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ECONOMIC GROWTH IN CHINA AND ITS POTENTIAL IMPACT ON AUSTRALIA-CHINA BILATERAL TRADE: A PROJECTION FOR 2025 BASED ON THE CGE ANALYSIS

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Economic Growth in China and Its Potential Impact on Australia-China Bilateral Trade:

A Projection for 2025 based on the CGE Analysis

[Abstract]

This paper uses the GTAP Static model to predict the potential impact of economic growth in China on bilateral trade between China and Australia in 2025, under three different scenarios representing the business-as-usual, the successful reform and the stagnation cases respectively. The results show that exports from Australia to China will continue to increase in both absolute and relative terms, irrespective of which economic growth path China takes, partly due to the strong complementary relationship of production between the two countries. The results also indicate that education service exports will become a new engine of bilateral trade in addition to agricultural and mineral products. Furthermore, comparing the results obtained from the three scenarios shows how successful reform will bring more benefits to both China and Australia in trade, which provides useful insights for policy making to facilitate bilateral economic relationship.

[Key Words]

GTAP Model, China Economic Growth, China-Australia Bilateral Trade

[JEL Code]

1. Introduction

In the past three and a half decades, China has grown rapidly. Between 1978 and 2015, the real gross domestic product (GDP) of the country increased from US$0.21 trillion to US$10.86 trillion, an annual growth rate of 11.3 per cent. As a consequence, China has overtaken Japan to become the second largest economy in the world since 2010. It is widely believed that the rapid economic growth in China is heavily related to its trade with the rest of the world. On one hand, China increased the aggregate demand for domestic production through exporting labour intensive products so as to facilitate the urbanisation and industrialisation process; on the other hand, China imported a large amount of primary commodities such as petroleum, iron ores and agricultural products, and services to feed the need of domestically expanding production.

As one of China's most important trading partners in the Asia-Pacific region, Australia has benefited from the increased bilateral trade between China and Australia. Due to the highly complementarity in trade pattern between the two countries, Australia continued to export agricultural and mineral products to China over the past decade in exchange for textile and clothes, and metal and machinery products. In 2014, real exports from Australia to China were worth US$83.8 (including US$76.3 billion for commodities and US$7.4 billion for services) accounting for 28.5 per cent of Australian total exports. Similar to the effects of the US economic boom in the 1950s and 1960s and the Japanese economic boom in the late 1970s, the increased demand from China for primary products and services improved the terms of trade for Australia and brought additional work opportunities to exporting sectors. This helped Australia to maintain better performance in economic growth relative to other developed countries though the 2009 global financial crisis.

To further strengthen bilateral relationship, China and Australia have signed a free trade agreement that came into effect on 20 December 2015. This agreement will unlock significant opportunities for Australia in China which is Australia's largest export market for both commodities and services, accounting for nearly a third of total exports and a growing source of foreign investment (ChAFTA 2015). However, to fully understand the role of ChAFTA in affecting bilateral trade between China and Australia, it is important to examine how economic growth and population change in the two countries will contribute to reshaping the trade pattern over the next decade. In particular, questions still remain on how trade will change between the two countries if China's economic growth takes a different path.

This paper simulates a static computable general equilibrium model, namely the Global Trade Analysis Project (GTAP) Static Model, to analyse and forecast the impact of economic growth and population change on bilateral trade between Australia and China in 2025. In order to reflect reality,

three scenarios including the business as usual case, the structural reform case and the slow-down growth case have been designed to capture different paths that Chinese economic growth may take. The results show that bilateral trade between China and Australia will increase irrespective of which scenario China takes, although there are some differences in trade patterns between different policy assumptions.

Contributing to the literature, our paper examines the impact of economic growth on bilateral trade between China and Australia from a general equilibrium perspective. Since the GTAP allows for both the direct and indirect effects of growth and population shocks, this provides a better projection on trade potential between the two countries than the partial equilibrium analysis. Second, in addition to the business as usual case, we endogenise the drivers underlying the two alternative cases for China's economic growth: the structural change case and the slow-down growth case by modifying the shocks. This helps to provide a clear channel through which the potential change in bilateral trade is driven which in turn provides more useful insights for policy making.

The remainder of the paper is organised as below. Section 2 provides a summary on the potential impact of China's economic growth on bilateral trade between China and Australia. Section 3 briefly describes the GTAP static model and its major features, and outlines three scenarios that could be used to predict bilateral trade between China and Australia in the next decade. Section 4 discusses the data used to update the base year for the simulation, and Section 5 analyses the projection results with a particular focus on bilateral service trade. Section 6 makes the conclusion.

2. Economic Growth in China and Its Potential Impact on Australia-China Bilateral Trade

Theoretically, changes in China's economic growth will impact bilateral trade between China and Australia despite the two countries being at different economic development stages. This is not only because the two countries are important economies in the Asia Pacific region that have a good trade relationship, but also because the production and export of commodities and services of the two countries are complementary (Sheng et al. 2008).

In commodity production, Australia has the comparative advantage in producing land- and resource-intensive commodities such as agricultural, mineral, chemical and medicinal products relative to the rest of the world, while China has the comparative advantage in producing the labour- intensive commodities such as textile and clothes, metal products and plants and machinery relative to the rest of the world. In service production, Australia (as a developed country) has the competitive advantage in finance and insurance, business services and education, while China is gradually

increasing its capacity in public infrastructure, transportation and communication services. As Australia mainly specialises in the upstream industries and the supply of primary products and services to meet increasing demand from China, rapid economic growth in China will generate more potential for Australian exporters, at least through three channels.

