The competitiveness and its stability of fruit products: the case of China

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Abstract

The purpose of this paper is to evaluate the export competitiveness of fruit products of China in the world market and the stability of the competitiveness during the period from 2000 to 2016. Before analyzing the competitiveness, the production and trade performance of the fruit products had been investigated. The growth in fruit production provides the foundation of export. The trade volume of export and import expanded greatly during the time period. China had been in the state of trade surplus for fruit products in the last seventeen years. The Revealed Asymmetric Comparative Advantage (RSCA) index was used to analyze the competitiveness of fruit products in different levels. The result showed that most of the fruit products experienced revealed comparative disadvantages in the global market. As the time passing by, the competitiveness of the fruit products became worse and worse. The results of the stability test found that the level of the comparative advantage of the fruit products had been away from the level of the initial time. The overall comparative advantage of fruit products in China was gradually declining.

Key words: Fruit. Competitiveness. Stability. China

1. Introduction

In the process of globalization, domestic products have to face the competition from products of other countries both in the international market and in the domestic market. The international competitiveness of agricultural products for developing countries is becoming more and more important because improving the competitiveness of agricultural products can enlarge the export and increase the income of the farmers.

Fruit is an important agricultural product all over the world, and the proportion of fruit trade in the global agricultural trade has also been increasing. Fruit export has experienced consistent increase in many countries. Because compared with other agricultural products, this sector has become the most important in value terms. From 2000 to 2010, the trade of fruit and vegetables sector had grown by more than 11 percent per year at the global level and by 17 percent in Asia (FAO2014). China enjoys a long history of fruit production, and now it has three major advantages for developing fruit industry in China. Firstly China has the largest

population in the world and possesses huge labor resources.

Fruits and related products production belongs to labor-intensive industries, both in the production, processing, sales and other aspects requires a lot of labor input. As for this aspect, China holds greatest advantages than the world's other fruit producing countries. Secondly, China is abundant in a massive land area which is suitable for growing a variety of fruits, so it increases the resources advantages of fruit cultivation. Thirdly, China's sustainable and rapid economic growth has been improving the people's income level greatly. What is more, it expanded the demand for fruit and provided a great fruit consumption market. At present, China has become the world's largest producer of fruit, accounting for 20% of the world's fruit output (FAO2014).

Fruit industry occupies an important position in the national economy, and fruit has become China's third important agricultural product, behind the seafood and vegetables. According to the data of China National Bureau of Statistics, in 2015 China's fruit production was 274 million tons, and the orchard planting area was 12817 thousand hectares. In terms of varieties, the production of apples, pears, peaches, plums and persimmons ranks among the top 5 in the world, especially the cultivation and production of persimmons and pears, which account for 71.5% and 52.9% of the world's total output, respectively. The productions of apples and plums make up 40% of world output (Chen Jun, 2014). Production expansion does not mean the improvement of the competitiveness, but it is necessary for the government and enterprises to evaluate the competitiveness and its stability of fruit products in the international market so as to provide the basis for the development of trade strategy of fruit products of China.

The main purpose of this paper is as follows: firstly to describe the production and trade performance of fruit products in China; secondly to measure the level of competitiveness of fruit products of China in the international market during the period from 2000 to 2016; thirdly to analyze the stability of competitiveness trends; at last, to explore the feasible way to promote the development of Chinese fruit trade and improve the international competitiveness in order to make contribution for industrial upgrading and the income increasing of farmers.

2. Theoretical background of competitiveness

Although there are lots of literatures analyzed the trade competitiveness in many

fields, there is no single authorized definition for the concept of competitiveness (Bojnec and Ferto 2016). At present, the majority of academic papers focusing on trade competitiveness mainly are described in two ways. On one hand, taken the comparative advantage theory of Ricardo and H-O model as the theoretical background, the various types of trade indices are to be calculated and according to the value of the index to evaluate trade competitiveness.

On the other hand, based on the theory of competitive advantage which was put forward by Potter (1990), the six factors of the diamond model are to be measured for a state, an industry or one kind of product so as to evaluate the competitiveness (Qi an Juan2000).

In this study, the first method is used to measure the competitiveness of Chinese fruit products. Since Balassa (1965) put forward the index of revealed comparative advantage, a large number of scholars have emphasized their research on the international competitiveness of countries and products in the empirical works. However, the analysis and measurement of competitiveness mainly focus on manufactured products. Until recently the competitiveness of agricultural products has attracted attention (Ferto and Hubbard2003; Bojnec and Ferto 2015).

As one of the most important agricultural sector, the competitiveness of fruit products has attracted the attention of some scholars. Bojnec and Ferto (2015) analyzed the competitiveness of fruit and vegetable products of EU in the world market by calculating the revealed comparative advantage index, and they found that the fruit and vegetable products for most of the members of the European Union in the international market have no competitiveness. Sattam Almodarra (2016) measured the export competitiveness and the effect of competitiveness on date export of Saudi Arab in the period from 1990 to 2011.

The results of the study show that the international competitiveness of dates of Saudi Arab is strong, and the competitiveness index increased by 10% the exports will increase 10.37%. Alieu GIBBA (2017) has evaluated the global competitiveness of tropical fruit and its stability, and the results show that the revealed comparative advantage index of Costa Rica and Ecuador is the highest. Also the comparative advantage of the stability test results show that for most countries the level of comparative advantage then gradually decreased.

With the promotion of the significance of fruit production and export in China's economy, the research on the international competitiveness and trade of Chinese fruits is also increasing.

Liu Hancheng and Yi Fahai (2007) revealed the export characteristics of Chinese fruit products from 1996 to 2006 and calculated the revealed comparative advantage index of

seven kinds of fruits, and also analyzed the factors affecting the international competitiveness. From 1991 to 2006, the international competitiveness of Chinese fruits declined first and then increased. However, the Chinese fruits did not have international competitiveness. Except that the comparative advantage of apples had been on the rise, other fruits had declined to varying degrees.

