_____

Impact of Structural Change on China's Exports Post-WTO Accession

Weysyee **Goh**[*] and Wee-Yeap **Lau**[**]
Faculty of Economics and Administration, University of Malaya

Abstract

This study investigates the structural change in China's export with its accession into the World Trade Organization (WTO) on 11 December 2001. It took 20 negotiations for China to join WTO. However, there were some obligations for China to follow, from legislation to trade and financial markets. Based on a gravity model on data from 1992 to 2001, and from 2002 to 2016, our results show that after WTO accession, statistics on FDI and GDP are significant. It is found that the WTO has brought a positive impact on China's export in the long term, primarily due to the high inflow of FDI after the accession. The impact is extended to the change in export composition. It is found that the export composition has changed from mainly consumer goods to capital goods, from agriculture to electronics. It is also observed that the import of raw materials for processing has increased substantially relative to intermediate goods. Eventually, China grew to be the second-largest economy after Japan in the second quarter of 2010.

1. Introduction

China's economy has been remarkable as it makes the transition from an agricultural society with restricted foreign trade into an economic powerhouse. Since 2012, China has surpassed Japan as the second-largest economy in the world, as it is the leading exporter too. It was said that the opening of the economy has attributed to a substantial extent of Chinese economic growth since Deng Xiaoping reformed the economy in 1979 and also accession to the WTO in 2001. The GDP of China increased from US$ 178 billion in 1979 to US$ 11.1 trillion in 2015. On the one hand, the exports increased from 5% of GDP to 22% of GDP in 2015. In contrast, imports rose from 6% of GDP to 19% of GDP during the same period.

Since the accession of WTO, the increase in China's trade has been stable. It took China more than 20 years for the negotiation of the membership, and such a prolonged negotiation is a particular case of China, as many fear the growth of China to be another superpower, given its vast population. As for the price of the membership, WTO imposed obligations more than other members for China to obey. The opening of the economy affected not only trade development but also investment opportunities as well.

General Agreement on Tariffs and Trade (GATT), the predecessor of the WTO, has been argued to be one of the most successful examples of international economic cooperation in history. From 23 founding members of GATT, WTO has now 164 members, and it is safe to say that all major economies in the world are part of the economic system. Trade had increased significantly since the WTO.

1.1. Overview of China trade

In recent years, the fundamental nature of global trade has been transformed by two interrelated phenomena. The first is international fragmentation of production, whereby the process of production is separated into many stages, and often the production fragments are carried out in different locations where the finished product involves the participation of many economies as countries specialize in different parts of the vertical production chain.

The second phenomenon is the growth of Chinese trade and the increasing importance of China in the global production chain. Over the past near two decades, China's real exports increased by more than 500 percent and overtook Japan as the world's third-largest exporter in 2004, just behind Germany and the United States. Since 1992, China's export structure has changed dramatically (Amiti & Freund, 2010). The composition of export has changed from agriculture and soft manufactures, such as textiles and apparel to hard manufactures, such as electric appliances, computers, and consumer electronics as shown in Figure 1 (Amiti & Freund, 2010), which was driven by processing trade – the practice of assembling duty-free intermediate inputs.

Generally, these inputs mostly originate from developed countries such as the United States and Japan (Dean, Fung, & Wang, 2007). The value of China's exports and imports grew to US$1,422.1 billion in 2005 from US$280.9 billion in 1995, and for export itself, there is a growth from US$ 136.50 to US$525.49 billion from 1995 to 2005 as shown in Figure 1 (Amiti & Freund, 2010).

Figure 1 Reallocation of Manufacturing Exports across Major
Two-digit Sectors
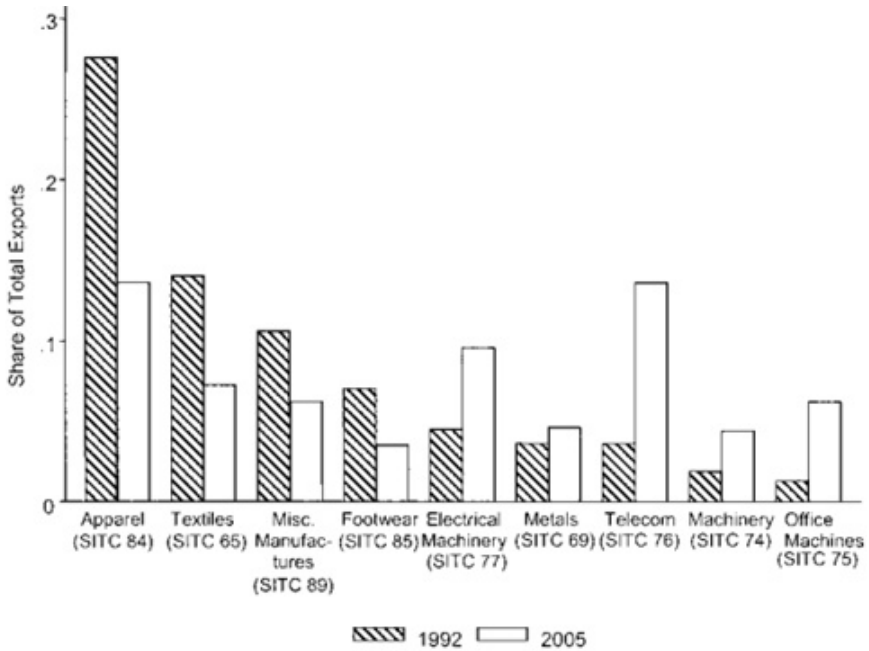
Note: A sector is defined as significant if the sector's share of total trade is above 3 percent in 1992 or 2005. These sectors account for about 70 percent of manufacturing exports.