First, as economic growth accelerates, the income per capita in China will increase which in turn generates more demand for high-value and high-protein foods as well as better education services and tourism overseas. Second, China's economic growth is accompanied with continuous industrialisation, urbanisation and export growth, which will consume a large amount of resource such as petrol, gas, coals, and iron ore. Given the limited domestic supply, the additional demand for resources to support domestic production needs to be met through imports. Third, rapid economic growth will generate great incentives for Chinese investors to make strategic investment overseas with the purpose either to secure the supply of primary products, to hedge investment risks or to learn advanced technology and management skills. The outflow of the direct investment will create more potential for trade back to China.

Historically, China's economic growth has facilitated international trade in particular between Australia and China. Between 1978 and 2014, Australian exports to China increased from US$0.5 billion to US$83.8 billion, an annual growth rate of 14.2 per cent (UN Comtrade 2016). However, Australian exports to China mainly specialised in three categories of products: agricultural commodities, mineral products and tourism and education related transportation. In 2014, Australian exports to China accounted for 28.5 per cent of Australian exports to the whole world and more than 70 per cent of these exports comes from mineral products, 7 per cent from agricultural products and another 8 per cent from services (in particular, education and tourism related transportation).

China's average annual growth to 2020 is expected to decline to 6.0 per cent from 2016-2020 to 5.0 per cent from 2021-2025 (Hubbard and Sharma 2016). Although this forecasted economic growth rate is much lower than its historical trend in the past three decades, it will still continue to have a significant impact on bilateral trade, especially the exports from Australia to China. A series of questions are thus required to be answered: 1) Will bilateral trade continue to increase under the current situation? 2) What will be the pattern of future trade between China and Australia? 3) If China takes a different path to accelerate its economic reform and growth or faces significant difficulty in re-organising its financial market, what will be the potential impact on bilateral trade in volume and structure?

3. The GTAP Model and Scenarios

In this paper, we adopt the latest version of a standard static GTAP model (namely, version 6.2 released in May 2007) to forecast bilateral trade between Australia and China. The model is a multi-region, multi-sector, computable general equilibrium model, with the assumption of perfect competition and constant returns to scale. Compared to previous versions, the current version of the GTAP model contains three innovative features (Hertel et al. 2000):

- The model uses a non-homothetic CDE function to define private household preferences;
- The Armington assumption to explicitly model international trade and split it from transport margins; and
- A global banking sector to allocate investment between global savings and consumptions.

To apply the model for policy analysis, a base year dataset reflecting the operation of the real world economy is required to calibrate the model. In this paper, we choose to use the GTAP 8 Database (with the base year 2009), and re-aggregate the 129 GTAP regions into 12 regions including Australia, China, East Asian countries, ASEAN countries, Southeast Asia, North America, Latin America, EU (25 countries), Russia and former soviet union countries, the middle east and north Africa, sub-Saharan Africa and the rest of the world. The 57 GTAP sectors are also grouped into 16 sectors, which include two agricultural sectors, ten manufacturing sectors and four service sectors.

The projection on the potential impact of China's economic growth on bilateral trade between China and Australia thus takes three steps. In the first step, we simulate the model to update the base data (used for model simulation) from 2009 to 2014. In doing so, we assume that the population and GDP growth over the period of 2009 to 2014 (shown in the first two columns of Table 1) to be the most important macro-economic shocks that will affect the trade between the two countries. This helps to generate the GTAP base year data for 2014.

Table 1: Expected Growth in Population and GDP

	GDP Growth (average per cent per year)		Population Growth (average per cent per year)	
	2009-2014	2014-2025	2009-2014	2014-2025
AUS	2.62	2.58	1.31	1.23
CHN	8.27	5.73	0.43	0.28
EAS	6.23	4.21	0.05	-0.11
ASEAN	5.45	4.24	1.00	0.98

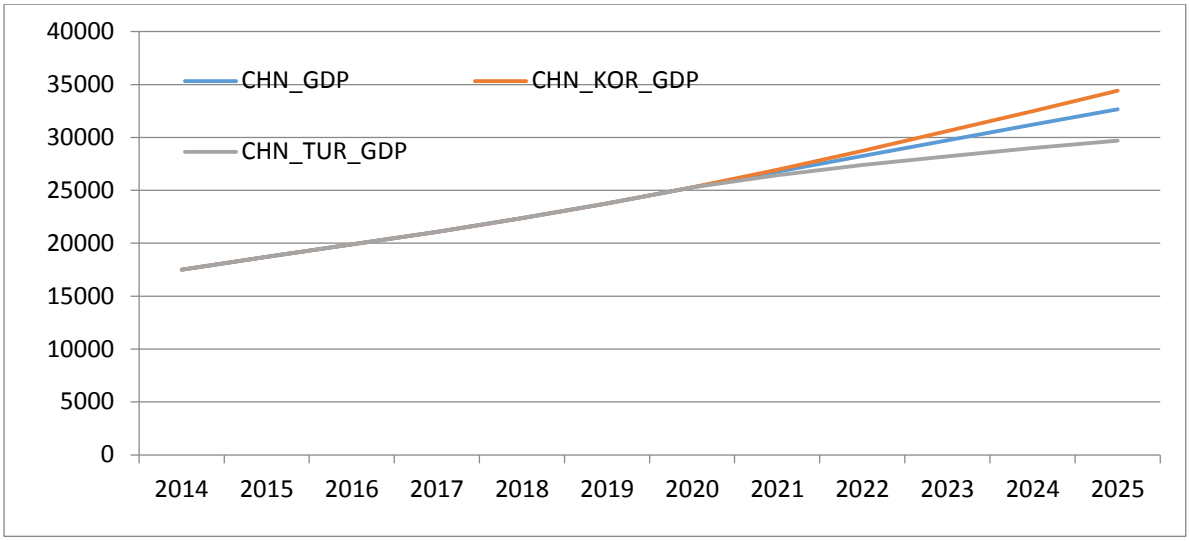
SAA	6.77	5.69	1.14	1.18
NAF	2.25	2.22	0.65	0.72
LatinAmer	2.87	1.42	0.94	0.93
EU_25	1.14	1.66	0.18	0.17
CIS	1.81	1.08	0.03	-0.16
MENA	3.42	2.79	1.53	1.55
SSA	5.00	4.02	2.28	2.57
RestofWorld	2.99	2.24	0.94	0.89

