Lecture Notes in Economics, Management and Social Sciences, ISSN 2617-1031
2021 6th International Conference on Economics, Business and Management
Vol. 37, 2021, pp. 26-35

Influencing Factors of China-Australia Comprehensive Healthy Agricultural Products Trade

Jun CHEN, Chenyang Zhao*, Kaikai Liu, Xinyi Wang, Yiran Zhangan

Silc Business School, Shanghai University, Shanghai, China
*Corresponding Author

ABSTRACT. In the past ten years, the agricultural trade between China and Australia has developed rapidly. They are trustworthy and important agricultural trade partners. This article uses the GL index, co-integration analysis technology and trade gravity model to analyze the intra-industry trade level, changing trends and influencing factors of agricultural products between China and Australia. On the whole, China's intra-industry trade in agricultural products is relatively high while Australia's is relatively low. In terms of changing trends, the weighted intra-industry trade index showed a stable, upward trend, with little fluctuation, and only a slight decline during the year. From the perspective of influencing factors, there is a positive co-integration relationship between economies of scale and the intra-industry trade index, while there is a reverse relationship between the income gap and the intra-industry trade index, and the relationship between trade openness and co-integration is not obvious.

KEYWORDS: Comprehensive health agricultural products, Trade complementarity, Trade potential

1. Introduction

Since the establishment of diplomatic relations between China and Australia in December 1972, the path of economic and trade cooperation between the two countries has been continuously widened and the level has been improved year by year. At present, China is Australia's third largest agricultural product export market, after Japan and the United States; Australia is the fourth largest source of imported agricultural products in China after the United States, Argentina, and Brazil. Although the agricultural trade between China and Australia fluctuated during the period, the overall trade volume showed an upward trend. Since 1996, bilateral agricultural trade has grown at an annual rate of 9.97%. By 2009, the total agricultural trade between China and Australia reached 1.537 billion U.S. dollars, of which China imported agricultural products from Australia totaled 984 million U.S. dollars and China exported agricultural products to Australia totaled 553 million U.S. dollars; the development of Australian agriculture was unique and competitive Strong, as of the 2008-2009 fiscal year, its agricultural population reached 318,000, and the fishing population reached 99,000, with output values of 45.162 billion Australian dollars and 2.183 billion Australian dollars respectively. Many of its agricultural products occupy a pivotal position in the world, such as beef, lamb, wheat And wool; at the same time, big health products are very active in the trade between the two countries. In 2009, China's exports to Australia reached 53.9 million U.S. dollars, and imports from Australia reached 23.94 million U.S. dollars in the same period, 13 times and 4.4 times that of 1996 This shows that the trade in big health products between the two countries is growing rapidly and there is still great potential for expansion in the future. In addition, China's export volume to Australia relying on the advantages of labor-intensive agricultural products has also increased year by year, and the number and grade of trade commodities are gradually increasing. This development will inevitably have an important impact on the distribution of trade interests and the welfare of the two countries. This requires an in-depth study of the agricultural trade between China and Australia from the perspective of intra-industry trade.

The past century has seen the rapid development of agriculture in Australia. Rural sector of this country is considered one of the most efficient around the world. Reeves (1990) estimated that rural exports could be a major driver of Australia's export income, accounting for over one-third of total export earnings. Particularly, in terms of its rural trade with China, Australia's total wine exports exceeded France for the first time in early 2019, ranking first on the list of major wine importers in China's market (Wine Australia 2019). It could be shown that achievements in the field of Australian agriculture trade have been remarkable. In recent years, there has been a new increasing interest in agriculture with the focus on its integration with Comprehensive Health (CH). This concept mainly emphasizes on people's clothing, food, housing and transportation, aimed at promoting self-health management as well as strengthening physical and mental health. In this industry, green agriculture can be regarded as a significant

  DOI: 10.23977/ICEBM2021007

component.

Recent concerns in health have heightened the need for green agricultural products. According to the latest research results released by Future Cubed (2019), consumers in various geographies are not satisfied with taking food only as energy source but trying to obtain products beneficial for their health. Therefore, the organic combination of agriculture and Comprehensive Health becomes increasingly prevailing globally. Such a new trend is probably due to the ongoing epidemic of 2019 Novel Corona virus, which poses a major threat to the global economy. Australian Comprehensive Health industry is also inevitably involved. However, the epidemic has given rise to consumer demand for healthy agricultural products even though it has curbed Australia's tourism and consumer's desire to purchase, leading to a severe decline in revenues and even bankruptcies of some offline stores. These healthy agricultural products, especially those working on improving immunity, have attracted unprecedented attention of consumers. Hence, it could be concluded that the epidemic brings considerable opportunities to the CH industry. In addition to the impact of the epidemic, the continuous improvement of disposable income as well as living standards will make the public pay more attention to health products and the consumption investment in health will increase correspondingly. Under these circumstances, it is predictable that demand for Comprehensive Health products will become one of the rigid demands. Moreover, the explosive growth of health demand also makes CH a promising industry, equipped with further growth potential and investment value. Therefore, it is of great significance to study the factors that will affect the trade between China and Australia with the focus on Comprehensive Health agricultural products.

