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Empirical study on determinants of China's commodity trade with Australia

Tianshu Liu*

This paper aims to analyze the impact of current regional trade agreements on commodity trade between China and Australia. The paper estimates data from 1992-2004, using China's commodity exports and imports to and from Australia as dependent variables. Economic variables that explain the economic condition in China are estimated. Additional dummy variables that are related with China's membership in a regional trade agreement are introduced into the model. The results show that the inception of a regional trade agreement, especially NAFTA and APEC, has affected China's commodity trade with Australia to some extent.

Field of Research: Economics

1. Introduction

Since the beginning of the twenty-first century many countries has tended to pursue regional or bilateral trade and economic cooperation with their major trading partners. China and Australia are also involved in this activity.

China has strengthened its trade and economic relationship with Australia since 1973 when the *Trade Agreement between the Government of Australia and the Government of the People's Republic of China* was carried out (Department of Foreign Affairs and Trade, and Ministry of Commerce of China (2005). Further bilateral agreements including reciprocal encouragement and protection of investments, cooperation in customs, agricultural products trade, sanitary and phytosanitary regulations, services trade and energy resources have been signed and implemented in the last thirty-two years which enhance both countries' trade relationship. This relationship is further improved by two countries' commitment in regional trade and economic development in the Asia-Pacific Economic Cooperation (APEC). With China's accession to WTO in December 2001, China begins to pursue multilateral preferential trade with Australia, representing a further cooperation with Australia in the world level. Simultaneously bilateral trade and economic relationship between both countries has achieved great success when *Trade and Economic Framework between Australia and the People's Republic of China* was signed in 2003. The expected future success of negotiation on a bilateral free trade on the basis of this Framework will further push two countries' trade and economic cooperation to a summit.

As a result of the implementation of these agreements, the two way trade between China and Australia has increased rapidly in a large amount. China's total merchandise trade with Australia has increased from US$1287 million in 1980 to US$8453 million in 2000, averagely increasing 12.58 percent per annum. China's merchandise exports to Australia increase 15.78 percent annually from US$224 million in 1980 to US$3574 million in 2001; and its merchandise imports from Australia increase 11.80 percent per annum from US$1063 million in 1980 to

* Ms Tianshu Liu, School of Economics, Finance & Marketing, RMIT University.
Email: Tianshu.liu@rmit.edu.au

US$5024 million in 2000. The 1990s is the fastest growing period for two countries' trade, with an average annual increase in China's total merchandise trade, exports and imports with Australia larger than average per annum increase of those with the world. The great success in two countries' merchandise trade improves both countries as a major trading partner to each other. In 2003 China has become Australia's third trading partner, second exports destination, and third imports source country; and Australia is China's twelfth trading partner, twelfth exports destination and eleventh imports source country (Author's calculation from Direction of Trade Statistics data of International Monetary Fund).

It is important for both countries to make their merchandise trade a further success in the future. As China and Australia tends to develop regional trade and economic cooperation, this paper studies what is the impact of current regional trade agreements on merchandise trade between China and Australia. Section 2 explains a revised gravity model that is studied in this paper and its explainable variables. Section 3 reports regression results, and Section 4 concludes.

2. Theoretical analysis

2.1 Commodity trade determinants

Several factors reflecting a country's economic condition have been considered affecting trade value to some extent, including gross domestic product (GDP), total population, distance between two countries, and exchange rate changes.

As larger economies could trade more than smaller ones, trade flows are considered to be larger between countries with higher or increased gross domestic product and per capita GDP, as wealthier economies could produce and trade more than poorer ones. Hence GDP is a crucial determinant of a country's trade volume. It is considered positively impacted on trade, i.e. a large GDP will enable China to trade more with Australia. An increase in population is expected to reduce trade due to a large domestic market that will enable the realization of production economies of scale. Thus population has a negative impact on trade, which indicates that a country tends to trade inside with a large population. Physical distance between pairs of countries is considered another crucial factor affecting trade flows. The reason is that long distance incurred higher transportation cost will increase products' price that reduce their competitiveness, thus has a negative impact on trade volume. Frankel (1997) highlighted this problem in his study and discussed its impact in his model in analyzing the impact of RTAs.

A relative change in exchange rate is thought to affect a country's import and export volumes because it can increase or decrease commodity prices counted in either national or foreign currency. Depreciation of a country's currency can enable this country to export more and import less; on the other hand, appreciation can enable a country to export less and import more. Furthermore, exchange rate can also be utilized to analyze a third country effect, which indicates that the competitiveness from a third country will put an additional effect on two countries' bilateral trade besides their economic situations (Bayoumi and Eichengreen 1997). In this paper if the exchange rate is getting larger, it means Renminbi is depreciated compared with U.S. dollars. Therefore it has a positive relationship with China's exports to Australia and negative relationship with China's imports from Australia.

