

Article

The Influence of Large-Scale Agricultural Land Management on the Modernization of Agricultural Product Circulation: Based on Field Investigation and Empirical Study

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Abstract: Large-scale agricultural land management has become the obvious development trend of China's rural land management. This paper focuses on large-scale agricultural land management in China and analyzes the influence mechanism of large-scale agricultural land management on the circulation of agricultural products. We use the methods of field investigation and empirical research, put forward the theoretical hypothesis through field investigation, and empirically test it. It is found that the impact of large-scale agricultural land management on the circulation efficiency of the agricultural products under the "input-output" index has a lag and shows a U-shaped characteristic of decreasing first and then increasing. For the modernization of agricultural product circulation under the comprehensive index system, large-scale agricultural land management has a significant positive promoting effect. This reflects the potential of large-scale agricultural land management in promoting the development of rural agriculture and agricultural product circulation. This suggests that in the process of promoting the modernization of agricultural product circulation, the government should pay special attention to the modernization of upstream agricultural production, promote large-scale agricultural land management in a standardized and orderly way, and realize the coordinated reform of agriculture and the agricultural product circulation industry. In addition, the Chinese government also needs to make up for the shortcomings in the upstream organization, the construction of wholesale markets for the agricultural products, and rural logistics infrastructure.

Keywords: China; large-scale agricultural land management; modernization of agricultural product circulation; field investigation; rural land



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1. Introduction

In recent years, the development of the internet and digitalization has brought tremendous changes to the circulation industry in China, especially in the terminal retail and logistics of a traditional industrial products. Represented by companies such as Taobao and JD, the e-commerce based on the platform has reshaped the consumption scene and promoted the integration of supply chains. By improving the level of digitalization, reducing transaction costs, promoting logistics integration, improving consumer experience, and other ways, it has greatly improved the circulation efficiency and promoted the liberation of consumption power. However, in this progress, agricultural products, as another core category, fails to attract enough attention compared to an industrial product. In the new period of economic structural adjustment, the Chinese government is paying more and more attention to rural development, emphasizing narrowing the gap between urban and rural areas and releasing the productivity and consumption potential of rural areas. Under the rural revitalization strategy, how to improve the modernization of agricultural product circulation has become the new focus of China's circulation construction.

Compared with industrial products, why does the circulation of the agricultural product fail to step on the fast lane of the circulation revolution represented by e-commerce in

the past twenty years? When thinking about this problem, we should not only focus on the circulation itself but also understand upstream agricultural production and consider why the agricultural product does not attract enough capital attention compared with industrial product [1]. First, we start with natural production conditions. Agricultural production is highly dependent on nature and is easily affected by unstable weather, diseases, and insect pests, so it is impossible to break through the constraints of natural resource endowments such as industry. It relies on the production of organic energy, which is different from modern industries that use inorganic mineral-based energy. The perishable nature of agricultural products and low standardization degree have also increased the difficulty of circulation. Secondly, from the perspective of the organizational form of production, China's agricultural production corresponds to small and scattered small-scale farms. Individual farmers have the weak anti-risk abilities and are easily misdirected by market information. When market prices fluctuate, they are prone to make collective overreaction, resulting in drastic price fluctuation of agricultural products, which forms a sharp contrast with stable and large-scale industrial production. Finally, for the economic nature of agriculture, because of the long production cycle and low elasticity of demand income, the profit of agriculture is lower than secondary and tertiary industries, so it is more difficult to attract new capital input. More differences between agricultural products and industrial products are shown in Table 1. These characteristics lead to the construction spending on agricultural product circulation lagging behind the circulation of industrial products in China. This also brings the research motivation of this paper. Although the downstream are connected to the national consumer market, the agricultural product circulation is more dependent on upstream production than an industrial product. Therefore, this paper will pay more attention to upstream agricultural production.

Table 1. Comparison of characteristics of industrial product circulation and agricultural product circulation.

The Difference	Circulation of Industrial Product	Circulation of Agricultural Product
Natural production conditions	Weak natural constraints	Production is based on specific climatic and geographical conditions; Strong seasonality in the production process, affected by bad weather
Form of production organization	Capital and technology intensive; Centralized scale production	Labor intensive; Decentralized production
Natural properties of product	Long storage life, not perishable	Fresh and perishable
Degree of standardization	High degree of standardization	Low degree of standardization
Sphere of circulation	Small regional and large national circulation coexist	Small regional and large national circulation coexist
Price fluctuations	Low	High
Profit level	High	Low
E-commerce platform adaptation	High	Low

Taking the reform and opening up as the time boundary, China's agricultural production and circulation system have obvious stage characteristics. In the period of planned economy, collectivized agricultural production corresponds to the circulation system of unified purchase and exclusive sale. After the reform and opening up, the government carries out the reform of rural land management under the household contract responsibility system, and the production is scattered again, forming a circulation system with a multi-level wholesale market as the core and field brokers as the starting point. In this process, although the new system calls for farmers' production enthusiasm, the small farmers bear more risks and are easily affected by market fluctuations. The construction of agricultural product standardization, quality traceability, and other aspects is weak,

and the modernization of agricultural product circulation is difficult to catch up with the speed of economic development. Meanwhile, with the development of the economy, the upstream agricultural production pattern is changing. Compared with secondary and tertiary industries, the profit level of agriculture is low, which leads to a large number of rural laborers moving to cities to seek income improvement. As a result, the rural farmers' aging trend is obvious, and the transfer of agricultural land among farmers has become a common phenomenon. According to the statistics of China's Ministry of Agriculture, by the end of 2016, there were 3.5 million farmers with a cultivated land area of over 50 mu. They have cultivated a land area of over 350 million mu, accounting for more than 20% of the total cultivated land area in China [2]. Large-scale agricultural land management is becoming a national fact that China's economic and social development must face.

From the international perspective, the modernization of agricultural production and circulation in developed countries is also based on the premise of large-scale or organization of agricultural production [1–3]. In the United States, the integration of agricultural management is an important feature of agriculture. On the one hand, the family farm is the basic unit of production. There are more than 2 million farms, each of which covers an area of more than 400 acres on average and is supported by a high level of mechanization. Each farm has only about three farmers, and the nationwide farmers account for less than 2% of the total population [4]. On the other hand, the development of agricultural social service organizations promotes the process of agricultural integration. If the United States is characterized by "large-scale production and large-scale circulation," in contrast, Japan has taken another construction road. Japan and China have similar natural conditions of high population density and small cultivated land scale. Still, Japan formed a national organization with the Japan Agricultural Cooperatives to provide integrated services in marketing, finance, insurance, production guidance, and other aspects for its peasant members. These two typical development paths also contain the construction possibility for China's agricultural production and circulation, which can reaggregate the scattered upstream production and achieve the agricultural scale to improve scattered production upstream.

The main research problem of this paper is the influence of large-scale agricultural land management on the modernization of agricultural product circulation. The research of this paper can supplement the research gap in large-scale agricultural land management and agricultural production circulation. In the 1990s in China, there was a big discussion about the impact of large-scale agricultural land management on agricultural production efficiency [5]. However, most of them pay more attention to the impact on agricultural production and less attention to circulation. Some scholars believe that large-scale agricultural land management in China has the possibility to promote agricultural production efficiency by reducing labor input, improving the mechanization degree, and accelerating the extension of technology. However, there are some scholars who believe that the scale efficiency of agricultural production is weak. Under the condition of the increasing fixed asset input and the expanding financial subsidies, the over-expansion of land scale may bring about the loss of overall welfare [2,5]. Among these studies, there are a few articles that directly investigate the relationship between large-scale agricultural land management and agricultural product circulation. This paper tries to make contributions from this perspective. We discuss the impact of large-scale agricultural land management on agricultural product circulation using field investigation and empirical test methods and give appropriate policy suggestions and enlightenment.

In the article structure, this paper starts with the theoretical analysis. In the literature review, we start with the change in rural land management systems in China and review the relevant literature research on large-scale agricultural land management. Next, we analyze the influence mechanism of large-scale agricultural land management on agricultural production and circulation and discuss how large-scale agricultural land management changes the form and efficiency of agricultural production and affects the downstream circulation. In the third section, based on the sociological characteristics of upstream

agricultural production and circulation, this paper uses the field investigation method. Based on the field investigation in Handan, Hebei Province, this paper proposes the theoretical hypothesis that large-scale agricultural land management has different influence mechanisms on agricultural product circulation efficiency and modernization. In the fourth section, we use the empirical test method to verify the relationship between large-scale agricultural land management and the efficiency and modernization of agricultural product circulation. At the end of this paper, we make a discussion and put forward conclusions and policy suggestions on how to promote the modernization of agricultural product circulation.

2. Literature Review and Mechanism Analysis

2.1. Literature Review

Under the geographical conditions of a large population and small land, China has formed the dispersive smallholder production mode, with the characteristics of small-scale, fragmented, and dispersed. In 2007, the World Bank referred to farmers with a land management scale of 2 hectares or less as “Smallholders”. The average agricultural land scale of the Chinese farmers are only 1/3 of this standard, thus, they are referred to as “super small-scale” [6]. During the planned economy period, China imitated the Soviet Union in implementing collectivized social organization and production. During the “Great Leap Forward” period, China was even more influenced by the false belief that “Bigger is Better” [7]. After the reform and opening up, China implemented the household contract responsibility system. Most regions divided the land equally according to population or labor force, thus forming a decentralized small-scale production mode. This adapted to the rural productivity level at that time and achieved extraordinary agricultural success in China [8].