This paper is organized in the following way. In the second section, a literature review based on government report, professional magazines and academic journals is presented. The third section is introducing research method and data collection. An empirical analysis to identify factors which may influence Sino-Australian trade in terms of Comprehensive Health agriculture is conducted in the following sections. The final section is about conclusions, together with recommendations for future research directions.

2. Literature Review

In order to describe the concept of Comprehensive Health as well as its current situation, study the influencing factors of CH trade volume between China and Australia, and put forward specific recommendations in respect of promoting the ongoing Sino-Australian trade, this section will use concepts of Comprehensive Health that had been demonstrated elsewhere and provide a theoretical basis for the growth of Sino-Australian trade with the focus on CH agriculture. This is followed by an analysis of impact on trade in terms of traditional trade and cross-border e-commerce, respectively. The section then establishes hypotheses on this theoretical basis.

2.1 Development Status of Comprehensive Health

Hu (2020) defined Comprehensive Health industry as the sum of the prevention, treatment and rehabilitation services provided to patients in the economic system, generally referring to medical and health services. According to GICS (2002), the health industry is specifically composed of five subordinate industries, namely health care suppliers, medical equipment, medical supplies, biotechnology, and pharmaceuticals. Furthermore, the is also a broad definition of it, basically covering both the direct needs of the industry like serving patients with health medicine products, and also derived needs for health service activities to non-patient groups in the economic field such as providing health care, public hygiene and big data of public health (Yang 2020). It is not only the extension of the traditional health industry chain, but also the integration of modern industries. Therefore, this broad concept seems to be more in line with the current social philosophy. Moreover, the health industry chain is aimed at health and longevity, including the entire social population and the whole life cycle. Hence, the all-encompassing CH industry chain completely could cover the individual's health development process from birth to death, which is worth digging from various angles.

In terms of the current situation, researchers have shown an increased interest in Comprehensive Health industry. The outbreak of COVID-19 epidemic has brought significant impact to the society over the world, leading to the rapid increase of the public’s health awareness. Due to this, Comprehensive Health industry ushered in a new round of growth dividend. Zhang (2020) analyzed from the perspective of market sales that health function has changed from meeting people's medical requirements to daily rigid demand. It can be predicted that even though after the epidemic, there will be an outbreak of delayed demand. Simultaneously, CH products demand will continue to be generated, which is likely to create a new round of growth. However, there is still a gap between developed countries and developing countries regarding the development status of Comprehensive Health industry. Hu (2020) concluded that the added value of CH industry accounts for more than 15% of GDP in developed countries in average, which is comparatively higher than the level of many developing countries. This means the development prospects of Comprehensive Health industry in developing countries is quite considerable. Hu (2020) applied China as an example. NBSPRC (2020) indicated that in the first half of 2019, the expenditure of health care consumption was 941 yuan per capita, accounting for 9.1% of total consumption expenditure. In the next five years (2019-2023), the rate of China's Comprehensive Health industry will be approximately 12.55%. By 2030, the scale of this market is expected to exceed 16 trillion, three times the current market.

As for the prospects of Comprehensive Health industry, implementing technological innovation could be an advanced research direction. Aceto et al. (2020) stated that production and services are completely changed because of *Industry 4.0*, characterized by its main enabling information and communication technologies. The term *Industry 4.0* is tracked back to a document disclosed by the German government that summarizes its high-tech strategy as *Industry 4.0* (Zhou et al. 2015). Comprehensive Health domain is already facing the influence of such advanced technologies in the industry, where the Cloud Computing and Big Data technologies are revolutionizing its entire e-health ecosystem, effectively putting it forward towards Healthcare 4.0 (Aceto et al. 2020). In particular, this kind of influence is especially true in the field of agriculture, which is one of the most significant areas in Comprehensive Health industry. A new extension way of agriculture has emerged that applies new social media including various kinds of apps, along with the evolution of portable mobile terminals and Internet information technology. Gao et al. (2020) found that this new extension technology could enhance the adoption level of farmers to a certain degree, therefrom making it beneficial to them.

2.2 Sino-Australian Agricultural Trade Growth and Reasons

According to statistics, Australia is China's largest exporter of agricultural products. For example, Australia exports about 1.5-20 billion Australian dollars of barley each year, and more than half of it is sold to China. In recent years, the trade volume of agricultural products between China and Australia has grown rapidly, and there are several proofs that this growth is mostly due to the growth of Australia’s exports to China. Li (2015) predicted through the GM (1, 1) model that the future growth rate of Australia's agricultural exports to China is greater than the growth rate of China's agricultural exports to Australia. From the perspective of export competitiveness, China's export competition effect on Australian agricultural products has gradually declined. Similarly, Meng (2018) concluded from the China-Australia Agricultural Products Trade G-L Index, which has a clear downward trend, that China's imports from Australia grows faster while exports slow. At the same time, China's agricultural trade with Australia has been in a state of deficit, which has led to the gradual increase of China's deficit.