Zhang Fuhong, Hu Jilian (2012) calculated the market share, trade competitiveness index, revealed comparative advantage index of the main fruits of China and ASEAN export countries in the period from 1999 to 2008 in the ASEAN market. The market share of Chinese fruit in the ASEAN market had been high. After joining WTO, the market share of Chinese fruits was in the first place in the ASEAN market and maintains a steadily upward trend. Compared with other fruit trading country in ASEAN fruit market, the fruit products of China occupy the leading advantage of overall exports. From the comparison and changing trend of RCA index, China had four kinds of fruit products (0805, 0808, 0811, and 0812) with strong or moderate competitiveness, and the remaining 10 types of products did not have competitive advantages.

Zheng Xuyun and Zhuang Lijuan (2015) measured the level of competitiveness of Chinese tropical fruit products. The results show that the competitiveness level of tropical fruit of China was low and gradually decreased. Most of the tropical fruit did not have comparative advantage. The output and planting area of tropical fruits in China increased rapidly, but the fruits products for export were quite less. The proportion of dry and fresh tropical fruit exports increased year by year, and the proportion of manufactured exports decreased significantly.

Compared with the major tropical fruit exporting countries such as the United States, Brazil and Thailand, most tropical fruits in China were not competitive and the competitiveness grew slowly. Only minority of tropical fruit products of China had comparative advantages, most of the dry and fresh tropical fruits and fruit products were in a relatively inferior position. Therefore, the adjustment of tropical fruit industry structure will be a long-term process, and we should give priority to the fruit varieties with potential advantages.

The former scholars have made some research on the international competitiveness of fruit products of China, but these academic achievements mainly took the revealed comparative advantage index to measure the competitiveness. And these research works have not taken into account the dynamic changes of comparative advantage. The contribution of

this paper is to use Revealed Symmetric Comparative Advantage (RSCA) index to measure the level of comparative advantage of the fruit products of China in the world market, further Dalum (1998) stability analysis of the comparative advantage will be taken to evaluate the stability of competitiveness of fruit products of China.

3. Methods and Data

In the empirical literature, scholars often use the revealed comparative advantage index and the other modified revealed comparative advantage index to describe the change of trade competitiveness of a country and a kind of product. In this study, the competitiveness of fruit products of China is investigated by the Revealed Symmetric Comparative Advantage (RSCA) index which is a kind of modified revealed comparative advantage index.

The index is based on the famous revealed comparative advantage index (RCA). RCA index was put forward by Hungarian economist Balassa (1965). According to the definition, the dominant comparative advantage index is measured by the proportion of the commodities in the country's total exports relative to the world's exports. The equation is as follows:

$$RCA_{ij} = (X_{ij} / X_i) / (X_{wj} / X_w) \qquad (1)$$

Where RCA_{ij} is expressed as the Revealed Comparative Advantage Index of product j in country i. X_{ij}stands for the export volume of product j in country i; X_{wj}stands for the world total export of product j; $X_i$is total export of country i; $X_w$is the world total export. If RCA_{ij}> 1 indicates that there is revealed comparative advantage for product j of country i; If RCA_{ij}<1 illustrates that there is no revealed comparative advantage for product j of country i.

Dalum et al. (1998) in the study of OECD national specialization problem pointed out there are some defects when evaluate the competitiveness by revealed comparative advantage index, because the value of this index is from 0 to infinity, does not meet the normal distribution. In order to treat the asymmetric value problem of Balassa index, Dalum et. al (1998) transformed the RCA in to Revealed Symmetric Comparative Advantage （RSCA）index （TOROK and JAMBOR2016）. The formula is as follows:

$$RSCA = \frac{RCA-1}{RCA+1} \qquad (2)$$

RSCA ranges from -1 to 1, if RSCA>0 shows a comparative advantage, and conversely, if RSCA<0 indicates no comparative advantage. Since the range of RSCA is from -1 to 1, this avoids the asymmetry of the distribution. In this study, trade competitiveness of fruit products of China is investigated by using the Revealed Symmetric Comparative Advantage （RSCA）index.

The study by Dalum et al (1998) not only analyzed the RSCA index of OECD countries but also investigated the dynamic changes of revealed symmetric comparative advantage index. In this study, we are going to employ the method of Dalum et al (1998) to test the stability of comparative advantage of the fruit products of China. This method is to take the RSCA index at time $t_2$as the dependent variable, and the RSCA index at time $t_1$as independent variables to run a regression. The equation is as following：

$$RSCA_i^{t2} = \alpha_i + \beta_i RSCA_i^{t1} + \varepsilon_i \qquad (3)$$

Where α and β are linear regression coefficients, and ε is the residual disturbance. If $\beta = 1$ suggests that RSCA pattern has not changed during the two time period, and that is to say the international division of labor of fruit products in China is the same at these two time periods. It means that the level of comparative advantage of fruits products has no change. On one hand, if $\beta > 1$ indicates that compared with the comparative advantage level at time t_1 the comparative advantage at time t_2 has been strengthened. On the other hand, if $0 < \beta < 1$ the comparative advantage of fruit products will decline. What is more, if $\beta < 0$, the sign of the index has been changed (TOROK and JAMOR2016).

At the same time, Dalum et al. (1998) pointed out that $\beta > 1$ is not a necessary condition for the change of comparative advantage, and other methods should be used for further analysis. R is the regression correlation coefficient, if $\beta = R$ shows that the comparative advantage has not changed, and if the $\beta > R$ is considered that the comparative advantage has been strengthened. And then if $\beta < R$ then the comparative advantage has been weakened. In the empirical study, the ratio of $\frac{\beta}{R}$ is always to be calculated, if the value is greater than 1, then it means the comparative advantage has been strengthened in the whole time period. If the value is less than 1, indicates that the comparative advantage has been weakened.