In the Eighteenth Brumaire of Louis Bonaparte, Marx wrote about the French smallholders: “The smallholders are many in number, and their living conditions are the same, but they do not have a variety of relations with each other. Their mode of production does not keep them in contact with each other, but keeps them apart from each other” “Just as a bag of potatoes is assembled from one potato to another.” Although small farmers in the modern market economy are no longer isolated and closed in terms of production mode, they still objectively have the remarkable characteristics of scattered small-scale operation, which cannot achieve the division of labor and cooperation in modern society, and it is difficult to meet the development needs of agricultural productivity [9]. With the development of the economy and society, the Chinese government has begun to guide large-scale agricultural land management in the policy. In 1990, Deng Xiaoping put forward the proposal of “two leaps” in agricultural modernization. One is the implementation of the household contract responsibility system, and the other is the development of land management on an appropriate scale to meet the needs of scientific farming and production socialization. The government implements the institution of “separating the three rights” of rural land so that the ownership right, contract right, and the right to use contracted rural land are separated, and the separated using right becomes marketization rights so as to lead to the agricultural land transfer. In 2013, the Chinese government put forward the initiative of “family farms” for the first time in the No.1 Central Document, stressing the principle of voluntary land transfer by farmers, ensuring that the interests of farmers cannot be harmed, the use for agriculture cannot be changed, and the productive capacity of land cannot be destroyed. We can see that under the requirements of economic and social development, the Chinese government has begun to build a large-scale agricultural land policy system, and it still needs to be improved.

It has been a hot topic in the field of the agricultural economy whether to carry out large-scale agricultural land management and what impact it will bring to agricultural production. Many scholars have given their opinions from different perspectives [10–12]. Tasso Adamopoulos thinks that the scale of agricultural land is an important basis for distinguishing poor countries from rich ones, leading to huge differences in agricultural

labor productivity and providing a key stepping stone for further understanding of total labor [13]. Morten Hartvigsen starts with land reform in Central and Eastern Europe and finds that land fragmentation is often hampering agricultural land rural development when both land ownership and land use are highly fragmented [14]. R. Prosterman thinks that there is an inverse correlation between farm scale and production efficiency, and agricultural production has limited scale efficiency, so capital input cannot be ignored. Family farms, he argues, are more efficient than collective farms [5]. According to the analysis of domestic and foreign data, Luo Biliang thinks the increasing land scale does not necessarily bring more food production, and agriculture itself does not necessarily have a significant scale economy [2]. Du Pengfei explains this point again from the principal-agent theory under the assumption of scale economy and information asymmetry [15]. About the argument that large-scale agricultural land management is harmful, Mei Jianming believes that although there are some problems in policy practice, such as disrespecting farms' will, the positive significance of large-scale agricultural management cannot be ignored, and moderate large-scale agricultural land management is the inevitable choice of agricultural modernization [16]. From the perspective of family farms, Huang Zongzhi believes that the dominant logic of American agricultural modernization is to save labor. The "Big and Coarse" model is not in line with the reality of Chinese agriculture. The moderately operated "Small but Fine" family farm is the way out for Chinese agriculture [7].

In addition, some scholars have studied the impact of large-scale agricultural land management from an empirical perspective. Duc Trana takes Vietnam as an example and finds that large-scale land transfer greatly reduces labor input, especially in rice production, which is due to the improvement of farmland irrigation and the increase in machinery [17]. Meng Qu thinks that the improvement of the agricultural land scale promotes farmers' purchase of socialized agricultural services (SAS), and different land scales have significant threshold effects on farmers' willingness and behavior [18]. Rahman Sanzidur analyzes the farm survey data in Bangladesh and finds that the increase in land fragmentation would lead to a decline of rice yield, which has a negative impact on land productivity and technical efficiency [19]. You Heyuan's study shows that the transfer of rural land does not directly lead to the transfer of rural labor force but depends on the industrialization process, agricultural machinery input, agricultural land social security, and others [3]. This is the same as Han Jun's view that a large number of agricultural labor forces transferring to non-agricultural industries is necessary for the development of large-scale agricultural land management [8]. Zhang Xiaohan and Yue Qifan think that large-scale agricultural land management promotes labor-saving investment but inhibits land-saving investment [20]. Chen Ming and Zhou Farming found that the driving effect of agricultural science and technology investment on improving agricultural production efficiency is restricted by the low level of agricultural scale, so the intensification of agricultural production should be accelerated [21].

Studies on the circulation of agricultural products pay more attention to the circulation channel link. Ji Baocheng thinks that according to the production and consumption, the natural attributes, the economical nature, and other factors of different commodities, the circulation channels have different organizational characteristics. The circulation channels of agricultural products in China are characterized by dispersed links, small-scale, and long channels [22]. Zhao Dawei classifies the agricultural product circulation channel in China as traditional and new types. The former takes wholesale markets, cooperatives, and chain supermarkets as the core channels, while the latter takes e-commerce platforms as the core channels [23]. Chen Yaoting et al. thinks that the circulation of fresh agricultural products should shorten the distance between production and sales and improve the farmer organization degree [24]. Xiang Nan et al. takes Wu Mart as an example and finds that the change consumer demand is the direct driving force for the transformation of offline retail, and using digital technology is an important measure for a supermarket's transformation [25]. In general, existing circulation studies mostly focus on the links in

circulation channels and channel construction, or the impact of internet development on retail and consumption but neglect the production link of agricultural products.

From the above analysis, it can be seen that it is more and more difficult for smallholder production to meet the needs of modern production. From the perspective of policy, Chinese policymakers are guiding the large-scale management of agricultural land. From the perspective of theoretical research, few pieces of literature can connect large-scale agricultural land management with the modernization of agricultural product circulation. The existing literature is mostly conducted from the institutional perspective of a unified market, wholesale market, and logistics or from the perspective of e-commerce, platform economy, and other new business forms and pays less attention to agricultural production [26–29]. In this paper, we think that the circulation of agricultural products, due to their special production form, product nature, and channel construction characteristics, has a stronger dependence on upstream agricultural production. As one of the key characteristics of production, large-scale agricultural land management has an important potential impact on the circulation of agricultural products. This paper will study from this perspective and contribute to the research of large-scale agricultural land management and agricultural product circulation.

2.2. Mechanism Analysis

In the existing research, there are few pieces of literature that directly discuss the impact of large-scale agricultural land management on agricultural product circulation. Based on the relevant studies, large-scale agricultural land management is likely to have a compound impact on the efficiency of agricultural product circulation. Although it has a positive impact on the efficiency of agricultural product circulation, many factors will limit its effect and even lead to a negative impact. In addition, the modernization of agricultural product circulation cannot be replaced only by the single index of circulation efficiency of agricultural products. The modernization of agricultural product circulation in practice involves the transformation and upgrading of multiple channels and subjects, which is a comprehensive problem.

2.2.1. The Impact of Large-Scale Agricultural Land Management on Agricultural Production

As a form of production, the antagonistic relationship between large-scale management and smallholder management can be reflected in organizational form, land scale, labor input, and other aspects, but there is no clear academic definition of its specific connotation and expression form. According to Luo Biliang, small-scale agricultural operation is matched with family management organization, while the large-scale operation corresponds to collective management or farm organization, which refers to the concentration of small labor-intensive family farms to form large-scale mechanized farms [2]. Before investigating the modernization of agricultural product circulation, it is necessary to clarify the compound influence mechanism of large-scale agricultural land management on agricultural production, which can be researched from the perspectives of agricultural labor productivity and land productivity.

From the angle of scale economy, large-scale agricultural land management will bring about an increase in agricultural labor productivity. The expanded land scale is conducive to the application of large agricultural machinery, the construction of agricultural infrastructure, the innovation of agricultural technology, and the reduction in unit labor input on the premise of ensuring output [5]. In addition, large-scale agricultural land management will bring greater investment in socialized agricultural services and technology at the production link so as to improve the productivity potential [17].

However, large-scale agricultural land management will not necessarily bring an increase in land productivity. First, agricultural production has a strong dependence on nature, which makes agricultural scale production not have an obvious scale economy as industrial production. Secondly, large-scale agricultural land management involves the principal-agent theory. In the principal-agent theory, the goals of shareholders and

managers are not consistent. Under the assumption of “rational economic man,” the inconsistency of interest determines that the principal wants to encourage the agent to work hard at a lower cost. In contrast, the agent wants to obtain a higher labor reward with less effort [30]. In agricultural land management, the operator is the principal and the farmhand is the agent. In the process of agricultural production, since it is difficult for the principal to observe the true effort of farmhands, information asymmetry is easy to emerge. The interest demands of the two are not the same, and the moral hazard with hidden action is more likely to occur. In addition, due to the characteristics of agricultural production, it is difficult to establish a standardized management institution. In contrast, family management can ignore employment input and have a higher degree of production enthusiasm. In the field investigation, we also found similar results. The actual work effect may be affected by many factors such as salary, work intensity, preference for the employer, and even the very day’s mood of the farmer. The employers are trying to establish a compensation incentive system to improve it. Thirdly, from the perspective of resource endowment, large-scale production means greater productive capital input, and the increase in self-owned assets will increase the specificity of assets and transaction costs [20]. From the perspective of land input, differences in water, light, soil, and other conditions between lands may also reduce scale efficiency. All these factors will lead to the decline of the scale efficiency brought by large-scale agricultural land management and may eventually lead to the decline of land productivity. To sum up, it can be seen that large-scale agricultural land management may have both positive and negative effects on agricultural production, which is the basis for us to understand the impact of large-scale agricultural land management on circulation.