As for the reasons for Sino-Australian agricultural trade growth, many documents confirm that the growth benefits from the complementarity of agricultural products on both sides. Tong (2016) analyzed the recent NCRA index, CI index and TII index of the two countries and believed that most of the agricultural products exported by China and Australia do not overlap; indicating that the agricultural products trade between the two countries is highly complementary. Yu et al. (2019) analyzed the similarity index and the TCI index and concluded that the grain export structure of China and Australia is less similar and more complementary. Especially for barley, the trade complementarity index of the two countries is high when Australia is the exporter. Moreover, Tong and Qi (2019) demonstrated that because of the difference in resource endowments and eating culture between China and Australia, the complementary products of the two countries are not mutually exclusive. It indicates that the enhancement of complementarity will continue in the future.

Except for the complementarity of agricultural products, the continuous improvement of the export structure is one of the important reasons as well. In fact, Noble et al. (2019) pointed out that the adjustment of agricultural structure is the main result of global deregulation and is the main reason for affecting Australia rural communities as well. As a result, the agricultural export structure in Australia has changed a lot. According to the GM (1, 1) model analysis, Tong and Qi (2019) stated that the growth of China’s imports of Australian agricultural products is being determined by the growth effect of Chinese agricultural product import demand to the effect of Australian agricultural products in China’s product structure. This shows that Australia's export structure for Chinese agricultural products has been more adaptable to changes in the scale of Chinese agricultural product import demand (Li 2015). There is no doubt that the influence of Australian agricultural products in the Chinese market is expanding.

In addition, the growth of agricultural trade is cyclical due to the growth cycle of crops. However, taking the wine industry belonged to the agricultural industry in Australia as an example, Anderson (2018) pointed out that the last boom was almost twice the average of the previous period, and the subsequent plateau or downturn was less than half. Overall, the Australia's wine export volume and value grew in the last trade cycle compared with the previous period. It reflects that the growth of Australia’s export trade to China is no longer related to the month, but to the agricultural products exported and the trade structure. Therefore, this trade growth is currently an inevitable trend for China and Australia.

2.3 Influence of Trade Modes on Sino-Australian Agricultural Trade Growth

To analyze the growth trend of China-Australia trade, it is necessary to analyze all trade data between two countries.

However, due to the rise of cross-border e-commerce, trade between China and Australia is not only through the traditional trade model anymore which might cause slight errors in data. Warf (2013) listed several disadvantages of traditional trading methods, such as high cost, long time consumption, slow information transmission and large fluctuations in transaction prices etc. Therefore, cross-border e-commerce has obvious advantages over traditional international trade in terms of market mechanisms or trading methods. Yang and He (2019) considered that the cross-border e-commerce could promote changes in the import and export trade model, business model and management methods. Overall, reflects from the side that the continuous development and proportion of cross-border e-commerce in the import and export trade model has continued to rise in recent years.

In addition, Li (2018) pointed out that as cross-border e-commerce can meet people's actual pursuit of high-quality life, China will become the country with the most imported food and the largest consumption, which will gradually increase the import and export of agricultural products. From the perspective of Australia, Swisse, a natural health brand from Australia, indicated that it combines cross-border e-commerce and general trade with each other providing more chooses for customers as well (Chen et al. 2019). Therefore, it is necessary to identify which trade model leads to the trade growth when analyzing data of different trade modes.

In response to the rapidly growing international trade worldwide, WCO created and managed HS. By using HS codes, it is expected to standardize trading products by codes, descriptions, quantity units and classification obligations (Ding et al. 2015). In general, looking up the date of different products' trade volume is based on the HS code. Overall, Zheng (2011) demonstrated that the accuracy of the classification has a significant impact on the business of the commodity management model, the application of inspection standards, billing, tax calculation, statistics, and other aspects. Depending on whether the coding is classified into a traditional trade model or a cross-border e-commerce, customs declaration method and the tax rate will be different. As for the trade statistics between China and Australia, different ways of categorizing trade commodities affect the import and export value of each sector, furthermore, resulting in undervalued or overvalued trade.

However, when collecting data, the trade products are often distinguished by the HS codes, where there is the risk of categorization. Ding et al. (2015) showed that about 30% of declarations submitted use the wrong HS code through the trade studies. This clearly shows that accurate HS classification can be a very challenging task. Because different commodities and different classification standards intersect with each other. Specifically, the same type of commodities may belong to different standards while the same standard could involve multiple different commodities (Liu & Wang 2014). In addition, Zheng (2011) stated that some commodities, especially agricultural products, may secretly classify the wrong HS code because they fail to meet the inspection standards.

