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Implications of World Trade Organisation accession for China's agricultural trade patterns

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This paper examines the composition of China's international trade from 1980 to 1997, with a focus on agriculture and a view towards understanding agriculture's changing trade structure relative to other sectors. We analyse the time series behaviour of individually traded goods at the Standard Industrial Trade Classification three-digit level, categorised into three groups: agricultural commodities, 'other' primary commodities and manufactures. We find that China's agricultural trade has expanded along comparative advantage lines in only a very modest way, suggesting that World Trade Organization membership will have a large impact on China's agricultural trade patterns.

1. Introduction

China has rejoined the World Trade Organization (WTO) after several years of negotiations. As part of WTO accession, China has agreed to undertake a series of important commitments to open and liberalise its trading regime and China now offers a more predictable environment for trade and foreign investment, in accordance with WTO rules. Accession will involve substantial reductions in tariffs and non-tariff barriers, and will reinforce market forces and the role of comparative advantage in China's economy.

The re-emergence of China as a significant trading nation in merchandise trade has been described by West (1993); Lardy (1994); Wall *et al*. (1996); and Naughton (1996). Greater integration with the global economy began in the mid 1980s and is now recognised as a fundamental feature of China's ongoing economic reform. Outside of agriculture, significant import tariff reductions have occurred in the past decade. As a measure of openness, China's nominal value of exports grew by 13 per cent annually from 1980 to 1996. During the same time period, imports grew by 12 per cent per year, on average. By 1997, China's total merchandise trade accounted for about 3 per cent of world trade, up from 0.8 per cent in 1978.

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However, the degree to which China's door is open to the world is debatable and China may be less open to foreign trade than initially appears (Naughton 1996). From 1986 to 1996, China's growth in real merchandise trade exceeded growth in real GDP by 2.1 per cent, which was not particularly high by international standards. Using the real exchange rate, China's trade as a percentage of GDP dropped slightly from 8.6 per cent in 1980 to 8.2 per cent in 1996 (World Bank 1999).

The focus of this paper is China's agricultural trade. If current trade patterns in agriculture are consistent with China's comparative advantage, then rejoining the WTO may not have a large impact on trade patterns. However, the global impacts of China's WTO membership are somewhat unclear, especially with regard to agricultural trade. The uncertainty arises because China's agricultural trade regime has not been liberalised to the same extent as its trade in manufactures (Naughton 1999) and the current level of agricultural protection is non-transparent (Ianchovichina and Martin 2001). This means that WTO membership will have an uncertain impact on China's farmers and there is a difference of opinion as to the direction of this impact. For instance, Colby *et al.* (2000) predict large gains for USA agriculture after China joins the WTO, and they imply that China's farmers will be worse off. Du (2001) suggests that WTO membership will be positive for China's farmers.

With an abundant rural labour force relative to the land base, it is broadly accepted that China's agriculture has a comparative advantage in labour-intensive crops, not land-intensive products such as grain (Carter *et al.* 1996). Zhang (2000) shows that China has lost its comparative advantage in grains, but has maintained a comparative advantage in labour-intensive agricultural products, such as fruits and vegetables. Naughton (1996) argues that China's merchandise exports have shifted to reflect its abundant labour. Has this also happened in agriculture?

Huang (unpublished data, 1995) has found that economic reform in China has had a significant impact on agricultural trade. Wailes *et al.* (1998) argue that China's agricultural trade has expanded rapidly and that the pattern of trade roughly adheres to the laws of comparative advantage. Wang (1997) also suggests that China's agricultural net trade structure is consistent with its resource endowment. He finds that land-intensive bulk and processed intermediate commodities account for most of the imports, while labour-intensive horticultural and consumer ready products make up most of the agricultural exports. However, his analysis is based on 1995 and 1996 data, a period during which China had a temporary blockage on grain exports. Alternatively, Anderson and Strutt (1999) find there has been little growth in China's food import dependence.

In contrast to manufacturing that is characterised by extensive intra-industry trade, agricultural trade patterns should roughly conform to

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predictions by the Heckscher-Ohlin-Viner (HOV) model if trade barriers are low. Some of the above mentioned papers argue that in the last two decades China's agricultural trade has shifted to conform to its comparative advantage. In order to test this claim, the present paper examines the changing pattern of China's agricultural trade over the 1980–1997 period, with comparisons to trade patterns in manufactures and other primary products. Our working hypothesis is that China's agricultural trade patterns have not shifted by a significant degree.

