXL	Pearson Pertinence	1	0.129*	0.127*	0.114*
	Significance (bilateral)		0.014	0.015	0.030
	N	364	364	364	364
LNNY	Pearson Pertinence	0.129*	1	0.797**	0.758**
	Significance (bilateral)	0.014		0.000	0.000
	N	364	364	364	364
LNJGY	Pearson Pertinence	0.127*	0.797**	1	0.804**
	Significance (bilateral)	0.015	0.000		0.000
	N	364	364	364	364
LNXS	Pearson Pertinence	0.114*	0.758**	0.804**	1
	Significance (bilateral)	0.030	0.000	0.000	
	N	364	364	364	364

Note: “*”- significant correlation at 0.05 level (bilateral) ,“**”- significant correlation at 0.01 level (bilateral)

According to the test results, there exists strong correlation among LNNY, LNJGY and LNXS. To overcome the impact of multicollinearity, the first difference treatment has been done aiming at LNXL, LNNY, LNJGY and LNXS.

Following the step of judging model form, considering DLNJSXL as explained variable and DLNZCZ, DLNGZJ and DLNXF as explaining variables, this paper makes regression analysis on the basis of three different model forms of variable parameter model, variable-intercept model and constant coefficient model. The residual sum of squares in the results of three model regression respectively is S_1=261.1205, S_2=327.5185 and S_3=329.7929. If S_1, S_2 and S_3 are respectively substitute into formula (7) and (8) to calculate the value of F_1 and F_2, of which N=28, T=13 and k=3, in the end the value F_2=0.614～(108,252)can be obtained. And the critical value of F distribution is got by means of function @qfdist(d,k_1,k_2) (d is critical point and k_1 and k_2 are degrees of freedom.). Setting the significance level of 5% (d=0.95) to acquire the critical value of F_2 to be 0.758. For F_2＜0.758 and the hypothesis H_2 has been accepted, the model form should be set as constant coefficient model.

In accordance with the results in Table 5, significant positive relationship has been revealed between DLNNY and DLNXL. The enlargement of agricultural production scale plays a certain role in promoting the TE level of agricultural products logistics, but it is not so remarkable. In the aspect of agricultural product processing industry, significant negative relationship has been shown between DLNXS and DLNXL. That is, the expansion of the scale of agricultural product processing industry will do harm to the improvement of TE level. The negative relationship also exists between the scale of agricultural products retail industry and the TE level of agricultural products logistics.

Table 5. The analysis Results of Regression of Constant Coefficient Model

Variable	coefficient	Std.Error	t.Statistic	Prob.
C	-0.008954	0.054373	-0.164674	0.`
DLNNY?	0.201683	0.072629	2776883	0.0058
DLNJGY?	-0.144141	0.068811	-2.094730	0.0370
DLNXS?	-0.381846	0.092423	-4.131520	0.0000
R.squared	0.089424	Mean dependent var	-0.010893	
Adjusted R.squared	0.081195	S.D.dependent var	1.039777	
S.E.of regression	0.996671	Akaike info criterion	2.843040	
Sum squared resid	329.7929	Schwarz criterion	2.888482	
Log likelihood	-473.6308	Hannan.Quinn criter	2.861155	
F.statistic	10.86806	Durbin.Watson stat	3.100660	
Prob(F.statistic)	0.000001			

As what mentioned before, the expansion of upstream-downstream industries of supply chain contributes to enlarging the scale of agricultural products logistics through appealing to more capital and labor force. However, if the logistics development in a certain region has been at the stage of scale merit keeping constant or decreasing, the input of large quantity of resources is certainly to result in the decline of SE and TE. Taking 2014 for example, the data in table 6 show that the PTE level of agricultural products logistics of most of provinces in Mainland China was very low and the logistics resources had not been sufficiently used. To meet increasing logistics demand, the logistics scale must be expanded, which would inevitably lead to the drop in SE level and overall TE level since most of provinces had reached the stage of scale merit keeping constant or decreasing. Obviously, the development of upstream-downstream industries had hindered the promotion of TE level. However, the logistics demand caused by them must be met. In the case of keeping the scale of logistics, it is necessary to focus on improving the managerial ability of domestic agricultural products logistics practitioners and lifting the existing logistics resources utilization degree to achieve greater logistics output.

Table 6. The PTE and Scale Merit Condition of Three Regions and Whole Country in 2014

Region	East	Central	West	Whole Country
-	6	3	6	15
irs	2	1	4	7
drs	2	4	0	6

Note：“irs”-scale merit increasing，“drs”-scale merit decreasing，“-”-constant scale merit。

3.3. The Function Analysis of Exogenous Environmental Factors

3.3.1. Index Setting and Data Selection: As previously mentioned, this paper has set five indexes, regional economic development level, institutional environment, informationalized level, degree of opening and industrial structure as exogenous environmental factors.