Based on the existing literature research, it can be found that the research on Sino-Australian agricultural trade is relatively mature and involves many empirical processes. However, from a more macro perspective, the status quo and trend of the emerging comprehensive health industry between China and Australia have not been systematically studied and conclude. On the other hand, some detailed factors of Sino-Australian trade growth trend have not been comprehensively covered in existing literature neither. Therefore, this research will attempt to analyze the impacts of monthly variances and HS codes on Sino-Australian agricultural trade, based on the data of several representative agricultural products' trade volume between China and Australia.

3. Empirical Research on the Intra-Industry Trade of Agricultural Products between China and Australia

3.1 Calculation of China-Australia Intra-Industry Trade Index

Based on the Grubel-Lloyd index, this article analyzes the development and changes in the intra-industry trade in agricultural products between China and Australia, with a time span of 2007-2019. The results are as follows:

Table 1 g-L Index of Intra-Industry Trade of Various Agricultural Products between China and Australia

G-L index	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	平均值
hs 01	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
hs 02	0.0000	0.0040	0.0000	0.0096	0.0040	0.0059	0.0474	0.0003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0055
hs 03	0.8726	0.4603	0.4723	0.5804	0.5309	0.6822	0.8508	0.7801	0.6838	0.6770	0.6124	0.8279	0.7530	0.6757
hs 04	0.0562	0.0607	0.0659	0.0558	0.0649	0.0606	0.0400	0.1229	0.0625	0.0525	0.0552	0.0476	0.0539	0.0614
hs 05	0.2969	0.2854	0.2561	0.4069	0.2570	0.2356	0.3152	0.2746	0.0713	0.2096	0.3858	0.2390	0.3035	0.2721
hs 06	0.5307	0.9100	0.4853	0.9218	0.1252	0.3448	0.3642	0.8239	0.1253	0.2394	0.1125	0.0171	0.0557	0.3889
hs 07	0.4196	0.8387	0.1698	0.1372	0.3626	0.4002	0.3668	0.1615	0.1711	0.0757	0.0481	0.0303	0.0510	0.2487
hs 08	0.2000	0.2246	0.2499	0.6146	0.6591	0.5501	0.4785	0.6021	0.8024	0.7237	0.6372	0.6869	0.6498	0.5445
hs 09	0.1728	0.0952	0.2293	0.0855	0.1002	0.1440	0.2134	0.3720	0.3030	0.3671	0.2610	0.2469	0.1972	0.2144
hs 10	0.0004	0.0008	0.0011	0.0013	0.0015	0.0014	0.0012	0.0172	0.0024	0.0007	0.0017	0.0176	0.0345	0.0063
hs 11	0.5898	0.5090	0.4109	0.1343	0.0396	0.0475	0.1156	0.5646	0.4972	0.8750	0.7717	0.9065	0.5791	0.4647
hs 12	0.0541	0.3984	0.2059	0.0781	0.0388	0.1250	0.1021	0.9705	0.9969	0.5779	0.9083	0.7187	0.7490	0.4557
hs 13	0.5670	0.1157	0.2708	0.1390	0.3344	0.1699	0.0988	0.2257	0.5926	0.1358	0.1966	0.0905	0.0892	0.2328
hs 14	0.1245	0.0283	0.0248	0.0103	0.1919	0.2214	0.4887	0.5263	0.5690	0.0704	0.1314	0.0000	0.0027	0.1838
hs 15	0.0772	0.1569	0.1797	0.1323	0.0615	0.0418	0.0543	0.0503	0.0474	0.0723	0.0632	0.0466	0.0350	0.0783
hs 16	0.1666	0.4779	0.1319	0.1648	0.1684	0.0936	0.0240	0.0170	0.0373	0.0295	0.0132	0.0206	0.0923	0.1106
hs 17	0.0131	0.0332	0.1095	0.0935	0.1715	0.1025	0.1907	0.6598	0.5383	0.3937	0.7140	0.9315	0.3238	0.3288
hs 18	0.1458	0.1194	0.3687	0.6333	0.6566	0.3560	0.3156	0.4818	0.1508	0.9623	0.3207	0.3468	0.2000	0.3891
hs 19	0.1338	0.0817	0.0963	0.1667	0.2667	0.3326	0.4585	0.5540	0.5630	0.4741	0.4778	0.5866	0.7820	0.3826
hs 20	0.0790	0.0677	0.0715	0.0639	0.1278	0.1521	0.1094	0.0645	0.0827	0.0713	0.0479	0.0505	0.0201	0.0776
hs 21	0.7373	0.5461	0.3662	0.4458	0.6509	0.4615	0.4715	0.2876	0.2824	0.3923	0.4791	0.4298	0.3797	0.4562
hs 22	0.8220	0.9029	0.6715	0.6346	0.7783	0.7310	0.8636	0.9888	0.7592	0.5955	0.3281	0.2697	0.4654	0.6777
hs 23	0.0400	0.0747	0.0410	0.1672	0.1066	0.3861	0.5177	0.3367	0.1669	0.1428	0.1132	0.4946	0.7180	0.2543
hs 24	0.0000	0.0000	0.0138	0.0043	0.0069	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0019
hs 41	0.0118	0.0016	0.0482	0.0155	0.0091	0.0009	0.0019	0.0044	0.0013	0.0017	0.0081	0.0071	0.0010	0.0087
hs 51	0.0000	0.0046	0.0011	0.0021	0.0002	0.0001	0.0001	0.0002	0.0001	0.0002	0.0001	0.0001	0.0001	0.0007
hs 52	0.0004	0.0001	0.0000	0.0000	0.0005	0.0000	0.0002	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0001

