Changes in Net Barter Terms of Trade for Sino-Australian Agricultural Products after China's Accession to the WTO

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Abstract Using "chain-based and constant-based" two-step method, this paper measured Paasche net barter terms of trade index for Sino-Australian agricultural products from 2001 to 2013, and further calculated contribution of each category of agricultural products to changes in overall net barter terms of trade. The results showed that since 2001, the overall net barter terms of trade for Sino-Australian agricultural products fluctuated between deterioration and improvement. In 2013, the net barter terms of trade index was 1.02, and its improvement is not significant. From 2001 to 2013, the net barter terms of trade for Sino-Australian agricultural products improved about 16.44%, which dominated by the category 0 agricultural products whose influence degree is 6 times and 28 times the degree of category 4 and category 1. In years when the net barter terms of trade for Sino-Australian agricultural products deteriorated, category 2 agricultural products were the root cause for the deterioration.

Key words Sino-Australian, Agricultural products, Net barter terms of trade, Export price index, Import price index

1 Introduction

After accession to the WTO, with tariff concession and removal of non-tariff barriers, Sino-Australian agricultural products trade develops rapidly. According to UN Comtrade data, total volume of Sino-Australian agricultural products trade has risen from 1.573 billion USD in 2001 to 10.318 billion USD in 2013, increasing about 5.56 times. Also, China has become the third largest agricultural products importer of Australia, following New Zealand and the United States, while Australia becomes the fourth largest agricultural products importer of China following the United States, Brazil, and Canada. In the mean time, China and Australia actively promote bilateral free trade area construction. On June 17, 2015, China and Australia formally signed the free trade agreement. According to the agreement, China reduces tariffs for part agricultural products export to Australia, while Australia implements tariff reduction for all agricultural products exported to China. It means that bilateral agricultural products trade will be further opened. In this context, we discussed changes in net barter terms of trade for Sino-Australian agricultural products after China's accession to the WTO and analyzed causes for changes, to provide reference for future adjustment and development of bilateral agricultural products trade.

2 Method and data

2.1 Calculation of net barter terms of trade Net barter terms of trade index is calculated as the parity between volume of export and import, and it reflects import capacity of unit product. To make the net barter terms of trade accurately reflect changes in terms of trade for Sino-Australian agricultural products, we calculated its index with reference to "chain-based and constant-based" two-step method of Wu Dantao and Chen Ping (2011).

Step 1: calculate Sino-Australian agricultural products import and export price index of each year compared with previous year using Paasche price index by "chain-based" method. The calculation formula is as follows:

$$P_x^t = \sum_{i=1}^{n} p_{ix}^t q_{ix}^t / \sum_{i=1}^{n} p_{ix}^{t-1} q_{ix}^t$$

$$P_m^t = \sum_{i=1}^{n} p_{im}^t q_{im}^t / \sum_{i=1}^{n} p_{im}^{t-1} q_{im}^t$$

where P_x^t and P_m^t denote the export and import price index in the period t respectively; P_{ix}^t and P_{im}^t signify the export and import price of the i-th agricultural products in the period t separately; P_{ix}^{t-1} and P_{im}^{t-1} denote the export and import price of the i-th agricultural products in the period t-1 separately; q_{ix}^t and q_{im}^t denote the quantity of the i-th agricultural products in the period t separately; n is number of kinds of agricultural products.

Step 2: convert the import and export price index with a certain year as base period using"constant-based" method, then with the base period's export price index divided by the import price index, the net barter terms of trade index is obtained. The calculation formula is as follows:

$$P_x^{t'} = P_x^t / P_x^0 \times P_x^{t-1'}$$

$$P_m^{t'} = P_m^t / P_m^0 \times P_m^{t-1'}$$

$$NBTT^{t'} = P_x^{t'} / P_m^{t'}$$

where $P_x^{t'}$ and $P_m^{t'}$ denote adjusted export and import price index in the period t; $NBTT^t$ is comparable net barter terms of trade index.