2.2.2. Large-Scale Agricultural Land Management, Agricultural Product Circulation Efficiency, and Modernization of Agricultural Product Circulation

Marxist political economy has described the relationship between production and exchange in the organic whole of social reproduction. In the Introduction to the Critique of Political Economy, Marx thinks that social production and reproduction, as the research object of political economy, is an organic system composed of four links: production, distribution, exchange, and consumption. Among them, production determines exchange, and exchange plays the role of mediating production and consumption. Production determines the nature of the exchange, and the degree of production development determines the degree of exchange development. For circulation of commodities, the circulation of commodities in *Das Kapital* is the exchange from the whole, which is the continuous whole of the exchange of commodities. At the same time, circulation itself also affects production, distribution, and consumption and then affects the total process of social reproduction. For production, rapid circulation means a faster product value realization process, which involves capital turnover, inventory optimization, product adjustment, and other issues. For consumption, circulation is a necessary means to realize consumption, which not only creates new consumption demand but also guides the formation of the consumption structure. For distribution, the different circulation properties of commodity characteristics, logistics facilities, economic profits, and other aspects determine the formation of different types of distribution networks and supply chains. Therefore, we can see that the development of circulation plays an important role in social reproduction, and it is important to explore how to improve the efficiency and modernization of circulation. This also applies to our next research on the circulation of agricultural products.

In our opinion, large-scale and smallholder agricultural production, as two different production forms, directly determine the channel and the organization forms of downstream commodity circulation, thus affecting the efficiency and modernization of agricultural product circulation. From the angle of circulation efficiency, large-scale agricultural land management has two compound mechanisms: positive and negative. Circulation efficiency is an index to measure input and output. In the mechanism analysis above, large-scale agricultural land management may reduce land productivity, thereby reducing

the final commodity quantity, which will bring pressure to inhibit the growth of efficiency under the condition that the input of capital and labor is unchanged. At the same time, the increase in capital input and higher capital specificity will also increase the fixed cost, which may damage the efficiency of production and circulation in the short term.

On the other hand, large-scale agricultural land management has the potential mechanism to promote the efficiency of agricultural circulation. First, from the aspect of the circulation channel, the original channel starts with field brokers, who are responsible for connecting with scattered farmers. In this process, farmers are in a passive position and are easily infringed on their interests through forced pricing and delayed payment. In contrast, large-scale agricultural land management can improve the pricing power based on an expanded production scale. Large-scale production can directly connect with the wholesale market and even supermarket procurement, eliminating the channel link of field brokers. Second, from the perspective of channel organization, a highly organized circulation system is a major feature of agricultural product circulation systems in developed countries. A typical example is the channel system in Japan, which takes the Agricultural Cooperative Association as the core organization and the wholesale market as the core channel. On the one hand, the upstream circulation organization has the transaction functions of commission sales and agent sales and can play the guidance of upstream production and the service functions of agricultural materials and finance through the means of informatization. After the collapse of planned economy systems, the upstream of China's agricultural product circulation has always lacked such an organized form, and the large-scale agricultural land management is conducive to the organized form's formation. Third, large-scale upstream production can provide more possibilities for expanding circulation entities, promoting the connection between production and marketing, and matching China's internet consumption format. Smallholder production has slowed the standardization of agricultural products in China. Large-scale production is conducive to the improvement of the standardization degree of agricultural products. The circulation participants can save transaction costs and put more energy into cleaning, sorting, packaging, and other function improvement. Under the background that the wholesale market is still the core of circulation, large-scale production is also conducive to reducing the transaction costs of purchase and sale, facilitating the cultivation of large-scale circulation enterprises. In addition, large-scale upstream entities also have the potential to participate in new business forms represented by e-commerce with a more active attitude.

Finally, for the modernization of agricultural product circulation, its connotation is richer than the index of agricultural product circulation efficiency based on "input-out". The circulation of agricultural products includes the acquisition, transportation, storage, sales, and other links. First of all, the modernization of agricultural product circulation is the comprehensive upgrade of the whole chain, which means the improvement of technical ability, the accumulation of human capital, the improvement of circulation organization, the implementation of modern trading methods, the improvement of logistics cold chain storage facilities and so on. Secondly, the modernization of agricultural product circulation means the modernization of the circulation function, which can play the functions of connecting supply and demand, meeting consumption, information gathering and guiding production, better strengthening the market participants, and playing the macro responsibility of stimulating employment and promoting economic growth.

Next, we will use the field investigation method in sociology to understand the progress of large-scale agricultural land management in practice and focus on the relationship between large-scale agricultural land management and the efficiency and modernization of agricultural product circulation.

3. Field Investigation and Theoretical Hypothesis

3.1. Site Selection of Field Investigation

Fei Xiaotong thinks that social investigation is the starting point of epistemology, which is a process of cognition from practice to theory and from theory to practice. To

understand society, we must start with an actual investigation [31]. The circulation of the agricultural product itself has strong sociological characteristics, with scattered links and numerous operators, and is particularly related to upstream production links. Therefore, it is very important to perform a field investigation in depth. This paper selects Guantao County and Yongnian District of Handan City, Hebei Province, as the field area, both of which are standard agricultural areas. Guantao's agricultural industry is famous for cucumber cultivation. It is the first area in Handan to have greenhouse cultivation. All the arable lands in the village are used for cucumber cultivation, and the village has its own vegetable wholesale market. Yongnian District of Handan City is also dominated by agricultural cultivation, which is characterized by the local Nandapu vegetable wholesale markets, which are one of the largest vegetable wholesale markets in China.

3.2. Investigation Situation

After collecting abundant preliminary data, the author sorts out the key questions for different interviewees. The research period is from December 2021 to March 2022, and the subjects cover self-employed farmers, employed farmers, principals of large-scale agricultural production bases, buyers and sellers in wholesale markets, and other business entities. In addition, we interview relevant government workers. The total number of interviewees is 14, and they are interviewed in a semi-structural way. The information about the investigation is shown in Table 2.

Table 2. Field data collection description.

Site Selection	Research Subject	Research Method	Research Problems
Guantao County Zhai Zhuang village cucumber wholesale market	Staff of market management department	Face to face	Formation of wholesale market, formation of cucumber industry, government support, price changes of agricultural product, direction of circulation channels, large-scale cultivation
Guantao County Zhai Zhuang village orders agricultural production base	Farmhand, farm owner	Face to face	The management model and management dilemma of order agriculture, the future of large-scale land management, the role of the government, the difficulties in the connection between agriculture and supermarket, the difficulties in the branding of agricultural products, the channel positioning of wholesale markets
Guantao County Jinfeng wholesale market	Director of market administration committee, egg buyer and seller	Face to face	The process of egg circulation in the market, the formation of egg price, the cost of long-distance transportation, the function and digitalization of wholesale market, the competition among wholesalers, and the cooperation mode with e-commerce
Guantao County agricultural and rural administration	The section chief of quality inspection department and vegetable department	Face to face	Government functions in the field of agricultural production and circulation, government's attitude to large-scale management, government support policies
Guantao County land property rights administration	The director general	Face to face	The development of land transfer, the support of large-scale management subjects, the difficulties and future of rural cooperative, and the future of large-scale agricultural land management
Guantao County market supervision and administration	The deputy director general	Face to face	The function of the market supervision department in the agricultural product circulation, the difficulty of supervision
Yongnian District Nandabu vegetable wholesale market	Parsley wholesaler, marketing management member	Face to face	The work of wholesalers of agricultural product, the connection with upstream and downstream, the influence brought by large-scale operation of agricultural land, how to connect with e-commerce platform, wholesalers' view on the impact of the connection between production and marketing in traditional circulation, establishment and management of wholesale market.
Guantao County community group purchase general agent	General agent	Face to face	The operation mode of community group purchase, the platform structure of agricultural product supply chain, the circulation infrastructure and functions

3.3. Research Results and Theoretical Hypotheses

3.3.1. Agricultural Production

Guantao County Zhai Zhuang village's agricultural land scale management has a unique development way. The local cucumber industry arose in the 1980s when Zhai Zhuang village took the lead in growing cucumbers under the leadership of imported agricultural experts and gradually formed a scale. Although there are more than 30 years of agriculture basis, the production scale and degree of standardization are still low. Anyway, the cucumber also lacks a specific market brand. After 2010, with the support of the government, the village established the cucumber planting base and introduced enterprises represented by Sanlu Agricultural Co., Ltd., Handan, Hebei in China. The company covers more than 200 mu of land, builds 46 greenhouses, and uses organic agriculture as the competition point. In addition, there are other small-scale land entities, both of which employ farmers of a certain size.

From the interviews with the farmhands and the head of the base, we can find the compound influence mechanism of farmland scale on agricultural production. The mechanism of the principal-agent theory can be verified by the words of the farmhand, who pays more attention to his own land and has the mentality of commuting to his employer. Vegetable production is highly refined. Take cucumber as an example; if farmers don't pay enough attention to the growing process, it will cause a significant decrease in yield. For the employed farmer, the amount of salary, the management of the leader, and even the mood of the farmer can affect the quality of the work. However, from the base leader's interview, we also see the positive mechanism that large-scale land management brings. After large-scale land management, the base has stronger bargaining power in the purchase of chemical fertilizers. In addition, it also introduces ecological circular agriculture forms such as "aquaponics" and achieves good results.

