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Research on the Impact of Agricultural Trade on Agricultural Carbon Emissions in China

Xinyu Zhang

College of Economics, Anhui University of Finance and Economics, Bengbu 233000, Anhui, China

Abstract: Based on the panel data of 31 provinces in mainland China from 2001 to 2020, this paper empirically examines the impact of agricultural trade on agricultural carbon emissions and its mechanism. The results show that agricultural trade has a significant inhibitory effect on agricultural carbon emissions, and its effects are heterogeneous, and the effect is more obvious in the central and western regions and non-grain-producing areas than in the eastern regions and major grain-producing areas. From the perspective of mechanism, agricultural technology progress is an important channel for agricultural trade to inhibit agricultural carbon emissions, and agricultural trade can inhibit agricultural carbon emissions by promoting agricultural technology progress. Based on this, it is proposed to actively promote the liberalization of agricultural trade, strengthen the exchange of agricultural low-carbon development experience among provinces and trade between agricultural products, and strengthen the progress of agricultural technology to achieve agricultural carbon reduction.

Keywords: Agricultural trade, Agricultural carbon emissions, Agricultural technological progress.

1. Introduction

Extreme weather changes around the world have triggered a series of unprecedented events such as ecosystem destruction and frequent natural disasters, which is ultimately the global warming effect brought by greenhouse gas emissions such as carbon dioxide. In this context, governments all over the world are vigorously advocating low-carbon emission reduction actions, the IPCC (Intergovernmental Panel on Climate Change) issued "Climate Change 2022: Mitigation of Climate change" pointed out that the world's goal in 2030 is to reduce carbon emissions by 40%. At the same time, the Chinese government has also taken a series of measures to this end, and pointed out that it will reach the carbon peak before 2030 and strive to achieve carbon neutrality by 2060 (Wang Yiming, 2020). The proposal of China's "double carbon" goal is conducive to promoting the comprehensive green transformation of economy and society, and forming a new pattern of modernization construction with harmonious development of man and nature.

The realization of the "double carbon" goal requires the participation of various industries, and agriculture, as a basic industry of the national economy, also needs to practice the concept of low-carbon agriculture. Agricultural development is closely related to climate change. On the one hand, agricultural production will be affected by temperature, precipitation, natural disasters and other factors, which will bring risks and challenges to food security (Darwin R, 1999). On the other hand, agriculture is also one of the important sources of greenhouse gas emissions such as carbon dioxide and methane, and the carbon emissions generated by the agricultural sector account for about a quarter of the total emissions, and has become the second largest source of carbon emissions (Yang Chen et al., 2021). China is a large agricultural country, and the carbon dioxide emissions from the planting industry account for 16%-17% of the total carbon dioxide emissions in the country (Huang Jie et al., 2022). Therefore, it is of great significance to find a path to realize low-carbon agriculture and reduce agricultural carbon emissions to achieve China's "double carbon" goal. In existing studies, there are many factors affecting agricultural carbon emissions, and agricultural trade is also considered to be one of the important factors affecting agricultural environment such as carbon emissions. Grossman and Kruger (1992) proposed that trade can affect the environment through scale, technology and structure effects, and agricultural trade is one of the important factors affecting agricultural environment such as agricultural carbon emission. Under the background of the "two-carbon" strategy, exploring the impact of agricultural trade on agricultural carbon emissions has certain practical significance for promoting low-carbon development of agriculture, transforming the mode of agricultural development, and promoting high-quality development of agriculture.

2. Literature Review

Agricultural carbon emission refers to the emissions of greenhouse gases (mainly carbon dioxide) directly or indirectly caused by the use of fertilizers and pesticides, energy consumption and land ploughing and irrigation in the process of agricultural production (Li Bo et al., 2011). At present, scholars have done some research in the field of agricultural carbon emissions, mainly focusing on the following three aspects: First, the measurement of agricultural carbon emission. Foreign scholars have measured agricultural carbon emission earlier. Many other scholars have comprehensively measured China's agricultural carbon emissions from a more comprehensive perspective, basically covering the main sectors of agricultural production (namely planting and animal husbandry), and the specific carbon sources involve four aspects: input of agricultural materials, rice planting, livestock and poultry breeding and destruction of soil carbon pool (Min Jisheng et al., 2012; Tian Yun et al., 2020). Second, analysis of influencing factors of agricultural carbon emissions. Existing studies mainly used LMDI decomposition method for analysis (Li Hanbing et al., 2019), which showed that economic growth was the key driver for the increase of agricultural carbon emissions (Li Bo et al., 2011; Tian Chengshi et al., 2021), in addition, human capital, industrial structure, urbanization, agricultural technology progress and other factors will promote or inhibit agricultural carbon emissions. The third is the study of agricultural carbon productivity. Existing studies have analyzed agricultural carbon productivity from the aspects of spatial differentiation characteristics, farmer specialization, agricultural industry agglomeration and planting (Song Bo et al., 2016; Zhang Zhexi, 2019).