2.2 Calculation of factors for changes in net barter terms of trade To study influence of each category of agricultural products on changes in overall net barter terms of trade, with reference to ideas and methods of Jarita (2011) and Zhao Xiaomei (2013), we believed that it depends largely on trade share of the agricultural products and amplitude of changes in net barter terms of trade for this category. The calculation formula is as follows:

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$$CVNBTT_j = TS_j \times deltNBTT_j$$

where $CVNBTT_j$ signifies influence degree of category j agricultural products on changes in overall net barter terms of trade. If this value is consistent with the direction of changes in overall net barter terms of trade, the higher absolute value, the higher influence degree of this category on changes in overall net barter terms of trade. On the contrary, if this value is opposite to the direction of changes in overall net barter terms of trade, the higher absolute value, the lower influence degree of this category on changes in overall net barter terms of trade; TS_j signifies trade share of category j agricultural products, the proportion of total volume of import and export of this category to the total products; $deltNBTT_j$ denotes degree of changes in net barter terms of trade for category j agricultural products, the change rate of net barter terms of trade compared with previous year.

2.3 Data description All data were selected from UN Comtrade database with China report data as basis. As per SITC Rev. 3 three digit code classification, agricultural products are divided into 4 categories: category 0 (food and live animals) involves 36 kinds of agricultural products; category 1 (beverages and tobacco) involves 4 kinds of agricultural products; category 2 (crude materials, inedible, except fuels) involves 22 kinds of agricultural products after excluding section 27 and section 28; category 4 (animal and vegetable oils, fats and waxes) involves 4 kinds of agricultural products. Finally, we selected volume and quantity of import and export of 66 kinds of agricultural products between China and Australia form 2000 to 2013, and excluded those kinds of agricultural products whose trade quantity is unavailable with the 2001 as the base period.

3 Analysis on changes in net barter terms of trade

3.1 Net barter terms of trade for Sino-Australian agricultural products fluctuated between deterioration and improvement From Fig. 1, the export price index of Sino-Australian agricultural products has been stably rising since 2001, and it has risen to 1.93 in 2013. By contrast, the import price index rose with fluctuation and it remained at 1.9 after three rounds of increase and reduction in 2006, 2009, and 2012. Because the import price index is generally manifested as fluctuation around the export price index, the net barter terms of trade index fluctuates always at the base period level. The changes of net barter terms of trade since 2001 can be divided into three periods of "deterioration-improvement": (i) from 2001 to 2006, the net barter terms of trade for Sino-Australian agricultural products dropped from 1.00 in 2001 to 0.83 in 2003 and then rose to 1.12; (ii) from 2006 to 2009, the net barter terms of trade dropped to 0.86 in 2008 and rose to 1.18 in 2009; (iii) from 2009 to 2013, the net barter terms of trade dropped to 0.87 in 2011, and later slightly rose, but only kept at the level of 1 in 2012 and 2013, which was equivalent to the level in 2001. On the whole, the net barter terms of trade for Sino-Australian agricultural products fluctuated between deterioration and improvement. The situations were improved in 2013 compared with 2001, but the improvement trend was not significant.

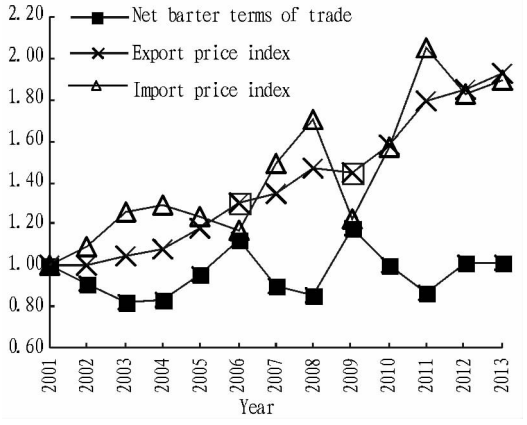

Fig. 1 Changes in net barter terms of trade for Sino-Australian agricultural products