2. Overview of China's agricultural trade

In China, rapid economic growth has been accompanied by dramatic changes in the structure of the economy. Agriculture's share in the total economy declined from about 40 per cent of GDP in 1970 to less than 20 per cent in 1997. At the same time, agriculture's share in total employment declined from 81 per cent to 49 per cent.[1] The declining role of agriculture in the economy means the share of agricultural trade in China's total trade has decreased significantly. In 1980, agriculture's share of both exports and imports was around 30 per cent, and this declined to about 10 per cent by 1997. This is an indication of the improvement in resource allocation among sectors and the shifting of comparative advantage between agricultural and manufactured products.

In nominal terms, the value of China's agricultural exports grew at an average rate of 7.1 per cent a year from 1980 to 1996. Agricultural imports grew at an average rate of 5.9 per cent over the same time period. However, the real value of China's agricultural trade (exports plus imports) grew at only 2 per cent per year, on average, from 1980 to 1996.

The overall composition of China's agricultural trade is summarised in tables 1 and 2, where we report the nominal value of exports and imports, respectively, over the 5 years between 1992 and 1996. For the purposes of summarising China's trade data, we have broken the agricultural trade figures in tables 1 and 2 into four categories: grains, horticultural products, animal products and other.

China's total agricultural exports were valued at US$10.6 billion in 1996. Exports of grains were valued at US$1.4 billion in 1996 (about 13 per cent of the total) and edible oilseeds and oils accounted for most of these grain exports. Maize exports were near zero in 1995 and 1996 (due to the government blockade on exports). Earlier, in 1992 and 1993, maize exports were much more important and maize alone accounted for 13 per cent of

[1] There is considerable variation in estimates of the percentage of the labour force engaged in agriculture in China. The large discrepancy in labour statistics is not widely discussed, with the exception of Banister and Harbaugh (1992).

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Table 1 China's agricultural exports, 1992–1996, in nominal US$millions

	1992	1993	1994	1995	1996
Total exports	**9,189**	**9,158**	**11,001**	**9,902**	**10,609**
Grains	**2,491**	**2,485**	**3,095**	**1,343**	**1,402**
Rice	218	253	515	16	112
Wheat	0	8	10	2	0
Maize	1,187	1,154	944	13	30
Barley	0	0	0	0	0
Other grains	80	58	63	45	45
Grain products	47	66	80	90	223
Oil seeds	465	434	665	521	476
Vegetable oils and fats	494	511	818	655	515
Horticultural products	**3,572**	**3,703**	**4,618**	**5,300**	**5,137**
Vegetables	637	680	912	849	788
Nuts	132	169	175	172	171
Fruits	123	153	205	252	246
Fruit and vegetable products[a]	1,296	1,323	1,721	2,207	2,092
Plant based fibres	30	34	35	22	20
Tea	362	356	294	275	283
Tobacco crops	141	135	94	147	111
Other crops[b]	498	511	764	852	803
Other food products[c]	353	342	418	524	623
Animal products	**2,060**	**1,934**	**2,534**	**2,708**	**3,484**
Live bovine	74	72	70	69	48
Live swine	290	272	270	279	294
Live poultry	23	22	26	29	121
Processed bovine	127	193	126	169	138
Processed swine	182	198	277	406	328
Processed poultry	6	8	13	35	774
Meat products	86	70	93	110	144
Dairy products	22	27	23	28	32
Seafood products[d]	4	5	10	7	50
Raw wool	307	292	456	273	323
Raw silk	325	245	405	353	313
Other animal products	614	531	766	951	919
Other	**1,066**	**1,035**	**755**	**551**	**588**
Beverages	623	597	322	189	250
Sugar	226	214	271	313	324
Raw cotton	217	224	161	49	14

Source: compiled from China's Customs Statistics.
[a] These include canned, processed and preserved fruits and vegetables.
[b] These include bulbs, tubers, trees, flowers, coffee, spices, seeds, pharmaceutical plant products, gums, saps and other vegetable materials.
[c] These include starches, glucose, fructose, pastas, biscuits and animal feed.
[d] This category does not include total trade in aquatic products.

total agricultural exports in each of those 2 years. Prior to the export blockade, grains accounted for over 27 per cent of total agricultural exports.

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Table 2 China's agricultural imports, 1992–1996, in nominal US$millions