It can be seen that, on the one hand, large-scale agricultural land management has the risk of efficiency loss due to mechanisms such as decreased labor enthusiasm, increased salary input, and increased fixed asset input. On the other hand, it also has an efficiency compensation mechanism, which means greater innovation power and channel influence. For the index of agricultural product circulation efficiency based on "input-output," the increase in wage and fixed assets input in the short-term may bring a decrease in agricultural product circulation efficiency. However, as mentioned above, in the long run, large-scale agricultural land management has a mechanism to promote the efficiency of agricultural product circulation. Therefore, this paper puts forward Hypothesis 1:

Hypothesis 1 (H1): *The improvement of the large-scale management of agricultural land has two compound mechanisms, positive and negative, on the circulation efficiency of agricultural products, but it has a positive effect in the long run.*

3.3.2. Modernization of Agricultural Product Circulation

The site of the fieldwork includes three wholesale markets with different characteristics. The first is a small wholesale market built by the village itself, mainly for cucumber circulation. The second is a medium-scale wholesale market built by the county government, mainly for egg circulation. The third is a large-scale wholesale market built by the government and enterprises, which has more circulation categories. As shown in Table 3:

Table 3. Basic Situation of Wholesale Markets in Fieldwork Sites.

Market Name	Guantao County Zhai Zhuang Cucumber Wholesale Market	Guantao County Jinfeng Egg Wholesale Market	Yongnian District Nandabu Vegetable Wholesale Market
Built-up time	1997	1998	Built in 1987, readdressed and expanded in 2012
Area	35 mu	300 mu	1600 mu
Types of products in circulation	Mainly cucumbers	Eggs, vegetables, fruits, etc.	Complete categories, vegetables more than 200 kinds, fruit more than 60 kinds
Source of agricultural products	Mainly from Zhai Zhuang	Guantao County and surrounding areas	Handan City and surrounding regions, such as Yongnian, Jize, Quzhou county
Sphere of agricultural product circulation	Surrounding provinces and cities, Handan, Xingtai, Shijiazhuang, Tianjin, Shandong, Shanxi, etc.	Shenzhen, Dongguan, Chongqing and other places, mainly in southern provinces	Throughout the country
Wholesale market funders	Village and county government	The county government provides the land, and enterprises build the buildings	Enterprises invest and the government provides preferential policies
Circulation functions	As the trading places	As the trading places, and have the functions such as storage, refrigeration and logistics	As the trading places, and have the functions such as storage, refrigeration, logistics, sorting and packing

As the upstream circulation link, the wholesale market has assumed the primary function of logistics and circulation. To some extent, the existence of a wholesale market makes up for the disadvantages of the decentralized and small-scale of upstream agricultural production in China, realizing the agglomeration of agricultural product categories and scale. With the rapid development of land transfer and of large-scale management, can the function of the wholesale market be transferred to the upstream production entities? Based on this question, we investigate the person in charge of the agricultural production base and the buyer and seller of the wholesale market. The conclusion is as follows. First, take the fresh agricultural products as an example; although the large-scale upstream management is more concentrated and large-scale than the individual products, it has fewer types of products. For supermarket procurement, the lack of varieties in a single base brings higher transaction costs, while in wholesale markets, supermarkets, e-commerce platforms, and other downstream entities can realize one-stop procurement. In addition, sorting, packaging, and other functions are difficult to achieve completion by the agricultural production link. Second, from the perspective of upstream production, China's current agricultural land transfer scale is still small. Taking Zhai Zhuang agricultural production base as an example, it covers an area of 200 mu and is the largest vegetable cultivation base in the local area. However, due to the limited area and product variety, it still fails to meet the purchase requirement of supermarkets such as Aeon. As a result, only part of the agricultural products is sold through order agriculture, and the rest still rely on wholesale market channels.

Under the condition that the current large-scale agricultural production still cannot have the scale and functions of a wholesale market, how does large-scale agricultural land management affect the modernization of agricultural product circulation? First, circulation transaction costs will fall. From the interviews with buyers and sellers, we can see that their attitude toward upstream-scale production is positive because they understand that the upstream-scale is still not enough to replace the function of the buyer and seller. In

addition, the existence of large-scale production means more stability, which helps reduce communication and transaction costs. Second, the level of standardization and branding of the agricultural product will be improved. After large-scale cultivation, the quality of agricultural products generally rises. The classification of agricultural products can be performed well, and the construction of branding can also expand the profit space. Third, the circulation functions will be improved. Packaging and sorting in circulation are necessary for agricultural products to enter supermarkets or e-commerce platforms. The origin function occurs in the wholesale market or supermarket channel terminal, but now it can be realized in the large-scale production base. Therefore, Hypothesis 2 is put forward:

Hypothesis 2 (H2): *The improvement of large-scale agricultural land management has a positive effect on the modernization of agricultural product circulation.*

3.3.3. The Internal Logic of Traditional Agricultural Product Circulation in China

The basic reason for the current multi-level, multi-link, and multi-subject circulation mode of agricultural products is the circulation demand brought by China's scattered production dominated by smallholders. Take the cucumber industry in Zhai Zhuang village as an example. The largest farmer in the village contracts only 20 mu. The whole village has more than 800 mu's greenhouse area, most of which are individual farmers with 2–4 mu. This makes it difficult for the village to meet the large-scale needs of other regions. As a result, more than a dozen field brokers appear in the market, responsible for buying and concentrating agricultural products from smallholders. Due to the limited product categories and circulation functions, the Zhai Zhuang wholesale market is difficult to directly connect with the supermarket. In contrast, Nandabu wholesale market has a complete circulation function and product categories and therefore has a number of supermarket orders.

The logic of the traditional circulation channels of agricultural products in China is as follows. Under the production condition dominated by smallholder production, it is difficult to achieve large-scale production. Therefore, a certain group of upstream circulation subjects represented by field brokers are generated, who are responsible for information collection and connection with downstream buyers and sellers. As the trading place, the wholesale market is limited by deficient infrastructure, imperfect circulation function, incomplete product categories and so on, so it is difficult to realize the direct connection with supermarkets. Based on these conditions, China has formed multi-level wholesale markets as the core, multi-subject, multi-link form of agricultural product circulation. The current agricultural product circulation system is closely related to China's current agricultural production situation and economic development, having the basic economic logic. Therefore, Hypothesis 3 is put forward:

Hypothesis 3 (H3): *The development of traditional wholesale channels of agricultural product circulation will promote the modernization of agricultural product circulation in China.*

4. Econometric Model and Empirical Test

From the field investigation, we can see that large-scale agricultural land management may have a positive effect on the efficiency of agricultural product circulation, but it may also have a negative effect due to the change in production efficiency, the increase in capital input, and other factors. Furthermore, the positive promotional effect of the development of large-scale agricultural land management on the modernization of agricultural product circulation also needs to be empirically tested.

4.1. Variable Setting and Data Sources

In this paper, we use the panel data of 30 provinces in mainland China from 2003–2015 as analysis samples, with a total number of 390 samples (Tibet was excluded due to a large number of missing data). The data are mainly from the National Bureau of

Statistics, China Rural Statistical Yearbook, China Population, and Employment Statistical Yearbook, China Labor Statistical Yearbook, China Statistical Yearbook, and China Trade and External Economic Statistical Yearbook. In addition, some data are from China's provincial statistical yearbooks.

The explained variables are the modernization of agricultural product circulation and the efficiency of agricultural product circulation. It is worth noting that the indicators of agricultural product circulation are measured differently from agriculture indicators. For agriculture, its input often includes agricultural machinery, agricultural labor, and the output of agricultural products. For the agricultural product circulation industry, the input and output are mainly based on the circulation industry indicators rather than agriculture indicators. Next, we will explain in detail our measurement of the modernization and efficiency of agricultural product circulation.

The modernization of agricultural product circulation is a concept with many contents, which is a process of comprehensively improving the business flow, logistics flow, capital flow, and information flow in traditional agricultural product circulation [32]. Based on the connotation of the modernization of agricultural product circulation, it is necessary to consider not only the comprehensiveness of the index evaluation system but also the availability of data [33–35]. Finally, the index evaluation system of agricultural product circulation modernization is established from six aspects: technology and facilities of agricultural product circulation, organization and operation mode of agricultural product circulation, the concentration of agricultural product circulation, the structure of agricultural product circulation channel, scale, and benefit of agricultural product circulation and at last the modernization of agricultural product production. Next, the entropy weight method is used to obtain the weight of each index in each year and finally, select the average weight of the interval. After being weighted, the comprehensive index reflecting the development level of the modernization of agricultural product circulation is obtained. The index evaluation system and weight are shown in Table 4.

In the measurement of the efficiency of agricultural product circulation, we use the DEA-Malmquist method [26,36,37]. In terms of output indicators, the main agricultural products sold by each rural household in each province are multiplied by the total number of rural residents in each province to calculate the total circulation volume of agricultural products. We select the most representative agricultural products of four categories: grain, oil crops, vegetables, and fruits. On the input index, we choose from capital and labor force two aspects. In the calculation of fixed asset investment, the gross production value of rural households in transportation, wholesale, and retail industries is multiplied by the final consumption rate, then multiplied by the proportion of household consumption in final consumption, and finally multiplied by Engel's coefficient [36,38]. After all of this, we measure the stock using the perpetual inventory method and set the depreciation rate at 10%. In terms of labor input, the total number of workers in the transportation, wholesale and retail industries are multiplied by the above coefficients.

