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COMPARATIVE ADVANTAGE AND AUSTRALIA–CHINA BILATERAL TRADE

by

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Bilateral trade between Australia and China has expanded in recent years. This paper examines the determinants of bilateral trade at the two-digit commodity level using a modified gravity model with explicitly specified revealed comparative advantage incorporated. This methodology allows us to explore how the relative comparative advantage of Australia and China to the world, mirroring their individual pattern of factor endowments, affects the pattern of trade between the two countries and to identify whether there exists a kind of complimentarity international specialisation between the two countries against the backdrop of each country's booming trade with the rest of the world. Key commodities such as agricultural products, iron ore, petroleum, textiles and clothing, and machinery goods are considered to estimate net welfare in terms of added value deriving from bilateral trade. The findings have policy implications for forging future trade and economic cooperation between Australia and China.

JEL Codes: F13, F14, F15

Keywords: Australia–China Bilateral Trade, Factor Endowment, Revealed Comparative Advantage, Gravity model

1 Introduction

Trade between Australia and China has been fast expanding, especially in recent years. The statistics of the Department of Foreign Affairs and Trade (DFAT) in Australia revealed that China became Australia's second-largest trading partner in 2005 while Australia became China's thirteenth-largest trading partner. The rapid increase in Australia–China bilateral trade stems not only from the fact that the two countries have both been experiencing rapid economic growth recently and reaping the benefit of trade liberalisation undertaken by both countries as part of the Asia–Pacific regional economic cooperation, but also from complementarity in the production and trading structure of the two economies. As an agriculture- and resource- based country, Australia exports its comparative advantage in agricultural and mineral goods, such as

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wheat, milk and animal product, textile fibres, iron ores and energy products to China, which provides China with low-priced raw materials for her industrial production. As a rapidly industrialising country, China absorbs raw materials from Australia and exports its comparative advantage in labour-intensive manufacturing goods, such as textiles and clothing, electronic products, and some general machinery to Australia, which in turn provides Australia with cheaper goods for consumption. Thus, Australia–China bilateral trade has been driven mainly by the two countries' underlying comparative advantages, which forms a special pattern of international specialisation between the two countries. Such specialisation plays a key role in each country's overall trade with the rest of the world.

Previous studies of bilateral trade between Australia and China have looked at trade between the countries from different angles. For example, Anderson (1995) examined Australia's changing trade pattern and growth performance and highlighted the role of regional and global trade liberalisation in affecting this changing trend in trade. Findlay and Song (1996) examined the structure of bilateral trade and argued that future bilateral trade between Australia and China would continue to be driven by each country's underlying comparative advantage. McKibbin (1997) used a dynamic computable general equilibrium model ('G-Cubed') to analyse the impact of multilateral trade liberalisation on Australia and China's economic growth and changes in its pattern of trade. Sheng (2002) used a global trade analysis project (GTAP) model to examine the potential impact of APEC trade liberalisation on Australia–China bilateral trade. More recently, some studies have started to examine complementarity and substitutability in Australia–China bilateral trade. Zhou *et al.* (2005) examined Australia–China agricultural trade by calculating the trade intensity index (TII), the revealed comparative advantage index (RCA) and the trade complementarity index (TCI) and found that there is great potential for expanded bilateral agricultural trade due to the two countries' individual comparative advantages. McDonald *et al.* (2005) systematically analysed trade flows between Australia and China, and found that there is a high degree of trade complementarity between the two countries, indicating that freer trade between them is likely to lead to mutual trade gains. Other studies have considered the effect of the boom in the Chinese economy (driven by its rapid urbanisation and industrialisation) on Australia–China bilateral trade in agricultural and mineral goods. Tcha and Wright (1999) analysed China's imports of iron ore from Australia, using annual time-series data for the period 1973–1996, and showed that the rapid economic growth and associated increase in consumption of steel and iron in China has had a significant positive effect on China's imports of iron ore from Australia. Zhao and Wu (2006) investigated the determinants of China's energy import demand and found that the rapid growth of industrial production and expansion of the transport sector in China has played an important role in driving her international energy demand, and, in particular, demand from Australia. Finally, some studies, such as Mai *et al.* (2005) and Hoa (2007) have modelled the potential benefits of an Australia–China free trade agreement.

Such studies help us to understand the development of Australia–China bilateral trade and its determinants. However, there are two areas where further studies are required. First, it is useful to look at bilateral trade by incorporating each country's relative comparative advantage to the rest of the world more explicitly in the modelling framework from both static and dynamic perspectives. Second, it is instructive to analyse the pattern of bilateral trade and its determinants from a more general perspective, such that the issue is not only examined in a bilateral setting but also in relation to both country's overall trade with the world. To realise this objective, this paper adopts a 'gravity model' that explicitly specifies revealed comparative advantage in order to examine Australia–China bilateral trade at the two-digit commodity level. Its main objective is to explore how the relative comparative advantage of each country to the world—a widely agreed factor in determining inter-industry trade—affects bilateral trade between the two countries and to identify whether there exists *self-strengthening* complimentarity specialisation between the two countries against the backdrop of each country's booming trade with the rest of the world. Finally, key commodities, such as agricultural products, iron ore, petroleum, textiles and clothing, and machinery are considered to estimate net welfare in terms of the added value resulting from bilateral trade. The findings have policy implications for forging future trade and economic cooperation between Australia and China.