	1992	1993	1994	1995	1996
Total imports	**4,930**	**3,408**	**6,578**	**11,376**	**9,936**
Grains	**2,250**	**1,514**	**3,128**	**6,234**	**5,145**
Rice	39	35	141	434	286
Wheat	1,504	834	961	2,026	1,890
Maize	0	0	0	816	73
Barley	134	128	179	241	304
Other grains	0	0	0	65	1
Grain products	38	16	22	40	156
Oil seeds	31	28	61	107	323
Vegetable oils and fats	503	472	1,763	2,505	2,111
Horticultural products	**882**	**733**	**821**	**1,067**	**1,433**
Vegetables	38	23	14	74	69
Nuts	9	8	10	8	12
Fruits	14	22	40	67	185
Fruit and vegetable products[a]	49	76	104	115	131
Plant based fibres	6	14	37	54	35
Tea	3	3	2	2	1
Tobacco crops	87	51	28	75	61
Other crops[b]	174	168	152	180	200
Other food products[c]	501	368	434	492	739
Animal products	**1,067**	**994**	**1,280**	**1,747**	**1,671**
Live bovine	1	2	0	0	0
Live swine	0	0	0	2	2
Live poultry	16	11	10	14	15
Processed bovine	23	38	54	149	100
Processed swine	8	5	9	13	8
Processed poultry	0	0	0	1	140
Meat products	5	5	5	10	6
Dairy products	59	48	76	58	55
Seafood products[d]	11	11	8	10	10
Raw wool	793	716	825	1,018	880
Raw silk	3	1	9	15	7
Other animal products	149	159	285	457	449
Other	**731**	**167**	**1,348**	**2,329**	**1,687**
Beverages	255	111	406	901	393
Sugar	28	36	31	9	30
Raw cotton	447	20	910	1,419	1,264

Source: compiled from China's Customs Statistics.
[a] These include canned, processed and preserved fruits and vegetables.
[b] These include bulbs, tubers, trees, flowers, coffee, spices, seeds, pharmaceutical plant products, gums, saps and other vegetable materials.
[c] These include starches, glucose, fructose, pastas, biscuits and animal feed.
[d] This category does not include total trade in aquatic products.

In 1996, China's horticultural exports totalled US$5.1 billion, up from US$3.5 billion in 1992. As a share of total agricultural exports, horticultural products increased from 39 per cent in 1992 to 48 per cent in 1996. Fruit and

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vegetable products were by far the most important component of horticultural exports, followed by 'other crops' and vegetables (see table 1).

Exports of animal products also grew over the 1992–1996 time period, from US$2.0 to $3.4 billion, and from 22 to 33 per cent of total agricultural exports. Unlike grains and horticultural products, no single commodity has dominated animal product exports. Processed poultry, processed swine and raw wool were the most valuable exports in 1996, but in total these three commodities accounted for less than 15 per cent of animal product exports.

Turning to table 2, we find that China's agricultural imports grew from US$4.9 billion in 1992 to US$9.9 billion in 1996. Grains typically made up over half the value of imports, with wheat, vegetable oils, and fats the major imports. In 1992, wheat plus vegetable oils and fats comprised over 40 per cent of total agricultural imports, with wheat at 30 per cent and vegetable oils/fats at 10 per cent. In 1996, these two commodity groups still had a 40 per cent share of imports, but wheat's share fell to 19 per cent and vegetable oils/fats increased to 21 per cent.

From 1992 to 1996, the value of horticultural imports increased from US$0.8 to US$1.4 billion, but horticulture's share in total agricultural imports fell from 18 per cent to 14 per cent over this period. Fruits were the most important horticultural import, but imports were diversified across this product grouping. The share of animal products in total imports also fell over this period from 22 per cent to 17 per cent (valued at US$1.7 billion in 1996). Raw wool was by far the most important item in this group, accounting for over half of animal product imports.

The data in table 2 are the official trade data and for some commodities; they significantly under-report the value of trade due to smuggling from Hong Kong. This is especially true for horticultural and animal products and this issue is discussed in the following text.

Figure 1 displays China's net agricultural exports for four aggregate groups: grains, animal products, horticultural products and 'other.' These data are from a different source than the data in tables 1 and 2; they cover a longer time period (1980–1999), and they are expressed in real terms with the USA CPI as the deflator.[2] Although China continued to be a net importer of grains in the late 1990s, there were erratic swings in the value of trade and the value of net imports decreased sharply after 1995. The data in figure 1 show exports of horticultural products grew after 1980, until 1995.

If net exports of horticultural products (figure 1) were adjusted for imports smuggled into China, the rise in horticultural exports until 1995 would not be

[2] Food and Agriculture Organisation (FAO) trade data for China include Taiwan. Although not ideal, we believe that the inclusion of Taiwan does not unduly influence our observations with regard to figures 1 and 2.