Data source: calculated according to UNCOMTRADE data

Table 1 is the intra-industry trade index of various agricultural products between China and Australia in 2007-2019. In the 13 years, most of the years of intra-industry trade index around 0.5 are HS03 (fish, crustaceans, mollusks and other aquatic invertebrates), HS08 (edible fruits and nuts; melon or citrus fruit peel), HS11 (milling industry products) and HS22 (beverage wine and vinegar), indicating that these types of agricultural products are mainly based on intra-industry trade in Sino-Australian trade; the intra-industry trade index has been lower than 0.5 over the years. HS01 (live animals), HS02 (meat and food offal), HS04 (dairy; eggs; natural honey; other food animals), HS05 (other animals), HS09 (coffee, tea and flavorings), HS10 (cereals)), HS15 (animal vegetable fats; waxes and edible fats), HS16 (fish, crustaceans, and other aquatic invertebrate products), HS20 (vegetables, fruits, nuts or other parts of plants) , HS24 (tobacco, tobacco and tobacco substitute products), these ten types of agricultural products in the Sino-Australian trade in recent years are mainly inter-industry trade, of which HS01 (live animals) is a complete inter-industry trade, China only Imports are not exported, and the three categories HS02 (meat and edible offal), HS10 (cereals), HS24 (tobacco, tobacco and tobacco substitute products) are also close to complete inter-industry trade; In terms of average value, those with an average intra-industry trade index above 0.5 accounted for 3 of the 24 categories (HS03, HS08, HS22), indicating that in China-Australia agricultural trade, agricultural products mainly based on intra-industry trade There are relatively few types, mainly inter-industry trade. Among these three categories, HS03 (fish, crustaceans, and aquatic invertebrates) has a high intra-industry trade index. Except for the 08 and 09 years, the index is below 0.5, and the remaining years are all at 0. Above 5, the index fluctuations in the past years are not large, and the average value in 13 years has reached 0.6757, indicating that China and Australia have active intra-industry trade in aquatic products, because China and Australia have large production types of aquatic products. The difference is that Australia's aquatic products are mainly tropical fish, and China's aquatic products are mainly temperate fish; at the same time, with the rapid development of China's economy, domestic consumers have higher requirements on the nutritional value and variety of food, which is effective This has stimulated the development of intra-industry trade in major health products between China and Australia. This phenomenon is fully consistent with the interpretation of intra-industry trade by product differentiation theory. The export of big health products in China and Australia shows a big difference in product types, which are highly complementary, and there is still some room for trade expansion in complementary products. Therefore, the two sides trade big health products conditions are very favorable. It shows that there is still room for further improvement in the intra-industry trade of China-Australia health products.

Table 2 2007-2019 China-Australia Agricultural Products Intra-Industry Trade Index Simple Average and Weighted Average

G-L index	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Simple average	0.2264	0.2370	0.1830	0.2111	0.2117	0.2091	0.2404	0.3291	0.2780	0.2645	0.2477	0.2597	0.2421
Weighted average	0.0248	0.0416	0.0478	0.0527	0.0407	0.0499	0.0596	0.0866	0.0558	0.0653	0.0679	0.0800	0.0993

Data source: calculated according to UNCOMTRADE data

The data in Table 2 shows that, overall, the China-Australia intra-industry trade index has been far below 0.5, indicating that China-Australia's overall intra-industry trade is still very low and still has great potential for development. At the same time, the simple average intra-industry trade index is greater than the weighted average index, indicating that agricultural products with a high intra-industry trade index account for a small proportion of China-Australia bilateral trade, and the trade volume of agricultural products in the category with a low intra-industry trade index accounts for a large proportion. The development of trade in agricultural products of various varieties is very uneven. From the change trend, the overall agricultural intra-industry trade index of the two countries showed a clear trend, and the weighted intra-industry trade index showed a steadily increasing trend, with little fluctuation, only a slight decline from 2014 to 2015, but then until 2019 Years are showing an increasing trend year by year.

3.2 Empirical Analysis of Influencing Factors of Intra-Industry Trade in Agricultural Products between China and Australia

3.2.1 Model Construction and Selection of Variables

Based on the above-mentioned calculation of the China-Australia agricultural intra-industry trade index, and considering the availability of data, this paper mainly selects the variables of economic scale, economic scale difference, per capita income difference, and the degree of openness to China-Australia agricultural intra-industry trade. Empirical analysis of the influencing factors, variable definitions and prediction symbols are shown in Table 3.3.