From the angle of economic scale or speed of economic growth, GDP per capita or annual GDP growth rate are commonly used to measure the economic development level of one region. This paper selects the former as measurement index. About institutional environment, referring to existing literatures, the proportion of state owned economy in the whole social fixed assets investment (*i.e.,* the so-called "state owned ratio") is considered as the index of the institutional environment in this paper. In the aspect of informationalized level, the IDI (Informatization Development Index) has been regarded as the measurement index. As an index established by the nation since the informatization planning and construction of “the 11th Five-Year Plan”, the IDI can synthetically measure and reflect the informationalized level at large of one country or a certain region from the sides of informatization infrastructure construction, application level and restrictive environment of informatization and information consumption of residents. And “foreign trade dependence” (it is also called “dependence of foreign trade”) widely-used in literatures has been selected as the measurement index of degree of opening. Different from ordinary index, this paper chooses the ratio of total volume of imports and exports of agricultural products and GDP to stand for the active degree of opening of a certain provincial administrative region. In the aspect of industrial structure, the proportion of the added value of the third industry in the gross regional domestic product has been selected to representative the industrial structure condition within one province.

The data are mainly China Statistical Yearbook from 2000 to 2014 to ensure the authenticity and veracity.

3.3.2. Model Setting: The data range of the TE value calculated earlier is between 0 and 1, which belongs to typical truncation data. Because the estimation of parameter would have a deviation if ordinary least square were used to make regression for the measurement model taking truncation data as explaining variable, the truncation data model in standard Tobit model is applied to make analysis, which is also an idiomatical method at present.

The form of truncation data Tobit model is shown as formula (9),

$$y^* = x^* \beta + \varepsilon$$
$$y = \begin{cases} 0, & 当 y^* \le 0 \\ y^* & 当 y^* \le 0 \end{cases} \tag{9}$$

of which ε～(0，σ^2).

Owing to the wide variance in exogenous environmental factors among different provinces, the mean values of logistics TE of the east, the central region and the west from 2000 to 2014 are set as the explained variables in this article and the corresponding index values of each region as explaining variables to establish Tobit model.

3.3.3. The Analysis Result of Tobit Model： The analysis results using Tobit model to analyze the impact of exogenous environmental factors of each region are respectively shown in Table 7, Table 8, and Table 9, in which X1, X2, X3, X4 and X5 respectively stand for Per Captia GDP, informatization development index, state-owned rate, foreign trade dependence and the proportion of the added value of third industry accounted for GDP.

Table 7. Tobit Model Analysis Result of Exogenous Environmental Factors of the East

variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.868217	0.234346	3.704846	0.000200*
X1	0.000034	0.000006	5.480665	0.000000*
X2	-1.006380	0.475213	-2.117744	0.034200**
X3	0.442304	0.288240	1.534502	0.124900
X4	0.016243	1.435698	0.011313	0.991000
X5	-0.751556	0.371623	-2.022357	0.043100**

Table 8. Tobit Model Analysis Result of Exogenous Environmental Factors of the Central Region

variable	Coefficient	Std. Error	z-Statistic	Prob.
C	1.562308	0.218778	7.141057	0.000000*
X1	-0.000002	0.000010	-0.189453	0.849700
X2	-2.285031	0.374240	-6.105786	0.000000*
X3	-0.693116	0.215469	-3.216777	0.001300*
X4	-0.244214	1.041037	-0.234587	0.814500
X5	0.368542	0.275777	1.336377	0.181400

Table 9. Tobit Model Analysis Result of Exogenous Environmental Factors of the West

variable	Coefficient	Std. Error	z.Statistic	Prob.
C	0.043577	0.144148	0.302306	0.762400
X1	0.000013	0.000006	2.172857	0.029800**
X2	-0.118972	0.171202	-0.694926	0.487100
X3	0.098890	0.106356	0.929801	0.352500
X4	0.703813	1.102730	0.638246	0.523300
X5	0.326804	0.209680	1.558584	0.119100

Note: “*”-1％significance level; “**”-5％significance level; “***”-10％significance level

1. Regional Economic Development Level

Regional economic promotion can offer capital and human input for agricultural products logistics development. Table 7, 8 and 9 indicate a significant positive correlation between the economic development level of eastern and western region and the TE level of agricultural products logistics and a significant negative relationship between that of central region and the TE level. But it has no practical meaning because the coefficients of X1 variable of three regions are too small to be valued. This result agrees with the research of Wang & Tan (2013) and Xu & Li (2013) [14-15]. The reason is that compared with industrial products logistics, agricultural products logistics accounts for low proportion of total social logistics and the function of its “third profit source” is not so clear as that of industrial products logistics. Hence, although recently the development of agricultural products logistics has been increasingly taken seriously, the attention and investment dynamics are relatively insufficient, which results in that the efficiency of regional economic development can’t be embodied in the promotion of agricultural products logistics.