2 Australia–China Bilateral Trade: A Review

Australia–China bilateral trade has grown rapidly during the past three decades (see Figure 1).[1] According to statistics from the UN (2007), the total merchandise trade between the two countries increased from US$100 million in 1972, when the two countries first established diplomatic relations, to US$32.9 billion in 2006, with an average annual growth rate of 18.5% (year-on-year), which is around twice that for total world trade (around 9.8%) over this period. Based on Australian statistics, Australia's total merchandise exports to China have risen from US$46.4 million to US$19.3 billion representing a more than four hundred-fold increase, while Australia's merchandise imports from China have increased from US$53.7 million to US$13.6 billion increasing by over 250-fold over the same period (see Table 1). The bilateral balance of payments for Australia with China changed from around a 10% surplus to about a 10% deficit between 1972 and 2006 .

TABLE 1
ANNUAL GROWTH RATE OF AUSTRALIA–CHINA TRADE IN DIFFERENT TIME PERIODS (%)

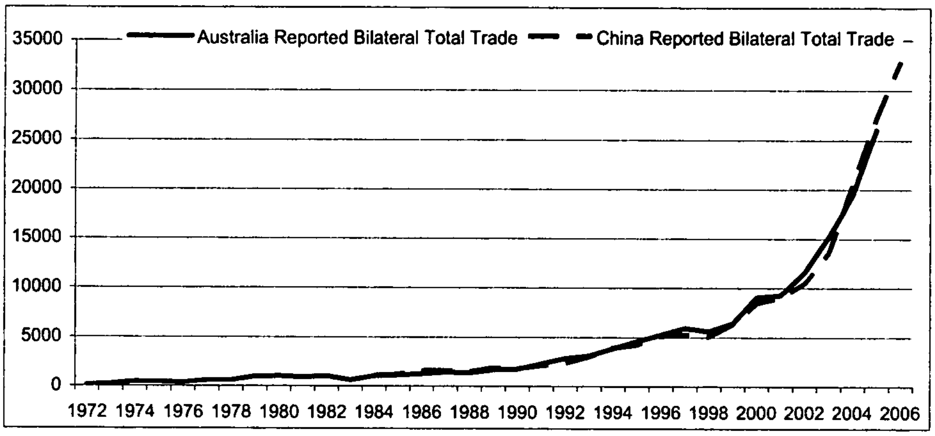
	1972–1992*	1992–2000	2000–2006	1972–2006
With Australian reported data				
Export (Australia–China)	17.22	10.35	35.46	17.67
Import (Australia–China)	18.81	18.58	19.62	18.86
Total Trade	18.22	17.93	29.52	18.36
With Chinese reported data				
Export (Australia–China)	8.11	14.75	25.17	14.29
Import (Australia–China)	14.77	22.85	25.85	19.66
Total Trade	9.66	17.47	25.45	15.86

Note: *The growth rates of imports, exports and total trade using Chinese reported data are calculated over the period 1984–1992.
Source: UN (2007).

1 Because of the difference in each other's reporting system, some discrepancies exist in the trade figures reported by Australia and China. Thus, data series reported by both countries are used in this paper.

FIGURE 1

AUSTRALIA–CHINA BILATERAL TRADE FLOW: 1972–2006 (MILLION US DOLLARS)



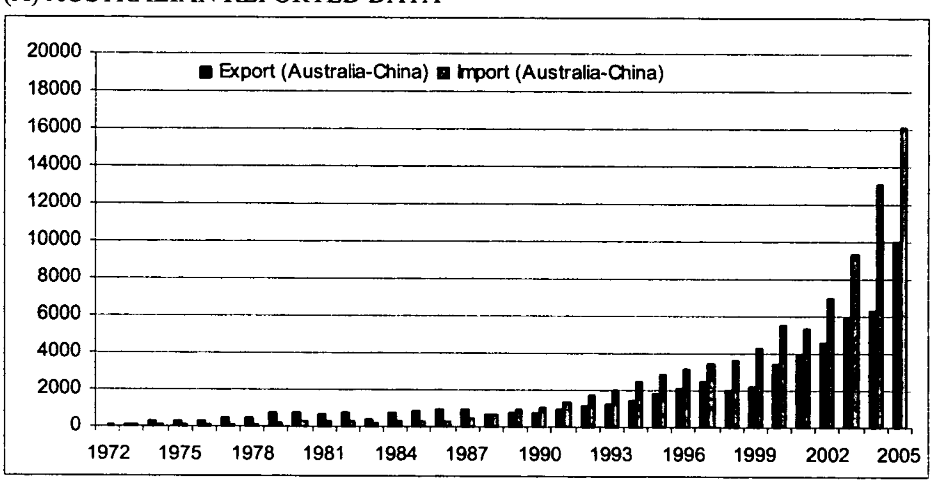
Source: UN (2007).

First, bilateral exports and imports on average kept increasing at a similar pace (see Figure 2). The average annual growth rate of exports and imports during the period was 17.7 % and 18.9 % respectively, which is similar to that of total trade at 18.4 per cent.[2]