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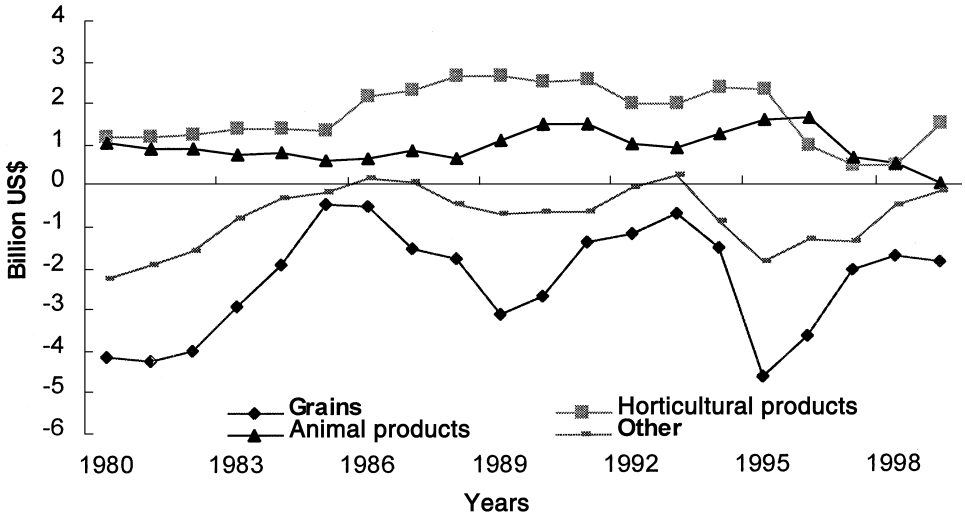

Figure 1 China's agricultural real net exports 1980–1999
Source: Food and Agriculture Organization (FAO) of the United Nations, FAOSTAT, www.fao.org

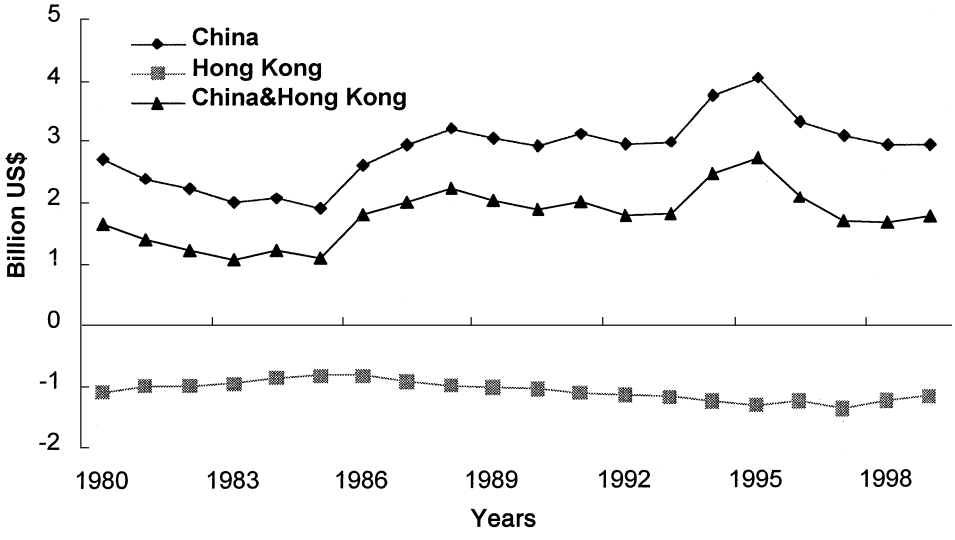

Figure 2 Fruits & vegetable real net exports China & Hong Kong, 1980–1999
Source: Food and Agriculture Organization (FAO) of the United Nations, FAOSTAT, www.fao.org

so strong. To help illustrate this point with regard to smuggling, figure 2 shows net exports of fruits and vegetables from China, Hong Kong and the two combined. We see from figure 2 that both Hong Kong's imports and

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China's exports of fruits and vegetables have shown little change in trend over the past 10 years. If we combine the trade data from Hong Kong and China, we find that the 1999 value of net exports into the region was not much different from that of the late 1980s.

China tends to directly import bulk agricultural commodities, whereas a large share of the processed food and consumer ready products are first imported into Hong Kong and then re-exported to mainland China. For example, almost all of the USA meat, fruit and vegetable exports to China are routed through Hong Kong. Despite a relatively small population of only 6 million, Hong Kong imported over US$14.2 billion in agricultural products in 1996 (US Department of Agriculture 1997) more than official imports into mainland China. Hong Kong ranks as one of the top Asian import markets for farm products. However, these imports are not all for domestic consumption purposes and, in fact, Hong Kong officially re-exports about 55 per cent of its agricultural imports.