In this paper, the trade data of fruit products is from the UN COMTRADE database. The fruit products in this study include the entire six digit product by HS classification of HS08, HS2006, HS2007, HS2008 and HS2009. The production and yield data of fruits is from the China National Bureau of Statistics.

4. Results

4.1 The production performance of fruits in China

The fruits production of China had been growing from 2000 to 2014(Fig.1). In year of 2000, the fruit production of China was 135 million tons. And in 2003 production increased to 153 million tons, in 2008 the production exceeded 200 million tons, reaching 204 million tons, fruit production in 2014 had increased to 274 million tons, was almost 2.02 times in 2000. For the production of all the fruits, watermelon accounted for the largest share. In 2000, watermelon accounted for 42% of the total fruit output, and the total production was 57.18 million tons.

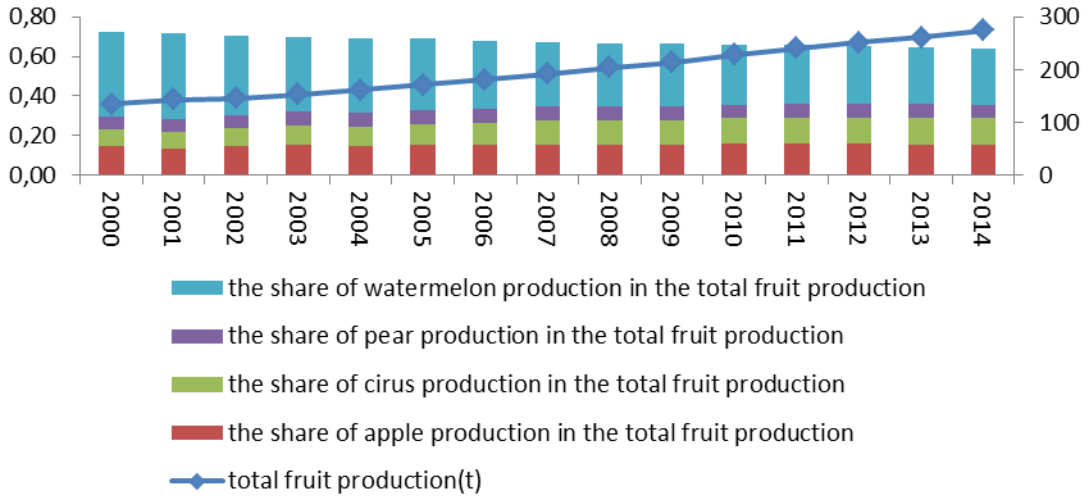

Figure1: The production performance of fruits of China
Data resource：China National Bureau of Statistics

The share of watermelon production was in peak in 2001, accounting for 44% of all fruit production. Since then, although the production of watermelon had been continuously increasing, the proportion of watermelon in all fruit production had been declining. The share of watermelon production fell to 28% in all fruit production in 2014, although watermelon production itself increased to 77.14 million tons.

Apple also plays a tremendous position in fruits production of China. Apple enjoyed the second largest amount of production in all the fruits. In the period from 2000 to 2014, the share of apple production in the overall fruits production had been at 15% or so, while apple production had increased from 4.94 million tons to 12.47 million tons in 15 years. The proportion of citrus production in the all fruits production had been increased gradually from 2000 to 2014. In 2000, citrus production was 11.61 million tons, occupying 9% of the total fruit production. In 2014, citrus production had risen to 36.60 million tons.

The share in the whole fruits production had been increased to 13%. Pear is a kind of traditional fruit which has been planting in China for many years. In 2000 Chinese pear production was 8.41 million tons, and since then the production had maintained a growth trend. In 2014 pear production had increased to 18.70 million tons. The number was as 2.2 times as that of in 2000, but the share of pear in the whole fruit production had been remaining at 7% in the 15 years.