The explanatory variable of this paper is the level of large-scale agricultural land management, which is measured in two forms: single index and compound index for robustness. As for the measurement of farm size, Sumner used the total farm operating income, total output, land area, and other input factors in the measurement of farm size in the United States [39]. We first use a single indicator, measured by the per capita arable land area of rural households (symbol: landarea1). In addition, we use the entropy weight method to calculate the level of agricultural land scale management under the compound index, which is from three indexes of vegetable planting area per household, the number of agricultural employees, and the total power of agricultural machinery per household (symbol: landarea2). The weight determined by the entropy weight method is 0.253189, 0.382718, and 0.364093.

Table 4. The Index Evaluation System of Agricultural Product Circulation Modernization.

First Level Indicators	Second Level Indicators	Specific Indicators	Measurement of Specific Indicators	Index Weight
Technology and facilities of agricultural product circulation	Level of informatization	Extent of long-distance optical cable coverage	Total length of provincial long-distance optical cable lines in each province/Land area of each province	0.046178
		Broadband access coverage	Internet broadband access port/Population of each province	0.089172
	Infrastructure	Development degree of transportation infrastructure	Total highway length of each province/Land area of each province	0.040128
		Rural household circulation infrastructure	Total value of fixed assets owned by rural households in transportation, wholesale and retail industry in each province /Total value of productive fixed assets of rural in each province	0.028917
Organization and operation mode of agricultural product circulation	Business pattern	Development level of chain operation	Sales of chain retail enterprises/Total retail sales of consumer goods in each province	0.048574
		Development level of e-commerce	Express volume of each province/Population of each province	0.128376
	Human capital	Education level of employees	Number of rural households with a college degree or above in each province/Number of rural households in each province	0.089123
Concentration of agricultural product circulation	Scale of trading market	The concentration level of commodity trading market	Sales of commodity trading market over 100 million yuan in each province/Total retail sales of consumer goods in each province	0.047986
Structure of agricultural product circulation channel	Length of circulation channel	Wholesale and retail turnover ratio	Turnover in wholesale market above quota in each province/Turnover in retail market above quota in each province	0.037158
Scale and benefit of agricultural product circulation	Scale of agricultural product circulation	Average value added of agricultural product circulation	Total value added in transportation, wholesale and retail industry in each province/Rural population in each province	0.169371
	Employment benefits of agricultural product circulation	Proportion of employment in agricultural product circulation	Employment in transportation, wholesale and retail industry in each province/Rural population in each province	0.187835
Modernization of agricultural product production	Agricultural production efficiency	Average agricultural labor output value	Total value of agricultural output in each province/Agricultural labor force in each province	0.048184
	Development of mechanization	Power of agricultural machinery per household	Total power of agricultural machinery in each province/Number of rural households in each province	0.038997

We select the following control variables. (1) Rural household circulation investment (symbol: circuassets). At present, the circulation infrastructure in China's rural areas is seriously insufficient, which is reflected in the lack of cold chain, storage, and other facilities. Therefore, farmers tend to invest in infrastructure. This index is measured by the total value of productive fixed assets owned by rural households in transportation, wholesale, and retail industries. (2) Human capital (symbol: edu). A highly educated force means higher human capital. It is calculated by the number of people with a college degree or higher in each province. (3) Level of commodity market development (symbol: marknub). There are obviously uneven characteristics of development among different regions in China. This index can measure the construction level of trading markets in different regions, and it is measured by the number of commodity trading markets above 100 million yuan. (4) State-owned components (symbol: soe). It refers to the ownership of capital by the state. The government' will determine that the state-owned enterprises are production and management forms integrating commercial nature and public welfare nature. The

proportion of state-owned components can reflect the government's ability to influence the economy to some extent. This index is measured by the ratio between the number of employed persons in state-owned enterprises and the total number of employed persons at the end of the year [40]. (5) Coefficient of wholesale and retail sales (symbol: wholeretail). The index uses the ratio of wholesale sales to retail sales in the same period, and the change reflects the change in the length of the circulation channel. The larger the coefficient is, the longer the circulation channel is. All variables are logarithmically processed. Descriptive statistics of all variables are shown in Table 5.

Table 5. Descriptive Statistics of All Variables.

Variable Name	Symbol of Variable	Average	Standard Deviation	Minimum	Maximum
Efficiency of agricultural product circulation	Ineffi	−0.0141	0.2418	−1.0936	1.5012
Modernization of agricultural product circulation	Incirmodern	−1.8491	0.7319	−3.6729	1.1583
Level of large-scale agricultural land management (single index)	Inlandarea1	0.5019	0.8127	−1.3470	2.7134
Level of large-scale agricultural land management (compound index)	Inlandarea2	−1.1749	0.5012	−4.1039	−0.3017
Rural household circulation investment	Incircuassets	7.4312	0.8192	4.4876	10.8231
Human capital	Inedu	4.531	1.1512	5.3752	13.3422
Level of commodity market development	Inmarknub	7.4312	1.1741	1.6094	7.8768
State-owned components	Insoe	−0.5128	0.3183	−1.5576	−0.1475
Coefficient of wholesale and retail sales	Inwholeretail	−1.3328	0.3967	−2.4247	−0.0753

4.2. Econometric Model Setting

In order to investigate the influence of large-scale agricultural land management on the efficiency of agricultural product circulation, and because economic development in China has obvious regional unbalanced characteristics, this paper constructs a fixed effect model, which controls the individual effect:

$$Y_{it} = \beta_0 + \beta_1 landarea_{it} + \beta_2 X_{it} + \beta_3 F_{it} + d_i + m_t + \varepsilon_{i,t} \quad (1)$$

On the basis of Equation (1), in order to investigate the nonlinear influence of large-scale agricultural land management on the efficiency of agricultural product circulation, the quadratic term $landarea_{it}^2$ of large-scale agricultural land management is introduced. The equation is as follows:

$$Y_{it} = \beta_0 + \beta_1 landarea_{it} + \beta_2 landarea_{it}^2 + \beta_3 X_{it} + \beta_4 F_{it} + d_i + m_t + \varepsilon_{i,t} \quad (2)$$

In addition, considering the possible lag effect of agricultural production on the circulation of agricultural products, the lag term $landarea_{i,t-1}$ of large-scale agricultural land management is introduced. The equation is as follows:

$$Y_{it} = \beta_0 + \beta_1 landarea_{i,t-1} + \beta_2 X_{it} + \beta_3 F_{it} + d_i + m_t + \varepsilon_{i,t} \quad (3)$$

$$Y_{it} = \beta_0 + \beta_1 landarea_{i,t-1} + \beta_2 landarea_{i,t-1}^2 + \beta_3 X_{it} + \beta_4 F_{it} + d_i + m_t + \varepsilon_{i,t} \quad (4)$$

In Equations (1) and (2), the explained variable Y_{it} is the agricultural product circulation efficiency in the t year of the i province. The explanatory variable $landarea_{it}$ is the large-scale agricultural land management in the t year of the i province. Considering the obvious regional imbalance in China's economic development, d_i is used to control the

region-fixed effect, m_t is used to control the time-fixed effect, $\varepsilon_{i,t}$ is the random disturbance term, and $\beta_0, \beta_1, \beta_2, \beta_3, \beta_4$ are the parameters to be estimated.

In order to make the coefficients obtained from the constructed model unbiased, it is necessary to make the hysteresis term uncorrelated with the random interference term as much as possible. Therefore, in addition to controlling the fixed effects of region and year, we also add the agricultural development characteristics vector F_{it} of each province to control the influence of agricultural development on large-scale agricultural land management. To be more specific, they include Proportion of total agricultural output value in total regional output value (Ag_prva), the proportion of the agricultural population in the rural employed population (Ag_popu), the total power of agricultural machinery per household (Ag_mach), proportion of per capita disposable income of rural residents in per capita disposable income of urban residents (Ag_inco), grain output per unit area (Ag_fod), grain output per labor (Ag_lapr). To normalize the processing, we logize Ag_fod and Ag_lapr. By supplementing the variables according to the characteristics of provincial agricultural development, the model can more effectively reduce the bias caused by the possible endogeneity problem in the estimation results.

In addition, in order to reduce the bias of omitted variables for the estimated coefficients, the model also controls other variables related to the agricultural circulation industry (X_{it}). To be specific, it includes rural residents' household circulation investment (circuassets), human capital (edu), trade market development (marknub), state-owned component (soe), and wholesale and retail ratio (wholertail), just as shown in the previous Table 5.

In order to further investigate the impact of large-scale agricultural land management on the modernization of agricultural product circulation, the following model is constructed:

$$Z_{it} = \beta_0 + \beta_1 \text{landarea}_{it} + \beta_2 X_{it} + \beta_3 F_{it} + d_i + m_t + \varepsilon_{i,t} \quad (5)$$

$$Z_{it} = \beta_0 + \beta_1 \text{landarea}_{it} + \beta_2 \text{landarea}_{it}^2 + \beta_3 X_{it} + \beta_4 F_{it} + d_i + m_t + \varepsilon_{i,t} \quad (6)$$

$$Z_{it} = \beta_0 + \beta_1 \text{landarea}_{i,t-1} + \beta_2 X_{it} + \beta_3 F_{it} + d_i + m_t + \varepsilon_{i,t} \quad (7)$$

$$Z_{it} = \beta_0 + \beta_1 \text{landarea}_{i,t-1} + \beta_2 \text{landarea}_{i,t-1}^2 + \beta_3 X_{it} + \beta_4 F_{it} + d_i + m_t + \varepsilon_{i,t} \quad (8)$$

Among them, the explained variable Z is the agricultural product circulation modernization index calculated by the entropy weight method, and other variables and parameters are the same as above.

