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Trade Facilitation and China's Agricultural Products Exports: Empirical Evidence from Japan and Korea*

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Abstract

Purpose – This paper analyzes the relationship between trade facilitation and agricultural products exports and estimates the effects of trade facilitation in importing countries on Chinese agricultural products exports, which is of great significance for promoting agricultural trade between China,Japan and Korea and the governments of the three countries to formulate targeted trade facilitation policies.

Design/methodology – Based on Wilson (2003) theoretical framework, this paper sets up its own trade facilitation level measurement system by involving four primary indicators and fifteen secondary indicators to evaluate the trade facilitation levels of Japan and Korea from 2011 to 2018 respectively. The paper selected the data on China's agricultural exports at the HS4 level from 2011-2018 and used a fixed-effects model to estimate the effect of changes in trade facilitation levels in trading partner countries on China's agricultural trade.

Findings – Our main findings can be summarized as follows: the level of trade facilitation in importing countries has a significantly positive effect on China's agricultural exports. The higher the level of trade facilitation in trading partner countries, the more Chinese agricultural exports trade, i.e. for every 1 percentage point increase in the level of trade facilitation, the volume of exports will increase by 2.299%.The sub-sample test shows that China's main agricultural products exported to Japan and Korea, such as aquatic products, vegetables, fruits and other perishable fresh products, are particularly significantly affected by the level of trade facilitation.

Originality/value – First, from the innovation of the research perspective, which is different from the analysis of the existing paper on the overall trade facilitation of all traded commodities. This article is based on the close trade relations between China, Japan and Korea, and the particularity of agricultural products, from the perspective of China's agricultural exports to Japan and Korea, discuss the impact of importing countries—Japan and Korea's trade facilitation levels on China's agricultural exports;Secondly, in this paper, the hierarchical data of the HS4 quartile is used to avoid the information loss of the industry, and to analyse the impact of the importing country's trade facilitation level on the export of different types of agricultural products more scientifically.

Keywords: Agricultural trade, Perishable fresh produce, Trade facilitation
JEL Classifications: F14, Q17

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1. Introduction

Since the 2008 international financial crisis, trade protectionism and anti-globalization have intensified, and global multilateral trade organizations and large-scale regional integration organizations have become increasingly difficult to play a role. Faced with this situation, China-Japan-Korea FTA based on Geo-economics is getting more and more attention. China, Japan and Korea are geographically close and have frequent economic and trade exchanges since ancient times. Up to now, they are still important trading partners with each other. Affected by the characteristics of agricultural products, geographical location and resource endowment factors, the three countries are also important agricultural product trading partners with each other. Japan and Korea are China's most important agricultural product export targets. However, in recent years, the structure of China's agricultural product export market has gradually changed, and its dependence on Korea and Japan has declined. Due to the particularity of agricultural products, the trade protection of agricultural products by various countries, and the restrictions on food trade caused by the outbreak of the COVID-19, the liberalization of agricultural trade between the three countries has not been realized. In the negotiations of the China-Japan-Korea Free Trade Zone, due to the important strategic position of agricultural products, the issue of agricultural product market opening has become one of the important factors hindering the establishment of the China-Japan-Korea Free Trade Zone. In this paper, how to further promote the export of agricultural products between the three countries requires another way.

It is known to all the theoretical circles that with the deepening of economic globalization and regional economic development, the adjustable range of traditional tariff and non-tariff barriers is becoming smaller and smaller, and the impact on international trade is becoming weaker and weaker. The impact of an implicit market access barrier on international trade has become increasingly prominent, and regional economic cooperation should pay more attention to the issue of trade facilitation aimed at removing institutional and technical obstacles in international trade and reducing transaction costs (Kong Qing-feng, 2015). In the agricultural trade between China, Japan and Korea, due to the particularity of agricultural products, tariffs cannot be further reduced in the short term, and traditional non-tariff barriers have also existed for a long time. Therefore, improving the level of trade facilitation may become an important starting point for promoting agricultural exports.

Trade facilitation contributes to increased trade flow by reducing trade costs. The heterogeneous firm trade theory, represented by Melitz (2003), argues that the existence of trade costs makes it possible for only firms with higher productivity to export or to operate in foreign markets. When trade costs fall, the firms of export oriented will expand trade, and firms that could only supply the domestic market can also participate in exporting, i.e. bringing about growth in trade through expansion of the margin.

Many scholars have done relevant research on the relationship between trade facilitation and export. Wilson,Mann and Otsuki(2003) used a gravity model to calculate the relationship involving four indicators: infrastructure,e-commerce, regulatory environment and customs environment, respectively. They found that trade scale was positively correlated to port efficiency. Francois et al. (2005) used a computable general model (CGE) to test the effects of trade facilitation policies and figured out that the welfare of trade facilitation is greater relative to free trade. In China, Fang and Zhu (2013) conducted an empirical study of relevant data from ASEAN countries. The results suggest that trade facilitation is increasingly important in a context where tariff levels are difficult to reduce.Kong King-Feng and Dong Wei-Hong (2015) measured the level of trade facilitation in 69 Asian and European countries along the "One Belt and One Road" and verified through a gravity model that trade facilitation has a

greater role in promoting trade than regional economic organizations, GDP of importing and exporting countries, and tariff reduction. Tang Yi-Hong and Gu Li-Hua(2019) used the World Bank's Enterprise Survey data from 2011 to 2016 to empirically study the impact of trade facilitation on the exports of manufacturing enterprises in three dimensions: customs efficiency,policy transparency and infrastructure, using a sample of 23,075 enterprises from 49 countries along the Belt and Road. It was found that the increase in the number of days for export clearance, court barriers and transport barriers significantly reduced the export share of enterprises.