Some scholars first explored the relationship between carbon emission and economy and trade (Wang Haipeng, 2010), especially greenhouse gas caused pollution and hindered economic growth (Gao Ming et al., 2014). Agricultural product trade is one of the important factors affecting agricultural environment such as agricultural carbon emission. Studies have pointed out that agricultural product trade reduces the amount of polluting production factors such as fertilizer (Gao Ming et al., 2014; Zhang Xiangwen et al., 2021), agricultural green total factor productivity improvement has a positive promoting effect (Li Xiaolong et al., 2021). Many scholars focus on issues such as the carbon emission leakage implied by agricultural products themselves in the process of agricultural trade (HU J et al., 2021; DAI F et al., 2021), the differences in carbon emission intensity generated by agricultural trade between different countries (KASTNER T et al., 2021) and other research aspects have made great contributions, but few scholars have explored the specific impact of agricultural trade on carbon emissions generated in the process of agricultural production.

According to the existing literature, few scholars have deeply explored the specific impact of agricultural trade on the carbon emissions generated in the process of agricultural production, and there is still much room for deepening the research on the impact of agricultural trade on agricultural carbon emissions. In addition, agricultural technological progress is also an important factor affecting agricultural carbon emissions, and what role agricultural technological progress plays between agricultural trade and agricultural carbon emissions is also a question worth thinking about.

3. Theoretical Analysis and Research Assumptions

Grossman and Kruger put forward the trade environment effect in 1992. According to the trade environment effect, agricultural trade will have scale effect, structure effect and technology effect. From the perspective of scale effect, the expansion of agricultural exports will lead to the consumption of agricultural production resources and the excessive input of agricultural polluting factors, thus breaking the balance of agricultural ecological environment and promoting agricultural carbon emissions (BANDARA J S, 1999). The increase in the import trade of agricultural products not only helps to reduce the environmental pressure caused by carbon emissions caused by the excessive loss of agricultural production factors, but also helps to avoid falling into the dilemma of "pollution refuge" (Shen International, 2017). China's agricultural trade has been in deficit pattern for a long time and becomes more and more prominent with the passage of time. In terms of scale effect, agricultural trade deficit may help restrain agricultural carbon emissions; From the perspective of structural effect, the green barriers imposed by developed countries on the export of Chinese agricultural products will make agricultural production pay more attention to the improvement of quality, the reduction and efficiency of polluting factor input and the scientific ratio, adjust the input structure of agricultural factors, and then curb agricultural carbon emissions. From the perspective of import, the import of agricultural products will introduce new green production technologies. Stimulating domestic producers to carry out technological imitation (SCHR A, 2004) will also have the effect of improving agricultural environment. In terms of technological effect, trade can play a certain role in promoting the flow of resources, information sharing and technology dissemination, and promote the sharing of advanced technologies through technology spillover channels. This paper proposes hypothesis 1: Agricultural trade can inhibit agricultural carbon emissions.

The factor endowment theory shows that in the case of free trade, due to the different agricultural factor endowments among regions and provinces, there will be certain differences in the input focus in agricultural production links, and the agricultural product trade status will also be different in different regions. Therefore, the impact of agricultural product trade on agricultural carbon emissions of different provinces will be different. Since the establishment of major grain-producing areas, agricultural policies and financial funds have been tilted toward major grain-producing areas (Wei Houkai and Wang Yeqiang, 2012). Major grain-producing areas will make agricultural production activities more concentrated and frequent than non-major grain-producing areas, which will make a great contribution to China's grain production increase and at the same time bring about an increase in agricultural carbon emissions. Therefore, there are differences in the functional areas of food production in different regions, and agricultural trade also has heterogeneity in agricultural carbon emissions.

This paper proposes hypothesis 2: The impact of agricultural trade on agricultural carbon emissions has regional heterogeneity.