Regional trade agreements tend to liberalize trade among their member countries, either cutting off or diminishing customs duties. They also pursue to formalize domestic regulations that protecting their trade from others and foreign direct investment. Thus it is understandable that trade between member countries in an RTA can be increased by the implementation of this RTA. Therefore RTAs are selected to put in the model as dummy variables to study their impact on changes of trade volume between their members and non-members since the 1970s. Many researchers, such as Aitken (1973) and Braga, Sadafi and Yeats (1994), Bayoumi and Eichengreen (1997), Frankel (1997), Soloaga and Winters (2001), have introduced RTAs in order to achieve this goal.

RTA dummies of EU, CUSFTA, NAFTA, and ASEAN are considered to have a positive impact on China's trade with Australia (both China and Australia are not members in these RTAs), where member countries in these regions intend to trade more within the region, thus pushing China to trade more with other non-members (including Australia). Therefore, positive coefficients are expected for these RTAs. APEC's development will enable China trading more with other members including Australia when both China and Australia are members; hence a positive coefficient is expected. When only Australia is a member of an RTA while China is not, Australia is expected to have the tendency to trade more with other members rather than with China; consequently a negative coefficient is expected for this RTA, i.e. CER.

2.2 Model

The model estimated in this paper is a revised gravity model, using logarithms of exports and imports as dependant variables in the equation, logarithms of GDP, distance, population and exchange rate as explainable variables, and RTAs including EU, CUSFTA, NAFTA, ASEAN, CER and APEC as dummy variables.

$$\ln(DTRADE_{it}) = c_1 + c_2 \ln GDP_t + c_3 \ln dis\tan ce + c_4 \ln population_t + c_5 \ln exchangera te_t$$
$$+ c_6 EU_t + c_7 CUSFTA_t + c_8 NAFTA_t + c_9 ASEAN_t + c_{10} CER_t + c_{11} APECP_t + \varepsilon_{it}$$

In the equation, DTRADE stands for China's exports and imports by commodity to and from Australia respectively; the exports and imports are adjusted by GDP deflator. GDP is China's gross domestic products at constant 1990 prices. Distance is the distance between capital cities of China and Australia. Population is China's population. Exchange rate is defined as one U.S. dollar equals to a number of Renminbi. t is time period, and i stands for different classified commodities.

EU, CUSFTA, NAFTA, and ASEAN are regional economic integration excluding China and Australia as their members. They take the value of one after they form a regional trade agreement, indicating the impact of their aggregation on China's commodity trade with Australia, and zero otherwise. CER takes the value of one after it is formed and zero otherwise, indicating the impact of Australia's participation as a member on its commodity trade with China.

APEC is the only RTA China participates in. It is defined differently from other RTA dummies. As China became a member of APEC in 1991 and the available commodity trade data is from 1992, it is incredible to estimate the impact of APEC

when it is defined the same as other RTA dummies. Therefore a substitute dummy variable definition is adopted here. Lu (2004) points out that APEC's development over these fifteen years (from 1989 until 2004) can be separated into two periods: the first period is the prosperous and developing period from 1989 to 1997; the second period is the adjusting and slow developing period from 1998 up to now. The 1997 Asian financial crisis is the turning point. During the first eight years, APEC actively promoted liberalizing trade and investment in Asia-Pacific region pushed by 1994 Bogor Goals, 1995 Osaka Action Agenda, and 1996 Manila Action Plan. However, as the 1997 Early Voluntary Sectoral Liberalization that tends to liberalize trade in sector level was negatively affected by the 1997 Asian financial crisis, APEC enters a slowly developing period, slowing down its trade and investment liberalization progress. Up to now APEC has not yet come out of the low tide.

In regard to different developing period, I choose to separate APEC development into two periods as a dummy variable, i.e. 1992-1997 and 1998-2004. It takes the value of one for the former period and zero for the latter period, indicating the high speed development of APEC has a positively significant impact on China's commodity trade with Australia. Thus a positive relationship is expected between APEC's development and trade.

The data of China's merchandise trade with Australia are obtained from SourceOECD International Trade by Commodities Statistics from 1992 to 2004 in thousand U.S. dollars. The data are classified according to Standard International Trade Classification System Revision 2. One-digit subheadings including ten broad classified commodities are estimated in the model. GDP and exchange rate data are collected from United Nations National Aggregate Database. The distance (measured in kilometers) between Beijing and Canberra is obtained from "Direct-Line Distances (International Edition)" of Fitzpatrick and Modlin. Exports, imports and GDP are deflated by GDP deflator which is obtained from the United Nations database.