2. Informationalized Level

According to the analysis result of Tobit model, the informationalized level has played a blocking role in the TE level of agricultural products logistics in three regions, which is more significant in the eastern and central regions. In theoretical sense, the higher the informationalized level is, the more obvious the promotion in the TE level has been. But that in eastern and central regions and the TE level is showing a significant negative relationship, which is because some disadvantages have been exposed with the deepening of dependence degree of agricultural products logistics on information. Firstly, the public information platform development of agricultural products logistics lags behind. At present, logistics public information platform has been the important channel to publish and acquire relevant information and some well-reputed platforms have appeared, such as Southern Intelligent Freight Public Information Platform and so on. Relatively speaking, the number of agricultural products logistics information platform is small and the support that existing platforms have supplied is not enough. Secondly, the authenticity and authority of information cannot be ensured. Most of information platforms are established and managed by enterprises. Owing to the profit motive, the authenticity and authority of information have been impacted. Equally, the reliability of logistics information published on the enterprises’ own websites relies on the integrity degree of these enterprises. Thirdly, the degree of information sharing is not high. To meet the development demand, the logistics parks, logistics centers or large-scale logistics enterprises of agricultural products voluntarily exploit logistics information system one after another. But, information release and access are limited within the enterprises, and among member enterprises or cooperative partners. The developing standard of information system is also inconsistent. The mismatch between sharing degree and sharing need has been more and more prominent. For relatively backward informationalized level, the interference of above disadvantages with the TE level of agricultural products logistics of the west is by no means significant.

3. Institutional Environment

The research results show that the institutional environment can improve the TE level of agricultural products logistics in eastern and western regions, although the function is not remarkable. But it plays a significant hindering role in central region, which is similar to the study result put forward by Tian & Li (2011) [35]. The basic mode and path of modern property right system of state-owned enterprises is to change the capital structure of enterprises by means of shareholding reform, merging and reorganization and joint venture to realize diversification of the main investors, drive the flow and recombination of public-owned capital and optimize the configuration of state-owned capital, which can form reasonable fathering organization within reformed state holding enterprises and state sharing enterprises and definite the subject toliability of national asset to promote the operating efficiency of government capital. To boost the construction of modern property right system, it’s necessary to strip away the policy burden of stat-owned business and set up social insurance and re-employment assistance system to arrange laid-off workers. Meanwhile, enough attraction is also vital to absorb external capital and private capital. Taking them as measuring standard, the advantage of the east is comparatively evident and the acceleration of state-owned rate is greater than that of western region. Because of late start, small scale, light burden, few difficulties, strong state financial support, vast development space, giant potential and strong appeal for capital, the state-owned rate of western region has shown positive promoting effect on the TE level of this region. Compared to the two regions, the reform of property right system of state-owned agricultural products logistics enterprises in central region is relatively slow, so the state-owned rate has clearly negative impact on the TE level of agricultural products logistics.

4. Degree of Opening

The results of Table 7, 8 and 9, demonstrate that the opening degree of agricultural products trade has improved the TE level of agricultural products logistics in eastern and western regions, although the function is not significant. Different from above-mentioned two regions, the enlargement of opening degree in central region has played an inapparent hindering role in the rise of the TE level, which is caused by two reasons. One is due to geographic position and the type of agricultural products (The agricultural production in central region is mainly based on land intensive products and that in China is on labor intensive products), the import and export level of agricultural products falls behind that of eastern and western regions (During 2000-2014, the average value of import and export reached \$63.7089 billion in eastern region, \$5.8652 billion in central China and \$6.009 billion in the west.). Inactive foreign trade leads to less opportunities to exchange and cooperate with foreign logistics businesses in central region, where the impact of “technology spillover” effect is the weakest. The other is that compared with overseas-funded agricultural products logistics enterprises, the logistics businesses in China has of the short slab that they cannot effectively complete the logistics activities about fresh and perishable agricultural products. But in the logistics of other products, domestic enterprises have of sufficient capability approaching foreign businesses. The proportion of fresh and perishable products, such as fruits, fresh meat and frozen meat and dairy products, has reached 34.7% in central region, 42% in western region (33.5% in eastern region), so the “quality” of “technology spillover” effect in import and export trade of agricultural products is relatively inferior.