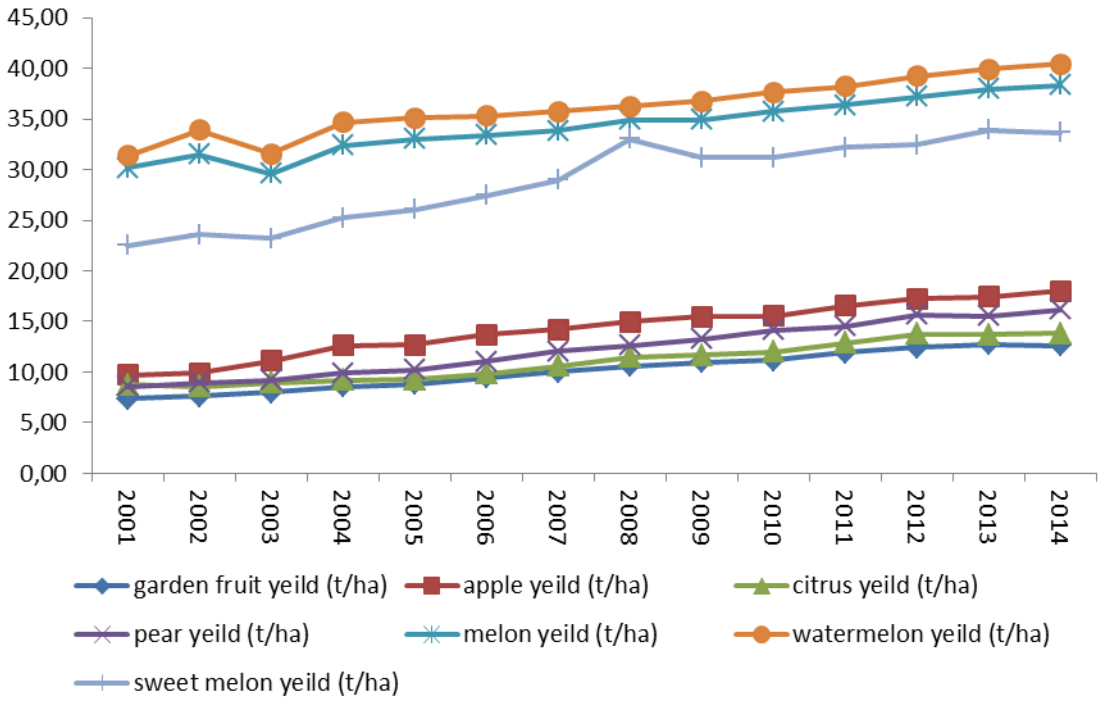

Figure 2: The yield of the fruits
Data resource: author's calculation by the data from China National Bureau of Statistics

In terms of fruit yield of China, there is a big gap in yield of different fruits products. Both the yield of melon and the yield of garden fruit had been expressing slight increase. The yield of melon products is much higher than that of garden fruit. The yield of watermelon was

the highest in all the fruit products, with yield of 31.38 tons per hectare in 2000. And the yield had risen up to 40.41 tons per hectare in 2014.

The yield of other sweet melon was significantly lower than the yield of watermelon. The yield of other sweet melon in 2001 was 22.51 tons per hectare which was far less than the yield of watermelon. Then the yield got to the highest level in history in 2008 which the yield of other sweet melon was 33 tons per hectare. The yield decreased thereafter again, until 2013 the yield exceeded the level of 2008 that was 33.89 tons per hectare. But in 2014 the yield decreased again and reduced to 33.62 tons per hectare.

As far as the garden fruit was concerned, the yield of all the products had been increasing slightly during the period of 2000 to 2014. Among them, the yield per hectare of apple was the highest. In 2001, the yield of apple was 9.69 tons per hectare, which was higher than that of 8.77 tons per hectare of citrus and 8.57 tons per hectare of pears. The yield of these three kinds of fruits was higher than the average yield of garden fruit. In the period of 2001 to 2014, the yield of garden fruit had also been improved. In 2014, yield of apples increased to 18.01 tons per hectare which was as 1.86 times as that of 2000. The yield of pears and oranges also increased correspondingly which are 16.14 tons and 13.85 tons per hectare, respectively.

In a word, the improvement of fruit production and yield of China has provided a foundation for the development of fruit trade.

4.2 Trade performances of fruit products of China

4.2.1 The trade volume and the position of fruit products

The import and export of fruit products of China in the year from 2000 to 2016 is investigated. In the last 17 years, great changes of the trade flows in fruit products had taken place, mainly because China has participated in many preferential trade agreements. These behaviors of trade integration have great effect on the trade flow of fruit products. For trade partners which are in the same free trade agreement, China will export and import fruit product for duty-free. So the elimination of duty and other trade barriers have stimulated the trade flow of fruit products.

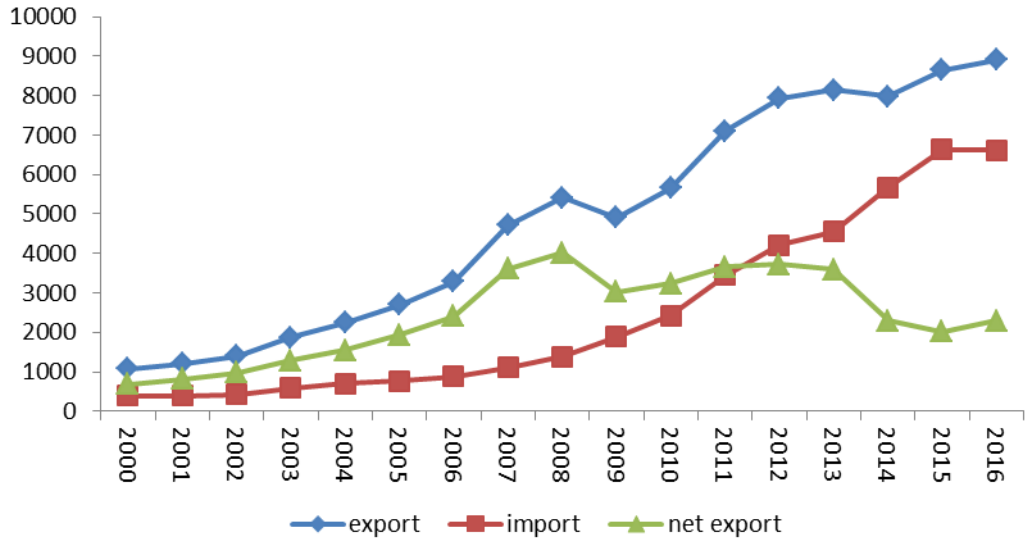

Figure 3: The development of the trade of fruits products of China
Data resource：UN COMTRADE database

According to the figure, the value of both import and export showed a sharp increase in the trend in the period from 2000 to 2016, except the economic crisis in 2008-2009. Although the export of fruit products fell in 2009, the imports of fruits seemed not to have been affected. The value of import still appeared to increase. In 2000, China exported the fruit products of 1.018 billion USD, and imports of $387 million. The trade surplus was $631 million.