Source: GDP growth statistics are IMF World Economic Outlook historical data and forecasts to 2020, then derived from Hubbard and Sharma (2016), and the estimation of population growth comes from UN Population Projection Project (United Nation 2016).

In the second step, we used the GTAP model to predict the impact of economic growth in China on bilateral trade of commodities and services between China and Australia by using the newly generated 2014 data. To capture different trajectories of economic growth in China for the next decade, we design three scenarios including the business as usual case, the reform case and the stagnation case respectively (Figure 1). In particular, in order to translate the assumption of different GDP growth rates at the aggregate level into changes in economic structure, we modify the original GTAP model through developing a different combination of policy shocks under the reform case and the stagnation case. Meanwhile, in all three scenarios, the relative terms of trade in Australia is assumed to hold constant and the consumption preference of China for mineral products is assumed to decline with an increase of income per capita (to reflect the change in consumption appetite due to the 'love of variety' assumption). Some major assumptions that we have made to construct policy shocks for these exercises are summarised in Figure 1.

In the business as usual case, China's GDP is assumed to grow at an average annual rate of 5.73 per cent a year over the projection period of 2014 and 2025. This change in China's economic growth at the national level is translated into two shocks: population growth and technological progress. Specifically, the population in China is assumed to grow at the rate of 0.28 per cent a year following the UN population projection, and the Hick-neutral technological progress is assumed to take place evenly across all sectors with the annual labour productivity growing at 4.12 per cent. When the two shocks are applied to the GTAP model, it will not only generate the assumed GDP growth but also provide an estimation on bilateral trade between China and Australia. The projection on bilateral trade is then used as a reference case, which can be compared with the results obtained from the other scenarios.

Figure 1: Projection of China's Economic Growth in Three Scenarios (US 2012 $billion PPP)



GDP growth statistics are IMF World Economic Outlook historical data and forecasts to 2020, with alternative scenario projections after 2020 derived from Hubbard and Sharma (2016).

In the reform case, China's GDP is assumed to grow at an annual average rate of 6.3 per cent a year over the projection period of 2014 and 2025. The relatively higher GDP growth in China is expected to result from the successful implementation of industrial reform. To incorporate this change into our model, we assume that there will be asymmetric technological progress taking place between different sectors in China, and this will further enlarge the relative scale of the tertiary industry in the whole economy and change the internal structure of the manufacturing industry. In doing so, we developed a group of sector-specific productivity shocks, which will capture this change in industrial structure while maintaining the aggregate productivity (and thus the GDP) growth, by using the weights obtained from the literature (Table 2). As a consequence, the aggregated GDP growth at the national level is translated into the population growth and the Hick-neutral technological progress (similar as the reference case), plus a group of sector-specific productivity shocks. Following this assumption, the resource and technologies will shift more quickly from the labour-intensive industries to the capital intensive industries and from the low-valued primary/extraction industries and the manufacturing industries to the high-valued service sectors in China over the coming decade, and this will significantly impact bilateral trade between China and Australia.

In the stagnation case, China's GDP is assumed to grow at an annual average the rate of 4.7 per cent a year over the projection period of 2014 to 2025. Compared to the business as usual case, the relatively lower GDP growth for China in this scenario is assumed to result from the potential failure of economic reform in the financial sector (for example, the collapse of real estate or the stock market). If this situation happens, the Chinese economy will grow at a much slower rate than the

business as usual case due to a tightened budget constraint for the next decade. To incorporate this change in our model, we assume that the supply of capital goods to the whole economy is constrained and the efficiency of the sector that produces the capital goods will decline by 8 per cent a year, compared with the reference case.

Table 2: Expected Share of Industries in China: 2015-2025

Sector/China	2015	2020	2025
GrainsCrops	5.56	4.09	2.61
MeatLstk	2.78	2.20	1.62
Extraction	2.86	2.82	2.77
ProcFood	4.48	4.63	4.78
TextWapp	4.17	4.31	4.44
Leawp	2.90	2.99	3.08
Petrocm	7.15	6.77	6.38
Metal	6.70	6.29	5.89
Mtra	2.64	2.48	2.32
Elet	5.13	5.02	4.91
Mach	6.85	6.73	6.60
Oman	2.81	2.70	2.60
Util_Cons	4.90	5.04	5.18
TransComm	6.67	6.86	7.05
Finisur	6.67	6.86	7.05
OthServices	27.73	30.21	32.70
Sum	100.0	100.0	100.0

Source: Extracted from Zhao (2016)

In the third step, we use the statistics obtained from the UN Comtrade Statistics, OECD Statistics and the Australian Bureau of Statistics to re-construct bilateral trade in commodities and services between Australia and China in 2014. Applying the predicted linkage between 2014 and 2025 from the GTAP model, we can re-base our projection on bilateral trade flow and pattern between China and Australia in 2025 on the real database in 2014. This treatment helps to avoid the measurement error in projection related to using the projected 2014 GTAP data as the base for the model calibration.