There is a large two-way trade in agricultural products between Hong Kong and China. Hong Kong's imports from China include poultry, fruits, vegetables, rice and nuts. At the same time, Hong Kong exports substantial amounts of poultry, fruit, vegetables, nuts, oilseeds and cotton to China. In addition to the legal shipments from Hong Kong to China, there is a large illegal trade (US Department of Agriculture 1996; US Trade Representative 1998 and 1999; Wong unpubl. data 1998). Undocumented shipments of fresh fruit may account for up to 70 per cent of Hong Kong's imports (Wong unpubl. data 1998). For example, the value of chicken parts smuggled into China alone could amount to more than US$300 million per year (US Trade Representative 1998 and 1999). It is difficult to estimate the total dollar value of undocumented agricultural exports from Hong Kong to China, but it could exceed US$1 billion per year.

3. Changing trade patterns

Prior to the 1978 reforms, almost all of China's foreign trade was subject to central planning through a small number of foreign trade corporations (FTC). For most sectors, the government had liberalised central planning of trade, and the process of trade policy reform had involved the introduction of some competition in international trading. The opening of China's economy involved policies to promote exports and attract foreign direct investment as well. However, agricultural trade is a major exception to this move towards decentralisation of foreign trade.

To more fully examine the question of whether or not China's agricultural exports increasingly reflect its changing comparative advantage, we study the persistence of trade patterns, following the methodology of Gagnon and

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Rose (1995) and Carolan *et al.* (1998). This involves an examination of the persistence of trade balances for three groups: agricultural products, 'other' primary products and manufacturing. Each group's international trade status is in surplus, balance or deficit in any given year and we track whether or not the trade status changes over time. If the trade status of a good does not change in a significant way throughout the time period studied, then the trade pattern of this good is viewed as being persistent. The trade pattern of a category will be persistent if most goods in that category do not experience a change in their trade status. For example, agricultural trade patterns will show persistence if relatively few agricultural goods that were net exports (i.e., in surplus) move to either a net import (i.e., deficit) position or to a balanced trade position, etc.

It is the relative trade performance of agriculture compared to other primary products and manufacturing that is the interesting question. Our trade data for this section were obtained from Statistics Canada (the World Trade Analyzer) and the original data source was from the United Nations. The raw data were the nominal USA dollar value of China's exports and imports annually from 1980 to 1997, disaggregated at the 3-digit Standard Industry Trade Classification (SITC) level.

Using 3-digit SITC classifications, we first divided the data into 67 agricultural subgroups, 56 subgroups of 'other' (i.e., non-agricultural) primary commodities, and 155 manufacturing subgroups. Examples of goods at this level of disaggregation for agriculture were unmilled wheat (SITC #041); fresh, chilled and frozen vegetables (SITC #054); manufactured tobacco (SITC #122); and unmanufactured tobacco (SITC #121). For other primary commodities, examples include crude fertilizer (SITC #271); coal, lignite and peat (SITC #322); and tanned furskins (SITC #613). For manufactures, examples include telecommunications equipment, parts and accessories (SITC #764); toys, games and sporting goods, etc (SITC #894); and passenger motor vehicles excluding buses (SITC # 781).

Following Gagnon and Rose (1995), the trade balance figures were then normalised in order to remove any trend in the data due to systematic factors such as inflation. The normalised trade balance (NB) for commodity group i at time t is defined as:

$$NB_{it}^{j} \equiv \left(\frac{X_{it}^{j}}{\sum_{i} X_{it}^{j}} - \frac{M_{it}^{j}}{\sum_{i} M_{it}^{j}} \right) \times 100 \qquad (1)$$

Where for each j (agriculture, other primary products and manufacturing), X_{it} is the value of exports of subgroup i at time t and M_{it} is the value of imports. The sum of NB_{it} is zero for any given year, for each j, $j = 1$, 2 or 3.

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After the data were normalised, the NB subgroups were then classified into three categories for each year: namely, trade surplus, trade balance or trade deficit. Subgroups in trade surplus were defined as those goods whose NB was greater than one standard deviation above zero. Those subgroups with an NB within one standard deviation of zero were classified as being in balance. Finally, those subgroups with a value of NB more than one standard deviation below zero were classified as being in a trade deficit. As part of this classification procedure, the standard deviation was computed for each commodity's NB series.

After normalising and categorising[3] each NB subgroup, we constructed the two-way trade tables, labelled as tables 3, 4 and 5. These tables provide a breakdown of China's trade values by the initial and final trade balance. For the initial period we chose a 3-year period centered on 1981 and for the final period the 3-year mean is centered on 1996. The construction of tables 3 to 5 was based on a normalised trade share (NV). This normalisation measures the relative importance of a commodity group i in category j in terms of its share for a given year, t, as follows:

$$NV_{it}^{j} \equiv \frac{1}{2} \times \left(\frac{X_{it}^{j}}{\sum_{i} X_{it}^{j}} + \frac{M_{it}^{j}}{\sum_{i} M_{it}^{j}} \right) \times 100 \qquad (2)$$

The sum of NV_{it}^{j} for any time period, t, over goods for each category, j, is 100. Therefore, NV_{it}^{j} is a percentage measure.