For manufactured commodities, there is a consensus that increased trade facilitation contributes to increased trade flows. In the case of agricultural produce, as time-sensitive trade commodities, is the impact of trade facilitation more significant? In particular, for fresh and perishable products such as fruits, vegetables and aquatic products, which are among the top agricultural exports of China, are their exports more dependent on the development of trade facilitation in importing countries? Based on this, this paper focuses on Japan and Korea, the major agricultural trade partners that are close to China, and selects Chinese agricultural exports data at the HS4 level from 2011 to 2018 to test the effect of changes in trade facilitation levels in trading partner countries on Chinese agricultural trade by using a fixed effects model. It is found that the level of trade facilitation of importing countries has significantly promoted the export of agricultural products of exporting countries, which is of great significance for promoting agricultural trade between China and Japan and Korea and for the governments of the three countries to formulate targeted trade facilitation policies.

The contribution of this article is mainly reflected in the following two aspects: First, from the innovation of the research perspective, which is different from the analysis of the existing paper on the overall trade facilitation of all traded commodities. This article is based on the close trade relations between China, Japan and Korea, and the particularity of agricultural products, from the perspective of China's agricultural exports to Japan and Korea, discuss the impact of importing countries—Japan and Korea's trade facilitation levels on China's agricultural exports;Secondly, in this paper, the hierarchical data of the HS4 quartile is used to avoid the information loss of the industry, and to analyse the impact of the importing country's trade facilitation level on the export of different types of agricultural products more scientifically.

2. Definition of agricultural products and Chinese agricultural exports to Japan and Korea

2.1. Agricultural Products Classification

The agricultural products referred to herein cover all the products listed in Annex 1 of the WTO *Agreement on Agriculture* and some fishery products.The Harmonised Commodity Description and Coding System (HS) developed by the Customs Cooperation Council (CCC), widely used globally, is used for statistics on agricultural products. The HS codes for each major category of agricultural products are shown in Table 1.

2.2. Chinese Agricultural Exports to Japan and Korea

2.2.1. Total Scale of Chinese Agricultural Exports to Japan and Korea

Fig. 1 shows the scale trends of China's agricultural export to Japan and Korea. From 2011 to 2018, Chinese agricultural exports to Japan went much higher above Chinese agricultural

exports to Korea. However the trends in the scale of China's agricultural exports to Japan and Korea were markedly different. Chinese agricultural exports to Japan showed an overall decreasing trend, while Chinese total agricultural exports to Korea showed an upward trend. This difference may be related to the Level of trade facilitation of trade facilitation between Japan and Korea.

Table 1. Classification of agricultural products based on HS codes

Product Categories	HS4 Code
SECTION I live animals; animal products	0101-0106,0201-0210,0301-0308,0401-0410, 0501-0511
SECTION II vegetable products	0601-0604,0701-0714,0801-0814,0901-0910, 1001-1008,1101-1109,1201-1214, 1301-1302,1401-1404
SECTION III animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal or vegetable waxes	1501-1518,1520-1522
SECTION IV prepared foodstuffs; beverages, spirits and vinegar; tobacco and manufactured tobacco substitutes	1601-1605,1701-1704,1801-1806,1901-1905, 2001-2009,2101-2106,2201-2209, 2301-2309,2401-2403
SECTION VI products of the chemical or allied industries	3301
SECTION VIII raw hides and skins, leather, furskins and articles thereof; saddlery and harness; travel goods, handbags and similar containers; articles of animal gut (other than silk-worm gut)	4101-4103,4301
SECTION XI textiles and textile articles	5001-5003,5201-5203,5301-5303,5101-5103

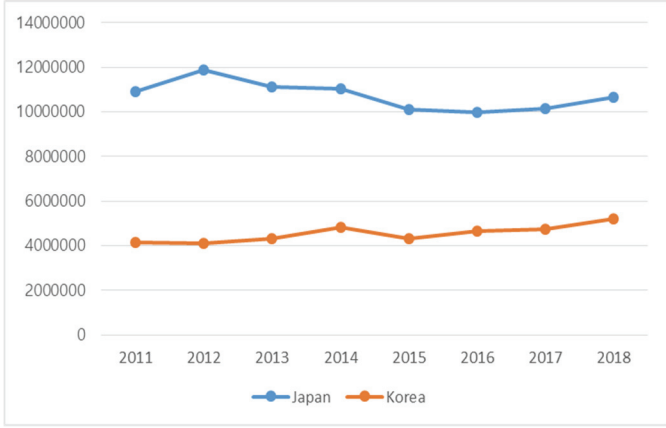
Actually the agricultural exports from China to Japan went in fluctuations as they rose from USD 1,091,075,000 to USD 1,189,068,000 from 2011 to 2012 with an increase of USD 979,921,000, and reached its highest point in 2012. But from 2013 to 2016 the agricultural exports from China to Japan experienced continuous decline and fell to USD99,690,700,000. A little rise occurred since 2017 to 2018 (Referring to Fig. 1). This trend coincides with the trend in Japan's Trade Facilitation Index measured later, as can be seen in Table 7 for Japan, where the Trade Facilitation Index was highest in 2011 and 2012, then declined two years later and began to rise slightly in 2015, but at a lower overall level, before rising sharply again in 2017 and remaining at a relatively high level.

When it comes to the agricultural exports from China to Korea, it enjoyed a steady rise with minor fluctuations in some years.From 2011 to 2018 China's agricultural exports climbed up from USD4,132,933,000 to USD 520,816,000 with an increase of USD107,526,000 (Referring to Figure 1). In particular, since 2014, the scale of China's agricultural export trade to Korea has gradually increased, while Korea's trade facilitation index has started to rise gradually.

