

The Stabilizing Effect of Cross-Border E-Commerce on Agricultural Import and Export Price Volatility in China

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Abstract: *As an innovative trade model, cross-border e-commerce (CBEC) significantly influences China's agricultural import and export trade and exerts a discernible effect on agricultural price volatility. Using empirical data from 2018 to 2022, this study investigates the impact of CBEC development on price fluctuations in China's agricultural trade. The results indicate that CBEC development exerts a significant stabilizing effect on agricultural price volatility. However, this effect varies by trade direction: CBEC imports more strongly stabilize import prices, while CBEC exports more effectively stabilize export prices. Additionally, the stabilizing role exhibits marked regional heterogeneity, being stronger in eastern China and weaker in the western region. Based on these findings, the paper proposes targeted policy recommendations for stabilizing China's agricultural trade prices through accelerated CBEC development.*

Keywords: cross-border e-commerce; agricultural trade; price fluctuation; stabilizing effect; regional heterogeneity; empirical analysis.

1. INTRODUCTION

The report of the 20th National Congress of the Communist Party of China put forward the strategic goal of building a trading power. The Central Economic Work Conference in 2024 emphasized that China should promote high-level opening up and further enhance its trade competitiveness. As an important innovation in China's trade model for expanding opening up, cross-border e-commerce plays a significant role. In recent years, the development of China's cross-border e-commerce has seen both quantitative and qualitative growth and achieved rapid development. Data from the General Administration of Customs shows that the transaction scale of China's cross-border e-commerce has increased from 1.7 trillion yuan in 2020 to 2.1 trillion yuan by the end of 2022. The latest statistical data in 2023 shows that in the first nine months, the import and export scale of China's cross-border e-commerce reached 1.7 trillion yuan. With its fast development speed, great potential, and strong radiation effect, cross-border e-commerce has become an important means for China to build a trading power, accelerating trade exchanges between China and other countries in the world, promoting the trade and circulation of various commodities including agricultural products, and providing convenience for China's agricultural product import and export. China is a major agricultural country and also a big country in agricultural product import and export. Agricultural products are closely related to the lives of Chinese residents. The price fluctuations of agricultural products will directly affect residents' demand for agricultural products and also relate to residents' needs for a better life. Therefore, studying the relationship between the development of cross-border e-commerce and the price fluctuations of agricultural products is of great significance for relevant departments to formulate reasonable policies and measures, meet residents' needs for a better life, and contribute to the construction of common prosperity.

2. LITERATURE REVIEW

There has been relatively little research on the relationship between the development of cross-border e-commerce and the price fluctuations of agricultural products. Current research mainly focuses on the impact of the development of cross-border e-commerce on China's agricultural product import and export trade. Liu Ana and Liu Fangjing (2020) explored whether there is a causal relationship between the development of cross-border e-commerce and China's agricultural product exports, as well as the impact of the development of cross-border e-commerce on agricultural product exports, and examined the role of cross-border e-commerce comprehensive pilot zones in the impact of cross-border e-commerce on China's agricultural product exports. Gong Ting (2022) empirically analyzed the impact of the development of cross-border e-commerce on China's agricultural product import and export trade based on data from 2001 to 2020 in China, and also examined the mediating effect of cross-border e-commerce comprehensive pilot zones. Han Li (2022) put forward policy suggestions to promote

China's agricultural product import and export trade through the development of cross-border e-commerce on the basis of analyzing the current situation of China's agricultural product import and export trade under the background of the "Belt and Road Initiative". Zhao Shuang and Zhang Li (2022) empirically studied the impact of cross-border e-commerce on the international competitiveness of China's agricultural products on the basis of measuring the international competitiveness of China's agricultural products, and put forward policy suggestions to promote the improvement of the international competitiveness of China's agricultural products through the construction of cross-border e-commerce platforms and infrastructure. Li Yuan (2022) analyzed the facilitating role of the development of cross-border e-commerce in China's agricultural product export trade, focused on analyzing the practical problems and reasons of the dual-channel supply chain of China's cross-border e-commerce exports of agricultural products, and put forward an implementation plan to promote the operation of the dual-channel supply chain of cross-border e-commerce exports of agricultural products. Chen Dehui and Jiang Yuhua (2023) analyzed the problems faced by cross-border e-commerce exports of agricultural products, such as asymmetric transaction information, inconsistent quality standards, and imperfect logistics systems, and put forward suggestions to promote the high-quality development of cross-border e-commerce of agricultural products. Tang Zhong and Li Jing (2023) examined the heterogeneous impacts of economies of scale, geographical distance, and language differences on the exports of different categories of agricultural products and the exports of agricultural products from different countries in cross-border e-commerce on the basis of analyzing the role of cross-border e-commerce in promoting China's agricultural product exports. Gao Ya (2023) empirically analyzed the impact of the development of e-commerce in China on the price fluctuations of agricultural products from the perspective of price fluctuations of agricultural products.