When it came to the year of 2008 in which the financial crisis broke out, the value of fruit exports reached $5.26 billion and got to the peak in history, which was the 5.17 times as that in 2000. At the same time, imports of fruits also increased to $1.39 billion, which was 2.2 times as that in 2000. Both the export and import increase in this period of time, but it was obvious that the export grew faster than import. So also in 2008, trade balance of fruits had dramatically expanded to $3.87 billion. As a result of the 2008 financial crisis, the export of fruit product fell to $4.775 billion in 2009. But in the same year, the import of fruit products still increased to $1.892 billion. The decrease of export and the increase of import made the trade surplus dropped to $2.883 billion in 2009.

After 2010, both export and import of fruit products began to show a dramatically increasing trend. And in 2016 fruit products export of China had increased to $8.660 billion, which was as 7.9 times as that of in 2000. The import rose to $6.595 billion, which was as 18 times as that of 2000. In the period from 2010 to 2016, the import growth was significantly faster than the growth rate of exports, so from the beginning of 2013 trade surplus of fruit

products began to decline. Until in 2015 the trade surplus dropped to $1.798 billion which was the lowest point in the last ten years, and was also far less than the $3.872 billion in 2008.

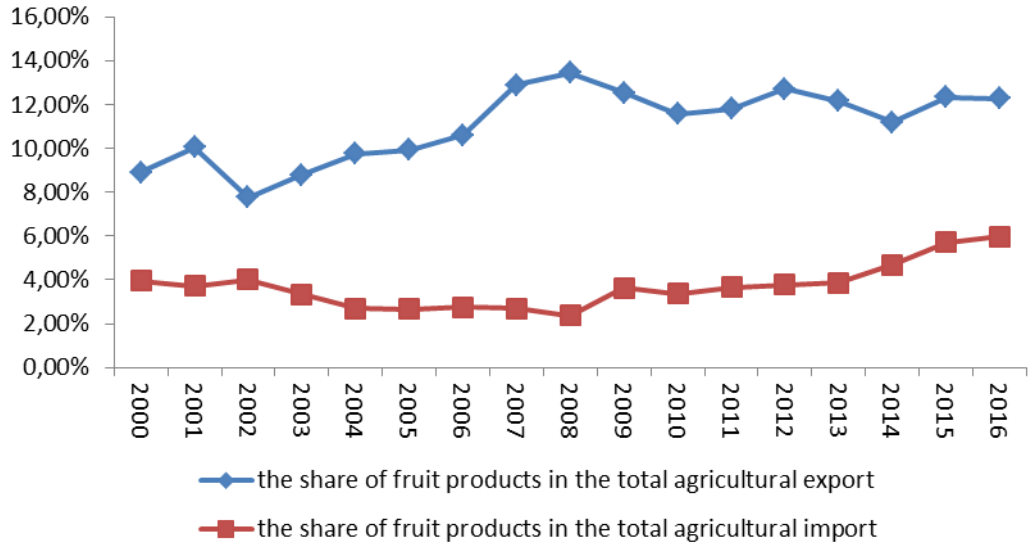

Figure 4: The share of export and import of fruit products in the export and import of total agricultural products
Data Resource: UN COMTRADE database and www.mofcom.gov.cn

The growth of fruit exports and imports also promoted the status of fruits trade in all trade in agricultural products in China. In the past 17 years, the share of fruit products in the total agricultural export showed a fluctuating state. In 2000, export value of fruit products accounted for 8.9% in all export of agricultural products in China. And in 2001 the export share sharply increased to 10.06%. But in 2002, the share dropped to the lowest point in history, accounting for only 7.77% in the total export of agricultural products. In the next six years, the share took on an increasing look and rose to the highest point in history in 2008 which accounted for 13.45% in the total exports of agricultural products.

After that there was a significant decline, and the share dropped to a minimum of 11.18% in 2014. And then the share increased slightly to 12.27% in 2016. The status of imports of fruit products in the total import of agricultural products is obviously lower than that of exports. The proportion of import of fruit products in the overall agricultural products had been below 6% from 2000 to 2016. Although in 2016 the share reached the highest point of the history which was only 5.98%. In short, while the share of fruit imports grew, but the growing speed was very slow.

4.2.2 The main trading fruit products of china

When it comes to the main exporting fruit product of China, the products with the largest proportion are also different in different periods. In the period from 2000 to 2004, there were only three kinds of fruit products whose share was more than 10% in the total fruit products. The export value of HS200811 (peanut) accounted for 13.79% in all the fruit products exports. HS200970 (apple juice) was ranked second which accounted for 13.39% in the total fruit product export. HS080810 (fresh apple) took the proportion of 10.84% in the overall fruit products export.

Table 1: Top 5 export fruit products and their shares in the total fruit products export

Product	2000-2004	Product	2005-2010	product	2011-2016
200811	13.79%	200970	18.80%	080810	13.51%
200970	13.39%	080810	13.05%	080520	10.57%
080810	10.84%	200811	9.71%	200970	10.53%
200830	9.81%	200819	6.50%	200899	9.56%
200819	7.38%	200830	6.14%	200811	8.55%
Total	55.20%	total	54.21%	total	52.73%

Data resource: calculated by the author based on the data from UN COMTRADE database

While in the period from 2005 to 2010, HS200970 (apple juice) had become the largest share of export products which had accounted for 18.80% in the all fruit product export. HS080810 (fresh apple) rose to second largest export product whose share accounted for 13.05%. The export of HS200811 had declined to the third which took the proportion of only 9.17%. From 2011 to 2016, the share of HS080810 (fresh apple) remained to be the No.1 export product which accounted for 13.51% in the total fruit products export. HS080520 (peanut) took the second position in all the products with a share of 10.57%. HS200970 (apple juice) reduced to the third important product, which accounted for 10.53% in the total exports. From the point of view of all the export products, only a handful of products took large shares in all fruit product exports, and the export of most of the fruit products accounted for a very small share in total fruit exports.