5. The Condition of Industrial Structure

The analysis result of Tobit model displays that the relationship is significantly negative between the proportion of the value added of the third industry in GDP and the TE level of agricultural products logistics in the east. The situation is the opposite in central region and the west, although the positive support is not so significant. The actual cause is that the east has stepped into "Late Industrialization" and is experiencing the change from "the large" to "the strong". The outsourcing trend of productive service has been from strength to strength, which creates enormous space for the development of producer services. To satisfy this need, the traditional logistics industry with simple storage and transportation as the main function is constantly adjusting its own organization, upgrade technical equipment and extend and innovate service functions to improve the TE level of the logistics industry in the region. Therefore, the logistics industry of this region tends to serve the industrial upgrading and transformation and various demands in the logistics information service support, technical support and financial support deriving from it have driven the development of some sub-industries, such as financial industry, insurance industry, information consulting service industry and all kinds of technical service industries. In conclusion, the development of the third industry has mainly supported the industrial products logistics. In contrast, in order to ensure the life of urban residents, China carries out long-term low pricing policy of agricultural products and the profit space of agricultural products logistics is far less than that of industrial logistics (Total amount of industrial logistics usually accounts for 90% of the total social logistics, and that of agricultural products logistics has lingered at around 5% for a long time.). Obviously, the support of above sub-industries for agricultural products logistics is insufficient and the development of the third industry has not promoted its TE level in the east. The industrial base of the central region and the west is too weak to show the blocking phenomenon. And based on the same reason, its positive support for the TE level is not significant.

4. Main Conclusion and Suggestion

By means of a range of measurement methods, following conclusions can be obtained.

1. During two periods of time, the TE level on a national scale was very low, which was basically in the state of inefficiency, which was mainly due to low PTE. It indicates that the existing input of agricultural products logistics hasn't been fully used to realize sufficientlogistics output.

2. Because the PTE is low and the development of agricultural products logistics of most of provincial administrative regions in Mainland China has reached the stage of constant or decreasing scale merit, the enlargement of agricultural production scale can improve the growth of TE level of agricultural products logistics to a certain extent, but the function is not remarkable. On the contrary, The expansion of farming industry scale is harmful to the rise of the TE level and the same is true for the development of agricultural retail businesses.

3. Regional economic development level has very small impact on the TE level of agricultural products logistics of three regions and has no practical meaning. The informationalized level has played a blocking role in the TE level of agricultural products logistics in three regions, which is more significant in the eastern and central regions. The institutional environment can improve the TE level of agricultural products logistics in eastern and western regions, although the function is not remarkable. But it plays a significant hindering role in central region. The opening degree of agricultural products trade has improved the TE level of agricultural products logistics in eastern and western regions, but the function is not significant. Different from above-mentioned two regions, the enlargement of opening degree in central region has played an inapparent hindering

role in the rise of the TE level. The relationship is significantly negative between the proportion of the value added of the third industry in GDP and the TE level of agricultural products logistics in the east. And the situation is the opposite in central region and the west, although the positive support is not so significant.

Relying on these conclusions, following suggestions can be adopted to improve the TE level of agricultural products logistics and actively perfect the exogenous environment. Firstly, government and enterprise should stop blindly expanding the scale of agricultural products logistics and lead the change of growth pattern from “extensive type” to “intensive type”. The copy and transfer of high operating capacity of agricultural products logistics can be achieved through introducing high-level foreign logistics businesses and strengthen the regional integration construction of agricultural products logistics. Secondly, while enhancing the PTE level, government and enterprise should put emphasis on the improvement of “hard” technology and “soft” technology, that is, to establish national and regional logistics information platform to reinforce the but joint between public information platform and enterprise logistics management information system and promote the application of intelligent transportation system. Thirdly, taking the central region as the focus, adopting a series of favorable measurements in financial subsidies, land, taxes, fees, financing and management, government should further promote the reform progress of property rights of state-owned agricultural products logistics enterprises in a variety of ways, such as renting or entrusted operation, capital’s participation, recombination etc. In the end, government should encourage all regions, especially the central region, to strive to develop many industries containing vegetable, fruit, tea, flower and plant and aquiculture, promote the export of green and pollution-free agricultural products, increase the proportion of deep processing of agricultural products and construct the security system of supporting the enlargement of agricultural products export to expand the import and export of agricultural products.

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