Reviewing the above research, it can be found that the vast majority of current research focuses on the impact of the development of cross-border e-commerce on China's agricultural product import and export trade. Very few studies have explored the impact of the development of rural e-commerce on agricultural product price fluctuations, and there is almost no research on the impact of the development of cross-border e-commerce on the price fluctuations of China's agricultural product imports and exports from the perspective of the dual circulation. At present, the international big cycle has become an important part of China's new development pattern of dual circulation. Therefore, the research on the impact of cross-border e-commerce on the price fluctuations of China's agricultural products is particularly important. Accordingly, the marginal contribution of this paper is to focus on the perspective of dual circulation, examine the impact of the development of cross-border e-commerce on the price fluctuations of China's agricultural product imports and exports, and conduct a comparative analysis of the heterogeneous relationship between the development of cross-border e-commerce and the price fluctuations of agricultural product imports and exports.

3. RESEARCH DESIGN

3.1 Variable Selection

1) Explained variables: The fluctuations in agricultural product import prices (Price-IMi) and export prices (Price-EXi), which are measured by the change rate of the agricultural product import (export) price index.

2) Explanatory variables: Cross-border e-commerce imports (Business-IMi) and exports (Business-EXi), which are measured by the logarithm of the transaction scale. In the robustness test, the cross-border e-commerce import index and export index released by the Alibaba Research Institute will be used for measurement.

3) Control variables: The level of opening up to the outside world ($Open_{it}$), industrial structure (Str_{it}), regional residents' income level ($\ln Income_{it}$), urbanization level ($Town_{it}$), residents' education level (Edu_{it}), and the number of cross-border e-commerce comprehensive pilot zones (Num_{it}) are selected as control variables. The level of opening up to the outside world is measured by the proportion of import and export trade in GDP; the industrial structure is measured by the proportion of the tertiary industry; the regional residents' income level is measured by the logarithm of per capita disposable income; the urbanization level is measured by the proportion of the urban population at the end of the year sampled by the National Bureau of Statistics; the education level is measured by the proportion of the population with a junior college degree or above in the region; the number of cross-border e-commerce comprehensive pilot zones is calculated by statistical aggregation according to the documents issued by the State Council.

3.2 Data Sources and Explanations

The above data are all from the database of the General Administration of Customs, local statistical yearbooks of each province, the Wind database, and are sorted out according to the research reports published by the Alibaba Research Institute and the documents of cross-border e-commerce comprehensive pilot zones approved by the State Council.

3.3 Model Construction

Based on the above variable settings, an impact effect model of cross-border e-commerce on the price fluctuations of China's agricultural product imports and exports is constructed as shown in equations (1) and (2):

$$\text{Price} - \text{IM}_{it} = c_1 + \alpha_1 \text{Business} - \text{IM}_{it} + \beta_1 \text{Business} - \text{EX}_{it} + \gamma_1 X_{it} + \mu_{it} \quad (1)$$

$$\text{Price} - \text{EX}_{it} = c_2 + \alpha_2 \text{Business} - \text{IM}_{it} + \beta_2 \text{Business} - \text{EX}_{it} + \gamma_2 X_{it} + \mu_{it} \quad (2)$$

Among them, $\text{Price} - \text{IM}_{it}$ represents the volatility rate of China's agricultural product import prices, $\text{Price} - \text{EX}_{it}$ represents the volatility rate of China's agricultural product export prices, $\text{Business} - \text{IM}_{it}$ represents the cross-border e-commerce import variable, $\text{Business} - \text{EX}_{it}$ represents the cross-border e-commerce export variable, X_{it} is the set of control variables, and μ_{it} is the error correction term.

4. EMPIRICAL ANALYSIS

In this empirical study, the relevant data from 2018 to 2022 are used, and the sample provinces are the remaining 30 provinces after excluding Hong Kong, Macao, Taiwan regions and Tibet Autonomous Region.