3.2 Net barter terms of trade for Category 0 agricultural products rose with fluctuation and net barter terms of trade was slightly improved From Fig. 2, we know that the export price index of Category 0 agricultural products kept rapid rising trend since 2001 and it reached 1.99 in 2013. Comparatively speaking, the import price index rose with fluctuation but the rising amplitude was relatively gentle. The import price index rose from 1.00 in 2001 to the peak value 1.54 in 2008, but sharply dropped to 1.17 in 2009, and later it slowly rose to 1.36 in 2013. Because the export price index of Category 0 agricultural products is significantly higher than the import price index, the net barter terms of trade generally takes on the trend of rising with fluctuation. In 2013, it reached 1.47 and the net barter terms of trade was slightly improved. In addition, only in 2008 the net barter terms of trade was lower than the level of base period, being 0.96.

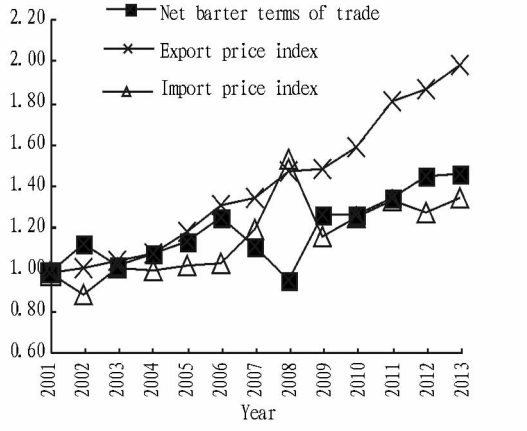

Fig. 2 Changes in net barter terms of trade for Category 0 agricultural products

3.3 Net barter terms of trade for Category 1 agricultural products declined with fluctuation and net barter terms of trade was deteriorated From Fig. 3, it is known that the export price index of Category 1 agricultural products gently rose from

1.00 in 2001 to 2.14 in 2012, and dropped to 1.50 in 2013. There was great fluctuation in the import price index. It rose from 1.00 in 2001 to 2.08 in 2005; then experienced rapid drop to 0.95 in 2006 and 1.75 in 2009; later, it continued to rise to 3.90 in 2013. Because the import price index of Category 1 agricultural products is higher than the export price index, the net barter terms of trade dropped with fluctuation. It firstly dropped from the base period to 0.55 in 2005, then it rose to two peaks, 1.33 in 2006 and 0.98 in 2010 respectively; later, it continued to drop to the lowest level 0.38 in 2013, showing the net barter terms of trade of Category 1 agricultural products was constantly deteriorated.