4. Model Setting and Variable Selection

4.1. Econometric Model Setting

In order to verify hypothesis 1 and explore the correlation between agricultural trade and agricultural carbon emissions, this paper constructs the following measurement model:

$$\ln carbon_{it} = \alpha_0 + \alpha_1 trade_{it} + \alpha_2 \sum X_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (1)$$

Where, i and t are provinces and years respectively; lncarbon are logarithms of explained variables, representing agricultural carbon emissions; trade represents the level of agricultural trade; Xit represents other control variables affecting agricultural carbon emissions; α_1 and α_2 are the estimated coefficient of the corresponding variable; α_0 represents the intercept term; μ_i and λ_t are the province and year effect; ε_{it} is a random error term.

In order to verify hypothesis 2 in this paper and investigate whether agricultural technological progress plays a mediating effect in the impact of agricultural trade on agricultural carbon emissions, this paper draws on the practice of Wen Zhonglin et al. (2004), and uses the intermediary effect model to test its mechanism through step by step regression method. Combined with equation (1), the model is set as follows:

$$tfp_{it} = \beta_0 + \beta_1 trade + \beta_2 \sum X_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (2)$$

$$\ln carbon_{it} = \gamma_0 + \gamma_1 trade_{it} + \gamma_2 tfp_{it} + \gamma_3 \sum X_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (3)$$

Where, β_0 and γ_0 are constant terms, tfp_{it} represents the intermediate variable agricultural technological progress.

4.2. Variable Selection

4.2.1. Explained variable

Based on the availability of data, this paper draws on the studies of Wu Xianrong et al. (2014) and Tian Yun et al. (2021), and mainly investigates the following aspects.In addition, the formula for calculating total agricultural carbon emissions is:

$$C = \sum C_i = \sum e_i \backslash \varepsilon_i \quad (4)$$

Where, C represents the total agricultural carbon emission, i represents various carbon sources, e represents the amount of each carbon source, and εrepresents the emission coefficient of each carbon source. The specific carbon source and carbon emission coefficient are shown in Table 1 below.

Table 1. Sources and emission coefficients of agricultural carbon emissions

Carbon source	Emission coefficient	Data reference source
Chemical fertilizer(kgCE/kg)	0.8956	T.o. west[33] ORNL
Pesticide(kgCE/kg)	4.9341	ORNL
Agricultural film(kgCE/kg)	5.1800	IPCC
Diesel oil(kgCE/kg)	0.5927	Institute of Agricultural Resources and Ecological Environment, Nanjing Agricultural University
Rice(gCE/ (m^2•day)	3.1360	Document[17]
Turn over(kgCE/km^2)	312.6000	College of Biology and Technology, China Agricultural University
Irrigation(kgCE/hm^2)	20.4760	Dubey[34]
Pig(kgCE/ (number•year))	34/0910	IPCC
Cow(kgCE/ (number•year))	415.9100	IPCC
Sheep(kgCE/ (number•year))	35.1819	IPCC

4.2.2. Core explanatory variable

The level of agricultural trade is the dark explanatory variable of this paper. Refer to the research results of scholars Ma Yiqun (2018) and Fang Hui et al. (2018) on agricultural trade, and measure the proportion of agricultural trade in the added value of agriculture, forestry, animal husbandry and fishery. The trade level of agricultural products can be divided into export trade level and import trade level. Export trade level is measured by the proportion of export trade volume of agricultural products in the added value of agriculture, forestry, animal husbandry and fishery of each province, and import trade level is measured by the proportion of import trade volume of agricultural products in the added value of agriculture, forestry, animal husbandry and fishery. The agricultural trade volume of each province in this paper comes from the statistical table of agricultural trade volume issued by the Ministry of Commerce.

4.2.3. Control variable

Based on the existing literature and the actual situation of agricultural development in China, this paper selected the level of financial support for agriculture, the level of urbanization, the scale of rural land management, the level of rural human capital, the level of rural economic development, and the degree of agricultural disaster as the control variables. The level of fiscal support for agriculture (gov) is expressed by the ratio of local fiscal expenditure on agriculture, forestry and water affairs to the general budget expenditure of local finance. The level of urbanization (urban) is expressed by the proportion of urban population in the total resident population of each region. The scale of rural land management is measured by the ratio of the total sown area of crops to the number of employees in the primary industry. The rural human capital level (edu) refers to the practice of Bai Xuemei et al. (2004) and uses the average education level of the rural population to express it. According to the composition of the educational level of the rural family labor force, it can be divided into 6 categories: illiterate or little literate, primary school, junior middle school, senior high school, secondary school, junior college and above. The corresponding years of schooling are 0, 6, 9, 12 and 15 years respectively. The average years of schooling of rural family population in different provinces represent the level of rural human capital. The rural economic development level (gdp) is expressed as the per capita agricultural output value of each province and treated as logarithm. The degree of rural disaster (dis) is expressed by the ratio of the area of agricultural disaster caused by natural weather and uncertainty factors to the area of agricultural arable land in each province.