4.1 Benchmark Model Estimation and Analysis

Before the empirical study, a panel unit root test was conducted on each variable, and the unit root test statistics of each variable were significant at the 1% significance level. Next, following the common practice in current research, when there are many individuals and a short time span in the panel data model, it is suitable to use the fixed effects method for estimation. At the same time, this paper also conducted a Hausman test on whether to use fixed effects or random effects in the model, and also found that it is more reasonable to use the fixed effects method for estimation. Based on this, this paper used the fixed effects method to conduct benchmark model estimation on models (1) and (2), and the estimation results are shown in Table 1.

As can be seen from Table 1, the estimated coefficients of the impact of cross-border e-commerce imports and cross-border e-commerce exports on the price fluctuations of China's agricultural product imports and agricultural product exports are both negative and statistically significant. This indicates that the development of cross-border e-commerce has a stabilizing effect on the price fluctuations of China's agricultural product imports and exports, playing a role in stabilizing the import and export prices of China's agricultural products. This is basically in line with the objective reality. The reasons are as follows: First, the development of cross-border e-commerce reduces the intermediate links in agricultural product transactions, directly selling agricultural products from the place of production to foreign markets, or directly selling from foreign production places to the domestic market, reducing the intermediate links in traditional trade and lowering import and export costs and price fluctuations; Second, the development of cross-border e-commerce expands the market scale and realizes economies of scale to a certain extent. Cross-border e-commerce sells agricultural products to the global market through the Internet platform, expanding the sales channels and market scale of agricultural products and increasing the demand for agricultural products, thus effectively stabilizing the prices of agricultural products; Third, the development of cross-border e-commerce helps to improve market transparency. Cross-border e-commerce can provide rich information and data for both supply and demand sides through the platform, enabling buyers and sellers to better understand the market supply and demand situation and price changes, and reducing price fluctuations caused by information asymmetry; Fourth, cross-border e-commerce, with its convenient payment and logistics services, helps to reduce the trade barriers of agricultural product imports and exports, accelerate the speed of agricultural product imports and exports, and reduce price fluctuations. However, judging from the contribution of cross-border e-commerce imports and exports to the stabilizing effect on the price fluctuations of agricultural product imports and exports, cross-border e-commerce imports have a stronger stabilizing effect on the price fluctuations of China's agricultural product imports, while cross-border e-commerce exports have a stronger stabilizing effect on the price fluctuations of China's agricultural product exports. This is also relatively easy to understand. The larger the scale of cross-border e-commerce imports and the wider the market channels, the smaller the volatility of China's agricultural product import prices. And cross-border e-commerce exports have more impact on the price fluctuations of

agricultural product exports, thus making the stabilizing effect of the scale of cross-border e-commerce exports on the price fluctuations of China's agricultural product exports greater. Among the control variables, the greater the level of opening up and the more the number of cross-border e-commerce comprehensive pilot zones, the more conducive it is to stabilizing the price fluctuations of China's agricultural product imports and exports. However, the upgrading of the industrial structure will instead exacerbate the price fluctuations of China's agricultural product imports and exports because the upgrading of the industrial structure will lead to a smaller proportion of the primary industry represented by agriculture, a reduction in domestic agricultural product supply, and a greater dependence on agricultural product imports and exports to a certain extent, such as reducing agricultural product exports and expanding agricultural product imports, thus causing greater price fluctuations in agricultural products. The increase in residents' income levels will drive the fluctuations in the prices of imported agricultural products. When residents' income levels increase, the demand for higher-quality agricultural products will increase, leading to an increase in the demand for imported agricultural products, making high-quality agricultural products in short supply and driving the fluctuations in import prices to become more severe. The impact of the education level on the price fluctuations of China's agricultural product imports and exports has not been manifested during the research sample period.

Table 1: Estimation Results of the Baseline Model

Variable	Model (1) Fluctuation of Agricultural Product Import Price		Model (2) Fluctuation of Agricultural Product Export Price	
Business –IM _{it}	-0.0556*** (-3.28)	-0.0372*** (-1.98)	-0.0372*** (-2.65)	-0.0174*** (-4.32)
Business –EX _{it}	-0.0417*** (-3.96)	-0.0163*** (-2.27)	-0.0647*** (-3.09)	-0.0448*** (-2.28)
Open _{it}	-	-0.0473*** (-2.27)	-	-0.0228*** (-3.28)
Stri	-	0.0182*** (2.28)	-	0.0112*** (3.27)
LnIncome _{it}	-	0.0536*** (3.38)	-	0.0204 (1.03)
Town _{it}	-	-0.0273*** (-2.28)	-	0.0118*** (4.85)
Edu _{it}	-	0.012 (1.18)	-	0.0228 (0.84)
Numi	-	-0.0448*** (-2.28)	-	-0.0382*** (-5.84)
Regional effect	Y	Y	Y	Y
Time effect	Y	Y	Y	Y
Constant term	1.0284*** (3.28)	2.1826*** (4.43)	0.9837*** (3.38)	1.0738*** (4.48)

Note: *** indicates that the estimated coefficient is significant at least at the 10% level, and the same applies hereinafter.