Finally, it is to be noted that service trade in education related activities is of more interest to policy makers. Although they are not explicitly split from other service sectors, we can retrieve the

potential impact of economic growth in China on it by combining the estimates on several different service sectors that are associated with the export of education services. Assuming that the share of education related activities in “transportation and communication” and “other services” holds constant, the growth of the two sectors is used to construct the change in combined education service trade due to different assumptions on China’s economic growth.

4. Data Sources and Collection

The data used in this paper primarily comes from three sources: the GTAP Database 8.0 version for 2009 and other external data sources to update bilateral trade between China and Australia for the base year to 2014, the projection for population and economic growth throughout the world between 2014 and 2025, and information on the future industrial structure in China with and without deepening reforms.

The first and primary data source is the GTAP 8.0 database, which provides the benchmark data and parameters that could be used to simulate the model to predict bilateral trade between China and Australia. In order to capture the potential impact of other countries/regions on this trade, we have also split the rest of the world into 10 regions. The 57 GTAP sectors have also been aggregated into 16 industry groups. A detailed conversion table used to mapping the GTAP countries/commodities with our region and commodity specification is provided in Appendix A.

Although the GTAP 8.0 database provides a complete picture on global trade and economic linkage between countries, it could not reflect the change in bilateral trade between China and Australia in recent years. To reflect this in our model simulation for projection, we use the UN Comtrade database to update commodity trade between China and Australia in 2014 and the OECD Statistics for service trade (including ABS statistics) to update bilateral trade in services between China and Australia. In doing so, the 2-digit level HS code has been used to match the 12 commodity groups and the OECD EBOP service categories have been aggregated into 4 service groups. A detailed conversion table for this calculation is provided in Appendix B.

The second data source is from the UN Population Projection Project (UN 2015), IMF World Economic Outlook historic data and forecasts for GDP growth to 2020, and GDP projections to 2025 made by Hubbard and Sharma (2016). These projections are based on the methodology developed

by the Australian Treasury for the *Australia in the Asian Century* White Paper (Au Yeung et al 2013).[1] The UN Population Projection Project, when aggregated in an appropriate way to match our definition, provides the potential changes in population of China and Australia as well as 10 other regions in the world for the next decade. The GDP estimates not only provide the projected annual real GDP growth rate for the 12 regions specified in our model, but also inform the three possible economic growth paths for China over the next decade. This assists us in generating the benchmark for our assumptions on macroeconomic shocks.

The third data source we use is research on China which provides the estimates of the industrial structure of the country in the next decade and links it back to the implementation of further economic reforms. This research has been carried out by CASS, and provides useful information for us to split the aggregate GDP growth at the national level into sectoral level technological shocks.

[1] Unlike Au Yeung et al (2013), Hubbard and Sharma (2016) do not apply a Hodrik-Prescott (HP) filter to separate trend and cyclical components of GDP growth. The figures supplied for this paper do apply a HP filter, and so can differ slightly from Hubbard and Sharma in some cases.

Table 3: Bilateral Trade between Australia and China in 2014

	Trade Flow (Million US$)				Share of each industry in total trade (per cent)				Share of bilateral trade	
	AUS-CHN	AUS-WLD	CHN-AUS	CHN-WLD	AUS-CHN	AUS-WLD	CHN-AUS	CHN-WLD	AUS-CHN/AUS-WLD	CHN-AUS/CHN-WLD
GrainsCrops	2067.4	13218.6	182.0	35306.0	2.47	4.49	0.44	1.37	15.64	0.52
MeatLstk	4013.7	17764.7	200.0	18130.0	4.79	6.03	0.49	0.70	22.59	1.10
Extraction	59228.0	137345.7	951.0	53158.0	70.64	46.61	2.31	2.06	43.12	1.79
ProcFood	476.8	5644.0	502.0	23836.0	0.57	1.92	1.22	0.93	8.45	2.11
TextWapp	23.9	709.5	8907.0	419924.0	0.03	0.24	21.67	16.30	3.37	2.12
Leawp	485.2	2639.4	1859.0	80516.0	0.58	0.90	4.52	3.13	18.38	2.31
Petrocm	6894.5	25611.0	5781.0	312112.0	8.22	8.69	14.06	12.12	26.92	1.85
Metal	2448.6	12908.2	3701.0	184264.0	2.92	4.38	9.00	7.15	18.97	2.01
Mtra	61.8	4730.0	1967.0	104783.0	0.07	1.61	4.78	4.07	1.31	1.88
Elet	170.8	2733.5	5807.0	570940.0	0.20	0.93	14.13	22.17	6.25	1.02
Mach	542.5	8639.6	8070.0	474844.0	0.65	2.93	19.63	18.43	6.28	1.70
Oman	30.9	8500.4	1221.0	64530.0	0.04	2.88	2.97	2.51	0.36	1.89
Util_Cons	57.7	1048.4	55.9	16409.0	0.07	0.36	0.14	0.64	5.50	0.34
TransComm	6730.0	37971.3	1502.7	95156.0	8.03	12.89	3.66	3.69	17.72	1.58
Finisur	400.2	5406.7	147.8	29278.0	0.48	1.83	0.36	1.14	7.40	0.50
OthServices	215.4	9817.4	256.9	92667.0	0.26	3.33	0.62	3.60	2.19	0.28
Total	83847	294688	41111	2575853	100.00	100.00	100.00	100.00	28.45	1.60