4.3. Data sources and descriptive statistics

In this paper, 31 provinces in China are selected for research. The relevant index data for estimating agricultural carbon emissions were derived from provincial Statistical Yearbook, China Statistical Yearbook and China Rural Statistical Yearbook from 2001 to 2020. The data of the trade volume of agricultural products comes from the Statistical Table of the Import and Export Volume of Agricultural Products released by the official website of the Ministry of Commerce. The control variables of financial support for agriculture, urbanization, rural land management scale, rural human capital level, rural economic development level and agricultural disaster degree were derived from the statistical yearbook of each province, China Statistical Yearbook and China Rural Statistical Yearbook. The missing data is interpolated by interpolation method. The descriptive statistical analysis results of the main variables are shown in Table 2 below.

Table 2. Descriptive statistical table of each variable

variant	observed value	average value	standard deviation	minimum value	maximum value
lncarbon	620	6.397	1.034	2.800	7.809
trade	620	0.621	1.989	0.000	17.844
exp	620	0.129	0.282	0.000	4.658
imp	620	0.491	1.797	0.000	16.762
gov	620	0.100	0.038	0.010	0.204
urban	620	0.502	0.167	0.059	0.896
scale	620	0.296	0.194	0.004	1.229
edu	620	7.437	0.849	3.741	9.838
gdp	620	0.842	0.749	0.009	4.351
dis	620	0.220	0.849	0.000	0.881
tfp	620	1.163	0.426	0.615	4.078

5. Empirical Estimation and Analysis of Results

5.1. Baseline regression analysis

In order to explore the relationship between agricultural trade and agricultural carbon emissions, the fixed-effect model should be selected for testing according to the results of F-test and Hausman test. And the agricultural products trade level is divided into export trade level and import trade level two trade models to test again. The model test results are shown in model (1) in Table 3. Model (2) and model (3) respectively show the test of export and import trade. According to the results, agricultural trade can effectively inhibit agricultural carbon emissions, which is significantly negative at the level of 1%. Compared with exports, the development of agricultural import trade can effectively promote carbon emission reduction. The impact of export trade on agricultural carbon emissions did not pass the significance test, possibly because the export of agricultural products mainly consumes domestic production resources and carries out large-scale production, which is more likely to generate more carbon emissions. However, at present, most of China's agricultural exports are fruits and vegetables, aquatic products and other traditional advantages and labor-intensive primary processing products. The green trade barriers faced by agricultural exports will also make domestic agricultural producers change their original business models and transform agricultural development mode to green and low-carbon mode. Therefore, the impact of agricultural export trade on agricultural carbon emissions is uncertain. The import trade of agricultural products can directly reduce the loss of domestic agricultural production factors, reduce the input of production links, and directly reduce agricultural carbon emissions. In addition, the advanced agricultural production technology introduced by import trade can also restrain agricultural carbon emissions.

Table 3. Baseline regression results

explanatory variable	Model (1)	Model (2)	Model (3)
trade	-0.0415*** (0.004)		
exp		-0.0284 (0.026)	
imp			-0.0446*** (0.004)
urban	-0.173* (0.067)	-0.184* (0.072)	-0.182** (0.067)
gov	1.229*** (0.242)	1.268*** (0.257)	1.231*** (0.241)
scale	0.193*** (0.042)	0.272*** (0.044)	0.184*** (0.042)
gdp	-0.0348* (0.013)	-0.0614*** (0.014)	-0.0337* (0.013)
edu	-0.0303 (0.020)	-0.0824*** (0.021)	-0.0272 (0.020)
dis	-0.117** (0.041)	-0.132** (0.043)	-0.118** (0.041)
constant term	6.610*** (0.147)	6.979*** (0.150)	6.589*** (0.147)
Individual effect	yes	yes	yes
Time effect	yes	yes	yes
N	620	620	620

Note: "***, **, *" represent 1%, 5%, and 10% significance levels, respectively. The parentheses represent the standard error,