The above analysis shows that the trends in the scale of China's agricultural export trade to

Japan and Korea are generally consistent with the trends in trade facilitation in Japan and Korea in terms of data.

Fig. 1. China's agricultural exports to Japan and Korea (Unit: 1000USD)



Source: UN's Comtrade database.

2.2.2. Structure of Chinese Agricultural Exports to Japan and Korea

Tables 2 and 3 show the share of China's agricultural exports to Japan and Korea in different HS2[1] decile categories. The export structure of Chinese agricultural products to Japan mainly shows the following characteristics:

Firstly, the export products are relatively concentrated. As seen in Table 2, they concentrate on three major categories of products, namely, aquatic products, vegetables and fruits, which

[1] First major category: movable objects, animal products

01: live animals, 02: meat and edible miscellaneous, 03: fish, crustaceans, molluscs and other aquatic invertebrates, 04: dairy products, eggs, natural honey, other food animal products, 05: other animal products

Second major category: plant products

06: living trees and other living plants, bulbs, roots and similar products, flower arrangements and decorative clusters, 07: edible vegetables, roots and tubers, 08: edible fruits and nuts; rind of melon or citrus fruits, 09: coffee, tea, maté tea and flavoured spices, 10: cereals, 11: products of the milling industry, malt, starch, inulin, gluten, 12: oil seeds and fruits, miscellaneous seeds and fruits, and industrial or medicinal plants, straw, straw and fodder, 13: gum, gum, resin and other plant liquids and juices, 14: plant material for preparation, other plant products

Third major category: animal and vegetable oils and fats and their breakdown products, refined edible fats and oils, animal and vegetable waxes

15: Animal and vegetable oils and fats and their breakdown products, refined edible fats and oils, animal and vegetable waxes

Fourth major category: food, beverages, wine and vinegar, tobacco and tobacco substitute products

16: Products of meat, fish, crustaceans, molluscs and other aquatic invertebrates, 17: Sugar and sugar food, 18: Cocoa and cocoa products, 19: Cereals, grain flour, starch or dairy products; pastry and confectionery, 20: Products of vegetables, fruit, nuts or other parts of plants, 21: Mixed edible ingredients, 22:Beverages, wine and vinegar, 23: Food industry residual waste, animal feed, 24: products of tobacco, tobacco and tobacco substitutes.

Others: 33: essential oils, 41: raw hides and skins, 50: silk, 51: wool, fine and coarse animal hair, 52: cotton, 53: other vegetable textile fibres.

totally account for more than 75% of agricultural exports every year.

Secondly, owing to the labor-intensive feature of aquatic products, vegetables and fruits, Chinese agricultural exports to Japan are mainly labour-intensive products.

Chinese agricultural exports to Korea are similar to those of Japan.The export product structure, the concentration on three categories of aquatic products,vegetables and fruits accounting for over 60% are of the same case with Korea (Referring to Table 3) .

This shows that Chinese agricultural products exported to Japan and Korea are mainly labour-intensive products. They are perishable compared to other products, indicating that the quality will obviously affect the taste, the health and safety of consumers in the importing countries. In short, they are sensitive to the time of trading. Therefore, the facilitation and efficiency in trade in these perishable agricultural products turns to be the key factors.

Table 2. Statistics of China's exports of agricultural products to Japan by category, 2011-2018

(Unit :%)

HS2	2011	2012	2013	2014	2015	2016	2017	2018
16	30.44	29.33	27.91	26.67	26.22	24.95	27.36	28.15
03	17.83	17.58	17.95	18.14	18.51	20.14	19.91	19.15
20	15.19	15.93	17.45	16.21	16.57	16.17	16.40	16.17
07	12.88	11.69	11.55	11.81	12.33	12.96	12.96	12.64
23	3.77	5.84	5.52	7.60	7.16	6.64	4.73	5.09
12	3.60	3.54	3.18	3.49	3.14	3.54	3.30	3.16
19	2.56	2.64	2.65	2.59	2.36	2.18	2.27	2.11
21	2.09	2.13	2.11	2.02	2.19	2.17	2.03	2.00
13	1.20	1.20	1.40	1.59	1.70	1.73	1.87	1.84
05	2.23	2.17	2.06	2.21	1.91	1.46	1.67	1.78
09	1.77	1.41	1.51	1.60	1.59	1.50	1.54	1.60
08	1.66	1.74	1.78	1.67	1.51	1.49	1.50	1.41
06	0.82	0.81	0.83	0.80	0.86	0.99	0.98	0.99
04	0.88	0.82	0.97	0.82	0.86	1.22	1.01	0.94
10	0.61	0.65	0.45	0.43	0.54	0.45	0.33	0.72
22	0.48	0.48	0.43	0.31	0.31	0.34	0.34	0.43
15	0.28	0.34	0.52	0.28	0.35	0.29	0.26	0.32
11	0.39	0.29	0.26	0.31	0.36	0.32	0.31	0.27
18	0.08	0.11	0.19	0.22	0.26	0.25	0.25	0.22
14	0.19	0.20	0.20	0.19	0.21	0.21	0.23	0.21
50	0.23	0.24	0.28	0.25	0.20	0.19	0.23	0.16
17	0.18	0.18	0.16	0.13	0.13	0.13	0.13	0.14
51	0.14	0.13	0.12	0.14	0.14	0.13	0.13	0.14
24	0.24	0.27	0.28	0.27	0.31	0.31	0.09	0.10
41	0.05	0.06	0.08	0.08	0.09	0.09	0.08	0.07
52	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.07
01	0.06	0.04	0.03	0.05	0.06	0.05	0.05	0.04
33	0.07	0.09	0.07	0.05	0.05	0.04	0.03	0.04
43	0.02	0.02	0.02	0.02	0.03	0.02	0.02	0.02
53	0.03	0.04	0.05	0.03	0.03	0.03	0.02	0.02
02	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.01

Source: UN's Comtrade database.