Table 2: Results of Robustness Tests

Variable	Model (1)			Model (2)		
	Replace explanatory variables	Exclude the four direct-administered municipalities	System Generalized Method of Moments	Replace explanatory variables	Exclude the four direct-administered municipalities	System Generalized Method of Moments
Business-IMi	-0.0483*** (-4.32)	-0.0384*** (-4.34)	-0.0298*** (-1.98)	-0.0219*** (-5.23)	-0.0174*** (-3.04)	-0.0206*** (-2.84)
Business- EX _{it}	-0.0227*** (-2.95)	-0.0196*** (-2.74)	-0.0204*** (-3.67)	-0.0447*** (-3.06)	-0.0328*** (-4.43)	-0.0558*** (-3.64)
Control variables	Y	Y	Y	Y	Y	Y
Regional effects	Y	Y	Y	Y	Y	Y
Time effects	Y	Y	Y	Y	Y	Y
Constant term	1.0283*** (4.86)	1.3482*** (5.45)	1.6273*** (3.96)	2.0973*** (2.28)	1.1627*** (4.47)	1.0625*** (2.64)

Table 3: Estimation Results of Regional Heterogeneity

Variable	Model (1)			Model (2)		
	Eastern Region	Central Region	Western Region	Eastern Region	Central Region	Western Region
Business –IM _{it}	-0.0583*** (-3.29)	-0.0427*** (-2.55)	-0.0168*** (-2.21)	-0.0326*** (-3.18)	-0.0213*** (-2.45)	-0.0078*** (-1.91)
Business –EX _{it}	-0.0441 *** (-3.05)	-0.0317*** (-2.02)	-0.0094*** (-4.47)	-0.0552*** (-4.16)	-0.0392*** (-3.12)	-0.0221*** (-1.99)
Control Variables	Y	Y	Y	Y	Y	Y
Regional Effects	Y	Y	Y	Y	Y	Y
Time Effects	Y	Y	Y	Y	Y	Y
Constant Term	0.9736*** (3.12)	0.8722*** (4.42)	0.6728*** (2.56)	1.1721*** (4.93)	2.0821*** (3.27)	1.7628*** (4.18)

4.2 Robustness Tests

Based on the above estimation of the benchmark model, this paper first replaces the explanatory variables and uses the cross-border e-commerce import index and cross-border e-commerce export index provided in the research report of Alibaba Research Institute to measure the development level of cross-border e-commerce imports and exports. Secondly, four municipalities directly under the Central Government in the 30 sample provinces and regions in the benchmark model are removed, and robustness tests are conducted on the remaining 26 sample provinces and regions. Finally, considering the endogeneity problem, the system generalized method of moments is used for robustness tests. The test results obtained through the three robustness tests are shown in Table 2.

Three methods of robustness tests on models (1) and (2) find that the impact of cross-border e-commerce on the import and export prices of agricultural products in China still shows a negative inhibitory effect, and the conclusion that the stabilizing effect of cross-border e-commerce imports on the import prices of agricultural products in China is stronger and the stabilizing effect of cross-border e-commerce exports on the fluctuations of agricultural product export prices in China is stronger still holds. It has passed various robustness tests, indicating that the analysis conclusions of the benchmark model adopted above are highly credible.

4.3 Regional Heterogeneity Analysis

To further explore whether there is regional heterogeneity in the impact of cross-border e-commerce development on the price fluctuations of China's agricultural product imports and exports, following the practices of traditional literature, the sample was divided into three regions: the eastern, central, and western regions for regional heterogeneity tests, and the estimation results are shown in Table 3.