5.2. Heterogeneity analysis

5.2.1. Based on regional heterogeneity analysis

Due to the obvious regional characteristics of China's economic development level, there are obvious differences among provinces in resource endowment, trade openness and industrial emphasis, etc. Such regional differences may lead to different impacts of agricultural trade on agricultural carbon emissions among regions. Therefore, this paper divides the total sample into three regions: east, middle and west. To explore whether there is regional heterogeneity in the impact of agricultural trade on agricultural carbon emissions. Table 5 reports the estimated results of the eastern, central and western regions. The results show that the coefficient of agricultural trade on agricultural carbon emissions in the eastern, central and western regions is negative, but there are some differences in the effect of agricultural trade on agricultural carbon emissions. The inhibitory effect of agricultural trade on agricultural carbon emissions passed the significance test of 1% in the eastern region, which was more significant than that in the central and western regions. In terms of the coefficient size, agricultural trade in the central and western regions has a more obvious inhibitory effect on agricultural carbon emissions than that in the eastern region. The reason may be that the eastern region is the leading region of agricultural production and agricultural trade in China, and the environmental problems such as agricultural carbon emissions have been noticed earlier and the measures to reduce agricultural emissions have been taken in time. However, the level of agricultural trade and agricultural development in the central and western regions is relatively backward, and the problems of agricultural ecological environment are more serious. Therefore, compared with the eastern region, the opening of agricultural trade is more conducive to easing the pressure on agricultural carbon emissions in the central and western regions.

Table 4. Geographical heterogeneity

explanatory variable	east model (7)	middle model (8)	west model (9)
trade	-0.0276*** (0.004)	-1.010** (0.378)	-0.712* (0.333)
urban	-0.170 (0.102)	0.258 (0.142)	0.381** (0.135)
gov	-0.361 (0.548)	1.350*** (0.396)	0.282 (0.344)
scale	0.193** (0.073)	0.253 (0.161)	0.165 (0.117)
gdp	-0.0455 (-0.054)	0.00801 (0.029)	0.0396* (0.017)
edu	-0.104** (0.032)	0.0489 (0.043)	0.0934** (0.028)
dis	0.0226 (0.061)	-0.261*** (0.068)	-0.0928 (0.065)
constant term	6.897*** (0.261)	6.518*** (0.338)	5.468*** (0.195)
Individual effect	yes	yes	yes
Time effect	yes	yes	yes
N	220	160	240

Note: Same as Table 3.

5.2.2. Heterogeneity analysis based on grain functional regions

In this paper, two types of subsamples of main grain-producing areas and non-main grain-producing areas are estimated. According to the Outline of the National Medium - and Long-Term Program for Food Security (2008-2020), the main grain-producing regions include Henan, Inner Mongolia, Hunan, Hebei, Sichuan, Jilin, Liaoning, Jiangxi, Shandong, Jiangsu, Anhui, Hubei and Heilongjiang. The grain production and marketing balance zone includes 11 provinces and municipalities, including Shaanxi, Yunnan, Guangxi, Xinjiang, Chongqing, Gansu, Shanxi, Qinghai, Guizhou, Ningxia and Tibet. Major grain sales areas include Zhejiang, Beijing, Fujian, Shanghai, Guangdong, Tianjin and Hainan. The specific estimated results are shown in Table 6. It can be found that the inhibitory effect of agricultural trade on agricultural carbon emissions is more obvious in non-grain-producing areas than in grain-producing areas. The reason may be that many major grain producing areas are located in the eastern region, where agricultural development and agricultural product trade are in the lead, and the concept of standardization and green development has been incorporated into the agricultural production process. Therefore, the agricultural ecological environment has been in a good development trend for a long time, and is less affected by agricultural product trade. However, many non-grain producing areas are distributed in the central and western regions, and the level of agricultural systematic development is low. Therefore, agricultural trade has a more obvious inhibitory effect on agricultural carbon emissions.

Table 5. Functional heterogeneity of food production

explanatory variable	Major grain producing areas	Non-major grain producing areas
	Model (10)	Model (11)
trade	-0.351* (0.156)	-0.0376*** (0.004)
urban	-0.951*** (0.205)	-0.0477 (0.070)
gov	0.339 (0.344)	1.472*** (0.334)
scale	0.571*** (0.121)	0.151*** (0.044)
gdp	-0.163*** (0.038)	-0.0372* (0.014)
edu	0.139*** (0.035)	-0.0969*** (0.023)
dis	-0.281*** (0.063)	-0.0533 (0.050)
constant term	6.630*** (0.276)	6.461*** (0.165)
Individual effect	yes	yes
Time effect	yes	yes
N	260	360

Note: Same as Table 3.