The results in table 3 suggest that for agriculture, the subgroups that were in surplus in 1980–1982 accounted for 55.4 per cent of the value of normalised

Table 3 Breakdown of final period agricultural trade (%)

	1995–1997 Surplus	1995–97 Balance	1995–97 Deficit	1995–97 Total
1980–1982 Surplus	43.88	5.22	6.28	55.37
1980–1982 Balance	1.19	13.13	18.43	32.75
1980–1982 Deficit	0.00	4.47	7.40	11.88
1980–1982 Total	45.07	22.82	32.11	100.00
χ^2 (d.f. = 8)	58.73			
C-statistic	0.54			
Number of goods	67			

Source: estimated from WTA (World Trade Analyzer) 1980–1997 CD-ROM database, Statistics Canada.

[3] For categorisation purposes, we estimated two standard deviations for each NB, one for the first half of the dataset (1980–1988) and one for the second half of the dataset (1989–1997). Although not reported we also tried estimating one standard deviation for the entire period and our results did not change appreciably.

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Table 4 Breakdown of final period 'other' primary product trade (%)

	1995–1997 Surplus	1995–97 Balance	1995–97 Deficit	1995–97 Total
1980–1982 Surplus	13.75	16.43	10.29	40.46
1980–1982 Balance	15.24	2.83	8.40	26.47
1980–1982 Deficit	4.38	2.64	26.05	33.07
1980–1982 Total	33.36	21.90	44.74	100.00
χ^2(d.f. = 8)	32.50			
C-statistic	0.40			
Number of goods	56			

Source: estimated from WTA (World Trade Analyzer) 1980–1997 CD-ROM database, Statistics Canada.

Table 5 Breakdown of final period manufacturing trade (%)

	1995–1997 Surplus	1995–97 Balance	1995–97 Deficit	1995–97 Total
1980–1982 Surplus	24.96	5.10	0.83	30.89
1980–1982 Balance	9.31	4.72	11.14	25.17
1980–1982 Deficit	3.13	4.15	36.65	43.94
1980–1982 Total	37.40	13.98	48.62	100.00
χ^2(d.f. = 8)	51.98			
C-statistic	0.51			
Number of goods	155			

Source: estimated from WTA (World Trade Analyzer) 1980–1997 CD-ROM database, Statistics Canada.

agricultural trade in 1995–1997. Of these goods in surplus, subgroups accounting for 5.2 per cent of the end-of-period trade moved to a balance, and sub-groups accounting for 6.3 per cent of the end-of-period trade moved to a deficit. Of the trade volume, 24.7 per cent moved from balance or surplus to deficit. If we add up the per centage of trade that is persistent (the diagonal elements in table 3) we find for agriculture that this sum is 64 per cent.

For 'other' primary products (table 4), the subgroups that were in surplus in 1980–1982 accounted for 40.5 per cent of the value of normalised agricultural trade in 1995–1997. Of these goods, 16.4 per cent moved to balance by 1995–1997 and 10.3 per cent moved to a deficit. Adding up the diagonal elements in table 4, we find that 42.3 per cent of the trade in primary products was persistent, from 1980 to 1997. These results suggest less persistence in 'other' primary product trade compared to agricultural trade.

Turning to manufacturing, in table 5, the subgroups that were in surplus in 1980–1982 accounted for 30.9 per cent of the value of normalised manufacturing trade in 1995–1997. Of these goods, 5.1 per cent moved to balance by the ending period and 0.8 per cent moved to deficit. Adding up the diagonal elements in table 5, we find that 66.3 per cent of the trade in

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manufacturing was persistent, from 1980 to 1997. These results suggest that there is as much persistence in manufacturing trade as in agricultural trade.

As a statistical measure of trade persistence, we can use a transformation of the standard chi-squared (χ^2) test–Cramer's C-statistic as suggested by Kendall and Stuart (1961). The C-statistic lies between zero and one, with one representing complete association between the beginning and the ending trade balance. From tables 3, 4 and 5 we find the C-statistic is 0.54 for agriculture, 0.40 for other primary products and 0.51 for manufactures. These results suggest that agricultural and manufacturing trade patterns were more persistent than patterns for other primary products.[4]

Rather than just comparing the beginning and ending time periods, we can construct histograms for agriculture and manufacturing based on the number of years each subgroup runs a surplus (see Gagnon and Rose 1995). Figure 3 shows histograms for agriculture, 'other' primary products and manufactures. Figure 3 classifies subgroups indicating how many years the subgroup was in surplus. This means that a subgroup that was in surplus for each of the 18 years would be in the cell at the extreme right of the histogram. The histogram for agriculture displays strong evidence of bi-modality, which also indicates persistence in trade flows. These histograms are therefore consistent with the C-statistic results, suggesting greater persistence in the composition of agricultural trade, especially compared to 'other' primary products.