Table 3 Variable Definitions And Prediction Symbols

Explanatory variables and abbreviations	Openness of trade (X1)	Per capita income difference (X2)	Economic scale difference (X3)	Economic scale (X4)
Variable meaning	Total foreign trade as a percentage of GDP	The absolute value of the difference between the gross national incomes of the two countries	The absolute value of the difference between the GDP of the two countries	The average of the sum of the GDP of the two countries
Theoretical prediction symbol	+	-	-	+

According to the selected variables, we establish a multivariate linear model, Y represents the China-Australia agricultural industry intra-industry trade index, and the regression equation is set as follows:

$\ln Y = C + a\ln X1 + b\ln X2 + c\ln X3 + d\ln X4 + u_t$

3.2.2 Empirical Analysis Process and Conclusion

According to the selected time series data, using STATA software, the least square method is used to perform regression analysis on the above equation. The process is as follows:

(1) Stationary test of variables

Because taking the natural logarithm of the data does not change the co-integration relationship of the original variables, and can linearize the trend of the variables, thereby eliminating the problem of heteroscedasticity in the time series data, the natural logarithm transformation is performed on all variables, which is recorded as ln Y, ln X1, ln X2 and ln X3, ln X4, before the co-integration test of each variable, we must ensure that the variables are of the same order stability, so we first use the ADF test method to perform unit root test to determine the stability of each variable Sex. The ADF test includes a regression equation. On the left is the first-order difference term of the sequence, on the right is the first-order lag term and lag difference term of the sequence, and sometimes there are constant term and time trend term. There are three options when performing ADF inspection. The first is whether a constant term is included in the regression, the second is whether a linear time trend is included in the regression, and the third is how many lag difference terms should be included in the regression. The output of the ADF test includes the ADF statistic of the coefficient of the lag variable and the critical value required for the test. If the coefficient is significantly non-zero, but less than zero, then the hypothesis that the variable contains unit roots will be rejected, thus accepting the stationary alternative hypothesis. If the ADF statistic is negative and the absolute value is large, the unit root hypothesis is rejected to indicate that the series is stationary. After the ADF test, the actual regression equation needs to be tested, and if necessary, the test should be re-tested by adding or deleting constant terms and trend terms. At the same time, if the value of the ADF statistic is greater than the reported critical value, the assumption of non-stationery and unit root cannot be rejected. The sequence may be non-stationary, and it is necessary to further test whether the sequence is I (1) (first-order single integer) or Higher order rounding until it is stable. The results of stationarity test are shown in Table 4.

Table 4 Variable Stationarity Test

variable	Inspection type	A DF statistics	Critical value at 10% significance level	DW value	Stationarity
LN Y	(C, 0, 3)	−0 . 325885	−2. 7822	2 . 507203	unstable
∠LN Y	(C, 0, 3)	−2 . 670921	−2. 8169	2 . 022036	unstable
∠²LN Y	(0, 0, 3)	−3 . 167349	−1. 6415	2 . 940273	stable
LN X1	(C, 0, 3)	−2 . 649180	−2. 7822	2 . 430897	unstable
∠LN X1	(C, 0, 3)	−0 . 257102	−2. 8169	1 . 574552	unstable
∠²LN X1	(C, T, 3)	−7 . 739885	−3. 628	2 . 113569	stable
LN X2	(C, 0, 3)	−0 . 224653	−2. 7822	1 . 707847	unstable
∠LN X2	(C, T, 3)	−3 . 202106	−4. 1961	2 . 871395	unstable
∠²LN X2	(C, T, 3)	−2 . 520729	−2. 864	2 . 628248	stable
LNX3	(C, 0, 3)	1.419446	−2. 7822	2 . 218630	unstable
∠LN X3	(C, T, 3)	0.853907	−4. 1961	2 . 005454	unstable
∠²LN X3	(C, T, 3)	−9 . 349373	−3. 628	2 . 861837	stable
LN X4	(C, 0, 3)	5.431868	−2. 7349	1 . 440196	unstable
∠LN X4	(C, 0, 3)	−0 . 051755	−3. 335	2 . 067409	unstable
∠²LN X4	(C, 0, 3)	−2 . 537682	−2. 864	2 . 500471	stable

Note: ∠² represents the second-order difference operator; C, T, and L in the test form (C, T, L) represent unit root test equations including time intercept term, trend term, and lag divisor; The trend term, c means that the tested model has the intercept term, 0 means there is no trend term; the number corresponding to the lag divisor indicates the lag order. L represents the lag order used in the test. The lag term is added to make the residual term white noise.