As can be seen from Table 3, the impact of cross-border e-commerce development on the price fluctuations of agricultural product imports and exports in different regions of China exists, and it all shows a negative inhibitory effect. That is, the development of cross-border e-commerce is conducive to stabilizing the price fluctuations of agricultural product imports and exports in different regions of China. Moreover, cross-border e-commerce imports also have a greater stabilizing effect on the price fluctuations of agricultural product imports, while cross-border e-commerce exports have a greater stabilizing effect on the price fluctuations of China's agricultural product exports, which is consistent with the conclusions obtained from the previous benchmark model and robustness test estimations. However, it is worth noting that there are significant regional heterogeneities in the stabilizing effect of cross-border e-commerce development on the price fluctuations of agricultural product imports and exports in different regions of China. Comparatively speaking, the stabilizing effect of cross-border e-commerce development on the price fluctuations of agricultural product imports and exports in China shows a trend of gradually decreasing from east to west. The stabilizing effect on the price fluctuations of agricultural product imports and exports in the eastern region is stronger, while the stabilizing effect on the price fluctuations of agricultural product imports and exports in the western region is relatively small. This may be because the development level of cross-border e-commerce in the eastern region is relatively high, the corresponding cross-border e-commerce infrastructure is more complete, and the number of cross-border e-commerce comprehensive pilot zones and the level of opening up in the eastern region are significantly higher, which helps to provide a broader market and channels for the imports and exports of agricultural products in the eastern region, thus stabilizing the supply and demand of agricultural products and playing a stronger stabilizing role in the price fluctuations of agricultural product imports and exports.

5. CONCLUSIONS AND POLICY RECOMMENDATIONS

5.1 Conclusions

Based on the empirical study of China's experience data from 2018 to 2022, the following main conclusions are obtained: The development of cross-border e-commerce has a significant impact on the price fluctuations of China's agricultural product imports and exports, and it shows a role in stabilizing the price fluctuations of agricultural products; There are significant differences in the impacts of cross-border e-commerce imports and exports on the price fluctuations of China's agricultural product imports and exports. Comparatively speaking, the role of cross-border e-commerce imports in stabilizing the price fluctuations of China's agricultural product imports is stronger, while the role of cross-border e-commerce exports in stabilizing the price fluctuations of China's agricultural product exports is stronger; There are obvious regional heterogeneities in the role of cross-

border e-commerce development in stabilizing the price fluctuations of China's agricultural product imports and exports. Generally speaking, the role of cross-border e-commerce development in stabilizing the price fluctuations of agricultural product imports and exports in China's eastern region is stronger, while the role in stabilizing the price fluctuations of agricultural products in the western region is smaller, showing a characteristic of weakening from east to west; The price fluctuations of China's agricultural products are also affected by factors such as opening up, industrial structure, urbanization level and the number of cross-border e-commerce comprehensive pilot zones, which urgently need to attract the attention of relevant departments.

5.2 Policy Recommendations

To better stabilize agricultural product prices, it is urgent to give full play to the role of cross-border e-commerce in smoothing out the fluctuations in the import and export prices of agricultural products in China. The following policy recommendations are put forward in this paper:

First, accelerate the construction of cross-border e-commerce platforms. Relevant departments should actively provide financial support and policy incentives, encourage and support the construction and development of cross-border e-commerce platforms, and do a good job in building cross-border e-commerce infrastructure such as technical support for cross-border e-commerce transactions, logistics support, and cross-border payment systems, so as to improve the operational efficiency and service quality of cross-border e-commerce platforms and ensure the stability of the scale and price of cross-border agricultural product transactions.

Second, reduce trade barriers in cross-border e-commerce transactions. Allow cross-border e-commerce comprehensive pilot zones to take the lead in implementing policies in the field of cross-border e-commerce, simplify customs clearance procedures, reduce tax burdens, strengthen intellectual property protection, etc., reduce the costs of cross-border agricultural product import and export transactions, stabilize the trade and circulation of cross-border agricultural products, and reduce price fluctuations.

Third, strengthen supervision and the construction of cross-border agricultural product transaction standards. Relevant departments need to strengthen the supervision of cross-border e-commerce platforms to ensure the quality and safety of imported and exported agricultural products through cross-border e-commerce. By formulating and implementing standardization measures, promote the standardized production and trade of agricultural products, improve product competitiveness, and reduce price fluctuations.

Fourth, strengthen the sharing of information on cross-border e-commerce platforms. Relevant departments need to initiate and establish an information system for cross-border e-commerce platforms, encourage enterprises to actively join the cross-border e-commerce platform system, and provide information support such as market demand, supply chain, and price trends for both sides of the supply and demand in cross-border e-commerce, to help cross-border e-commerce enterprises make reasonable sales decisions and reduce the fluctuations in the import and export prices of cross-border agricultural products.

Fifth, strengthen international cooperation in the development of cross-border e-commerce. Relevant departments should increase cooperation with other countries and regions, promote the establishment of cross-border e-commerce trade rules and standards, strengthen information sharing and cooperation mechanisms, reduce trade frictions and uncertainties, and stabilize the import and export prices of agricultural products.

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