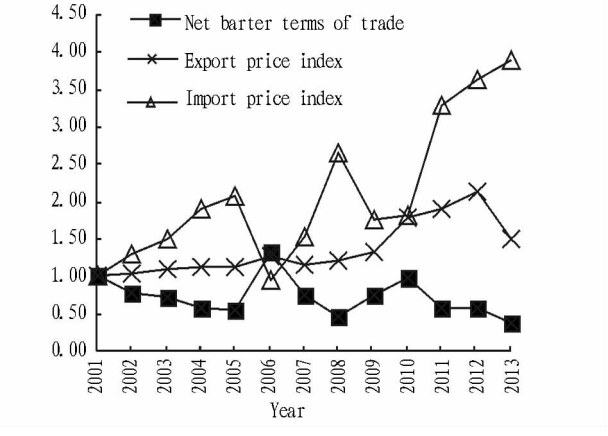

Fig. 3 Changes in net barter terms of trade for Category 1 agricultural products

3.4 Net barter terms of trade for Category 2 agricultural products fluctuated gently under the level of 1 and net barter terms of trade was slightly deteriorated From Fig. 4, it is known that the export price index of Category 2 agricultural products rose with fluctuation, and it was lower than 1 only in 2002 and 2003, and by 2013, it had risen to 1.76. The import price index was above the base period level all the time and kept the trend of rising with fluctuation, and it rose to 2.21 in 2013. Except in 2006, the import price index of Category 2 agricultural products was higher than the export price index, so the net barter terms of trade for this category was basically below the base period. It experienced three rounds of gentle "deterioration-improvement" periodical fluctuation and finally was stabilized at 0.80. Comparatively to 2001, the net barter terms of trade for this category was slightly deteriorated.

3.5 Net barter terms of trade for Category 4 agricultural products fluctuated wildly under the level of 1 and net barter terms of trade was slightly improved From Fig. 5, it is known that the export price of Category 4 agricultural products was below 1 in most years, and after two rounds of "drop-rise", the export price index rose to 1.24 with fluctuation. By contrast, the import price index was above the base period level in all years except 2006, but the fluctuation was great. With 2006 and 2009 as boundary line, it experienced three rounds of "rise-drop" and dropped to 1.29. Since the export price index was higher than the import price index only in 2006, the net barter terms of trade for

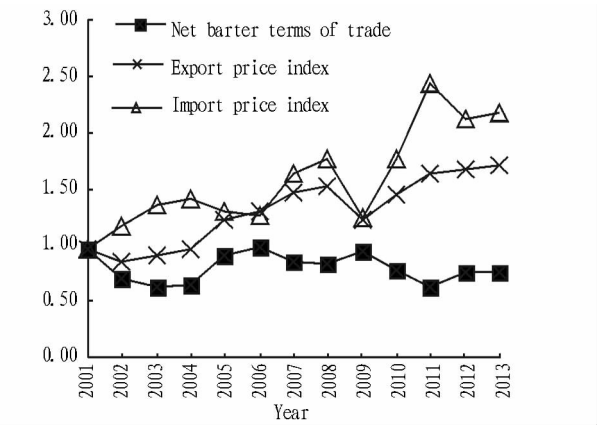

Fig. 4 Changes in net barter terms of trade for Category 2 agricultural products

Category 4 agricultural products fluctuated below 1 except in 2006. The net barter terms of trade for this category of agricultural products experienced two rounds of "drop-rise" with the year 2006 as the boundary line, the two valleys were 0.49 in 2003 and 0.43 in 2008, and one peak was 1.25 in 2006. However, since 2008, the net barter terms of trade for Category 4 agricultural products had been improving all the time, by 2013, it was very close to the base period level, being 0.96.

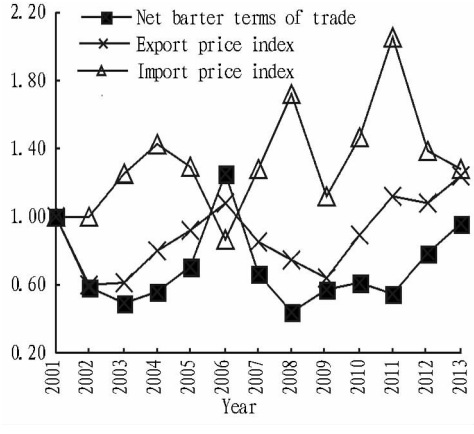

Fig. 5 Changes in net barter terms of trade for Category 4 agricultural products

4 Analysis on causes for changes in net barter terms of trade

To find out causes for changes in net barter terms of trade for Sino-Australian agricultural products, we calculated the influence degrees of each category of agricultural products on overall net barter terms of trade, namely, the contribution value. The results were listed in Table 1.