Table2: Top 5 import fruit products and their shares in the total fruit products import

Product	2000-2004	Product	2005-2010	product	2011-2016
080300	23.23%	081090	20.09%	081090	26.32%
081090	18.05%	080300	10.99%	080300	10.45%
080610	8.40%	080610	8.02%	080610	9.82%
200911	6.41%	200911	6.98%	080920	8.44%
080510	5.95%	080450	5.80%	081050	3.51%

Total	62.03%	total	51.89%	total	58.54%

Data resource: calculated by the author based on the data from UN COMTRADE database

On the other hand, from the import point of view, it is relatively stable for shares of the products in the total imports of fruit products. From the year of 2000 to 2004, HS080300 (banana) enjoyed the largest share in total imports of Chinese fruit products, taking the share of 23.23%. HS081090 (other fruit) was ranked the second which was accounted for 18.05% in the total import of fruit products. HS086010 (fresh grapes) with 8.4% market share ranked the third.

In the period from 2005 to 2010, HS081090 (other fruits) became the most important fruit products in the overall import with the share of 20.09%. HS080300 (bananas) dropped to second with the proportion of 10.99%. HS080610 (grapes) was still ranked third. In the next seven years, HS081090 (other fruits) was still the most important product whose proportion had increased to 26.32%. HS080300 (banana) was still ranked the second, and the share in total imports decreased to 10.45%. HS080610 (grapes) took the third position and its share had a slightly increase of 9.82%. Thus with the same situation as export, a small number of imported products took huge proportion in all imports of fruit products.

4.2.3 The main trading partners of fruit products of China

From 2000 to 2016, the major trading partners of fruit products of China have changed considerably from year to year. From the export point of view, the main export market of China in 2000 was Asia. Among the ten largest export markets of China seven of them were in Asia. In 2000, Japan was the largest fruit export destination which accounted for 41.66% of market share. United States was the second largest export market with the export share of 7.76%. Hong Kong was the third largest export destination.

Table 3: The main trade partners of fruit products of China

	export				import			
rank	2000		2016		2000		2016	
1	Japan	41.66%	Thailand	13.00%	Philippines	20.06%	Thailand	19.34%
2	USA	7.76%	Vietnam	10.77%	Ecuador	19.68%	Chile	19.00%
3	Hong Kong	6.91%	Japan	9.58%	Thailand	16.93%	USA	10.83%
4	Malaysia	4.75%	USA	8.43%	USA	13.60%	Viet Nam	10.48%
5	Philippines	3.89%	Hong Kong	6.68%	New Zealand	5.69%	Philippines	8.19%
6	Korea	3.83%	Malaysia	6.14%	Colombia	5.48%	New Zealand	5.18%

7	Germany	3.06%	Philippines	2.19%	Chile	4.35%	Australia	3.57%
8	Indonesia	2.77%	Korea	4.11%	Vietnam	3.24%	South Africa	2.82%
9	Russia	1.40%	Indonesia	3.61%	Myanmar	2.44%	Peru	2.77%
10	Thailand	1.03%	Germany	2.46%	Iran	1.30%	Ecuador	1.99%
total		77.04%		66.96%		92.77%		84.16%

Data resource：Calculated by the data from UN COMTRADE

These three countries and regions accounted for 56.33% of the overall fruit products exports, and top ten largest export markets accounted for 77.04% of the total fruit products exports. This showed that export markets of China were very concentrated. In 2016, Japan had fallen from the largest export market to the third largest export market, accounting for only 9.58% of the market.

Thailand had become the largest export destination of Chinese fruit products, accounting for 13% of the total fruit products exports. The market share of the top three export markets had dropped to 33.35%. The total share of the ten largest export markets had reached by 66.96%, and there had been a decline compared with the share of 2000. This expressed that the high concentration of China's fruit export market had been improved to a certain extent.

When it came to imports, the ten largest import markets had also been listed. In 2000, Southeast Asian countries were the most important sources of imports of fruit products. Among the ten largest sources of import markets, there were four Southeast Asian countries. Philippines was the largest source of imports of fruit products of China, and the import from Philippines accounted for 20.06% of total imports. Ecuador was the second largest source of imports of fruit products of China, with the share of 19.68% in total imports.

Thailand ranked the third with the market share of 16.93%. The total share of the ten major importing countries accounted for 92.77% of all Chinese fruit imports. In 2016, Thailand replaced Philippines as the largest source of imports of fruit products of China, which the market share was 19.34%. Chile became the second largest import source with the share of 19%. U.S. was the third largest source of imports of fruit product of China. Ecuador dropped to the tenth place, and imports share from Ecuador accounted for only 1.99% in all Chinese fruit imports in the year.

The market concentration of imports was much bigger than that of export. In 2000, the import share of the top ten trading partners hold 92.77% of all the imports. In 2016 the situation became better, the overall share of the top ten partners declined to 84.16%.

Generally speaking, fruit products import of China also highly focus on a few of trading partners.

4.3 The RSCA indices of the fruits products and the result of stability test

The results of RSCA index are provided by different products (Table4) from 2000 to 2016. There are eighteen categories of products in all the fruit products by HS 4 digit. We can find that the mean of RSCA indices of the sixteen categories products in the overall eighteen categories of products are negative, indicating that these sixteen categories of products on average has no competitiveness.