It can be seen from Table 4 that the horizontal sequences of variables ln Y, ln X1, ln X2 and ln X3, ln X4 cannot reject the unit root hypothesis, indicating that there is a unit root, so their horizontal sequences are all unstable; and their one Second-order difference sequences cannot reject the unit root hypothesis, indicating that the first-order difference sequences are not stationary; while their second-order difference sequences reject the unit root hypothesis, indicating that the original sequence second-order difference sequences do not have a unit root, so their second-order The difference sequences are all stationary, that is, all I (2) sequences. Since the cointegration relationship only exists between time series of the same order and single integer, we judge that there may be a cointegration relationship between ln Y, ln X1, ln X2 and ln X3, ln X4.

(2) Co-integration test and analysis

If the variables involved are all second-order differential stationary [I (2)], and some linear combination of these variables is stationary, it is said that there may be a cointegration relationship between these variables, which reflects the variables studied There is a long-term stable equilibrium relationship. In this paper, the EG two-step method based on regression residuals is used to test the co-integration relationship of variables that follow the same order single integer. First, multiple linear regression is performed on each variable, and the results are as follows:

$\ln y = - 19 .38402 - 0 .323030 \ln x1 - 0.489641 \ln x2 + 0 .772156 \ln x3 - 0 .010257 \ln x4$

$t = (-1 .743991) (-0 .652810) (-0.531338) (0 .894049) (-0 .006965)$

$R^2 = 0 .829255$

$F = 9 .713399$ D W =1 .994691

By performing regression on each variable and testing the stationarity of the residual sequence, it can be seen from Table 5 that the residual sequence is stationary and the cointegration relationship holds.

Table 5 Unit Root Test of Residual Sequence

A DF Test Statistic	-2.829191	1 % Critical Value*	-2 .8270
		5 % Critical Value*	-1 .9755
		10 % Critical Value*	-1.6321

From the results of equation estimation, the coefficient of determination is 0.829255, and the model fit is ideal. At the same time, DW = 1.994691, which is close to 2, so there is no autocorrelation, but it can be seen that although R2 is higher, but The values of t are not significant, and the signs of some variables do not match the predicted values, so we perform multiple collinearity tests for each explanatory variable, and determine the severity of legal multicollinearity based on simple correlation coefficients.

Table 6 Examination Variable Multicollinearity Test

	LN X1	LN X2	LN X3	LN X4
LN X1	1 .00	0 .464557	0 .875364	0 .884595
LN X2	0 .464557	1 .00	0 .554516	0 .684480
LN X3	0 .875364	0 .554516	1 .00	0 .980105
LN X4	0 .884595	0 .684480	0 .980105	1 .00

From Table 6, the correlation coefficient of ln X3 and ln X4 is 0.98, which is close to a completely linear correlation, but we know that multicollinearity is not a problem of existence or not, but only a degree problem, so we are considering the set model On the premise that the accuracy does not seriously damage the integrity of the model, the variable ln X3 is eliminated, and then the remaining variables are co-integrated. The regression model is as follows:

ln y = - 26 .68824 - 0 .521617ln X1 - 1 .1864991ln X2 +1 .270347ln X4

t = (-3 .581580) (-1 .193036) (-2 .440868) (3 .753548)

It can be seen from Table 7 that through the unit root test of its residual sequence, it is found that its residual sequence passes the stationarity test, and it can be known that there is a cointegration relationship among the variables.

Table 7 Unit Root Test of Residual Sequence

A DF Test Statistic	-2.725897	1 % Critical V alue*	-2 .9075
		5 % Critical V alue*	-1.9835
		10 % Critical V alue*	-1 .6357

From the estimation results of the equation, the coefficient of determination is 0.812195, the model fit is ideal, DW = 1.928957 is close to 2, so there is no autocorrelation, and the t value of each variable is also significant. According to the regression results of the model, the following conclusions can be drawn: the scale of the economy has a greater impact on the development of bilateral intra-industry trade. For each 1% increase in the average GDP between China and Australia, intra-industry trade will increase by about 1.27 percentage points. The expansion of the market scale is conducive to the development of China-Australia bilateral intra-industry trade, which also fully validates the theory of economies of scale. The difference in income levels between the two countries has a negative impact on bilateral agricultural intra-industry trade. For every 1% increase in the income gap, intra-industry trade will decrease by about 1.19%. There is relatively little overlap in the demand structure, which in turn leads to a low level of intra-industry trade, which is also fully in line with the theory of demand preference similarity; as for the sign of variable trade opening to the outside world does not match the predicted value, considering the degree of protection of agricultural products trade Higher, such as agricultural product protection policies, technical trade barriers, etc., so the openness of foreign trade does not really reflect the openness of agricultural trade, there are data distortions, so the sign does not match the theoretical prediction.

(3) Granger test and analysis

From the results of the cointegration test, we know that there is a long-term equilibrium relationship between the intra-industry trade between China and Australia's agricultural industry, economic growth, economic scale, per capita income, and openness to the outside world. How to do this still needs further verification. This paper uses Granger's causality test to solve this problem. The test results are shown in Table 8.