Table 3. Statistics of China's exports of agricultural products to Korea by category, 2011-2018

(Unit :%)

HS2	2011	2012	2013	2014	2015	2016	2017	2018
03	31.56	29.71	26.28	28.40	30.31	29.03	23.20	24.69
20	9.05	10.30	12.10	12.84	14.25	16.52	17.68	16.71
16	7.23	6.70	6.08	5.73	6.23	6.60	10.68	12.43
07	14.23	12.95	11.29	9.95	13.29	13.45	13.46	11.75
23	6.62	8.27	10.45	10.16	6.14	5.26	5.18	5.84
12	7.33	9.48	7.87	8.31	7.44	6.29	6.28	5.81
21	3.15	3.68	3.16	3.93	4.06	3.48	3.53	3.44
19	2.88	3.05	2.85	2.64	2.99	2.95	3.14	2.96
10	4.94	2.25	6.28	4.44	3.25	3.18	2.74	2.50
22	0.36	0.46	0.75	1.08	1.31	2.12	2.25	2.28
13	1.24	1.65	1.93	1.65	1.55	1.64	1.66	1.99
17	2.01	1.70	1.82	1.50	1.38	1.82	1.99	1.59
09	1.33	1.30	0.69	0.65	0.72	0.88	1.15	1.28
06	0.57	0.73	0.81	1.02	1.25	1.15	1.04	1.20
11	1.46	1.10	0.99	0.87	0.90	0.87	1.21	1.04
05	2.05	2.59	3.07	3.36	1.08	0.54	0.83	0.81
18	0.20	0.22	0.35	0.63	0.81	1.22	1.02	0.77
15	0.59	0.55	0.49	0.46	0.44	0.70	0.79	0.63
08	1.06	1.32	0.93	0.71	0.71	0.71	0.62	0.60
24	0.33	0.51	0.47	0.44	0.38	0.33	0.23	0.45
04	0.26	0.20	0.16	0.15	0.39	0.34	0.57	0.43
50	0.61	0.52	0.43	0.30	0.33	0.29	0.30	0.21
51	0.69	0.52	0.57	0.33	0.23	0.20	0.13	0.14
52	0.13	0.10	0.01	0.05	0.21	0.01	0.03	0.14
14	0.02	0.03	0.05	0.19	0.10	0.14	0.14	0.10
01	0.05	0.05	0.05	0.05	0.06	0.10	0.06	0.08
41	0.02	0.03	0.03	0.09	0.04	0.10	0.04	0.07
33	0.03	0.03	0.02	0.05	0.14	0.09	0.05	0.04

Source: UN's Comtrade database.

3. Trade Facilitation Measurements in Japan and Korea

3.1. Construction of the Indicator System

There is no standard definition for trade facilitation. Trade facilitation is a collective term for various measures that create a harmonized, transparent and predictable environment for international trade transactions through simplification of procedures, harmonization of applicable laws and regulations, and standardization and improvement of infrastructure.

The level of trade facilitation depends on a variety of factors, and its measurement usually takes the approach of a multi-indicator system, which is now broadly divided into two categories: one is the Trade Facilitation Index (TFI) compiled by the OECD in accordance with the provisions of the World Trade Organization (WTO) Agreement on Trade Facilitation; the other is Wilson (2003) who constructed a trade facilitation index system

using four major indicators: port efficiency, customs environment, institutional environment and e-commerce. Based on relatively fixed indicators, the former cannot reflect the infrastructure and e-commerce aspects; the latter can add or subtract indicators depending on the focuses of the researchers.

In this paper, the measurement of trade facilitation draws on Xie Juan-Juan and Yue Jing(2011) idea of constructing a system for measuring the level of trade facilitation, combining the characteristics of agricultural trade, and selecting four primary indicators: transport infrastructure (A), customs environment (B), institutional environment (C) and e-commerce (D), and refining them to 15 secondary indicators, where infrastructure (A) and customs environment (B) reflect cross-border barriers, and institutional environment (C) and e-commerce (D) reflect domestic factors. This is shown in Table 4.

Table 4. Indicator components of the trade facilitation measurement system

Tier 1 indicators	Secondary indicators		Score range	Source of indicators
Transport infrastructure (A)	Road quality	A1	1-7	GCR
	Quality of railway infrastructure	A2	1-7	GCR
	Quality of port infrastructure	A3	1-7	GCR
	Quality of air transport infrastructure	A4	1-7	GCR
Customs environment (B)	Degree of market dominance	B1	1-7	GCR
	Trade tariffs	B2	per hundred	GCR
	Buyer maturity	B3	1-7	GCR
	The burden of government regulation	B4	1-7	GCR
Institutional environment (C)	Efficiency of legal and regulatory dispute resolution	C1	1-7	GCR
	Reliability of police services	C2	1-7	GCR
	Judicial independence	C3	1-7	GCR
	Intellectual property protection	C4	1-7	GCR
Finance and E-Commerce (D)	Availability of venture capital	D1	1-7	GCR
	Number of Internet users (percentage)	D2	per 100 people	GCR
	Bank Robustness	D3	1-7	GCR

Note : The 15 secondary indicators are from the Global Competitiveness Report (GCR). GCR scores range from 1-7, with higher scores for indicators other than trade tariffs indicating higher levels of trade facilitation.