Table 4：The distribution of the RSCA index by product

Commodity	Obs	Mean	Std.Dev.	Min	Max	RSCA>0	RSCA>0.5
0801	34	-0.987	0.0220	-1.000	-0.924	0.00%	0.00%
0802	181	-0.654	0.542	-1.000	0.763	19.33%	4.97%
0803	17	-0.976	0.0140	-0.994	-0.951	0.00%	0.00%
0804	81	-0.974	0.0469	-1.000	-0.638	0.00%	0.00%
0805	85	-0.476	0.448	-1.000	0.352	22.35%	0.00%
0806	34	-0.619	0.246	-0.995	-0.171	0.00%	0.00%
0807	51	-0.765	0.193	-0.992	-0.0978	0.00%	0.00%
0808	34	0.0412	0.0581	-0.0418	0.214	79.41%	0.00%
0809	68	-0.886	0.165	-1.000	-0.284	0.00%	0.00%
0810	86	-0.876	0.244	-1.000	-0.0763	0.00%	0.00%
0811	51	-0.219	0.356	-0.846	0.355	31.37%	0.00%
0812	36	-0.153	0.784	-0.998	0.748	47.22%	44.44%
0813	85	-0.587	0.485	-0.995	0.501	15.29%	1.18%
0814	17	-0.489	0.182	-0.701	-0.124	0.00%	0.00%
2006	17	0.600	0.123	0.424	0.823	100%	82.35%
2007	51	-0.634	0.202	-0.954	-0.278	0.00%	0.00%
2008	202	-0.0438	0.524	-1.000	0.823	51.98%	15.35%
2009	170	-0.733	0.452	-0.999	0.647	10.00%	7.06%

In the seventeen years, only the RSCA indices of HS0808 and HS2006 products were greater than 0, demonstrating these two kinds of products on average had comparative advantage. Especially for the HS2006 products, the value of RSCA indices was more than 0.5 from 2000 to 2016. From the statistical results of the maximum value of all 18 categories of products, we can see that the maximum value of nine kinds of products was greater than 0, which indicated that these nine types of products in some years had comparative advantage.

On the other hand, the minimum value of 17 products in the overall 18 categories of products was less than 0, and the minimum value of RSCA indices of HS0801 HS0804,

HS0805, HS0802, HS0809, HS0810, and HS2008 products were equal to -1, demonstrating that the above products in some years had reached a very strong comparative disadvantage. We also calculated the share of the products which had comparative advantage in the total fruit products. The results described that the competitiveness of HS2006 product was the strongest.

All the HS 6 digit products in this category in the past seventeen years were competitive, and RSCA index of 82.35% products were greater than 0.5 showing strong competitiveness. For HS0808 products, the RSCA indices of 79.41% of products in this category were greater than 0, but the RSCA index of no products was higher than 0.5, which showed that most of the products were competitive, but the level of the competitiveness was not strong. 51.98% of the RSCA indices were calculated to be larger than 0 for the HS2008 category products, but only 15.35% of the results were higher than 0.5.

For HS0812 products, 47.22% of the observations were greater than 0 and 44.44% of the observations were greater than 0.5, which told us that the overall competitiveness of such products was still strong. All the value of RSCA indices of HS0801, HS0803, HS0804, HS0806, HS0809, HS0810, HS0814 and HS2007 products was less than 0, which expressed that these eight products had no competitiveness in the year from 2000 to 2016.

Table 5: The distribution of the RSCA index by year

year	Obs	Mean	Std.Dev.	Min	Max	RSCA>0	RSCA>0.5
2000	77	-0.536	0.580	-1.000	0.823	19.48%	7.79%
2001	75	-0.527	0.582	-1.000	0.814	18.67%	8.00%
2002	77	-0.540	0.568	-1.000	0.789	22.08%	9.01%
2003	75	-0.522	0.567	-1.000	0.768	22.67%	8.00%
2004	75	-0.532	0.559	-1.000	0.744	21.33%	9.33%
2005	78	-0.546	0.542	-1.000	0.720	21.79%	7.69%
2006	76	-0.542	0.540	-1.000	0.704	22.37%	7.89%
2007	76	-0.539	0.542	-1.000	0.823	19.74%	7.89%
2008	77	-0.541	0.539	-1.000	0.669	19.48%	6.49%
2009	76	-0.542	0.531	-1.000	0.622	23.68%	6.58%
2010	77	-0.554	0.527	-1.000	0.618	23.38%	6.49%
2011	77	-0.548	0.524	-1.000	0.627	20.78%	6.49%
2012	76	-0.558	0.517	-1.000	0.650	19.74%	6.58%
2013	76	-0.565	0.511	-1.000	0.664	19.74%	2.63%
2014	77	-0.585	0.496	-1.000	0.600	15.58%	2.60%
2015	77	-0.580	0.490	-1.000	0.530	18.18%	1.30%
2016	78	-0.563	0.504	-1.000	0.574	19.23%	3.85%

The results of RSCA index of fruit products in different years are also shown in table 5. It is obvious that the comparative advantage of fruit products varies greatly in different years. According to the statistic result of the mean, the value of RSCA shows a decreasing

trend. From 2000 to 2016, the average value of RSCA in each year was less tan 0, and the maximum value of the mean value of RSCA was the value in 2003 which the value was -0.522.

After then the mean value of RSCA decreased year by year. In 2015, the average value of RSCA was only -0.580 and by 2016, the index had a little improved. This demonstrated that from an average level, the comparative advantage of Chinese fruit products had gradually declined over time. Maximum statistics results showed that the maximum value of RSCA of fruit products constantly become smaller and smaller by year, from the highest value 0.823 in 2000 to the lowest point in the history of the 0.530 in 2015.

From the minimum statistics of RSCA index, we found that the minimum value of each year reached the boundary value -1.000. The proportion of the products whose RSCA value was greater than 0 in all products had remained below 25% during the seventeen years, which meant that the 75% Chinese fruit products lacked of the comparative advantage. The products with the RSCA indices more than 0.5 only held 9.93% in all products in 2004 which was the largest share in history and since then also showed a declining trend, by 2015 only 1.3% of the products had strong comparative advantage.