Table 8 Granger Causality Test Results

Null Hypothesis	Lags	F-Statistic	Probability
LN X1 does not Granger Cause LN Y	1	3 . 68438	0 . 08713
LN Y does not Granger Cause LN X1	1	2 . 29428	0 . 16415
LN X2 does not Granger Cause LN Y	2	0 . 22060	0 . 80827
LN Y does not Granger Cause LN X2	2	19.4448	0 . 00239
LN X4 does not Granger Cause LN Y	3	5 .46283	0 .09839
LN Y does not Granger Cause LN X4	3	1 .45821	0 .38202

According to Table 8, it can be seen that: (1) At a significant level of 10%, trade openness is the Granger reason for China-Australia ’s intra-industry trade in agricultural products, indicating that increased trade openness will help China-Australia ’s intra-industry trade Carry out, not the other way around, and there is no mutual cause and effect. (2) At a significant level of 10%, the difference between the gross national income per capita of the two countries and the industry trade in agricultural products between China and Australia are not Granger causal. (3) At a significance level of 10%, the GDP of the two countries is the Granger reason for Sino-Australian agricultural industry trade, indicating that the economic growth of the two countries has promoted the development of bilateral agricultural industry trade, not the other way around.

4. Conclusions and Recommendations

Empirical analysis shows that from the overall level, the level of intra-industry trade in agricultural products between China and Australia is relatively low, and the agricultural products of both sides are highly complementary. Inter-industry trade is the mainstay. In terms of sub-categories, HS03, HS08, and HS22 chapters have higher intra-industry trade levels, and most of the remaining categories of products are relatively low, while HS01, HS02, HS24, HS51, HS52 have been close to complete inter-industry trade over the years. From the change trend, the overall weighted intra-industry trade index of the two countries showed a steadily increasing trend, with little fluctuation in the past years, only a slight decline in 2014, but then it showed an increasing trend year by year until 2019. From the perspective of influencing factors, economies of scale have made a large contribution to the intra-industry trade of agricultural products between China and Australia, and have a positive correlation, while the income gap has a negative impact on the intra-industry trade of agricultural products between China and Australia. Has little effect on it.

In the future, China should pay attention to three points in the agricultural products trade with Australia. First, continue to play the role of superior agricultural products, and actively expand the labor-intensive and processed agricultural products market. Although Australia's agriculture is highly developed, there are many agricultural products in China that have a strong comparative advantage for Australian exports. Compared with Australia, China is rich in labor resources and food processing industry is also relatively developed, China has (HS22), meat and aquatic products (HS16), other plant products (HS14) and fruit and vegetable products (HS20), HS13, etc. With a strong comparative advantage, Chinese companies can open up more space in these agricultural products. Second, Australia has strict technical barriers to agricultural products, which to a large extent hinders the export of agricultural products from China to Australia. China is mainly affected by fruits, vegetables and some cash crops, and these are China's advantageous exports to Australia. From this point of view, in the future, China should strengthen research on Australia's agricultural-related environmental laws and regulations, technical standards and restrictions, and pay attention to changes in this information at any time, so as to make China's agricultural products export meet Australian requirements and reduce Chinese agricultural products' entry into the Australian market. In addition, China should also step up the agricultural production standard system that is in line with international standards, and use the system and mechanism to control and improve the quality and quality of China ’s agricultural products from planting to deep processing. In aquatic products, we should take the path of sustainable development of aquaculture, avoiding the vicious circle of destroying the ecological environment and reducing the quality of aquaculture products in pursuit of immediate benefits. Specific measures include the establishment of a strict aquaculture management system, starting with aquaculture permits and farm inspections to ensure sustainable farming and gain market share from a long-term perspective. Fundamentally cross the obstacles of non-tariff barriers. Third, the overall level of intra-industry trade in agricultural products between China and Australia is low, but they are highly complementary and have a good basis for intra-industry trade. Compared with China, Australia has a higher degree of mechanization, specialization, and intensive agricultural production. China will strengthen exchanges and cooperation with each other in the agricultural field in the future, through the introduction and promotion of new varieties and advanced production and processing technology for deep processing of agricultural products, transform China's trade model of mainly exporting low-value-added products and increase the proportion of high-value-added agricultural products in the intra-industry trade between the two countries.

References

[1] Chen Qiuyan, Tan Lu, Xiao Pang. Swisse China Executive President A Yuting Chinese Opportunities for Australian Health Products. 21st Century Business Review, No.04, pp.20-21, 2017.

[2] Hu Jing. The vigorous road of big health industry [N]. Journal of Social Science, 2 April 2020 (004).

[3] National Bureau of statistics of the People's Republic of China, Annual report 2019 of National Healthcare Security Administration, viewed 2 June 2020, < http://www.stats.gov.cn/ >.

[4] Noble K., Dennis T., Larkins S. Agricultural Development in Northern Australia. In: Agriculture and Resilience in

Australia’s North. Springer, Singapore, 2019.
[5] Standard & Poor's, Morgan Stanley, Global Industry Classification Standard (GICS), Poor’s Press, New York, 2002.