4.3. Analysis of Econometric Results

Firstly, we analyze the relationship between large-scale agricultural land management and the circulation efficiency of agricultural products quantitatively. The regression results are shown in Table 6.

In the first and second models, under the condition of controlling other factors, we find that large-scale agricultural land management may have a negative impact on the circulation efficiency of agricultural products in the short term. In the three-four-column model, we take into account the lag of the impact of large-scale agricultural land management on agricultural production and use the previous period variable of the explanatory variable for regression [20,40]. The results show that the rise of large-scale agricultural management will have a negative impact on the current period's agricultural product circulation efficiency but has a positive promoting effect on the next period's agricultural product circulation efficiency, showing a nonlinear "U-shaped" characteristic. This is basically consistent with our previous hypothesis. The index of agricultural product circulation efficiency is constructed from the perspective of input and output. However, in the short-term, the development of large-scale agricultural land management will lead to the decline of per capita production of agricultural products due to the decline of land productivity. In addition, the increase in capital input, logistics cost, and other factors will lead to the increase in input, which will eventually reduce the efficiency of agricultural

product circulation. The nonlinear “U” shape result proves that, through the influence mechanism of the rise of labor productivity, the simplification of circulation channels and the standardization of the circulation process, large-scale land management has a long-term positive impact on the efficiency of agricultural product circulation.

Table 6. Large-scale agricultural land management and circulation efficiency of agricultural products.

Explanatory Variable	Explained Variable: Lneffi			
	(1) Coefficient	(2) Coefficient	(3) Coefficient	(4) Coefficient
Inlandarea1	−0.0780 * (−1.90)	−0.0760 * (−2.05)	—	—
Inlandarea1 ²	—	0.0340 ** (2.35)	—	—
L.Inlanarea1	—	—	−0.2383 ** (−2.09)	−0.2418 * (−1.97)
L.Inlanarea1 ²	—	—	—	0.0573 *** (3.72)
Incircuassets	−0.1883 ** (−2.08)	−0.1921 ** (−2.16)	−0.2015 ** (−2.10)	−0.2026 ** (−2.11)
Inedu	0.0445 * (1.98)	0.0410 ** (1.91)	0.0847 *** (3.77)	0.0858 *** (3.58)
Inmarknub	0.3850 *** (2.12)	0.0416 * (1.99)	0.0791 * (1.88)	0.0671 * (1.79)
Insoe	0.0432 (0.76)	0.0465 (0.77)	0.3341 * (1.71)	0.3497 * (1.78)
Inwholeretail	−0.1883 ** (−2.08)	−0.5331 (−1.00)	0.0399 (0.58)	0.0412 (0.58)
Ag_prva	−0.3982 (−0.99)	−0.5331 (−1.00)	−0.6164 (−1.25)	−0.6394 (−1.27)
Ag_popu	−0.7742 (−1.15)	−0.8764 (−1.06)	−0.3738 (−0.43)	−0.5448 (−0.47)
Ag_mach	0.0035 * (1.98)	0.0168 * (1.91)	0.0147 * (1.94)	0.0054 * (1.89)
Ag_inco	0.0632 *** (4.21)	0.0408 *** (4.30)	0.7657 *** (5.21)	0.7535 *** (5.02)
Ag_fod	0.0227 * (1.78)	0.0447 * (1.84)	0.1698 * (1.83)	0.1282 (1.65)
Ag_lapr	0.0322 *** (3.37)	0.0615 *** (3.55)	0.1030 *** (4.01)	0.1646 *** (3.87)
Constant Term	1.4165 *** (4.42)	1.5480 *** (5.02)	3.0264 *** (4.21)	3.2789 *** (4.33)
Sample Size	390	390	360	360
R ²	0.2679	0.2685	0.2959	0.2973

Notes: ***, ** and * respectively indicate that the estimated values of the parameters are statistically significant at 1%, 5%, and 10% levels. “—” indicates no content. Robust standard errors are used for all regression results in the table. All regressions include time-fixed effects and region-fixed effects.

From the results of control variables, the paper draws enlightening conclusions. The circulation investment of rural households has a negative relationship with the circulation efficiency of agricultural products, which is consistent with the research conclusion of Liu Tianxiang [26]. In the case of insufficient social investment in circulation, rural households

tend to make up for it through household investment. However, due to repeated investment and limited diffusion effect, such investment is relatively inefficient, so it is necessary to strengthen infrastructure investment from the society perspective. From the perspective of human capital, the improvement of regional human capital has a significant positive impact on the efficiency of agricultural product circulation [32]. The development of regional commodity trading markets also has a positive effect on the improvement of the circulation efficiency of agricultural products. The development of large-scale wholesale markets plays an important role in reducing the transaction costs of agricultural product circulation. In contrast, the index reflecting the length of the circulation channel does not show a direct relationship with the efficiency of agricultural product circulation. At present, it is easy to conclude that the wholesale market should be reduced as much as possible if the channel length is only considered from the wholesale-retail index. However, due to the special production characteristics of China's agriculture, the wholesale market will still play an irreplaceable core role in circulation for a long time. Therefore, reconstructing the wholesale market is a problem that must be treated carefully. The influence of state-owned components on the circulation efficiency of agricultural products is also significantly positive, which is consistent with existing studies on state-owned components [41]. Maintaining a certain proportion of public ownership of the economy is conducive to ensuring the smooth and stable circulation channels of agricultural products in China [40].

In the above analysis, we found that the efficiency index of agricultural product circulation based on "input-output" has many shortcomings, and it cannot completely represent the development of agricultural product circulation. Therefore, this paper constructs the index of agricultural product circulation modernization under the entropy weight method and again observes the influence of large-scale agricultural land management on the modernization of agricultural product circulation. The results are shown in Table 7.

The empirical results show that large-scale agricultural land management has a significant positive impact on the modernization of agricultural product circulation, which is also consistent with the field investigation results and theoretical assumptions mentioned above. The centralization of upstream production helps the circulation to save upstream transaction costs in the process of production-consumption connection. Therefore, enterprises can invest more circulation capital in the improvement of circulation functions such as sorting and packaging and realize the docking of production and marketing on a larger scale. In addition, the centralization of land is also conducive to the industrialization of agriculture, promoting the application of new technology and large agricultural machinery, improving the level of modern agricultural production; and improving the organization of agricultural production so as to lay a foundation for further circulation innovation and efficiency improvement. In terms of control variables, it can be seen that regional human capital, regional commodity market development, and state-owned components all have a positive impact on the modernization of agricultural product circulation, and this has also been verified in previous literature studies [42]. The research result shows the systematization of agricultural product circulation construction again. The modernization of agricultural product circulation is a complex construction process, which needs regular investment and support in circulation infrastructure, human capital construction, and other aspects so as to gradually realize the transformation from extensive management to modern management [32,43,44].

Table 7. Large-scale Agricultural Land Management and Agricultural Product Circulation Modernization.

Explanatory Variable	Explained Variable: Lncircumodern			
	(5)	(6)	(7)	(8)
	Coefficient	Coefficient	Coefficient	Coefficient
Inlandarea1	0.0168 *** (3.54)	0.0247 *** (3.76)	—	—
Inlandarea1 ²	—	0.1956 * (1.74)	—	—
L.Inlanarea1	—	—	0.0236 ** (2.64)	0.0213 ** (2.57)
L.Inlanarea1 ²	—	—	—	0.1256 *** (3.04)
Incircuassets	0.3635 *** (3.62)	0.3733 *** (3.14)	0.3855 *** (3.37)	0.3439 *** (3.77)
lnedu	0.0063 *** (4.01)	0.0014 *** (4.26)	0.0025 *** (4.31)	0.0035 *** (3.86)
Inmarknub	0.4611 (0.87)	0.5018 (1.01)	0.4642 (0.72)	0.4843 ** (0.69)
Insoe	0.1831 * (1.73)	0.1584 (1.31)	0.3166 * (1.83)	0.2906 * (1.71)
Inwholereail	0.0012 (0.02)	0.0109 (0.16)	−0.0488 (−0.65)	−0.0510 (−0.62)
Ag_prva	2.9876 * (1.94)	1.7435 (1.33)	1.4397 * (1.70)	1.4779 * (1.78)
Ag_popu	0.6142 (0.61)	1.2469 (0.74)	0.7007 (0.56)	0.9861 (0.49)
Ag_mach	−0.0057 (−1.29)	−0.0557 (−1.14)	−0.0835 (−0.99)	−0.0680 (−0.82)
Ag_inco	1.3491 ** (2.36)	1.6501 *** (3.10)	1.6843 ** (2.47)	1.7048 ** (2.67)
lnAg_fod	0.2895 ** (2.12)	0.1635 ** (2.05)	0.4955 ** (2.00)	0.4260 * (1.96)
lnAg_lapr	0.3672 *** (4.37)	0.1993 *** (5.23)	0.4876 *** (4.78)	0.3865 *** (4.82)
Constant Term	−3.5235 *** (−5.65)	−7.8591 *** (−5.01)	−8.1842 *** (−4.36)	−8.6055 *** (4.58)
Sample Size	390	390	360	360
R ²	0.3859	0.3971	0.3937	0.3959

Notes: ***, ** and * respectively indicate that the estimated values of the parameters are statistically significant at 1%, 5%, and 10% levels. “—” indicates no content. Robust standard errors are used for all regression results in the table. All regressions include time-fixed effects and region-fixed effects.