FIGURE 2

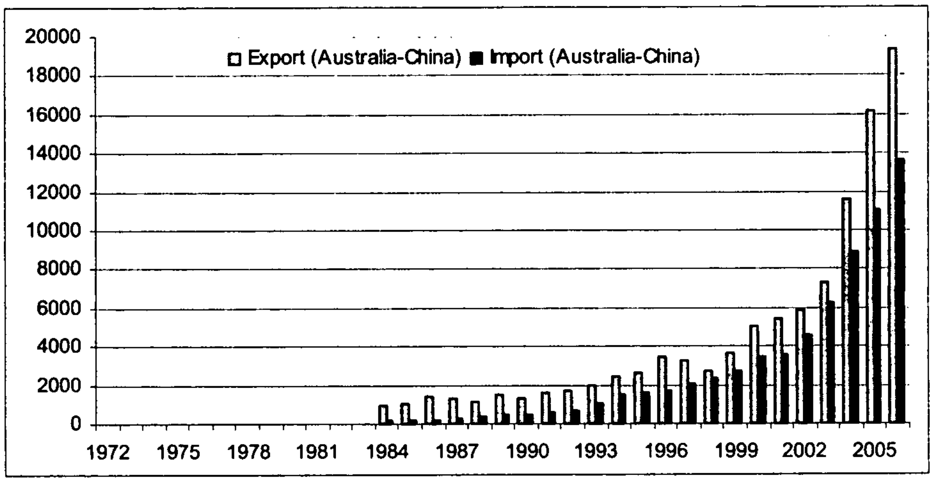
BILATERAL EXPORTS AND IMPORTS BETWEEN AUSTRALIA AND CHINA: 1972–2005 (MILLION US DOLLARS)

(A) AUSTRALIAN REPORTED DATA



[2] The numbers quoted here are calculated using Australian reported data..

(B) CHINESE REPORTED DATA

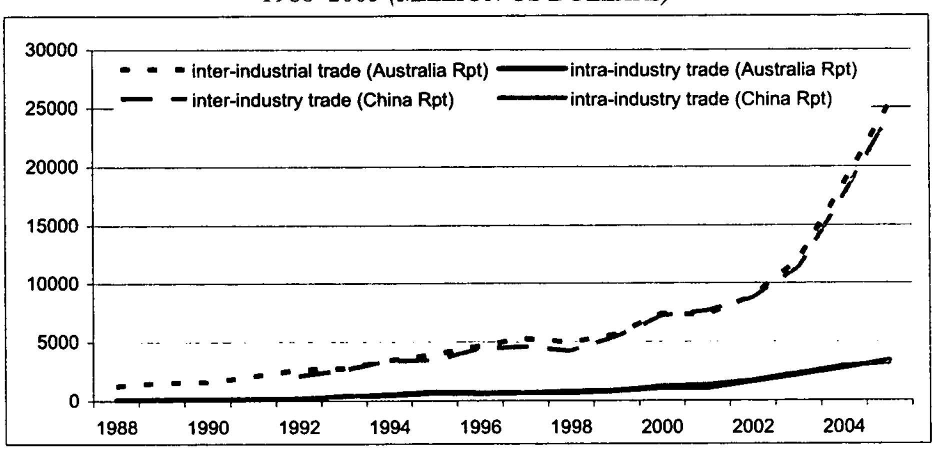


Source: UN (2007).

Second, inter-industry trade has been predominant in Australia–China bilateral trade in terms of both quantity and growth (see Figure 3). Using trade statistics from both countries, Figure 3 provides strong evidence that trade between the two countries is complementary. On average inter-industry trade as a proportion of total trade between Australia and China over the period 1988–2005 was 88.5%. Australia's main exports to China are agricultural, mineral, and energy products while China's main exports to Australia are chiefly labour intensive goods, including textile and clothing and footwear products, as well as machinery and electronics.

FIGURE 3

INTER- AND INTRA- INDUSTRY TRADE BETWEEN AUSTRALIA AND CHINA: 1988–2005 (MILLION US DOLLARS)



Source: UN (2007).

Third, trade dependency (defined as the shares of bilateral imports, exports and total trade in each country's total imports, exports and total trade) between Australia and

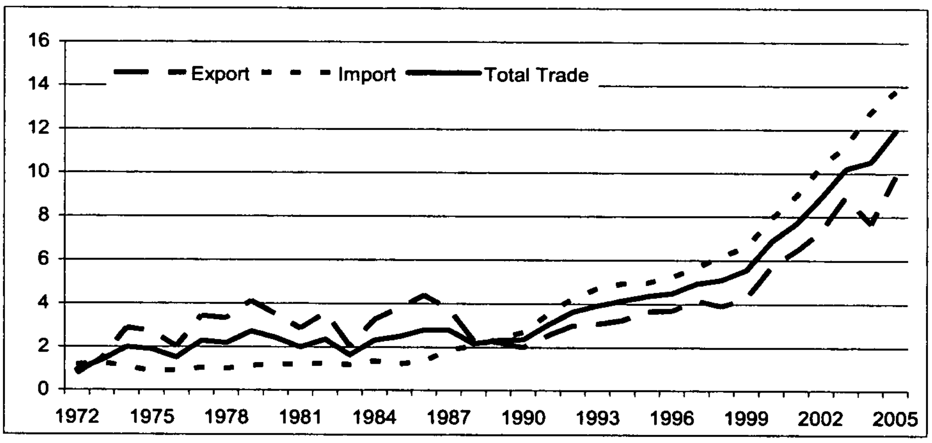
China has increased significantly over time (see Figure 4). For example the import and export dependency of Australia on China increased from 0.74% and 1.18% to 9.85% and 13.77% respectively over the period 1972–2006, indicating that the Australian economy has become increasingly dependent on the Chinese economy (especially for its exports). On the other hand, the import dependency of China on Australia increased from 0.84 to 1.99% while its export dependency on Australia has been falling during the period 1972–2006.

These characteristics show that economic integration between the two countries has been driven by their underlying comparative advantage. The following section explores how this process took place.