Source: Amiti & Freund, 2010.

The composition of China's export sector changed considerably from agriculture and textiles into machinery, electronics, and assembly, which means China's export has become more specialized and diversified to promote higher living standards. By plotting inverse cumulative export shares for all products at the HS six-digit level, China's export specialization could be seen in Figure 2.

Figure 2 Cumulative Share of Exports by Rank, Top 500 Products
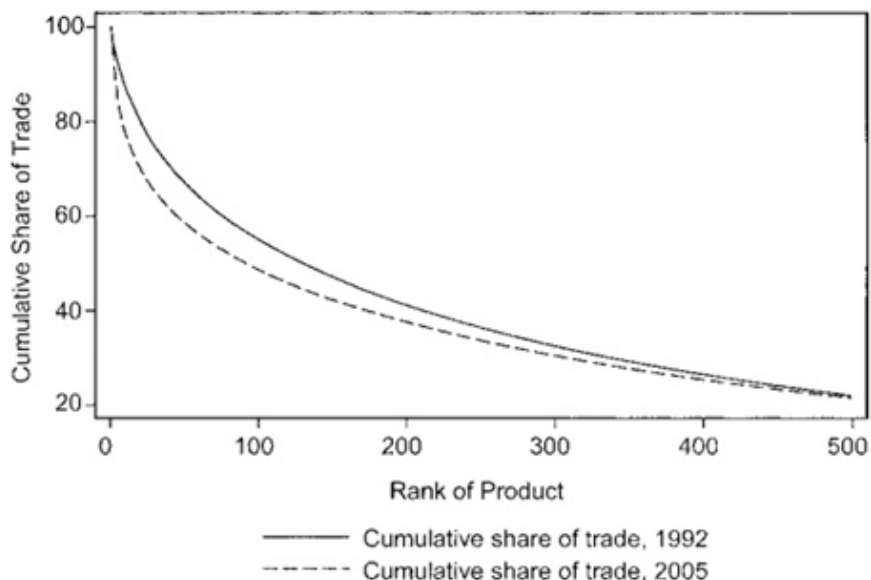
Notes: Data use HS six-digit classifications. Rank is arranged from the largest to smallest value.

Source: Amiti & Freund (2010).

In the year 2001, China joined the World Trade Organization (WTO) membership. Joining WTO is a significant event for the development of China at the beginning of the 21st century and preceded by the establishment of permanent normal trade relations with the United States in 2000. These events are significant as China is recognized by the United States and the world economic community as an equal partner who opens the door to the age of the Chinese economy. More international trade and investment are opened by WTO membership and opened up the world economy for China's exports. Few aspects of the WTO are:

(a) To ensure legal administration and the regime is uniform and transparent.

(b) To ensure all Chinese enterprises have the right to trade, import, and export goods, at the same time levy taxes and charges along with the General Agreement on Tariffs and Trade (GATT) of 1994.

(c) To liberalize the service sector, which was covered by the General Agreement on Trade in Services (GATS)

(d) To cooperate in anti-dumping cases and acceptance as a non-market economy.

(e) To comply with obligations as stated in the protocol, especially in agricultural products, in the elimination of export subsidies and quotas.

(f) To remove technical barriers to trade: - import and export licensing, phytosanitary measures, and price control. (Esplugues, 2011)

These efforts lead to changes in the composition of outputs and exports (Li, Wang, Huo, & Lin, 2000).