4.4. Regional Heterogeneity Analysis

The development of different regions in China has great imbalanced characteristics, which may affect the robustness of the regression results. Therefore, we conduct regional heterogeneity analysis by dividing China into eastern, central, and western regions. According to the statistical caliber commonly used in China, the eastern region includes 11 provinces: Beijing, Tianjin, Hebei, Liaoning, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong, and Hainan, and the central region includes eight provinces: Shanxi, Jilin, Heilongjiang, Anhui, Jiangxi, Henan, Hubei, and Hunan. The western region includes

11 provinces of Inner Mongolia, Guangxi, Chongqing, Sichuan, Guizhou, Yunnan, Shaanxi, Gansu, Qinghai, Ningxia, and Xinjiang. The regression results are shown in Tables 8 and 9.

Table 8. Regional Heterogeneity Analysis (1).

Explanatory Variable	Explained Variable: Lneffi		
	Eastern	Central	Western
	Coefficient	Coefficient	Coefficient
Lmlandarea1	0.9687 * (1.90)	0.3912 ** (2.15)	0.1536 (1.45)
Incircuassets	−0.3194 * (−1.99)	−0.0062 ** (−2.20)	−0.1681 * (−2.19)
lnedu	0.1130 * (2.07)	0.0756 *** (5.97)	0.0881 *** (4.88)
lnmarknub	0.2007 * (2.13)	0.0317 (1.31)	−0.0478 (−0.38)
lnsoe	0.4363 ** (2.46)	0.3670 *** (3.06)	0.2741 * (2.18)
lnwholereail	0.1129 (0.49)	0.0362 (0.5)	0.0437 (0.70)
Ag_prva	−0.2933 (−0.17)	−0.9959 * (−2.20)	−0.1168 (−0.21)
Ag_popu	−1.2644 (−0.91)	0.8376 (1.29)	−1.8807 * (−1.91)
Ag_mach	0.0915 (1.37)	−0.0687 (−1.72)	0.0173 * (2.09)
Ag_inco	0.9647 *** (3.75)	1.7264 *** (3.96)	0.5621 *** (3.24)
lnAg_fod	0.1259 * (2.21)	0.2549 (1.21)	0.5929 *** (3.52)
lnAg_lapr	0.0445 *** (4.02)	0.1832 * (1.95)	0.6984 * (2.17)
Constant Term	1.6325 *** (3.67)	3.1533 *** (4.51)	2.4546 *** (3.54)
Sample Size	143	104	143
R ²	0.2160	0.4612	0.4246

Notes: ***, ** and * respectively indicate that the estimated values of the parameters are statistically significant at 1%, 5%, and 10% levels. Robust standard errors are used for all regression results in the table. All regressions include time-fixed effects and region-fixed effects.

The regression results show that for the eastern, central, and western regions, the large-scale agricultural land management in the eastern and central regions has a significant positive effect on the efficiency and modernization of agricultural production circulation, while for the western regions, it is not significant. The possible reasons are the differences in agricultural production efficiency and circulation infrastructure in different regions [6,44]. The eastern and central regions have a higher level of economic development, better agricultural infrastructure, and greater capital input. It brings higher agricultural production efficiency, which has become a premise of promoting the transfer of rural surplus labor force and improving the agricultural land scale management. However, for the western region of China, economic development is highly dependent on the agricultural industry, the level of economic development is low, and agricultural production and circulation infrastructure are insufficient. These factors have greatly affected the improvement of large-scale agricultural land management and limited its economic promotion effect. These enlighten that

the government must consider the difference between regions when promoting large-scale agricultural land management. The regions with better economic development and higher agricultural production efficiency have more conditions to promote large-scale agricultural land management and can give full play to the promoting effect of large-scale agricultural land management on the modernization of agricultural production and circulation.

Table 9. Regional Heterogeneity Analysis (2).

Explanatory Variable	Explained Variable: Lneffi		
	Eastern Coefficient	Central Coefficient	Western Coefficient
Lndarea1	0.0679 *** (4.53)	0.1878 *** (3.28)	0.5064 * (2.16)
lncircuassets	0.1013 (0.90)	0.3301 *** (3.32)	0.0061 *** (9.08)
lnedu	0.0188 ** (2.15)	−0.0635 (−2.95)	0.0185 * (1.91)
lnmarknub	0.3567 ** (2.67)	0.1252 *** (4.27)	0.3195 ** (2.47)
lnsoe	0.1811 ** (2.07)	2.7330 * (1.95)	0.4627 (1.05)
lnwholeretail	−0.0035 (−0.05)	−0.2598 (−1.02)	−0.0315 (−0.44)
Ag_prva	2.9328 * (2.22)	3.3986 * (2.31)	3.5161 (1.43)
Ag_popu	−0.9491 (−0.68)	−1.5777 (−1.26)	1.3074 (1.51)
Ag_mach	0.0698 (1.41)	−0.2010 * (−2.32)	−0.0839 (−1.34)
Ag_inco	1.2721 *** (3.96)	−2.3140 ** (2.43)	0.8239 * (1.78)
lnAg_fod	0.4290 *** (4.06)	3.3718 ** (2.39)	0.1290 *** (3.51)
lnAg_lapr	0.2664 *** (3.53)	−1.3963 * (2.32)	0.1814 ** (2.64)
Constant Term	1.1514 (4.78)	−3.2914 (3.96)	−6.9279 (4.25)
Sample Size	143	104	143
R ²	0.3060	0.4481	0.4385

Notes: ***, ** and * respectively indicate that the estimated values of the parameters are statistically significant at 1%, 5%, and 10% levels. Robust standard errors are used for all regression results in the table. All regressions include time-fixed effects and region-fixed effects.

4.5. Robustness Test

In order to verify the robustness of the influence mechanism of large-scale agricultural land management on agricultural product circulation efficiency and modernization, we learn from the practice of Hu Zongze and Wang Xiaohui and use “Landarea2”, a compound index of large-scale agricultural land management calculated by entropy weight method, to conduct regression [45]. The regression results are shown in Tables 10 and 11.

Table 10. Robustness Test (1).

Explanatory Variable	Explained Variable: Lneffi			
	(5)	(6)	(7)	(8)
	Coefficient	Coefficient	Coefficient	Coefficient
Lnlandarea2	0.0765 ** (2.42)	0.0980 ** (2.54)	—	—
Inlandarea2 ²	—	−0.0603 *** (3.19)	—	—
L.Inlanarea2	—	—	0.014 *** (3.01)	0.1637 *** (2.78)
L.Inlanarea2 ²	—	—	—	−1.3405 *** (−3.82)
Incircuassets	−0.1932 * (−2.01)	−0.1959 ** (−2.07)	−0.2191 * (−1.98)	−0.2160 * (−1.94)
Inedu	0.0881 *** (4.09)	0.0880 *** (4.16)	0.0858 *** (3.68)	0.08598 *** (3.66)
Inmarknub	0.0518 (0.86)	0.0436 (0.82)	0.1016 * (1.83)	0.1208 * (1.96)
Insoe	0.3473 ** (2.12)	0.3674 ** (2.15)	0.2704 * (1.90)	0.3057 * (1.89)
Inwholereail	0.0352 (0.56)	0.0367 (0.58)	0.0359 (0.54)	0.0458 (0.70)
Ag_prva	0.4427 (0.90)	0.4787 (0.96)	0.5998 (1.25)	0.5767 (1.20)
Ag_popu	0.8166 (1.27)	1.0000 (1.23)	0.1710 (0.26)	0.1898 (0.31)
Ag_mach	−0.0310 (−0.63)	−0.0470 (−1.05)	−0.0035 (−0.07)	−0.0126 (−0.27)
Ag_inco	0.1059 *** (3.56)	0.1451 *** (3.63)	0.7857 * (1.71)	0.9566 * (1.89)
lnAg_fod	0.0450 ** (2.47)	0.0958 ** (2.41)	0.2793 * (1.89)	0.2372 * (1.99)
lnAg_lapr	0.0174 ** (2.28)	0.0242 ** (2.22)	0.0052 ** (2.30)	0.0776 ** (2.43)
Constant Term	0.9791 *** (4.18)	1.080 *** (4.25)	2.9789 (3.28)	3.6721 (3.42)
Sample Size	390	390	360	360
R ²	0.2695	0.2712	0.2901	0.3010

Notes: ***, ** and * respectively indicate that the estimated values of the parameters are statistically significant at 1%, 5%, and 10% levels. “—” indicates no content. Robust standard errors are used for all regression results in the table.

Table 11. Robustness Test (2).