3.2. Indicator Processing

The trade facilitation measurement system constructed in this paper involves a large number of indicators, and the data sources of its indicators are different, resulting in large differences in the range of values of some indicator data, so the original values of the selected secondary indicators need to be standardized.

This is done by dividing the raw data by the maximum value that can be obtained for each indicator, i.e. $A_i = A/A_{max}$, A_i being the raw data, Amax being the maximum value that can be obtained for the indicator and Ai being the indexed data, with values ranging from 0 to 1, to obtain the true level of each indicator.

The specific values of the fifteen secondary indicators for Japan and Korea in 2019 were first selected and indexed to obtain the results in Table 5.

Table 5. Results after standardisation of the indicators

Indicators	Japan	Korea
Road quality (A1)	1.000	0.967
Quality of railway infrastructure (A2)	1.000	0.868
Quality of port infrastructure (A3)	1.000	0.948
Quality of air transport infrastructure (A4)	1.000	0.952
Degree of market dominance (B1)	1.000	0.643
Trade Tariff (B2)	1.000	0.662
Buyer Maturity (B3)	0.926	1.000
Burden of Government Regulation (B4)	0.909	0.750
Efficiency of legal and regulatory dispute resolution (C1)	1.000	0.824
Reliability of Police Services (C2)	1.000	0.855
Judicial independence (C3)	1.000	0.629
Intellectual Property Protection (C4)	1.000	0.767
Availability of risk capital (D1)	0.977	0.773
Number of Internet users (%) (D2)	0.882	1.00
Bank soundness (D3)	1.000	0.930

Note: Higher values of trade tariffs indicate lower levels of trade facilitation and therefore the standardized calculation of trade tariff indicators does not follow the above formula.

3.3. Measurement Results

The four primary indicators have different magnitudes of contribution to trade, and this paper uses principal component analysis, using data from 2019, to obtain the weights of each secondary indicator, with the weight of the primary indicator equal to the sum of the weights of the secondary indicators.

Table 6. Indicator weights

Tier 1 indicators	Weighting	Secondary indicators	Weighting
Transport infrastructure (A)	0.291	Road quality (A1)	0.066
		Quality of railway infrastructure (A2)	0.083
		Quality of port infrastructure (A3)	0.073
		Quality of air transport infrastructure (A4)	0.070
Customs environment (B)	0.188	Degree of market dominance (B1)	0.082
		Trade Tariff (B2)	0.084
		Buyer Maturity (B3)	0.016
		Burden of Government Regulation (B4)	0.005
Institutional environment (C)	0.376	Efficiency of legal and regulatory dispute resolution (C1)	0.097
		Reliability of Police Services (C2)	0.091
		Judicial independence (C3)	0.091
		Intellectual Property Protection (C4)	0.097
Finance and E-Commerce (D)	0.145	Availability of risk capital (D1)	0.032
		Number of Internet users (%) (D2)	0.034
		Bank soundness (D3)	0.080

From Table 6, we can see that among the four level 1 indicators the institutional environment has the greatest influence, accounting for about 37.6%, the transport infrastructure has the second largest influence, accounting for about 29.1%, the customs environment has about

18.8% of the influence on the level of trade facilitation, and finance and e-commerce has the smallest influence on the level of trade facilitation, accounting for only 14.5%.

The trade facilitation scores were calculated based on the indicator weighting factors in Table 6, i.e.: Tier 1 indicator score = the sum of the standardized values of all Tier 2 indicators under the item * the weight of that value, and the trade facilitation score = the sum of the scores of each Tier 1 indicator.

Using the above method, the trade facilitation level scores of Japan and Korea from 2011 to 2019 were calculated respectively. As it can be seen from the Table 7, in these nine years, that the trade facilitation level score is higher in Japan, but the trade facilitation level score is showing a decreasing trend year by year; the score of Korea is lower, but the overall trade facilitation level of Korea is showing an increasing trend.

Table 7. Trade Facilitation Level Scores for Japan and Korea, 2011-2019

Country	2011	2012	2013	2014	2015	2016	2017	2018	2019
Japan	1.002	1.002	0.998	0.991	0.995	0.994	1.001	0.998	0.994
Korea	0.806	0.814	0.753	0.713	0.754	0.773	0.777	0.818	0.821

4. Empirical Method and Data

4.1. Empirical Method

The gravity model is the mainstream tool for quantitative analysis in the trade field. Most studies on trade facilitation and trade flow use the gravity model. The explanatory variables in the standard gravity model mainly include variables that measure the size of the market, such as the GDP and total population of importing and exporting countries; explanatory variables that measure geographic locations, such as the geographic distance between countries, whether the two countries border or not. Because China is very close to Korea and Japan, and this situation does not change over time, so it has no practical impact on the model estimation results. Therefore, this paper eliminates the explanatory variables for measuring geographic location and adopts the GDP per capita of China and the trading partner countries to measure the market size in accordance with the existing paper, and the trade facilitation index is introduced to set the basic model.