5. Projection on Bilateral Trade between China and Australia: 2025

The growth trajectory of China's economy will be one of the biggest stories in the global economy over the next decade. Not only will it matter for the living standards of Chinese people, but it will impact on China's trade with Australia and the rest of the world. Taking into account possible developments in both economies as well as the rest of the world, this section provides the estimates on the structure and scale of Australia-China trade for the next ten years and the results are presented in Tables 3-5.

In the business as usual case, the growth in Australia's exports to China are driven mainly by services which more than double as a proportion of total trade, led by transportation, telecommunications, and computer and information services (Table 3). This is led by education and tourism with education accounting for 11.9 per cent of Australian exports to China (of the 19.6 per cent that the transport and communications sector accounts for). Agricultural exports also rise substantially. The existing pattern in bilateral exports reflect the comparative advantage of the two countries: Australian exports are likely to specialise in agricultural and mineral products while China's exports are likely to specialise in textile and clothes, metal products and machinery. More than 70 per cent of exports from Australia to China is related to mineral and extraction industries.

Table 4: Projected Bilateral Trade between Australia and China: Scenario 1 BAU

	Trade Flow (Million US$)				Share of each industry in total trade (per cent)				Share of bilateral trade in total export	
	AUS-CHN	AUS-WLD	CHN-AUS	CHN-WLD	AUS-CHN	AUS-WLD	CHN-AUS	CHN-WLD	AUS-CHN/AUS-WLD	CHN-AUS/CHN-WLD
GrainsCrops	4367	25860	182	34803	3.02	4.84	0.31	0.86	16.89	0.52
MeatLstk	9228	36877	309	23125	6.38	6.90	0.53	0.57	25.02	1.34
Extraction	84871	192433	889	35794	58.70	36.00	1.53	0.89	44.10	2.48
ProcFood	1151	13560	638	29972	0.80	2.54	1.10	0.74	8.49	2.13
TextWapp	23	857	11592	607938	0.02	0.16	19.98	15.03	2.69	1.91
Leawp	665	3914	2723	136999	0.46	0.73	4.69	3.39	16.98	1.99
Petrocm	9041	45640	6180	346926	6.25	8.54	10.65	8.58	19.81	1.78
Metal	3220	17148	4518	247595	2.23	3.21	7.79	6.12	18.78	1.82
Mtra	82	9604	3065	180331	0.06	1.80	5.28	4.46	0.86	1.70
Elet	112	1301	8746	1050193	0.08	0.24	15.07	25.97	8.63	0.83
Mach	761	17716	16213	1038970	0.53	3.31	27.94	25.69	4.30	1.56
Oman	64	20348	1198	72659	0.04	3.81	2.07	1.80	0.31	1.65
Util_Cons	110	2472	79	25583	0.08	0.46	0.14	0.63	4.45	0.31
TransComm	28382	105443	1277	80440	19.63	19.73	2.20	1.99	26.92	1.59
Finisur	1597	13579	122	27295	1.10	2.54	0.21	0.67	11.76	0.45
OthServices	909	27800	295	105893	0.63	5.20	0.51	2.62	3.27	0.28
Total	144583	534550	58027	4044517	100.00	100.00	100.00	100.00	27.05	1.43

In the scenario with reforms in China that have institutions converging to South Korean-quality and an average GDP growth of 6.3 per cent per year, total Australian and Chinese trade is larger than the business as usual scenario. Chinese exports increase to US$3.74 trillion, compared to the US$3.37 trillion case under business as usual. Chinese exports to Australia are roughly the same under both scenarios, at US$49 billion in 2025. Total Australian exports are projected to be US$595 billion in 2025, larger than the business as usual case driven by the increase in exports to China.

Australia's exports to China are projected to be US$185 billion in 2025 if Chinese growth is 6.3 per cent compared to US$145 billion a year if Chinese growth is 5.73 per cent a year. Under the stagnation scenario with Chinese growth significantly contracting after 2020, Australian exports to China are projected to be US$107 billion. Total Chinese exports will be almost US$1 trillion less in 2025 under this scenario. This implies that GDP growth and population growth will raise bilateral trade flow in any of these situations.

The structure of Australian exports to China does not change significantly under each scenario. The mining and extraction sector will be less important and services and agriculture will grow in importance in all circumstances. (Table 5). The share of textiles and apparel in China's exports to Australia is 21.7 per cent in 2014. This is projected to fall to 20 per cent under the business as usual scenario and 16.5 per cent under the reform scenario. If growth in China stagnates, the share is projected to be 21.1 per cent. Electronic equipment, with a share of 14.2 per cent in 2014, exhibits a similar pattern. The share of textiles and apparel in China's total trade tells a similar story: higher growth scenarios indicate successful industrial transformation and upgrading with low skilled manufacturing becoming less important. Extracting education services from the larger transport and communications sector, it is clear that it will be a major Australian export destination to China under all three growth scenarios accounting for between 10 and 12 per cent of total exports.