What would be the impact of WTO membership on China's economy, especially China's export and import? As it is known that the WTO imposed many conditions for China's membership in the WTO. By joining the WTO in 2001, China's tariffs on industrial products will be lowered from 35 percent to 17 per cent in five years. Foreign manufacturers, including automobile companies, will be able to sell their products directly to domestic consumers without having to go through Chinese trade organizations. Up to 40 per cent of shares of commercial banks will be opened to foreign investors and up to 48 percent of telecommunication firms.

Besides, foreign banks will be able to provide services in local currencies to Chinese corporations. Foreign firms can also provide

accounting, management consulting, architecture, and engineering services. As for the return, the quota on China's textile and clothing exports will be removed by 2005. However, despite the changes in tariffs and the opening of the economy, has WTO given a positive impact to China, particularly the export market? If yes, why is there a mixed result from past empirical studies?

By providing lower tariffs, imports of both agricultural and industrial products will also be increased, which in turn force Chinese producers to lower their prices and improve the quality of their products given the competition from foreign investors, benefiting Chinese consumers. Involvement of foreign manufacturers operating in China not only providing competition but also bringing technology to the market as foreign producers have the advantages over importers by being able to use the low-cost labour in China. The FDI, in turn, causes a change in the composition of export and specialization of labour.

This paper offers different perspectives on analysing the impact of WTO accession in China. Previous literature has mixed results on WTO accession, although the studies do not focus only on China. Therefore, this study hopes to contribute to existing empirical literature as previous literature does not focus only on the export market itself, as well as determining the effect of accession to its trading partners. This study serves as a basis for future research. Primarily, this study aims to investigate the impact of WTO accession on China's export market by looking at the relationship between inward foreign direct investment (FDI) and trade.

This paper is organized as follows. Section two reviews the literature, followed by data and methodology. Section four discusses the results. The last section concludes the study by providing insight into China's trade strategy.

2. Literature Review

2.1. History of China's Entrance to WTO

China joined the WTO on 11 December 2001 as one of the newest members of the organization. As it owns one of the most significant populations in the world, recording more than 1.4 billion in 2018, it indeed owns an advantage to be the most significant economic powerhouse among developing countries. Negotiation was a rocky road process for China as Westerners were afraid that China's accession would harm their economies, making China commit to anomalous terms and conditions to get the membership of the WTO (Halverson, 2004; Clarke, 2003).

At the time of negotiation to accession, China's GDP per capita is less than $1000, which fits the conditions of being a developing country, enable it to negotiate for a different treatment as a developing country instead. The US, as a dominant in the international economy, was interested in China as it is the fastest-growing market for US goods and services as imports from China almost doubled within five years from $51.4 billion in 1996 to $102 billion in 2001 (Table 1).

Table 1 Summary of the History of China to WTO Accession

July 1986	China submitted to the GATT Secretariat to request of resumption to GATT (as a contracting party)
November 1995	China requested to join WTO formally.
December 2001	China officially became a WTO's member (143rd)

Source: WTO (2012).

As a part of the requirements of China's accession to the WTO, trade reforms and commitment have been made as a crucial part in promoting its integration with the global trading system. The

composition of export has changed dramatically from flexible manufacturing and raw materials to capital goods, focusing on electronics goods manufacturing and processing.

As shown in Table 2, the export has been driven by processing and assembling of duty-free intermediate inputs. Over the years, China's export has become more diversified and specialised. The accession to the WTO has led to higher living standards among the people (Li, Wang, Huo, & Lin, 2000).

Table 2 Selected Composition Change of Product Export

	1992	**%**	**2016**	**%**	**Δ in %**
Export value (US$ bil)					
All Products	84.94		2,097.64		
Capital goods	8.59	10%	927.32	44%	337%
Consumer goods	47.46	56%	785.49	37%	-33%
Intermediate goods	16.79	20%	342.02	16%	-18%
Raw materials	10.83	13%	38.25	2%	-86%
Product Group (US$ bill)					
Animal	2.78	3%	17.62	1%	-74%
Chemicals	4.12	5%	99.16	5%	-3%
Food Products	3.29	4%	28.54	1%	-65%
Footwear	5.14	6%	59.44	3%	-53%
Fuels	4.69	6%	26.87	1%	-77%
Hides and Skins	2.91	3%	31.40	1%	-56%
Mach and Elec.	11.54	14%	895.64	43%	214%
Metals	4.55	5%	154.38	7%	37%
Minerals	0.92	1%	3.25	0%	-86%
Miscellaneous	8.02	9%	224.81	11%	13%
Plastic or Rubber	1.83	2%	81.40	4%	80%
Stone and Glass	2.29	3%	66.01	3%	17%
Textiles and Clothing	24.62	29%	253.29	12%	-58%
Transportation	2.10	2%	92.88	4%	79%
Vegetable	4.42	5%	25.03	1%	-77%
Wood	1.70	2%	37.91	2%	-10%

Source: Data from WITS <*https://wits.worldbank.org/*>.