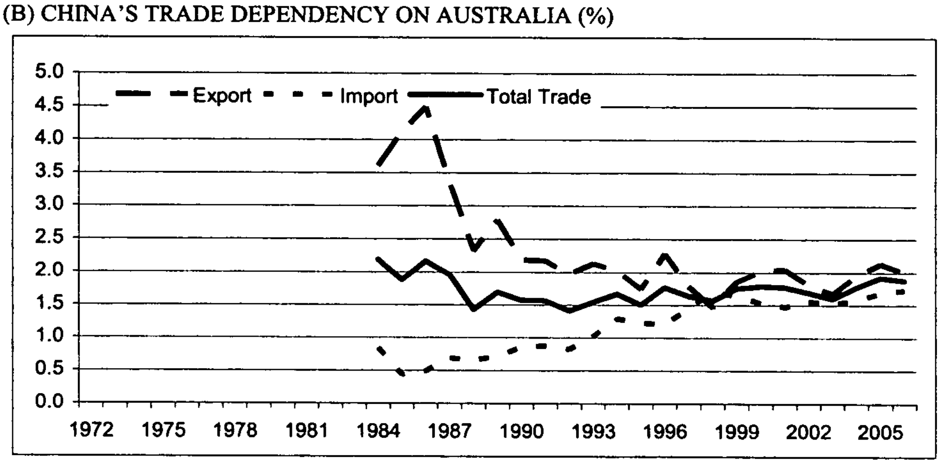
FIGURE 4

TRADE DEPENDENCY BETWEEN AUSTRALIA AND CHINA: 1972–2006 (%)

(A) AUSTRALIA'S TRADE DEPENDENCY ON CHINA (%)



(B) CHINA'S TRADE DEPENDENCY ON AUSTRALIA (%)



Source: UN (2007).

3 Comparative Advantage and Australia–China Bilateral Trade

To understand how comparative advantage affects bilateral trade between Australia and China, it is useful to know whether existing trade between the two countries is consistent with what the theory of comparative advantage predicts. This theory states that a country will export goods and services that employ its most abundant resources most intensively; and, conversely, it imports the goods and services produced from resources for which it has relative scarcity (see Heckscher [1919], Ohlin [1933]). For example, if Australia enjoys a relative abundance of agricultural land and mineral and energy resources compared with other countries while China enjoys a relative abundance of cheap unskilled labour compared with other countries, then these are likely to be where the two countries' comparative advantages lie (see Anderson, 1995).

In theory, the measurement of a country's comparative advantage should be based on the calculation of the relative abundance of its capital, land, and natural resources compared with that of the rest of the world (see Song 1996). However, due to the empirical difficulties in obtaining accurate data over time and across countries, Balassa (1965) suggested that the revealed comparative advantage index could be used as a substitute. The revealed comparative advantage index measures comparative advantage by observing the trade pattern to the extent that the goods and services traded reflect both relative costs and differences in factor intensities. It is usually defined as the ratio of the share of a particular product in a country's total exports to the share of world exports of this product in the world's total exports. Numerically, the index ranges between zero and infinity. Values greater than, or equal to, one indicate that a particular country is internationally competitive or, put loosely, it has a comparative advantage in exporting that product. Hillman (1980) suggested that the revealed comparative advantage index can also be used to measure dynamic competitiveness and comparative advantage of a country relative to the rest of the world if we assume that the elasticity of the revealed comparative advantage with respect to a particular export change is positive.[3]

Following Balassa (1965) and Hillman (1980), we have calculated the revealed comparative advantage indices for merchandise exports of both Australia and China at the two-digit commodity level (SITC Revision 3) for the period 1992–2005. The data are from the UN (2007). (While not reported here, the results are available upon request.) Based on these calculations, three general findings with regard to the pattern of Australia–China bilateral trade are observed.

First, comparing the average indices of revealed comparative advantage of Australia and China, bilateral trade patterns reveal a comparative advantage that seems to support our *a priori* assumptions about what the comparative advantage should be. Australia has a comparative advantage in producing and exporting agricultural products, such as grains and vegetables, animal products, textile fibre, and mineral and energy products, such as metallic ores, coal, and gas. The revealed comparative advantage indices for all those products are more than '1' during the whole period under study and, in particular, those for meats, cereals and cereals products, textile fibre, metallic ores, coal, and natural gas are on average 7.1, 5.8, 13.4, 15.6, 29.4, and 2.7 respectively. China seems to have a comparative advantage in producing and exporting labour-intensive goods,

[3] This condition holds for all merchandise exports from both Australia and China.

such as textiles and clothing, footwear, travel goods and furniture, and some general machinery, such as telecommunication equipment. The revealed comparative advantage indices for all those products are more than '1' during the whole period and, in particular, those for textile products, clothing, footwear, travel goods, and metal products are 2.7, 4.6, 4.8, 5.7, and 1.6 respectively. Comparison of these results with the bilateral pattern of trade as described in the last section, suggests our first hypothesis that the pattern of bilateral trade between the two countries can be predicted by the underlying comparative advantage of both countries.

Second, from a dynamic perspective, changes over time in the two countries' comparative advantages relative to the world as reflected in the revealed comparative advantage indices reflect changing patterns in Australia–China bilateral trade. As the indices of some Australian agricultural products, such as meat, milk and fat products, fruits and vegetables, and chemical products such as dyes and medicines increase over time, exports of these products to China have also tended to increase. For example, Australia initially had no comparative advantage in dyestuffs and its revealed comparative index in 1992 was 0.39, but the net export of dyes from Australia to China increased from US$ –0.1 million in 1992 to US$ +82.1 million in 2005. This was mirrored in an increase in its index of revealed comparative advantage to 2.27 in 2005. On the other hand, as China started to gain a comparative advantage in some manufacturing goods, such as office machines and electronics during the same period, she also increased her exports of these goods to Australia. For example, as the revealed comparative advantage index for electronics increased from 0.58 in 1992 to 1.19 in 2005, the net exports of electronics from China to Australia also increased from US$ 13.6 million to US$ 996 million. Thus, a second hypothesis is that changes in the factor endowments of Australia and China over time affect the pattern of trade between the two countries.