While the proportion of Australian exports to China relative to the world will increase from 28.5 per cent to 30.1 per cent, the proportion of China's export to Australia in its total exports will decrease from 1.6 per cent to 1.4 per cent. Still, the pattern of bilateral trade follows the relative comparative advantage of the two countries. In particular, Australia exports relatively more agricultural and mineral products and services to China.

The share of services in Australian exports to China and the world in 2014 is 13.7 per cent. The definition of the service sector includes Util_Cons, TransComm, Finisur and Other services. In the 2025 business as usual scenario, the ratio is 20.7 per cent and in the 2025 reform scenario the ratio is 23.2 per cent.

The only decline in service trade between the two countries takes place in the share of trade in "other services". In 2025 business as usual case, it is around 3.3 per cent while in the reform case, it decreased to 0.4 per cent. This is partly because that China will significantly increase the production of "other services" under the reform scenario by growing this sector as a proportion of the total economy. This will tend to increase the comparative advantage of this sector in China and increase its export competitiveness.

In the third scenario with Chinese growth significantly contracting after 2020, Australian exports to China are projected to be US$107 billion. Total Chinese exports will be almost US$1 trillion less in 2025 under this scenario. Table 5 shows the projection of China-Australia bilateral trade in 2025 if domestic reforms fail to change the industrial structure. Under this situation, bilateral trade will be significantly lower than the business as usual case as well as the reform scenario. However, even if growth stagnates in China, education services will triple to US$12 billion in 2025. Under the reform scenario education services will be as high as US$18.6 billion.

Table 5: Projected Bilateral Trade between Australia and China: Scenario 2 Reform Case

	Trade Flow (Million US$)				Share of each industry in total trade (per cent)				Share of bilateral trade in total export	
	AUS-CHN	AUS-WLD	CHN-AUS	CHN-WLD	AUS-CHN	AUS-WLD	CHN-AUS	CHN-WLD	AUS-CHN/AUS-WLD	CHN-AUS/CHN-WLD
GrainsCrops	6242	28794	63	13119	3.38	4.84	0.11	0.29	21.68	0.48
MeatLstk	18964	47567	11	723	10.26	8.00	0.02	0.02	39.87	1.46
Extraction	114947	246714	237	7106	62.18	41.48	0.40	0.16	46.59	3.33
ProcFood	1261	13871	472	22154	0.68	2.33	0.80	0.49	9.09	2.13
TextWapp	27	1127	9742	480213	0.01	0.19	16.48	10.71	2.39	2.03
Leawp	981	5225	1493	74642	0.53	0.88	2.53	1.66	18.78	2.00
Petrocm	5941	43136	7615	424567	3.21	7.25	12.89	9.47	13.77	1.79
Metal	2740	16032	4918	266500	1.48	2.70	8.32	5.94	17.09	1.85
Mtra	132	10055	1232	76536	0.07	1.69	2.08	1.71	1.31	1.61
Elet	108	1552	8396	969729	0.06	0.26	14.21	21.63	6.93	0.87
Mach	419	14273	20576	1295664	0.23	2.40	34.82	28.90	2.94	1.59
Oman	95	23900	460	28293	0.05	4.02	0.78	0.63	0.40	1.63
Util_Cons	84	2404	82	26104	0.05	0.40	0.14	0.58	3.48	0.31
TransComm	31084	102963	1814	112669	16.81	17.31	3.07	2.51	30.19	1.61
Finisur	1736	13271	168	36499	0.94	2.23	0.28	0.81	13.08	0.46
OthServices	103	23869	1820	649298	0.06	4.01	3.08	14.48	0.43	0.28
Total	184863	594754	59098	4483819	100.00	100.00	100.00	100.00	31.08	1.32

Table 6: Projected Bilateral Trade between Australia and China: Scenario 3 Stagnation Case

	Trade Flow (Million US$)				Share of each industry in total trade (per cent)				Share of bilateral trade in total export	
	AUS-CHN	AUS-WLD	CHN-AUS	CHN-WLD	AUS-CHN	AUS-WLD	CHN-AUS	CHN-WLD	AUS-CHN/AUS-WLD	CHN-AUS/CHN-WLD
GrainsCrops	2983	20269	155	29990	2.79	4.56	0.31	0.88	14.72	0.52
MeatLstk	6677	29010	239	17870	6.24	6.52	0.49	0.53	23.02	1.33
Extraction	63241	174035	584	20758	59.10	39.14	1.19	0.61	36.34	2.81
ProcFood	832	10599	554	26121	0.78	2.38	1.13	0.77	7.85	2.12
TextWapp	18	799	10358	526753	0.02	0.18	21.06	15.48	2.23	1.97
Leawp	507	3344	2322	115700	0.47	0.75	4.72	3.40	15.16	2.01
Petrocm	7054	36139	5023	278879	6.59	8.13	10.21	8.19	19.52	1.80
Metal	2711	14658	3652	197162	2.53	3.30	7.43	5.79	18.50	1.85
Mtra	83	7472	2478	147072	0.08	1.68	5.04	4.32	1.11	1.69
Elet	90	1346	8103	931805	0.08	0.30	16.48	27.38	6.69	0.87
Mach	781	14879	13316	855554	0.73	3.35	27.08	25.14	5.25	1.56
Oman	57	16859	922	55864	0.05	3.79	1.87	1.64	0.34	1.65
Util_Cons	117	1903	66	21367	0.11	0.43	0.13	0.63	6.15	0.31
TransComm	20069	81517	1054	66599	18.76	18.33	2.14	1.96	24.62	1.58
Finisur	1145	10420	100	22647	1.07	2.34	0.20	0.67	10.99	0.44
OthServices	637	21430	249	89625	0.59	4.82	0.51	2.63	2.97	0.28
Total	107003	444678	49174.331	3403767	100.00	100.00	100.00	100.00	24.06	1.44