In order to accurately identify the impact of trade facilitation on Chinese agricultural exports, this paper uses the trade facilitation indicators calculated in the previous section as the explanatory variables, and the amount of Chinese exports of agricultural trade to Japan and Korea at the HS4 level as the explained variables, and adopts a fixed-effects model to examine the effect of changes in trade partner's trade facilitation level on Chinses agricultural exports. The core expectation of this paper is that an increase in trade partner's trade facilitation level will increase Chinese exports of agricultural products to them, especially perishable fresh products which are more sensitive to changes in trade facilitation level, based on which the benchmark model constructed in this paper is as follows.

$$ltrade_{oijt} = \alpha_0 + \alpha_1 tf_{jt} + \alpha_2 lnpgdp_{jt} + \alpha_3 lnpgdp_{ot} + \gamma_i \left(+ u_t \right) + \varepsilon_{oijt} \quad (1)$$

where o is China, j denotes the trading partner country (Japan and Korea), i denotes the HS4 of agricultural products, and t denotes the year.$ltrade_{oijt}$ is the value of Chinese agricultural exports from China to trading partner country j in HS4 in year t after taking the logarithm,

and tf_{jt} is the trade facilitation index of trading partner country j in year t. $lnpgdp_{jt}$ is the GDP per capita of trading partner country j in year t, after taking the logarithm $lnpgdp_{ot}$ Since different products have different characteristics, we control for product fixed effects in the HS4 in the baseline model in order to control for the differential impact of different HS4 products, i.e.γ_i . Also to control for time trends to ensure the robustness of the baseline model estimation results. In this paper, robustness tests are performed by adding time fixed effects (u_t) to the baseline model with ε_{oijt} as a random disturbance term.

4.2. The Data

The data we used include the value of export trade reported by China Customs, the trade facilitation index, and GDP per capita for China, Japan, and Korea. The data sources are as follows.

The agricultural trade flow data come from the World Bank's World Integrated Trade Solution (WITS) database, and the WITS data come from the UN's COMTRDE database. This paper selects China reported agricultural exports to Japan and Korea at the HS4 level from 2011-2018, which fully retains the microdata information of the products. Data for the 15 secondary indicators in the Trade Facilitation Index are obtained from the Global Competitiveness Report (GCR) published by the World Economic Forum, and the core explanatory variable, the Trade Facilitation Index, is derived from the previous calculations. Data on GDP per capita between the two countries come from the CEPII database[2]. Based on the data obtained, the relevant indicator data were calculated, processed and combined to obtain a final sample of 2,438 HS4 levels from 2011-2018.

5. Empirical Results

5.1 Baseline Estimation Results

Table 8 reports the estimated results of the impact of trade facilitation in trading partner countries on Chinese agricultural export trade. Where column (1) shows the estimation results without any control variables, column (2) shows the estimation results with the inclusion of GDP per capita of trading partner countries, column (3) shows the estimation results controlling for GDP per capita of both China and trading partner countries, column (4) shows the estimation results of the baseline model, and column (5) shows the robustness estimation results controlling for time trends.

The estimated results from column (1) to column (4) of Table 8 with the stepwise addition of control variables reveal that the adj. R2 of the baseline estimation results is significantly better than the first three columns, indicating that the control variables in this paper are reasonable. The results of the benchmark regression in column (4) show that the higher the level of trade facilitation in trading partner countries, the more Chinese agricultural export traded, i.e. for every 1 percentage point increase in the level of trade facilitation, the export volume will increase by 2.299%, and it is significant at the 1% level, as expected. Meanwhile, we note that the level of GDP per capita in trading partner countries is significantly and positively related to Chinese agricultural trade exports, while it is not significantly and positively related to China's GDP per capita, which indicates that Chinese agricultural export trade depends mainly on the GDP per capita in trading partner countries, as expected, since a country's exports depend much on the demand of trading partner countries, which is clearly related to the per capita income of trading partner countries.

[2] Data from: http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id

Table 8. Baseline estimation results

	(1) ltrade	(2) ltrade	(3) ltrade	(4) ltrade	(5) ltrade
tf	**2.026*** **	**1.820**	**1.832**	**2.299*** **	**2.298*** **
	(0.563)	(1.122)	(1.136)	(0.535)	(0.554)
lpgdp_d		0.128	0.121	0.585**	0.666**
		(0.602)	(0.610)	(0.286)	(0.301)
lpgdp_o			0.0245	-0.0711	-0.0133
			(0.344)	(0.162)	(0.197)
_cons	6.317***	5.165	5.009	-2.934	-4.431
	(0.505)	(5.427)	(5.856)	(2.793)	(3.031)
HS4 fixed effect	No	No	No	Yes	Yes
year fixed effect	No	No	No	No	Yes
N	2438	2438	2438	2438	2438
adj. R2	0.005	0.004	0.004	0.785	0.786

Note: 1.Standard errors in parentheses
2.* $p< 0.10$, ** $p< 0.05$, *** $p< 0.01$.

5.2. Grouped Sample Test

As different categories of agricultural products have different properties and different needs for trade facilitation, for example, fresh and perishable agricultural products require higher levels of trade facilitation. In order to clearly analyze the relationship between different categories of agricultural products and trade facilitation, this paper conducts sub-sample tests by chapter (HS2), and the specific estimation results are presented in Table 9 to Table12, where Tables 9 and Tables 10 report products that are sensitive to changes in the level of trade facilitation in the HS2, and Table 11 and Tables Table 12 report products that are not sensitive to changes in the level of trade facilitation.

Table 9. Estimated results for agricultural exports sensitive to trade facilitation (a)

	(03) ltrade	(04) ltrade	(06) ltrade	(07) ltrade	(08) ltrade	(09) ltrade
tf	**1.486***	**15.77*** **	**9.724*** **	**3.296****	**8.203*** **	**3.676****
	(0.810)	(4.859)	(3.067)	(1.355)	(2.276)	(1.623)
lpgdp_o	-0.226	-0.768	0.903	-0.0504	0.111	0.0687
	(0.250)	(1.388)	(0.942)	(0.413)	(0.667)	(0.494)
lpgdp_d	0.423	-4.639*	0.0817	0.541	2.404**	1.230
	(0.438)	(2.590)	(1.679)	(0.730)	(1.194)	(0.880)
_cons	8.303**	44.70*	-12.86	-3.680	-31.92***	-8.624
	(4.147)	(23.03)	(16.12)	(7.031)	(11.99)	(8.150)
HS4 fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
N	112	86	63	185	150	104
adj. R2	0.866	0.564	0.753	0.836	0.802	0.878

Note: 1. Standard errors in parentheses
2.* $p < 0.10$, ** $p< 0.05$, *** $p < 0.01$.