5.3. Robustness test

In this paper, three methods of outlier processing, adding control variables and replacing explanatory variables are selected to carry out the robustness test. The test results of each method are shown in Table 7, which are respectively models (14), (15) and (16).

Table 7. Robustness test

explanatory variable	Model(14)	Model(15)	Model(16)
trade	-0.0312*** (0.006)	-0.0220*** (0.002)	-0.0449*** (0.004)
urban	-0.262*** (0.064)	-0.0137 (0.070)	-0.103 (0.069)
gov	1.137*** (0.223)	1.145*** (0.243)	1.313*** (0.240)
scale	0.192*** (0.040)	0.122** (0.045)	0.202*** (0.042)
eco	-0.0409** (0.013)	-0.0336* (0.013)	-0.0522*** (0.014)
edu	-0.0126 (0.019)	-0.0312 (0.020)	-0.0128 (0.021)
dis	-0.134*** (0.038)	-0.133** (0.041)	-0.111** (0.041)
ind			1.069*** (0.231)
str			0.100 (0.100)
constant term	6.538*** (0.139)	6.606*** (0.148)	6.257*** (0.164)
N	620	620	620

Note: Same as Table 3.

6. Conclusions and Policy Recommendations

6.1. Basic Conclusion

First of all, this paper includes agricultural carbon emissions into the analysis framework of agricultural trade environmental effects, and constructs the theoretical framework of agricultural trade and agricultural carbon emissions by elaborating the logical relationship between the two periods. Secondly, agricultural carbon emissions in China and various regions were calculated. Based on the panel data of 31 provinces in mainland China from 2001 to 2020, fixed effect models and intermediary effect models were established to empirically test the impact mechanism of agricultural trade on agricultural carbon emissions, and the following conclusions were drawn. First, trade in agricultural products can significantly curb agricultural carbon emissions and play a good role in promoting low-carbon and green development of agriculture. Compared with export trade of agricultural products, import trade of agricultural products can promote agricultural carbon emission reduction more. Secondly, the inhibitory effect of agricultural trade on agricultural carbon emissions is heterogeneous, which is more obvious in the central and western regions and non-grain-producing areas. Third, agricultural technology progress is an intermediate variable in the process of agricultural product trade's effect on agricultural carbon emissions. Agricultural product trade can inhibit agricultural carbon emissions by improving agricultural technology progress.

6.2. Policy Recommendations

First, promote the development of agricultural trade in various regions and promote the low-carbon and green development of agriculture. In terms of export trade, domestic agricultural producers should strengthen the quality control of export agricultural products, establish a good international image and reputation of our agricultural products, strengthen the international marketing of agricultural products, so that the quality, reputation and marketing of our agricultural products and other weak factors into advantages; Change the resource-intensive agricultural development model in the past, adjust the import and export trade structure of agricultural products, and reduce the production and export of agricultural products that are environmentally destructive, agricultural carbon emissions and natural resource consumption. In terms of import trade, it is necessary to implement a proactive agricultural import strategy, optimize the import structure of agricultural products, import foreign ecological resources, in order to reduce the input of agricultural resources, save natural resources, improve the efficiency of agricultural input and output, reduce agricultural carbon emissions, protect the agricultural ecological environment, and adhere to the ecological agriculture and sustainable agricultural development model.

Second, China has a vast territory, and there are differences in natural environment, economic development level and agricultural path dependence in different regions. In view of the different pressure and potential of agricultural carbon reduction in different regions, the establishment of inter-regional carbon emission trading mechanism can be considered, and the balanced development of agricultural carbon emissions in different regions can be achieved through the allocation of carbon emission quotas in different regions.

Third, the advancement of agricultural technology is an important driving factor leading the future development of agriculture, and the promotion and popularization of new technologies is an important guarantee for the development of low-carbon agriculture. In the process of opening up agricultural trade, it is necessary to learn from the successful experience of developed countries, learn from each other with other developing countries, jointly deal with the problem of agricultural carbon emissions, improve agricultural carbon emission policies and mechanisms in the process of trade, construct agricultural production technology research and development system, and enrich agricultural production management experience.

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