Table 7: Projected Bilateral Trade between Australia and China in Education Related Services

	Trade Flow (Million US$)				Share of each industry in total trade (per cent)				Share of bilateral trade in total export	
	AUS-CHN	AUS-WLD	CHN-AUS	CHN-WLD	AUS-CHN	AUS-WLD	CHN-AUS	CHN-WLD	AUS-CHN/AUS-WLD	CHN-AUS/CHN-WLD
2014 Base Year	4083.6	16171.5	3.6	1563.1	4.9	5.5	0.0	0.5	25.3	0.2
2025 Scenario BAU	17221.5	44951.4	4.1	1786.1	11.9	8.4	0.0	0.3	38.3	0.2
2025 Scenario Reform	18618.1	43621.5	25.6	10952.0	10.1	7.3	0.0	1.8	42.7	0.2
2025 Scenario Stagnation	12176.2	34746.5	3.5	1511.8	11.4	7.8	0.0	0.3	35.0	0.2

6. Conclusions

Bilateral trade between China and Australia will continue to increase not only due to the positive economic growth of the two countries but also due to the complementary relationship in the production system of the two countries.

In addition to the traditional sectors that Australia had comparative advantage in such as agricultural and mineral products, Australia will increase its service exports such as those related to education and tourism to China when income per capita further increases in China.

Although China taking different paths in economic growth will affect the trade amount and trade pattern between the two countries, the general trend of increasing bilateral trade. In particular, China will continue to be the most important exporting market for Australia and the role of Australia in China's export market will decline.

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Appendix A: Aggregation in Region and Sector for GTAP Model

Definition of Sector in GTAP Model

ID	Sector	Description
1	GrainsCrops	paddy rice, wheat, cereal grains nec, vegetables, fruit, nuts, oil seeds, sugar cane, sugar beet, plant-based fibers, crops nec
2	MeatLstk	cattle, sheep, goats, horses, animal products nec, raw milk, wool, silk-worm cocoons
3	Extraction	forestry, fishing, coal, oil, gas, minerals nec,
4	ProcFood	vegetable oils and fats, dairy products, processed rice, sugar, food products nec, beverages and tobacco products
5	TextWapp	textiles, wearing apparel
6	Leawp	leather products, wood products, paper products, publishing
7	Petrocm	petroleum, coal products, chemical, rubber, plastic products, mineral products nec
8	Metal	ferrous metals, metals nec, metal products
9	Mtra	motor vehicles and parts, transport equipment nec
10	Elet	electronic equipment
11	Mach	machinery and equipment nec
12	Oman	manufactures nec,
13	Util_Cons	electricity, gas manufacturie, distribution, water, construction
14	TransComm	trade, transport nec, sea transport, air transport, communication
15	Finisur	financial services nec., insurance, business services nec
16	OthServices	recreation and other services, public administration/defence/health/education, dwellings

Source: Hertel (1997).

Definition of Region in GTAP

ID	Region	Description
1	AUS	Australia
2	CHN	China
3	EAS	East Asian Countries
4	ASEAN	ASEAN countries
5	SAA	South Asian Countries
6	NAF	NAFTA countries
7	LatinAmer	Latin American countries
8	EU_25	European Union 25 countries
9	CIS	Former Soviet Union Countries
10	MENA	Middle and East North Africa
11	SSA	South Sahara African
12	RestofWorld	Rest of the World

Appendix B: The Conversion Table between HS Code and GTAP Aggregation Sectors

matching code for Agg match	Commodity Code hscode	Commodity comname
2	1	Live animals
2	2	Meat and edible meat offal
3	3	Fish and crustaceans, molluscs and other aquatic invertebrates
2	4	Dairy produce; birds' eggs; natural honey; edible products of animal origin, not elsewhere specified or included
2	5	Products of animal origin, not elsewhere specified or included
3	6	Live trees and other plants; bulbs, roots and the like; cut flowers and ornamental foliage
1	7	Edible vegetables and certain roots and tubers
1	8	Edible fruit and nuts; peel of citrus fruit or melons
4	9	Coffee, tea, mat?? and spices
1	10	Cereals
4	11	Products of the milling industry; malt; starches; inulin; wheat gluten
1	12	Oil seeds and oleaginous fruits; miscellaneous grains,seeds and fruit; industrial or medicinal plants; straw and fodder
1	13	Lac; gums, resins and other vegetable saps and extracts
1	14	Vegetable plaiting materials; vegetable products not elsewhere specified or included
4	15	Animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal or vegetable waxes
2	16	Preparations of meat, of fish or of crustaceans, molluscs or other aquatic invertebrates
4	17	Sugars and sugar confectionery
4	18	Cocoa and cocoa preparations
4	19	Preparations of cereals, flour, starch or milk; pastrycooks' products
4	20	Preparations of vegetables, fruit, nuts or other parts of plants
4	21	Miscellaneous edible preparations
4	22	Beverages, spirits and vinegar