Third, it may be the case that China exports certain manufacturing goods to the rest of the world, while importing from Australia the necessary inputs that are most intensively used to produce these goods. This pattern of trade dictates the way in which both countries are involved in participating in some complimentary and self-strengthening international specialisation. For example, the surging exports of textiles and clothing, iron and steel products and general machinery from China in recent years have generated additional demand for textile fibres, iron ore, coal and energy products from Australia. This suggests a third hypothesis, namely that the high degree of complementarity in Australia–China bilateral trade contributes to both countries' involvement in international specialisation characterised by China's high level of dependency on imported resources from Australia for producing manufacturing goods, which it exports to the rest of the world.

To test these three hypotheses, we have incorporated the revealed comparative advantage indices of Australia and China into a 'gravity model' at the two-digit commodity level to examine the determinants of Australia–China bilateral trade. We postulate that total trade of Good i between Australia and China (BT_{it}) is determined by their respective demand for the goods Y_{it}^{AUS} and Y_{it}^{CHN} (or the income used for purchasing these goods) and barriers to trade between the two countries $Tariff_{it}^{AUS}$ and $Tariff_{it}^{CHN}$. Thus, the basic specification of the gravity model capturing the detailed trade in goods between Australia and China can be written as follows:

$$\ln BT_{it} = \beta_0 + \beta_1 \ln Y_{it}^{AUS} + \beta_2 \ln Y_{it}^{CHN} + \beta_3 \ln Tariff_{it}^{AUS} + \beta_4 \ln Tariff_{it}^{CHN} + u_i + \varepsilon_{it} \quad (1)$$

where Y_{it}^{AUS} and Y_{it}^{CHN} denote the two countries' income used for importing Good i at Time t and $Tariff_{it}^{AUS}$ and $Tariff_{it}^{CHN}$ denote the two countries' tariff rates on Good i at Time t. Since we do not know what proportion of income will be spent on purchasing Good i in Australia and China at Time t, we use the total imports of Good i at Time t in each country as a substitute.

Equation 1 shows that Australia–China bilateral trade of Good i should be positively related to demand and negatively related to trade barriers in each country. Using Equation 1, we first test how the comparative advantage of each country relative to the rest of the world affects trade between Australia and China (Hypotheses 1 and 2) by incorporating the revealed comparative advantage indices of the two countries into Equation 1.

$$\ln BT_{it} = \beta_0 + \beta_1 \ln Y_{it}^{AUS} + \beta_2 \ln Y_{it}^{CHN} + \beta_3 \ln Tariff_{it}^{AUS} + \beta_4 \ln Tariff_{it}^{CHN} + \beta_5 \ln RCA_{it}^{AUS} + \beta_6 \ln RCA_{it}^{CHN} + \beta_7 D2000 + u_i + \varepsilon_{it} \quad (2)$$

where $\ln RCA_{it}^{AUS}$ and $\ln RCA_{it}^{CHN}$ denote the revealed comparative advantage of Good i at Time t for Australia and China respectively; and D2000 is the dummy variable for capturing the impact of China's accession to WTO on bilateral trade (which is equal to zero when $t < 2000$ and 1 when $t \geq 2000$). Equation 2 shows that if Australia–China bilateral trade is driven by the two countries' underlying comparative advantage, the coefficients of $\ln RCA_{it}^{AUS}$ and $\ln RCA_{it}^{CHN}$ should be positive and statistically significant holding other factors constant.

To test the third hypothesis—that rapid increases in Chinese exports of labour-intensive goods such as textiles and clothing and some capital-intensive goods such as machinery and metal products require more imports of resources from Australia—we have incorporated the revealed comparative advantage of China in some export-oriented downstream industries into Equation 2. The export share of those industries in total output is around 30% on average. The match between up-and down stream industries is shown in Table 2.

$$\ln BT_{it} = \beta_0 + \beta_1 \ln Y_{it}^{AUS} + \beta_2 \ln Y_{it}^{CHN} + \beta_3 \ln Tariff_{it}^{AUS} + \beta_4 \ln Tariff_{it}^{CHN} + \beta_5 \ln RCA_{it}^{AUS} + \beta_6 \ln RCA_{it}^{CHN} + \beta_7 D2000 + \beta_8 Up\_Linkage_{it}^{CHN} + u_i + \varepsilon_{it} \quad (3)$$

where $Up\_Linkage_{it}^{CHN}$ denotes the revealed comparative advantage of downstream industries for Good i at Time t. If the estimated coefficient of $Up\_Linkage_{it}^{CHN}$ is positive and statistically significant, it implies that world demand for Chinese exports of those manufacturing goods positively contributed to Australia–China bilateral trade, especially Australia's exports of resource-related goods to China.