Table 10. Estimated results for agricultural exports sensitive to trade facilitation (b)

	(16) ltrade	(20) ltrade	(21) ltrade	(24) ltrade	(50) ltrade	(53) ltrade
tf	**9.269*** **	**3.307*** **	**3.645*** **	**6.691** **	**4.497*** **	**8.940***
	(2.346)	(0.850)	(1.358)	(2.996)	(1.388)	(5.242)
lpgdp_o	-0.0887	0.113	-0.0209	-0.782	0.263	0.626
	(0.695)	(0.262)	(0.416)	(0.944)	(0.427)	(1.448)
lpgdp_d	1.938	1.544***	-0.0877	-0.555	-0.188	1.989
	(1.244)	(0.460)	(0.740)	(1.627)	(0.748)	(2.697)
_cons	-19.08	-9.640**	6.971	16.20	-0.279	-28.07
	(11.92)	(4.352)	(7.205)	(16.26)	(7.080)	(27.19)
HS4 fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
N	74	144	91	43	47	39
adj. R2	0.826	0.854	0.864	0.808	0.950	0.449

Note: 1. Standard errors in parentheses
2.* $p< 0.10$, ** $p< 0.05$, *** $p< 0.01$.

In Table 9 and 10, the regression results in Chapters 3, 4, 6, 8, 9, 16, 20, 21, 24, 50 and 53 show that the higher the level of trade facilitation in the importing country, the more agricultural products are exported from China. Compared with the HS2 code table, we can see that most of these products are perishable and have a high level of freshness, and their trade costs are a greater impediment to agricultural exports, so trade facilitation measures effectively reduce trade costs and increase export flow by reducing passage times and simplifying customs clearance procedures. This is in line with the expectations in the previous section. In particular, for aquatic products, vegetables and fruits (Chapters 3, 7, 16 and 7), which account for a relatively large proportion of Chinese agricultural exports to Japan and Korea, trade facilitation has a relatively significant effect on export flow, as expected.

Table 11. Estimated results for agricultural exports insensitive to trade facilitation (a)

	(01) ltrade	(02) ltrade	(05) ltrade	(10) ltrade	(11) ltrade	(12) ltrade	(13) ltrade	(14) ltrade	(15) ltrade	(17) ltrade
tf	**3.363**	**4.629**	**1.369**	**-4.461**	**-1.384**	**-1.950**	**0.717**	**0.989**	**-0.166**	**1.355**
	(2.551)	(6.560)	(2.593)	(2.910)	(2.573)	(2.014)	(1.652)	(1.549)	(2.646)	(5.318)
lpgdp_o	-0.0157	4.097**	-0.371	-1.027	0.441	-0.467	-0.861	1.486***	-0.617	0.231
	(0.800)	(1.827)	(0.790)	(0.884)	(0.766)	(0.619)	(0.509)	(0.477)	(0.786)	(1.650)
lpgdp_d	-0.285	2.019	0.837	-0.255	0.134	-0.691	1.281	3.938***	-0.450	1.239
	(1.373)	(3.645)	(1.395)	(1.539)	(1.349)	(1.069)	(0.893)	(0.838)	(1.407)	(2.877)
_cons	4.625	-57.10	1.505	20.28	-2.493	23.71**	-0.853	-47.14***	11.10	-10.62
	(11.45)	(45.08)	(13.45)	(14.03)	(12.63)	(10.23)	(8.457)	(7.929)	(13.37)	(27.19)
HS4 fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	23	26	114	71	118	188	32	32	187	50
adj. ^{R2}	0.894	0.496	0.631	0.831	0.562	0.766	0.973	0.814	0.526	0.417

Note: 1. Standard errors in parentheses
2.* $p< 0.10$, ** $p< 0.05$, *** $p < 0.01$.

Table 12. Estimated results for agricultural exports insensitive to trade facilitation (b)

	(18) ltrade	(19) ltrade	(22) ltrade	(23) ltrade	(33) ltrade	(41) ltrade	(43) ltrade	(51) ltrade	(52) ltrade
tf	**-7.254***	**0.562**	**-5.043***	**2.003**	**-1.061**	**2.658**	**8.332**	**3.143**	**-18.48****
	(3.499)	(1.638)	(2.863)	(1.832)	(2.256)	(2.179)	(24.85)	(2.018)	(7.156)
lpgdp_o	1.115	-0.0681	0.826	-1.102**	-0.196	1.697**	-0.449	-0.520	-0.747
	(1.039)	(0.505)	(0.878)	(0.555)	(0.696)	(0.639)	(0.530)	(0.605)	(2.132)
lpgdp_d	3.896*	0.843	3.964**	-0.268	3.047**	2.003	-0.803	0.194	3.994
	(1.862)	(0.886)	(1.568)	(0.978)	(1.220)	(1.158)	(1.282)	(1.072)	(3.857)
_cons	-36.85*	0.597	-37.70**	14.69	-20.87*	-30.09***	11.86	9.133	-12.13
	(18.62)	(8.388)	(15.65)	(9.306)	(11.55)	(9.856)	(21.52)	(10.71)	(40.74)
HS4 fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	23	80	133	115	16	21	8	37	26
adj. R2	0.915	0.858	0.404	0.870	0.499	0.948	-0.469	0.852	0.672

Note: 1. Standard errors in parentheses
2.* p< 0.10, ** p< 0.05, *** p < 0.01.