4.1 The improvement in terms of trade for Sino-Australian agricultural products from 2001 to 2013 was dominated by Category 0 agricultural products Generally, from 2001 to 2013, the terms of trade for Sino-Australian agricultural products was improved about 16.44% in total. Except Category 2 agricultural products, the contribution of other three categories of agricultural products to changes in overall net barter terms of trade was

consistent with the direction of changes in overall net barter terms of trade. Besides, as to the contribution value, the Category 0 agricultural products had the largest contribution value, followed by the Category 4, and the lowest was Category 1. Therefore, the influence degree of four categories of agricultural products on net barter terms of trade from 2001 to 2013 was Category 0 > Category 4 > Category 1 > Category 2. The improvement amplitude of net barter terms of trade for Category 0 agricultural products was 47.27%, second only to Category 4 agricultural products, and the share of import and export for Category 0 was 33.18% on average, much higher than 3.88% for Category 4 agricultural products, so the Category 0 agricultural products dominated the changes in net barter terms of trade for Sino-Australian agricultural products, and the influence degree of Category 0 was near 6 times and 28 times the degree of Category 4 and Category 1.

4.2 Category 2 agricultural products was the root cause for deterioration of net barter terms of trade for Sino-Australian agricultural products In most years, Category 2 agricultural products had the largest influence on annual changes in overall net barter terms of trade for agricultural products, especially when the net barter terms of trade for Sino-Australian agricultural products was deteriorated, Category 2 agricultural products was the root cause. In 2002, 2003, 2007, 2008, 2010, and 2011, the net barter terms of trade for Sino-Australian agricultural products was deteriorated compared with the previous year. Except in 2008, Category 2 agricultural products had the greatest influence on overall net barter terms of trade and the influence degree was much higher than other categories of agricultural products. Category 2 agricultural products was always the major category of Sino-Australian agricultural products trade and its volume of import and export took up about 60% all the time. Because of the big share, when the net barter terms of trade for Category 2 agricultural products was greatly deteriorated, it would greatly influence net barter terms of trade for Sino-Australian agricultural products. In the rest years when the net barter terms of trade for Sino-Australian agricultural products was improved compared with previous year, Category 2 agricultural products also showed the greatest contribution to the improvement in 2005, 2006, and 2012; Category 0 agricultural products showed the greatest contribution to the improvement in 2004 and 2009 while Category 4 agricultural products showed the greatest contribution to the improvement only in 2013.

Table 1 Contribution of each category of agricultural products to changes in overall net barter terms of trade in 2002 – 2013

Year	Changes in overall net barter terms of trade	Contribution to changes in overall net barter terms of trade			
		Category 0	Category 1	Category 2	Category 4
2002	-0.0816	0.0438	-0.0021	-0.1662	-0.0137
2003	-0.1000	-0.0291	-0.0010	-0.0465	-0.0082
2004	0.0089	0.0194	-0.0016	0.0054	0.0068
2005	0.1517	0.0199	-0.0008	0.2324	0.0086
2006	0.1679	0.0322	0.0247	0.0548	0.0285
2007	-0.1940	-0.0273	-0.0090	-0.0809	-0.0261
2008	-0.0504	-0.0481	-0.0089	-0.0214	-0.0250
2009	0.3829	0.1164	0.0248	0.0737	0.0152
2010	-0.1525	-0.0017	0.0104	-0.0915	0.0025
2011	-0.1313	0.0189	-0.0129	-0.1202	-0.0034
2012	0.1580	0.0289	0.0006	0.1110	0.0078
2013	0.0048	0.0017	-0.0093	-0.0006	0.0025
2001 – 2013	0.1644	0.1568	0.0056	-0.0351	0.0282

Note: contribution value of each category of agricultural products in 2001 – 2013 = average value of trade share of this category of agricultural products over the years × sum of changes in net barter terms of trade for this category of agricultural products over the years.