TABLE 2
MATCH BETWEEN UPSTREAM AND DOWNSTREAM INDUSTRIES

Backward Industry	SITC	Forward Linkage	SITC
Hides, skins, fur-skins	21	Leather, leather goods	61
Cork and wood	24	Cork, wood manufactures	63
Pulp and waste paper	25	Paper, paperboard,etc.	64
Textile fibres	26	Textile yarn, fabric,etc.	65
Metalliferous ore, scrap	28	Iron and steel	67
Coal, coke, briquettes	32	Iron and steel	67
Petroleum, petrol products	33	Organic chemicals	51
Gas,natural,manufactured	34	Organic chemicals	51

Source: Authors' own specifications according to China's Input-Output Table 2000.

The data on commodity trade between Australia, China and the rest of the world are obtained from UN (2007), and the related tariff data are from the UNCTAD (2007) online database. The commodities are defined at the two-digit level following SITC Revision 3 code (reported by both Australia and China).

Table 3 shows the results obtained by using Equation 2 with all commodities. The first four columns show the results using data reported by Australia and the other four columns show the results with data reported by China. In both cases, estimates are made based on two scenarios: including and not including a dummy variable for China joining the WTO. Both random and fixed effects models are employed. The R-squared ranges from 0.36 to 0.64 and the Wald-statistics and F-statistics suggest the model is a good fit for the data.

The results imply, first, that Australia–China bilateral trade in individual commodities is generally determined by the two countries' respective demand for each other's goods and trade barriers (the incorporation of which makes our analytical framework consistent with the standard gravity model). The coefficients for both the Australian and Chinese total demand variables are positive and their tariff barriers variables are negative and statistically significant at the 1% level. The results are robust as to whether we employ a random- or fixed-effects model or whether we use Australian or Chinese reported data. Thus the model specification for Australia–China bilateral trade is appropriate and consistent with the traditional 'gravity model'.

TABLE 3
ESTIMATES FOR AUSTRALIA–CHINA BILATERAL TRADE: 1992–2005
(Dependent Variable: ln BT)

	With Australian Reported Trade Data (PART A)			
	Random Effect		Fixed Effect	
Ln Y^{AUS}	0.49***	0.47***	0.41***	0.23***
	(6.28)	(6.46)	(3.75)	(2.22)
Ln Y^{CHN}	0.52***	0.34***	0.55***	0.35***
	(11.57)	(7.32)	(11.71)	(6.83)
Ln $Tariff^{AUS}$	–0.16***	–0.05	–0.19***	–0.11***
	(–3.79)	(–1.24)	(–4.59)	(–2.79)
Ln $Tariff^{CHN}$	–0.12***	–0.03	–0.2***	–0.12***
	(–2.41)	(–0.72)	(–3.41)	(–2.26)
Ln RCA^{AUS}	0.45***	0.55***	0.21***	0.32***
	(6.50)	(8.31)	(2.73)	(4.36)
Ln RCA^{CHN}	0.33***	0.38***	0.29***	0.41***
	(6.67)	(8.14)	(5.15)	(7.34)
D2000	–	0.63***	–	0.58***
	–	(9.66)	–	(8.27)
Constant	–2.25***	–1.39***	–1.86***	0.28
	(–4.17)	(–2.70)	(–2.38)	–0.36
Num. of Obs	717	717	717	717
R^2	0.49	0.61	0.36	0.42
Wald Test	914.37	1125.6	–	–
F-Test	–	–	154.38	155.63
	With Chinese Reported Trade Data (PART B)			
	Random Effect		Fixed Effect	
Ln Y^{AUS}	0.35***	0.31***	0.41***	0.26***
	(4.87)	(4.67)	(4.26)	(2.74)
Ln Y^{CHN}	0.63***	0.46***	0.67***	0.49***
	(15.89)	(11.34)	(15.99)	(10.8)
Ln $Tariff^{AUS}$	–0.18***	–0.08***	–0.19***	–0.12***
	(–4.81)	(–2.33)	(–4.94)	(–3.13)
Ln $Tariff^{CHN}$	–0.03	0.04	–0.07	0.00
	(–0.69)	(–1.06)	(–1.30)	(–0.09)
Ln RCA^{AUS}	0.46***	0.54***	0.33***	0.44***
	(7.39)	(9.18)	(4.92)	(6.63)
Ln RCA^{CHN}	0.37***	0.42***	0.30***	0.40***
	(8.32)	(9.96)	(5.82)	(8.01)
D2000	–	0.57***	–	0.52***
	–	(9.83)	–	(8.28)
Constant	–2.22***	–1.31***	–2.91***	–0.99
	(–4.44)	(–2.71)	(–4.15)	(–1.41)
Num. of Obs	718	718	718	718
R^2	0.54	0.64	0.48	0.59
Wald Test	1311.18	1588.92	–	–
F-Test	–	–	219.69	217.41

Notes: t values are displayed in parentheses. *** represents 1% level of significance, ** 5% level of significance and * 10% level of significance. The Hausman test for the four random-effect specifications are 126.35, 62.72, 58.19 and 81.72 respectively and each are statistically significant at 1% level. This result suggests that the fixed-effect specifications are preferred to the random-effect specification.