Finally, the results of an additional test for association are reported in table 6. We regressed $NB_{1995–97}$ on $NB_{1980–82}$. The regression coefficients for all three groups are all statistically significant, but the coefficient for other primary products is smaller than for agriculture or manufacturing. Similarly, the R^2 is relatively small for other primary products (0.09) compared to either manufacturing (0.26) or agriculture (0.42). These results support the conclusion that the surplus and deficit trade patterns appear to change the most for 'other' primary products. It is somewhat surprising that the structure of manufacturing trade was almost as persistent as agricultural trade during the time period studied. However, this result may be due to the prevalence of intra-industry trade in manufactures, measured at the 3-digit SITC level.

4. Conclusions

The major finding of this paper is that China's agricultural trade structure has not changed dramatically since 1980. Even if China's agricultural trade loosely corresponds to the basic principles of comparative advantage, there is

[4] Carolan *et al.* (1998) examined USA trade with eight Asian countries (Hong Kong, Japan, Malaysia, Taiwan, Indonesia, S. Korea, Singapore and Thailand). Their estimated C-statistics exceeded 0.5 in only two cases, for Hong Kong and Indonesia. They suggested that if the C-statistic was less than 0.5, this indicates a considerable change in trade patterns.

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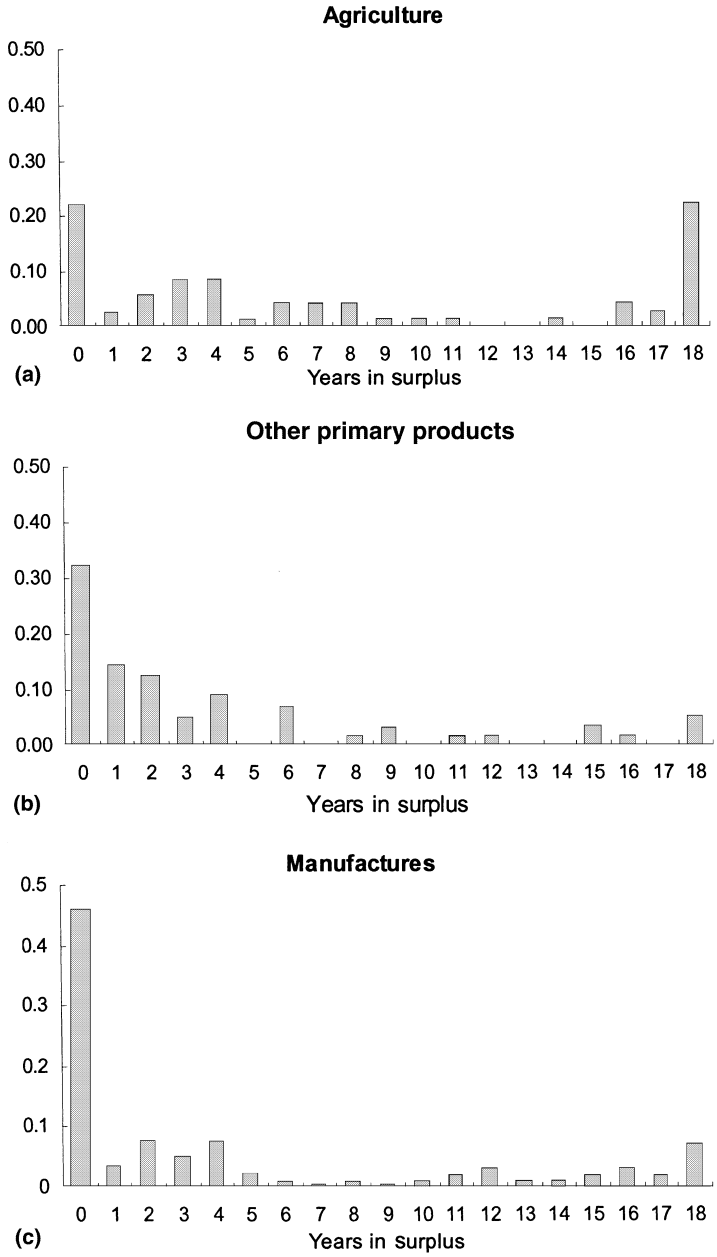

Figure 3 Histograms: China's changing trade patterns
Source: estimated from WTA (World Trade Analyzer) 1980–1997 CD-ROM database, Statistics Canada

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Table 6 Regression results: $NB_{1995–97}$ on $NB_{1980–82}$