3. Empirical result

The model is estimated in two ways from 1992 to 2004, i.e. panel data regression using pooled least squares method, and regressions for each one-digit commodity using ordinary least squares method. Only five variables can be estimated, including GDP, population, exchange rate, NAFTA and APEC; other variables are finally excluded from final regression because of data problems.

The results for panel data regression show clearly that none of the studied factors has any statistically significant impact on China's commodity trade with Australia, including the formation of NAFTA and different development periods of APEC (See Table 1). However, when considering each one-digit commodity, the results can be shown and explained by the following (See Table 2 and Table 3).

Generally speaking, most of the coefficients of GDP in both exports and imports estimations are expectedly positive and statistically significant, except negative coefficients for mineral fuels, lubricants and related materials in exports studies, and feeding stuff for animals and miscellaneous edible products in imports studies. The results indicate that most of China's commodities trade with Australia are

highly related with China's GDP changes, i.e. a higher GDP in China pushes more exports to Australia and absorbs more imports from Australia.

The coefficients of population have expected negative sign in eight out of ten one-digit commodities in exports studies, and seven out of ten one-digit commodities in imports studies. The coefficients of classifications 1 and 3 in exports estimation show positive signs, and the coefficients of classifications 3, 8 and 9 in imports estimation show the same sign. The positive results in exports studies indicate that China's increasing population does not block those goods from exporting outside China, especially for resources, crude materials and energy. This result is quite puzzling, totally opposite to common concept that China's large population consumes more resources, materials and energy goods.

Table 1: Results for China's total commodity trade with Australia

Variable	Exports		Imports	
	Coefficient	t-Statistic	Coefficient	t-Statistic
C	810.9909	0.2075	-1141.5820	-0.3770
GDP	5.7957	0.3215	-2.0370	-0.1459
Population	-41.5385	-0.2101	55.6521	0.3634
Exchange rate	-6.1032	-0.2753	9.4053	0.5475
NAFTA	2.5870	0.2890	-3.9954	-0.5761
APEC	0.0421	0.0291	0.5487	0.4897
R-squared	0.0481		0.1135	
Adjusted R-squared	0.0097		0.0778	
F-statistic	1.2524		3.1751	
Prob (F-statistic)	0.2889		0.0099	
Total panel (unbalanced) observations	130		130	

Table 2: Results for China's exports to Australia

	SITC0 Food and live animals	SITC1 Beverages and tobacco	SITC2 Crude materials, inedible, except fuels	SITC3 Mineral fuels, lubricants and related materials	SITC4 Animal and vegetable oils, fats and waxes	SITC5 Chemicals and related products, n.e.s.	SITC6 Manufactured goods classified chiefly by material	SITC7 Machinery and transport equipment	SITC8 Miscellaneous manufactured articles	SITC9 Commodities and transactions not elsewhere classified
Variable	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient
C	1180.1050***	-383.3885	341.686	-1444.2280***	1436.3960***	415.7823***	1240.2490***	1406.0520***	260.2148***	3657.0400***
	(19.5105)	(-0.7643)	(1.5542)	(-3.6533)	(3.8043)	(5.0259)	(17.807)	(14.1006)	(3.6256)	(2.9884)
GDP	8.4003***	0.0126	3.4112***	-2.2669	6.9932***	4.5399***	8.1148***	10.8089***	3.5807***	14.3622**
	(30.1115)	(0.0054)	(3.3641)	(-1.2433)	(4.0158)	(11.8984)	(25.2609)	(23.5021)	(10.817)	(2.5446)
Population	-61.0325***	20.6889	-17.7032	72.6191***	-72.2241***	-22.1471***	-63.7082***	-74.4288***	-14.5812***	-182.8676***
	(-19.9485)	(0.8154)	(-1.5919)	(3.6316)	(-3.7817)	(-5.2926)	(-18.0833)	(-14.7563)	(-4.0164)	(-2.9542)
Exchange rate	-3.5395***	-24.3139***	-4.6300***	-20.4328***	-7.5302***	-1.3347***	-2.4564***	10.0759***	5.8127***	-12.6830*
	(-10.315)	(-8.5441)	(-3.7122)	(-9.1108)	(-3.5155)	(-2.8438)	(-6.2168)	(17.8114)	(14.276)	(-1.8269)
NAFTA	0.8883***	10.6519***	1.6569***	8.7968***	3.2071***	0.3880**	0.6595***	-4.1768***	-2.3784***	6.1764**
	(6.4118)	(9.2707)	(3.2902)	(9.7146)	(3.7083)	(2.0477)	(4.134)	(-18.2868)	(-14.4671)	(2.2034)
APEC	0.0692***	-0.2155	0.2762***	0.7072***	-0.2887**	0.1342***	-0.1825***	-0.1316***	0.0429	0.0091
	(3.0935)	(-1.161)	(3.3953)	(4.8349)	(-2.0664)	(4.3851)	(-7.0798)	(-3.5678)	(1.6136)	(0.0201)
R-squared	0.9958	0.9221	0.8782	0.9709	0.4072	0.9927	0.9937	0.9958	0.9935	0.5534
Adjusted R-squared	0.9956	0.9189	0.8733	0.9697	0.3833	0.9924	0.9935	0.9957	0.9932	0.5354
F-statistic	5830.5120	293.3567	178.8327	826.0924	17.0362	3358.6830	3916.916	5930.9520	3773.6060	30.7297
Prob (F-statistic)	0	0	0	0	0	0	0	0	0	0
Included observations	13	13	13	13	13	13	13	13	13	13
Note: *** p<0.01, ** p<0.05, * p<0.10 mean statistically significant at one, five and ten percent level respectively. T-statistic is in brackets.										