TABLE 4

AUSTRALIA–CHINA BILATERAL TRADE WITH DOWNSTREAM INDUSTRIES' EXPORTS: 1992–2005 (Dependent Variable: ln BT)

	With Australian Reported Trade Data (PART A)			
	Random Effect		Fixed Effect	
Ln Y^{AUS}	−0.06	0.04	−0.45*	−0.26
	(−0.68)	(0.47)	(−1.78)	(−1.05)
Ln Y^{CHN}	0.88***	0.67***	0.97***	0.45**
	(−7.45)	(4.29)	(6.56)	(2.08)
Ln $Tariff^{AUS}$	0.02	0.02	0.02	0.01
	(1.47)	(1.49)	(1.37)	(0.49)
Ln $Tariff^{CHN}$	−0.65***	−0.70***	−0.34***	−0.33***
	(−10.64)	(−10.7)	(−2.71)	(−2.80)
Ln RCA^{AUS}	0.86***	0.85***	0.69***	0.89***
	(10.83)	(10.99)	(2.61)	(3.43)
Ln RCA^{CHN}	0.06	−0.07	−0.04	−0.04
	(0.52)	(−0.53)	(−0.18)	(−0.17)
D2000	–	0.43**	–	0.82***
	–	(2.01)	–	(3.17)
$Up\_Linkage^{CHN}$	0.06	0.27	0.64*	1.02***
	(0.30)	(1.22)	(1.69)	(2.68)
Constant	−2.78***	−1.89***	−1.76*	0.85
	(−4.45)	(−2.49)	(−1.35)	(0.57)
Num. of Obs.	98	98	98	98
R^2	0.95	0.95	0.85	0.80
Wald Test	1607.5	1665.58	–	–
F-Test	–	–	29.26	29.65
	With Chinese Reported Trade Data (PART B)			
	Random Effect		Fixed Effect	
Ln Y^{AUS}	−0.13*	−0.07	−0.20	−0.05
	(−1.67)	(−0.76)	(−0.87)	(−0.22)
Ln Y^{CHN}	1.00***	0.88***	1.18***	0.77***
	(9.13)	(5.96)	(8.88)	(3.93)
Ln $Tariff^{AUS}$	0.01	0.01	0.01	0.00
	(1.29)	(1.29)	(1.11)	(0.35)
Ln $Tariff^{CHN}$	−0.49***	−0.52***	−0.27***	−0.26***
	(−8.64)	(−8.44)	(−2.40)	(−2.44)
Ln RCA^{AUS}	0.91***	0.91***	0.26	0.42*
	(12.47)	(12.5)	(1.10)	(1.77)
Ln RCA^{CHN}	−0.02	−0.10	0.04	0.04
	(−0.21)	(−0.81)	(0.19)	(0.22)
D2000	–	0.25	–	0.64***
	–	(1.26)	–	(2.71)
$Up\_Linkage^{CHN}$	−0.07	0.05	0.37	0.66*
	(−0.4)	(0.25)	(1.09)	(1.92)
Constant	−3.40***	−2.87***	−3.81***	−1.77
	(−5.87)	(−4.04)	(−3.25)	(−1.30)
Num. of Obs.	98	98	98	98
R^2	0.95	0.95	0.72	0.84
Wald Test	1727.06	1740.14	–	–
F-Test	–	–	36.41	35.22

Notes: t values are displayed in parentheses. *** represents 1% level of significance, ** 5% level of significance and * 10% level of significance. The Hausman test results for the four random-effect specifications are 2.66, 2.17, 1.54 and 0.86 respectively, and are not statistically significant at the 10% level. This suggests that the random-effect specifications are preferred to the fixed-effect specifications.

Second, Australia's and China's comparative advantages relative to the rest of the world play an important role in promoting trade between the two countries. As is shown in Table 3, the estimated coefficients on the Australian RCA indices range from 0.21 to 0.54 while the estimated coefficients on the Chinese RCA indices range from 0.29 to 0.40. Both are statistically significant at the 1% level in all regressions. These results imply that the two countries' comparative advantages, in particular those of Australia, can have a significant positive effect on Australia–China bilateral trade.

Table 4 shows the results using Equation 3 with the key commodities that Australia exports to China. In both cases, the dummy variable for China's accession to the WTO is included. In both cases, estimates are made under two scenarios: with and without including a dummy variable for China's accession to the WTO. In terms of overall fit, the R-squared range from 0.70 to 0.95.

The results show that an increase in China's exports of goods produced in downstream industries strengthens Australian exports to China, especially for resource-related goods. As shown in Table 4, the estimated coefficients on the downstream linkage variables are 1.02 and 0.66 respectively in the models with fixed effects. When the dummy variable for China's accession to the WTO is incorporated, it is statistically significant at the 10% level. This result suggests that an important factor strengthening Australia–China bilateral trade is China's export of labour-intensive goods and general machinery to the world, which generates demand for imports from Australia.

This result also implies that external market conditions for Chinese exports will affect future development of bilateral trade between the two countries. In other words, any protectionist measures in China's trading partners such as the United States or the European Union aimed at limiting exports from China will hurt bilateral trading relations between Australia and China. It is therefore in the interests of both countries to maintain a freer trading environment.