Explanatory Variable	Explained Variable: Lncircumodern			
	(5)	(6)	(7)	(8)
	Coefficient	Coefficient	Coefficient	Coefficient
lnlandarea	0.2032 * (2.15)	0.2351 ** (2.32)	—	—
lnlandarea2 ²	—	0.0064 * (1.91)	—	—
L.lnlandarea2	—	—	0.2562 ** (2.08)	0.2100 * (1.88)
L.lnlandarea2 ²	—	—	—	0.8074 ** (2.21)
lncircuassets	0.3689 *** (3.35)	0.3689 *** (3.35)	0.3911 *** (3.34)	0.3887 *** (3.33)
lnedu	0.0022 *** (3.22)	0.0023 *** (3.25)	0.0012 *** (3.19)	0.0013 *** (3.21)
lnmarknub	0.4780 *** (4.98)	0.4775 *** (4.88)	0.4532 *** (4.31)	0.4400 *** (4.22)
lnsoe	0.1962 * (1.86)	0.1952 * (1.79)	0.1961 * (1.81)	0.1750 * (1.76)
lnwholereetail	−0.0023 (−0.03)	−0.0097 (−0.04)	−0.0564 (−0.79)	−0.0644 (−0.90)
Ag_prva	1.7090 (1.34)	1.7025 (1.33)	1.8077 (1.30)	1.7673 (1.26)
Ag_popu	0.5437 (0.49)	0.5499 (0.51)	0.3691 (0.32)	0.3522 (0.31)
Ag_mach	−0.1370 * (−1.90)	−0.1398 * (−1.99)	−0.1266 * (−1.85)	−0.1305 * (−1.93)
Ag_inco	1.3562 ** (2.34)	1.3425 ** (2.50)	1.2294 ** (2.78)	1.1331 ** (2.63)
lnAg_fod	0.4147 *** (3.87)	0.4121 *** (4.00)	0.5967 *** (3.86)	0.5832 *** (3.91)
lnAg_lapr	0.2808 * (1.81)	−0.2757 * (−1.76)	−0.3874 ** (−2.04)	−0.3570 ** (−1.93)
Constant Term	−8.3726 *** (−5.13)	−8.3555 *** (−5.26)	−9.1325 *** (−4.98)	−9.2928 *** (−5.05)
Sample Size	390	390	360	360
R ²	0.3957	0.4005	0.4080	0.4105

Notes: ***, ** and * respectively indicate that the estimated values of the parameters are statistically significant at 1%, 5%, and 10% levels. “—” indicates no content. Robust standard errors are used for all regression results in the table.

After replacing the measurement index of the original large-scale agricultural land management, the conclusion is basically consistent with the previous results. After controlling the lag effect of independent variables, it is found that large-scale agricultural land management has a certain negative influence mechanism on the agricultural product circulation efficiency in the short term, but in the long term, it still shows a “U-shaped” trend of first decreasing and then increasing, which is the same as the test conclusion above. In Table 11, the influence coefficient of large-scale agricultural land management on the modernization of agricultural product circulation passes the robustness test at the significance level of 1%. This verifies that large-scale agricultural land management has

a positive mechanism effect on agricultural product circulation. In addition, in terms of control variables, rural household circulation infrastructure investment, human capital, development of commodity trade market, state-owned components, and other variables also have a positive impact on the efficiency and modernization of agricultural product circulation [29,30,41].

5. Discussion

Based on the above research, this paper draws the following policy implications. First, we should pay more attention to the guiding role of agricultural production in agricultural product circulation and re-understand the correlation between agricultural production and circulation. The circulation of agricultural products is greatly different from the circulation of industrial products, and the former has a higher dependence on the agricultural production form. There is a complete economic logic behind the traditional circulation channels of agricultural products in China, which adapts to the form of smallholder agricultural production and cannot be denied as backward. The efficiency of agricultural product circulation can be improved through the innovation of circulation technology and the improvement of infrastructure. However, only coordinated development with upstream agricultural production can realize the modernization of agricultural product circulation as a whole.

Second, the government should promote land transfer in light of local conditions and appropriately improve the level of large-scale agricultural land management. From a global point of view, the development of large-scale agricultural land management and diversification of management subjects is the inevitable requirement of agriculture and circulation modernization. The appropriate scale of agricultural land management does not mean that “larger is better” but choosing the appropriate scale of land production according to different natural and economic conditions [9]. In the context of a large number of rural labor population moving to cities in China, the government should protect the market-oriented transfer of land management rights and encourage the establishment of a land management rights transfer market or rural property rights trading market. In this process, it is necessary to respect the will of farmers, protect their interests, and guide the transfer of land management rights orderly and standardized [46]. In addition, in order to reduce the economic pressure in rural areas, the government also needs to increase subsidies for agricultural machinery and stabilize the procurement price of agricultural products. It should be noted that China’s social development is highly uneven. In areas where agricultural production does not have the conditions for large-scale management, the government can actively promote the development of rural production cooperatives and organize scattered small farmers, so as to improve the ability to resist risks and the competitiveness of participating in the market.

Third, the wholesale market will continue playing a core role in the circulation of agricultural products in China for a long time. It has great potential to supplement the circulation service function, improve the circulation infrastructure, stabilize the circulation price of agricultural products, and improve the level of channel organization. For the wholesale market, in addition to the function of commodity distribution, also has production and marketing information dissemination, price formation, product commercialization, and other functions. The special channel role requires more effort in improving the environment and functions. It is necessary to promote the modernization of the wholesale market of agricultural products, guide the integration of local small-scale wholesale markets, form a batch of large-scale regional wholesale markets, upgrade the hardware and system design, and expand the service functions in cold chain logistics, quality testing, packaging, and sorting, etc.

Fourth, the inadequacy of infrastructure construction is the key element that hinders the further development of agricultural product circulation in China. The rapid circulation of agricultural products depends on large-scale logistics and warehousing. The brand construction of agricultural products depends on complete standardized grading, sorting,

and packaging equipment, and the quality assurance and reduction in the waste rate of an agricultural product depend on the further realization of cold chain logistics. This requires the government to improve the multi-level logistics system and upgrade the rural delivery logistics infrastructure. In terms of cold chain construction, the government should speed up the construction of cold chain logistics facilities for the storage and preservation of agricultural products and promote the construction of small-scale storage and preservation cold chain facilities and low-temperature direct-selling distribution centers in fields.

In summary, our research logic starts from theoretical analysis and then generates theoretical hypotheses through field investigation. Through field investigation and empirical research, we verify the influence of large-scale agricultural land management on the modernization of agricultural product circulation. The research of this paper provides a new perspective for the study of rural land and agricultural product circulation and provides a reference for the following scholars from the field investigation method and the construction of index system of agricultural production circulation. In addition, our study also provides a new perspective for policymakers. The improvement of agricultural land scale is not only necessary for production modernization but also an important condition to promote the fragmented circulation to further adapt to the demand of the modern market. Under the policy background of promoting rural revitalization in China, promoting the appropriate development of large-scale agricultural land management will be a powerful policy focus.

6. Conclusions

The research of this paper follows the research logic of “from theory to practice, and then from practice to theory” and uses the research method of field investigation and empirical research. This paper focuses on the compound influence mechanism of large-scale agricultural land management on the circulation of agricultural products. Through the literature review and theoretical research, it is found that large-scale agricultural land management has two compound effects on production, which include the increase in agricultural labor productivity and the decrease in agricultural land productivity. On the one hand, large-scale agricultural land management has a positive effect on the productivity of agricultural labor by promoting mechanized management, improving the level of agricultural infrastructure, and reducing labor input. On the other hand, from the perspective of the strong natural dependence on agricultural production, the moral hazard of asymmetric information under the principal-agent theory, and the increase in productive capital input, large-scale agricultural land management may lead to the decline of agricultural land productivity. How will this compound influence mechanism affect the development of agricultural product circulation? Under the premise of such problems, we learn from the field investigation method of sociology and go to Handan City of Hebei Province in China to conduct field research on the production and circulation of agricultural products. The results show that large-scale agricultural management has a compound impact on agricultural production, and large-scale agricultural land production has a profound impact on the downstream circulation mode. Large-scale agricultural land management weakens the necessity of field brokers, reduces the transaction costs of wholesale buyers and sellers, and promotes the scale expansion and the perfection of the circulation function of traditional wholesale markets. Therefore, it promotes the transformation of the traditional agricultural product circulation channel form on the whole and becomes the logical forerunner to reduce the circulation transaction cost and improve the modernization level of agricultural product circulation.

After obtaining theoretical hypotheses through the existing literature research and field investigation, we use econometric empirical methods to test them based on China’s provincial panel data. We have constructed an index of agricultural product circulation efficiency based on “input-output” and an index system of agricultural product circulation modernization based on the entropy weight method so as to test the impact of large-scale agricultural land management more comprehensively on agricultural product circulation.

The statistical results show that there is a U-shaped relationship between large-scale agricultural land management and the circulation efficiency of agricultural products, which decreases first and then increases, and has a positive promoting effect on the modernization of agricultural product circulation. The development of the wholesale market is still very important for the modernization of agricultural product circulation in China. Proper large-scale agricultural land management means that there are more possibilities for the optimization of the quality of agricultural products, the standardized grading system, and the traceability of origin. Through the mechanism of promoting larger-scale wholesale markets, reducing circulation links, and improving circulation function, it promotes the modernization of agricultural product circulation.

For policymakers, this study provides clear insights and guidance for policymaking in agricultural production and circulation. The improvement of the agricultural land scale is an important condition for the modernization of circulation and agriculture. It has huge development potential and is one of the driving forces for rural development in China. Chinese policymakers should start with the guarantee of the market-oriented transfer of land management rights, improve the relevant policy supporting system, ensure the standardization of the land market, and protect the interests of farmers in the transfer process from infringement. For large-scale operators, the government can give appropriate infrastructure investment subsidies. In addition, it should be noted that the supporting infrastructure in rural areas is still insufficient, which is reflected in cold chain, highway, express delivery, and many other aspects. This requires the government to guide social capital and make a long-term financial investment.

At present, there are still some research limitations waiting for improvement. First, due to the integrity of China's public data, there has been a lack of data in recent years. Second, from the granularity of the research object, this paper starts from the macro perspective, which can grasp the problem direction as a whole, but there is a lack of research from the micro perspective. In the future, we can start with a typical circulation enterprise, adopt a more focused case study method, and study from the micro perspective of the enterprise subject. Finally, from the time span of this study, China's economy and society are in a rapid transformation period, and the rural area development is a long-term evolutionary process. This requires the authors to carry out long-term follow-up research, which is helpful in producing more valuable research results.

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