Table 3: Results for China's imports from Australia

	SITC0 Food and live animals	SITC1 Beverages and tobacco	SITC2 Crude materials, inedible, except fuels	SITC3 Mineral fuels, lubricants and related materials	SITC4 Animal and vegetable oils, fats and waxes	SITC5 Chemicals and related products, n.e.s.	SITC6 Manufactured goods classified chiefly by material	SITC7 Machinery and transport equipment	SITC8 Miscellaneous manufactured articles	SITC9 Commodities and transactions not elsewhere classified
Variable	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient
C	836.9541**	1115.3660*	1106.0850***	-522.1651**	592.2022**	243.8116**	394.8714***	1574.6820***	-1939.7840***	-14817.8500***
	(2.0306)	(1.9536)	(8.0263)	(-2.0631)	(2.3481)	(2.4746)	(6.6943)	(11.7729)	(-4.5713)	(-8.5632)
GDP	6.2045***	10.2285***	8.0434***	2.2437*	5.8756***	4.0046***	4.3311***	9.2785***	-6.0849***	-64.4949***
	(3.2638)	(3.8843)	(12.6549)	(1.922)	(5.0511)	(8.8127)	(15.9197)	(15.0403)	(-3.109)	(-8.081)
Population	-43.8757**	-60.5355**	-57.0141***	25.5172**	-31.9218**	-13.8415***	-20.6726***	-81.8623***	95.7430***	744.9842***
	(-2.1045)	(-2.0962)	(-8.1792)	(1.9931)	(-2.5023)	(-2.7774)	(-6.9285)	(-12.0997)	(4.4606)	(8.5114)
Exchange rate	5.1640**	10.9532***	-4.5504***	-16.9219***	3.3811**	1.5254***	-4.5612***	14.0459***	17.2548***	67.7624***
	(2.2085)	(3.3817)	(-5.8205)	(-11.7851)	(2.3631)	(2.7291)	(-13.6302)	(18.5105)	(7.1676)	(6.9027)
NAFTA	-1.9196**	-4.8248***	1.2245***	4.9768***	-1.2651**	-0.6532***	1.3521***	-5.7483***	-6.7028***	-26.3934***
	(-2.0333)	(-3.6893)	(3.8792)	(8.5844)	(-2.1898)	(-2.8945)	(10.0075)	(-18.7622)	(-6.8959)	(-6.6589)
APEC	0.8126***	0.2956	0.2795***	0.7044***	0.5460***	-0.0811**	0.2677***	0.0238	0.5407***	2.0974***
	(5.3286)	(1.3995)	(5.4808)	(7.5216)	(5.851)	(-2.2237)	(12.2668)	(0.4804)	(3.4436)	(3.2758)
R-squared	0.6708	0.8801	0.9727	0.9716	0.9361	0.9936	0.9945	0.9409	0.8782	0.7287
Adjusted R-squared	0.6576	0.8753	0.9716	0.9705	0.9335	0.9933	0.9943	0.9385	0.8732	0.7178
F-statistic	50.5439	182.0899	884.4273	849.7159	363.1014	3835.326	4464.017	394.9353	178.7341	66.6254
Prob (F-statistic)	0	0	0	0	0	0	0	0	0	0
Included observations	13	13	13	13	13	13	13	13	13	13
Note: *** p<0.01, ** p<0.05, * p<0.10 mean statistically significant at one, five and ten percent level respectively. T-statistic is in brackets.										