In Table 11 and 12, the main reasons for the negative relationship between agricultural exports and the level of trade facilitation in Chapters 18 and 52 may be relevant to the small sample, and the possible existence of spurious regressions and they are not significant at the 1% level of significance; the negative relationship reflected in the export trade of Chapter 22 products is also significant only at the 10% level and therefore not decisive.

Table 13. Results of robustness test estimates for sensitive agricultural products (a)

	(03) ltrade	(04) ltrade	(06) ltrade	(07) ltrade	(08) ltrade	(09) ltrade
tf	1.414	15.97***	1.369	9.552***	3.084**	7.797***
	(0.853)	(5.239)	(2.593)	(3.284)	(1.431)	(2.314)
lpgdp_o	-0.204	-0.770	-0.371	0.685	-0.166	0.229
	(0.311)	(1.692)	(0.790)	(1.183)	(0.513)	(0.795)
lpgdp_d	0.524	-4.673	0.837	0.445	0.691	2.906**
	(0.468)	(2.808)	(1.395)	(1.831)	(0.782)	(1.242)
_cons	7.064	44.67*	1.505	-14.72	-4.041	-37.92***
	(4.617)	(25.85)	(13.45)	(17.94)	(7.808)	(12.60)
HS4 fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
N	112	86	114	63	185	150
adj. ^{R2}	0.862	0.531	0.631	0.738	0.831	0.812

Note: 1. Standard errors in parentheses
2.* p< 0.10, ** p< 0.05, *** p < 0.01.

5.3. Robustness Tests

In order to exclude the effect of time trends on Chinese agricultural exports, we include year fixed effects in the benchmark regression, see column (5) of Table 8. The estimation results show that after controlling for time trends, Chinese agricultural exports are still

significantly positively correlated with the level of trade facilitation in its trading partners, indicating that the core findings of this paper are very robust. At the same time, to ensure the robustness of the sub-sample test results in this paper, we conducted robustness tests for agricultural exports in Chapters 03, 04, 06, 07, 08, 09, 16, 20, 21, 24, 50 and 53, which are sensitive to changes in the level of trade facilitation, i.e. adding year fixed effects to the baseline model, and the estimated results are presented in Table 13 and 14. From the estimates in Table 13 and 14,The results show that most agricultural products sensitive to export trade facilitation remain sensitive to changes in the level of trade facilitation even after controlling for time-fixed effects, again indicating that the core findings of this paper are robust.

Table14. Results of robustness test estimates for sensitive agricultural products (b)

	(16) ltrade	(20) ltrade	(21) ltrade	(24) ltrade	(50) ltrade	(53) ltrade
tf	**3.418****	**8.688*****	**3.173*****	**6.416***	**4.907*****	**7.043**
	(1.695)	(2.405)	(0.851)	(3.344)	(1.513)	(5.345)
lpgdp_o	0.118	-0.496	0.0221	-0.938	0.229	-0.430
	(0.611)	(0.834)	(0.310)	(1.227)	(0.542)	(1.689)
lpgdp_d	1.445	2.449*	1.778***	-0.274	-0.324	3.424
	(0.930)	(1.295)	(0.466)	(1.872)	(0.820)	(2.852)
_cons	-11.13	-20.70	-11.39**	14.78	0.935	-33.08
	(9.024)	(12.63)	(4.604)	(19.13)	(8.064)	(27.56)
HS4 fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
N	104	74	144	43	47	39
adj. R2	0.874	0.830	0.863	0.785	0.946	0.485

Note: 1. Standard errors in parentheses
2.* $p< 0.10$, ** $p< 0.05$, *** $p < 0.01$.

6. Conclusion

This paper focuses on Japan and Korea, agricultural export partners that are closer to China, and draws on Wilson's basic theory to measure the trade facilitation index of Japan and Korea and selects Chinese agricultural export data at the HS4 level from 2011-2018 to analyze the relationship between trade facilitation in importing countries and Chinese agricultural exports. The main findings are as listed here.

Firstly, the level of trade facilitation in importing countries has a significantly positive effect on Chinese agricultural exports. The higher the level of trade facilitation in trading partner countries, the more Chinese agricultural exports traded, i.e. for every 1 percentage point increase in the level of trade facilitation, the volume of exports will increase by 2.299%.

Secondly, considering the heterogeneity of products, trade facilitation has more significantly increased Chinese exports of fresh and perishable agricultural products. In particular, for aquatic products, vegetables and fruit products, which account for a relatively large proportion of Chinese agricultural exports to Japan and Korea, the increased level of trade facilitation also had a significant impact on the exports of these products.

Policy implications of this paper's findings are presented as:

Firstly, China should cooperate with Japan and Korea on trade facilitation. Under the current international economic environment, tariffs on agricultural products between China, Japan and Korea cannot be reduced in the short term, so China should take a positive attitude

to promote multi-party cooperation among China, Japan and Korea, to further strengthen communication with Japan and Korea.

Secondly, to improve trade facilitation and promote the development of agricultural trade through measures such as promoting the construction of infrastructure, the China-Japan-Korea Maritime Highway, and establishing cross-border customs clearance cooperation mechanisms and promoting the development of cross-border e-commerce for agricultural products.

Thirdly, China should optimize the structure of China's agricultural exports. The export of agricultural products plays an important role in boosting farmers' employment and income. Chinese agricultural exports to Japan and Korea are mainly labour-intensive products involving aquatic products, vegetables and fruits which are more vulnerable to non-tariff barriers. China should actively accelerate the restructuring and optimization and upgrading of its agricultural industry, strengthen investment in science and technology.

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