	Agriculture	Other primary products	Manufacturing
Intercept (*t* Stat)	0 (0)	0 (0)	0 (0)
X Coefficient (*t* Stat)	0.29 (6.89)	0.12 (2.25)	0.32 (7.31)
R^2	0.42	0.09	0.26
Observations	67	56	155

Source: estimated from WTA (World Trade Analyzer) 1980–1997 CD-ROM database, Statistics Canada.
Note: values in parenthesis are t-statistics.

little evidence of increased reliance on comparative advantage. What is striking is the modest and limited way that agricultural trade has expanded along comparative advantage lines, despite an increase in foreign trade overall, and the implicit evidence this provides of foregone opportunities for benefit from agricultural trade. This result suggests that WTO membership is likely to have a significant impact on the pattern of China's agricultural trade. World Trade Organisation membership may sweep away non-transparent trade barriers, which can be inferred from their effect of constraining the pace of change in agricultural trade patterns.

References

Anderson, K. and Strutt, A. 1999, *China's Economic Growth, Policy Reforms and WTO Accession: Implications for Agriculture in China and Elsewhere by 2005*, paper presented at the International Agricultural Trade and Research Consortium Symposium, San Francisco, California, June 1999.

Banister, J. and Harbaugh, C.W. 1992, 'Rural Labor Force Trends in China', in *China: Agricultural and Trade Report, Situation and Outlook Series (RS-92-3)*, Economic Research Service, US Department of Agriculture, July 1992, pp. 59–68.

Carolan, T., Singh, N. and Talati, C. 1998, 'The Composition of U.S.–East Asia Trade and Changing Comparative Advantage', *Journal of Development Economics*, vol. 57, pp. 361–389.

Carter, C., Zhong, F. and Cai, F. 1996, *China's Ongoing Agricultural Reform*, San Francisco1990 Institute, Burlingame, CA.

Colby, H., Price, J.M. and Tuan, F.C. 2000, 'China's WTO Accession Would Boost U.S. Agricultural Exports and Farm Income', *Agricultural Outlook*, Economic Research Service, USA Department of Agriculture, March, pp. 11–16.

Du, Y. 2001, 'China's Agricultural Restructuring and System Reform Under its Accession to WTO', in *China's Agriculture in the International Trading System*, O.E.C.D, Paris, pp. 52–60.

Gagnon, J.E. and Rose, A.K. 1995, 'Dynamic Persistence of Industry Trade Balances: How Pervasive is the Product Cycle?', *Oxford Economic Papers*, vol. 47, pp. 229–248.

Ianchovichina, E. and Martin, W. 2001, *Trade Liberalization in China's Accession to the World Trade Organization*, working paper #2623, International Trade Research Group, World Bank, Washington DC.

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Kendall, M.G. and Stuart, A. 1961, *The Advance Theory of Statistics*, vol. 2, Hafner Publishing, New York.

Lardy, N.R. 1994, *China in the World Economy*, Institute for International Economics, Washington DC.

Naughton, B. 1996, 'China's Emergence and Prospects as a Trading Nation', *Brookings Papers on Economic Activity*, **2**, pp. 273–344.

Naughton, B. 1999, *China's Trade Regime at the End of the 1990s*, paper presented at the International Agricultural Trade and Research Consortium Symposium, San Francisco, California, June 1999.

US Department of Agriculture 1996, *Hong Kong: Attache Report*, Foreign Agricultural Service, Washington, DC, December 1996.

US Trade Representative 1998 and 1999, *National Trade Estimate Report on Foreign Trade Barriers: China*, USA Trade Representative, Washington DC.

US Department of Agriculture 1997, *China: Situation and Outlook Series*, Economic Research Service, Washington DC, June.

Wailes, E., Fang, C. and Tuan, F. 1998, 'U.S.–China Agricultural Trade: Constraints and Potential', *Journal of Agricultural and Applied Economics*, vol. 30, pp. 113–126.

Wall, D., Jiang, B. and Yin, X. 1996, *China's Opening Door*, Royal Institute of International Affairs, London.

Wang, Z. 1997, 'China's Agricultural Trade in 1996, Commodity Structure, Geographical. Distribution, and its Role in U.S. and World Agricultural Trade', in *China: Situation And Outlook Series*, *(WRS-97–3)*, Economic Research Service, USA Department of Agriculture, June, pp. 6–15.

West, L.A. 1993, *Reform of China's Foreign Trade System*, Center for International Research, USA Bureau of the Census, October 1993.

World Bank 1999, *World Development Indicators*, World Bank, Washington DC.

Zhang, X. 2000, *China's Trade Patterns and International Comparative Advantage*, St. Martin's Press, New York.

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