The results of the statistics analysis point out that the comparative advantage of Chinese fruit products is not strong. Many fruit products are in a condition of comparative disadvantage. As time goes on, there is a tendency to strengthen the comparative disadvantage.

Table 6: The RSCA value of the products with most comparative advantage

2000-2004			2005-2010			2011-2016		
Commodity	MS	RSCA	Commodity	MS	RSCA	Commodity	MS	RSCA
200830	43.69%	0.788	200830	44.94%	0.665	081290	49.73%	0.592
200811	34.09%	0.736	081290	41.20%	0.638	200830	46.71%	0.576
081290	31.85%	0.712	200970	34.27%	0.580	200811	32.38%	0.439
080240	26.51%	0.668	200811	33.57%	0.577	200840	32.27%	0.440

Data resource: Calculated by the data from UN COMTRADE database

From the specific product point of view, HS200830 was the most competitive fruit products of China which enjoyed big market share in the world market from 2000 to 2010. The value of RSCA index was as high as 0.788, 0.665 and 0.576 respectively in the different periods. HS200811 and HS081290 also were the products with high comparative advantage. The market shares in the world market had been over 30% in the past seventeen years.

From 2011 to 2016, HS081290 had become the products with the highest market share in the world market, and the market share increased to 49.73%, which showed that almost half of the products sold in the world market were produced in china. Although the market share had been expanded, the value of RSCA had a small decline. At the same time among all the fruit products, there were only two kinds of fruit products whose RSCA indices were greater than 0.5. In addition to HS081290, only HS200830, but compared with the RSCA indices in previous years the RSCA indices also fell. Both the market share and the value of RSCA index of HS200811 product had declined, while the market share of HS200840 had increased, but the value of RSCA had also decreased. From the above analysis, we can conclude that the comparative advantage of fruit products had deteriorated.

Table7: The result of the stability test

lags	α	β	R^2	R	$\frac{\beta}{R}$	N
1	-0.00777 (-0.78)	0.992*** (77.75)	0.988	0.994	0.998	75
2	-0.0188 (-0.95)	0.953*** (38.04)	0.952	0.976	0.977	75
3	-0.0313 (-1.07)	0.920*** (24.80)	0.895	0.946	0.972	74
4	-0.0497* (-1.67)	0.901*** (23.85)	0.888	0.942	0.956	74
5	-0.0671** (-2.05)	0.863*** (20.90)	0.855	0.925	0.933	76
6	-0.0817** (-2.37)	0.847*** (19.36)	0.834	0.913	0.927	74
7	-0.0889** (-2.28)	0.828*** (16.66)	0.794	0.891	0.929	74
8	-0.0997** (-2.35)	0.804*** (14.94)	0.754	0.868	0.926	75
9	-0.124*** (-2.75)	0.769*** (13.43)	0.715	0.846	0.909	74
10	-0.133*** (-2.98)	0.764*** (13.46)	0.713	0.844	0.905	75
11	-0.136*** (-2.96)	0.747*** (12.76)	0.690	0.831	0.899	75
12	-0.159*** (-3.45)	0.733*** (12.52)	0.685	0.828	0.886	74
13	-0.177*** (-3.76)	0.712*** (11.88)	0.662	0.814	0.875	74
14	-0.215*** (-4.45)	0.672*** (10.96)	0.622	0.789	0.852	75
15	-0.233*** (-4.50)	0.628*** (9.55)	0.556	0.746	0.842	75
16	-0.204*** (-3.82)	0.643*** (9.51)	0.550	0.742	0.867	76

In order to evaluate the trade specialization pattern of fruit products, we also

performed the stability test. The result confirms the conclusion above. Using RSCA indices from 2000 to 2016, we estimated the various lags for equation 3. The values of coefficient β of all lags are less than 1, which are very significant.

The values show a decreasing trend, which indicates that the revealed comparative advantage of fruit products of China has gradually worsened. As time passing by, the revealed comparative advantage becomes worse and worse. By using the correlation coefficient method, the same conclusion is obtained. The values of β/R are always less than 1, and the value is also gradually reduced.

The result of the stability test proves that the overall comparative advantage of Chinese fruit products is gradually deteriorating, and the deviation of the comparative advantage level in 2000 is becoming larger and larger.

5. Conclusions

This paper first analyzed the production of fruit products and the present situation of foreign trade development of China. The production of fruits in China had been growing during the last fifteen years which gave the base to enlarge the trade. The trade scale of fruit products had been expanded from 2000 to 2016. Except individual years, China enjoyed trade surplus in fruit products. The export destination and source of imports were relatively concentrated. Asian countries and regions played dominant role in export and import trade in fruit products of China.

Taken into account the RSCA indices, the results showed a downward trend. Both from the point of view of products and time, it was obvious that the comparative advantage of fruit products became worse and worse. From the product point of view, HS2006 had the strongest comparative advantage, and HS0801 had the weakest comparative advantage. The comparative advantage of the fruit products in 2000 was strongest, and the comparative advantage of fruit products in 2015 was weakest. The stability test of comparative advantage of fruit products in China showed that the overall comparative advantage of fruit products in China was gradually declining.

In order to expand the exports of fruit products, several measures could be taken to solve the issue. Firstly, the structure of export products need to be optimized and product varieties and proportion also need to be adjusted, accelerate the development of pollution-free green organic fruit products in order to increase the added value of export products. Secondly, the

quality of fruit products has to be inspected in all aspects of the production process so as to reduce the effect of the technical standards on the distortion of export competitiveness. Finally, the sales markets of the fruit products could be subdivided and according to the varieties of different countries and regions of the market to design products, improve the degree of difference in fruit products and meet consumers' diverse needs, so as to improve the level of international competitiveness of China's export products.

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