4	23	Residues and waste from the food industries; prepared animal fodder
4	24	Tobacco and manufactured tobacco substitutes
3	25	Salt; sulphur; earths and stone; plastering materials, lime and cement
3	26	Ores, slag and ash
3	27	Mineral fuels, mineral oils and products of their distillation; bituminous substances; mineral waxes
7	28	Inorganic chemicals; organic or inorganic compounds of precious metals, of rare-earth metals, of radioactive elements or of isotopes
7	29	Organic chemicals
7	30	Pharmaceutical products
7	31	Fertilisers
7	32	Tanning or dyeing extracts; tannins and their derivatives; dyes, pigments and other colouring matter; paints and varnishes; putty and other mastics; inks
7	33	Essential oils and resinoids; perfumery, cosmetic or toilet preparations
7	34	Soap, organic surface-active agents, washing preparations, lubricating preparations, artificial waxes, prepared waxes, polishing or scouring preparations, candles and similar articles, modelling pastes, ?€?dental waxes?€? and dental preparations with a basis of plaster
7	35	Albuminoidal substances; modified starches; glues; enzymes
7	36	Explosives; pyrotechnic products; matches; pyrophoric alloys; certain combustible preparations
7	37	Photographic or cinematographic goods
7	38	Miscellaneous chemical products
7	39	Plastics and articles thereof
7	40	Rubber and articles thereof
2	41	Raw hides and skins (other than furskins) and leather
6	42	Articles of leather; saddlery and harness; travel goods, handbags and similar containers; articles of animal gut (other than silk-worm gut)
6	43	Furskins and artificial fur; manufactures thereof
6	44	Wood and articles of wood; wood charcoal
6	45	Cork and articles of cork
6	46	Manufactures of straw, of esparto or of other plaiting materials; basketware and wickerwork

6	47	Pulp of wood or of other fibrous cellulosic material; recovered (waste and scrap) paper or paperboard
6	48	Paper and paperboard; articles of paper pulp, of paper or of paperboard
6	49	Printed books, newspapers, pictures and other products of the printing industry; manuscripts, typescripts and plans
2	50	Silk
2	51	Wool, fine or coarse animal hair; horsehair yarn and woven fabric
1	52	Cotton
1	53	Other vegetable textile fibres; paper yarn and woven fabrics of paper yarn
5	54	Man-made filaments; strip and the like of man-made textile materials
5	55	Man-made staple fibres
5	56	Wadding, felt and nonwovens; special yarns; twine, cordage, ropes and cables and articles thereof
5	57	Carpets and other textile floor coverings
5	58	Special woven fabrics; tufted textile fabrics; lace; tapestries; trimmings; embroidery
5	59	Impregnated, coated, covered or laminated textile fabrics; textile articles of a kind suitable for industrial use
5	60	Knitted or crocheted fabrics
5	61	Articles of apparel and clothing accessories, knitted or crocheted
5	62	Articles of apparel and clothing accessories,not knitted or crocheted
5	63	Other made up textile articles; sets; worn clothing and worn textile articles; rags
5	64	Footwear, gaiters and the like; parts of such articles
5	65	Headgear and parts thereof
12	66	Umbrellas, sun umbrellas, walking-sticks, seat-sticks, whips, riding-crops and parts thereof
6	67	Prepared feathers and down and articles made of feathers or of down; artificial flowers; articles of human hair
7	68	Articles of stone, plaster, cement, asbestos, mica or similar materials
7	69	Ceramic products
7	70	Glass and glassware
7	71	Natural or cultured pearls, precious or semi-precious stones, precious metals, metals clad with precious metal, and articles thereof; imitation jewellery; coin

8	72	Iron and steel
8	73	Articles of iron or steel
8	74	Copper and articles thereof
8	75	Nickel and articles thereof
8	76	Aluminium and articles thereof
8	78	Lead and articles thereof
8	79	Zinc and articles thereof
8	80	Tin and articles thereof
8	81	Other base metals; cermets; articles thereof
8	82	Tools, implements, cutlery, spoons and forks, of base metal; parts thereof of base metal
8	83	Miscellaneous articles of base metal
11	84	Nuclear reactors, boilers, machinery and mechanical appliances; parts thereof
10	85	Electrical machinery and equipment and parts thereof; sound recorders and reproducers, television image and sound recorders and reproducers, and parts and accessories of such articles
9	86	Railway or tramway locomotives, rolling-stock and parts thereof; railway or tramway track fixtures and fittings and parts thereof; mechanical (including electro-mechanical) traffic signalling equipment of all kinds
9	87	Vehicles other than railway or tramway rolling-stock, and parts and accessories thereof
9	88	Aircraft, spacecraft, and parts thereof
9	89	Ships, boats and floating structures
11	90	Optical, photographic, cinematographic, measuring, checking, precision, medical or surgical instruments and apparatus; parts and accessories thereof
12	91	Clocks and watches and parts thereof
12	92	Musical instruments; parts and accessories of such articles
12	93	Arms and ammunition; parts and accessories thereof
5	94	Furniture; bedding, mattresses, mattress supports, cushions and similar stuffed furnishings; lamps and lighting fittings, not elsewhere specified or included; illuminated signs, illuminated name-plates and the like; prefabricated buildings
12	95	Toys, games and sports requisites; parts and accessories thereof
12	96	Miscellaneous manufactured articles

12	97	Works of art, collectors' pieces and antiques
12	99	Commodities not specified according to kind