5 Conclusions

Based on the above research, it follows that: since 2001, the net barter terms of trade for Sino-Australian agricultural products fluctuated between deterioration and improvement. The situations were improved in 2013 compared with 2001, but the improvement trend was not significant. The net barter terms of trade for Category 0 agricultural products rose with fluctuation to 1.47 and slightly improved; the net barter terms of trade for other three categories fluctuated below the base period level. The net barter terms of trade for Category 1 and Category 2 agricultural products was deteriorated compared with the base period, while the net barter terms of trade for Category 4 agricultural products was slightly improved and had risen to 0.96 in 2013. From 2001 to 2013, the net barter terms of trade for Sino-Australian agricultural products improved about 16.44%, and category 0 agricultural products dominate the improvement, and its influence degree is 6 times and 28 times the degree of category 4 and category 1 agricultural products respectively. In years when the net barter terms of trade for Sino-Australian agricultural products deteriorated, category 2 agricultural products were the root cause for deterioration. China has been failing to manifest strong price advantage in the agricultural products trade with Australia. However, the net barter terms of trade for Category 0 agricultural products as the main category China exported to Australia has been improving. With constant advance and implementation of Sino-Australia free trade agreement, the Sino-Australia agricultural products trade will be further strengthened. In future, it is recommended to continue keeping the price advantage of agricultural products China exports to Australia and increase the added value of agricultural products to transform the deterioration of net barter terms of trade for other categories of agricultural products.

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ance of securities; for seed enterprises up to certain scale, support them to expand scale and improve level; for growth seed enterprises, support them to accelerate structure adjustment and technology structure, as well as improve brand image.

4.2 Creating seed research and development and public service platform with high influx Create several basic research and development platforms of seed at national level, face to long-term and stable development of state agriculture and national food security guarantee, combine with research and development advantages of seed industry for Beijing municipal science and research teaching units, select importing crop, vegetable, poultry and aquatic species, establish research and development and public service platform of Beijing seed industry species supported by government step by step; with high-end creation of seed industry as target, and with Beijing state modern agricultural science and technology city as bond, dock finance service center and networking information network service center, construct high-end creation platform integrating new species research and development, high-level seed production technology, seed production equipment research, development and production as a whole, actively push seed industry research and development and high-end creation.

4.3 Constructing seed industry transaction and information service support system Under the guidance and support of government, construct seed transaction institute and variety right transaction center, establish fair and efficient science and research achievement transaction mechanism, provide just, fair and highly efficient transaction environment for the enterprises to develop variety transaction, become seed industry transaction platform radiating all over the country gradually. Encourage to develop modern service industry of seed industry, construct science and technology trusteeship platform of seed industry, extend and expand diversified service functions of achievement administration, property right protection, information issuance, exhibition and introduction, transfer, achievement consulting and service after sale of science and technology achievements of Beijing seed industry. Construct high-end service platform of seed industry science and technology and finance, provide one-stop and individual finance service for differentiated seed enterprises, guide finance to combine with seed industry science and technology, lead related finance resources gather in seed industry, improve science and technology finance and information service support system of seed industry.

4.4 Cultivating breeding integration seed enterprises greatly Carry out and implement finance, banking and taxation preferential policies supporting seed industry enterprises by sate and Beijing municipality, support the large enterprises (especially agricultural enterprises) in Beijing to undertake seed industry research and development, production and operation by way of acquisition and equity participation; promote germplasm resources and breeding talents to transfer towards large seed enterprises through science and technology system reform, strengthen science and technology innovation ability of breeding integration enterprises; support strategic alliance of seed industry technology and innovation greatly, encourage breeding integration enterprises to develop efficient university-industry collaboration with science and research teaching institutes, construct seed industry alliance to become an important bridge and bond of seed enterprises development; implement development strategy of "walking out" by seed enterprises, accelerate to establish commercial breeding mechanism with enterprise as subject, encourage breeding science and research institutes and staffs to enter into enterprises or cooperate with them , explore talent policy that policies promote university-industry collaboration[11] , establish two different evaluation mechanism of science and research achievement basic research and variety commercial development of the seed industry.

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