4 Bilateral Trade and Welfare Gains

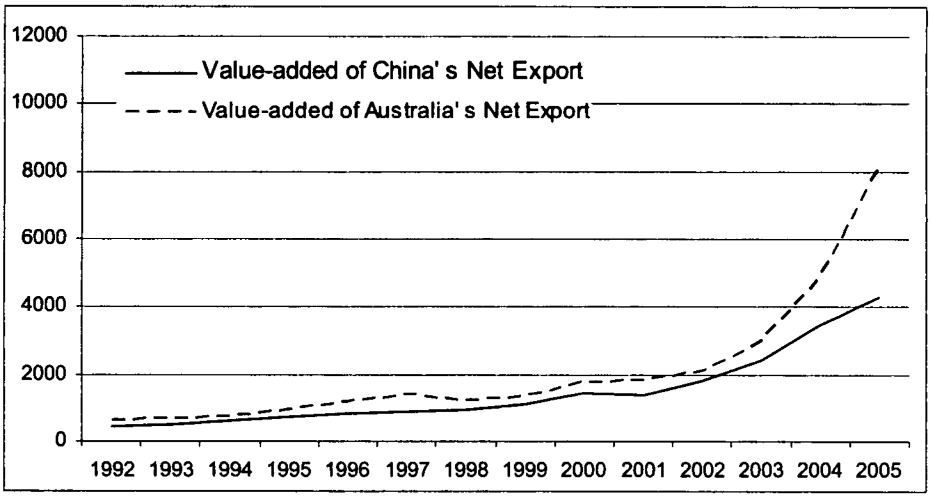
Countries gain from international trade when they specialise in production and trade according to their own comparative advantage. To answer the question as to whether trade between Australia and China benefits both countries, we have used the Input–Output Analysis method to calculate the valued-added of net exports between Australia and China. The first step in applying this method is to decompose bilateral trade flows between Australia and China by sectors, and then treat the net exports of each sector in the bilateral trade flows as additional consumption from the perspective of final use. Thus, using the valued added coefficients in the Input–Output Tables of both Australia and China to multiply the net exports, the added value of net exports in each sector between Australia and China can be recovered and aggregated at the country level as:

$$VAL_{ij} = \sum_{k=1}^{n} \pi_{ik} \cdot NBEX_{ijk} \qquad (4)$$

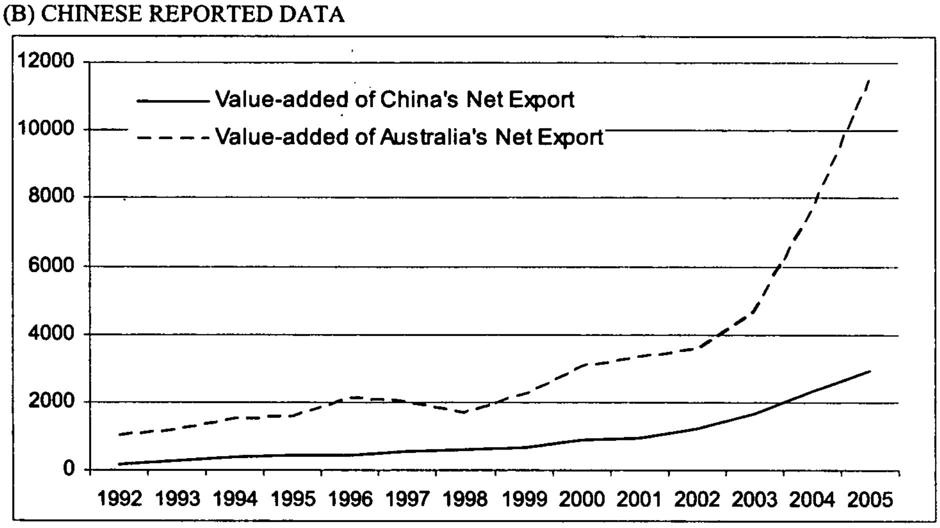
where VAL_{ij} is the value added of total net exports from country i to j ($i \neq j$) represents Australia and China), π_{ik} is the value-added coefficient of sector k in Country i and $NBEX_{ijk}$ is the net exports in Sector k from Country i to Country j (these coefficients range from 0 to 1 and are extracted directly from each country's Input-Output Tables).

FIGURE 5
VALUE-ADDED CONTRIBUTION OF AUSTRALIAN AND CHINESE BILATERAL EXPORTS: 1992–2005 (MILLION US DOLLARS)

(A) AUSTRALIAN REPORTED DATA



(B) CHINESE REPORTED DATA



Source: Authors' own calculation using the data from UN COMTRADE, Australian Input–Output Tables 1992–1993, 1993–1994, 1996–1997, 1998–1999, 2001–2002 and China Input–Output Tables 1992, 1995 and 2000.

In applying this method, we used the Input–Output Tables 1992, 1995 and 2000 for China and the Input–Output Tables 1992–1993, 1993–1994, 1996–1997, 1998–1999, 2001–2002 for Australia to estimate the value-added coefficients based on Equation 4. The bilateral net export data between Australia and China were taken from UN (2007). The results of the calculation were then converted into US dollars using current exchange rates.

The results are shown in Figure 5, using data reported by both countries separately. The figure shows, first, gains from trade in terms of value-added generated from the bilateral trade for both countries are positive and increasing. This has especially been the case since the beginning of the twenty-first century during which period the value-added of exports from both Australia and China have been accelerating. Second, in both cases, Australia seems to derive the greater benefit from Australia–China bilateral trade, if we regard the added value as a direct measure of the welfare derived from trade.

5 Conclusions

This paper has applied a 'gravity model' incorporating explicitly specified revealed comparative advantage in order to examine Australia–China bilateral commodity trade at the two-digit level. The main findings are: first, bilateral trade has been driven mainly by the respective demand for each other's goods; second, measures adopted for reducing barriers to trade will enhance bilateral trade between the two countries; third, Australia and China's underlying factor endowments determine the pattern of trade between the two countries; fourth, China's increase of exports to world markets seems to strengthen the Australia–China bilateral trade relationship through the industrial-linkage effect; and finally, current bilateral trade between Australia and China tends to promote the welfare of both countries in terms of generating more value-added from exports and by this measure Australia seems to gain more from bilateral trade. The finding that Australia's exports to China depend on barriers to China's exports to the rest of the world is a significant one and suggests that Australia and China share some common interests in promoting freer trade.

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