In exports regression, it is expected to see positively signed coefficients of exchange rate in classifications 7 and 8, which clearly supports the fact that when Renminbi is devalued, more machinery, transport and various manufactured goods are exported to Australia. However, other classified goods are not positively affected and seem to be exported less when RMB is depreciated. This may indicate that those goods are in large demand in domestic market; thus they are lured to serve Chinese market instead of Australian market. In imports estimation, the exchange rate is found expectedly negatively affected China's imports in classifications 2, 3 and 6, indicating that China tends to import fewer goods in these classifications when Renminbi is depreciated. The coefficients of the rest classifications are all positive and statistically significant at either one percent or five percent level. This result shows that China does not decrease imports from Australia although the imported cost in Renminbi increases; these commodities include food and live animals, beverages and tobacco, animal and vegetable oils, chemicals and related products, machinery and transport equipment and various manufactured products.

When considering exports estimation, most of the coefficients of NAFTA are statistically significant at one percent level and ten percent level for classifications 5 and 9. The coefficients show expected positive sign in classifications 0, 1, 2, 3, 4, 5, 6 and 9, while negatively signed coefficients are found in classifications 7 and 8. As China is expected to become a 'world factory', its cheap and high quality manufactured goods are quite competitive around world market. It is not a surprise that those products are hindered to North American market after NAFTA is formed and freely traded within the region, where Canada and USA can import from Mexico cheaply after reducing their customs duties. As a result it pushes China to export more to Australia, enlarging Australian market instead. However, there are still some kinds of goods that China does not enlarge its exports to Australia when NAFTA market is not as easy to enter as before. These kinds of commodities are major classified as fish, cereals and sugar products, pulp and waste paper, dyeing materials, medicines, perfumes, manufactured fertilizers and plastic materials, leather and paper goods. They are either largely needed in Chinese domestic market or Australia has other better importing sources. When considering imports estimation, it is expectedly to find positive coefficients of NAFTA in classifications 2, 3 and 6, while negative ones are found in classifications 0, 1, 4, 5, 7, 8 and 9. It indicates that under the influence of NAFTA's implementation, China begins to import more from Australia in crude materials, mineral fuels and material manufactured goods.

In the exports estimation, the expected positively signed coefficients for APEC dummy variable are found in classifications 0, 2, 3, 5, 8 and 9, while negative coefficients occur in classifications 1, 4, 6 and 7. The coefficients of classifications 1, 8 and 9 are not statistically significant; others are significant either at one percent or five percent level. The results show that China exports fewer goods in tobacco, cork and wood, metalliferous ores and metal scraps; coal, coke and briquettes; dyeing materials, manufactured fertilizers, explosives and pyrotechnic products; apparel and clothing accessories; arms of war; while at the same time China enlarges its exports to Australia in goods of cork and wood manufactures, paper articles, manufactures of metal, machinery specialized for particular industries, metalworking machinery, office machines and automatic data processing equipment, and road vehicles. In the imports estimation, most of the coefficients of APEC dummy are found expectedly positively signed and statistically significant at one percent level, while the coefficient of classification 5 is negative and significant at five percent level. The results indicate

clearly that the quick and prosperous development of APEC enables China importing more goods from Australia.

4. Conclusion

This paper studies the impact of regional trade agreements on China's commodity trade with Australia in discussing current China's exports to and imports from Australia in one-digit SITC listed commodities. The paper uses a revised gravity model to estimate the relationship between China's trade with Australia and other determinants, including China's GDP changes, population changes, changes of Renminbi prices, the formation of NAFTA and the development of APEC.

The increases of China's GDP enable Chinese consuming more goods from Australia and producing and exporting more to Australia. However, the large population of China discourages China's trade with Australia to some extent, which indicates that China has the tendency of trading inside the country if more population is expected in the future. The devaluation of RMB does not bring more trade to China from Australia as expected, while decreasing trade between two countries to some extent. It might indicate that China's currency depreciation policy does not achieve corresponding effect.

The inception and implementation of regional trade agreements have a crucial impact on China's commodity trade with Australia. The North American market is integrated by NAFTA in the 1990s, where Canada and USA can import cheaper manufactured goods from Mexico. China as a major exporter to USA is severely impacted by this activity. Thus China diverts to other countries to enlarge its exports and imports, making Australia become China's third major trading partner in 2003. At the same time the quick development of APEC has pushed both countries' commodity trade to some extent as well. Therefore, under the development of regional economic integration around the world, it is possible and necessary for China and Australia to involve in bilateral free trade, which in turn encourages trade between the two countries.

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