Over the last two decades, China's real exports had increased by more than 2000 percent and successfully overtook the United States as the world's largest exporter in 2016. The share of export to the US has also seen a significant increase (Table 3) from 1992 to 2016, mainly since accession to the WTO, which allowed more FDI to flow into China's economy.

Table 3 China Trade Data, years 1992 – 2016

	1992	1997	2002	2007	2012	2016
Export value (US$ billion)						
China	84.94	182.79	325.60	1220.06	2048.78	2097.64
United States	447.33	687.53	693.22	1162.54	1544.93	1450.46
Export to the US	8.60	32.74	70.05	233.17	352.44	385.68
Share of export to the US.	10%	5%	10%	20%	23%	27%

Source: Amiti & Freund (2010).

2.2. The Protocol of WTO Accession

China's protocol to WTO accession includes the commitment to reform their trade and economy. As China has been a closed central governed economy, all the obligations are to ensure that China will act in line with the principles of the international trade system as a free-market economy (Mayeda, 2005).

Before China joined WTO as a member, it took China 15 years of negotiations on the agreement which began when China submitted a request for resumption to GATT in 1986. Taking account of the size of China's economy and its status as a developing country, the extent of China's commitment is unprecedented.

(a) Transparency – Foreign exchange of WTO laws, regulations, and other measures of trade in goods, services, and others, are to be undertaken by China to make it readily available to other WTO members to comply with the fundamental principles of transparency, non-discrimination, and independent judicial review WTO upholds.

(b) Reducing tariff and removing import quotas on goods – Tariffs on all goods will be reduced to an average of 8.9%, down from about 17% before accession to WTO, at the same time committing to eliminating import quotas which restrict the volume of goods entering China by 2005. The WTO allows manufacturers from all around the world to participate in one of the world's largest markets.

(c) On agricultural goods – China has committed to not only reduce its tariffs on agricultural products, but also eliminating all agricultural export subsidies from its domestic exporter.

(d) Subsidies – By signing the Agreement on Subsidies and Countervailing Measures (SCM Agreement), subsidies provided to state-owned enterprises (SOE) will be viewed as too countervailing duty actions and not take advantage in SCM Agreement that applies to developing countries. China has also agreed to eliminate export subsidies on industrial goods upon WTO accession.

(e) Non-discrimination – Under WTO, it will be illegal to practice discrimination between Chinese and imported products, whether, on servicing, profit, pricing to pre-market testing, and certification of new products that cover areas including energy, transportation, basic telecommunications, as well as other utilities and factors of production.

(f) Anti-dumping policy – Under the protocol of WTO accession of China, there are trade defence instruments, and one of them is an anti-dumping policy from a non-market economy, which allows

authorities to determine the dumping margin by following the controversial approach. Although China has refused to be treated as a non-market economy after years of effort of reforming, it has agreed in its protocol to be treated as one for 15 years to conduct anti-dumping investigations against Chinese companies.

(g) Banking & securities – Openness to foreign banks are required under the accession. Within three years of accession, foreign banks will be able to establish and local currency business, and with private individuals around China within five years. This arrangement allows FDI, making capital more available to Chinese entrepreneurs at an unprecedented scale. (European Commission, 2003; World Trade Organization (WTO), 2001)

(h) Legal system – WTO accession requires China to modify its legal system to WTO's obligation. Besides transparency, there are requirements for uniformity, reasonable and impartial legal application, and prompt judicial review, making its legal system fairer and more predictable (Blazey & Govini, 2006).

2.3. Implication of Accession

Trade barrier reduction is the foundation of the WTO. While theories suggest that WTO increases trade flows, empirical literature measuring the impact has produced mixed results. However, there is a general agreement, where the accession will contribute to trade expansion in terms of an increase in export and import trade ratio to GDP. Without the accession, such expansion will not be possible.

　　Rose (2003) is the first literature that measures the effect of WTO to trade. The author uses a gravity model to gauge the WTO's impact across countries with ordinary least squares, random effect (RE) and fixed effect (FE) estimators to check for the robustness. Based on the data from 178 IMF entities, ranging from 1948 to 1999 with gaps, it is

found that the openness and WTO membership are weakly related, as shown in Table 4.

Table 4 Aggregate Openness, Tariffs, and the WTO

	Member of WTO	Log Real GDP per capita	Log population	Remoteness	Tariffs	R-squared
	-0.02 (0.2)	0.06 (0.01)	-0.23 (0.01)	-1.52 (0.58)	-0.010 (0.001)	0.51
Without year effects	-0.03 (0.02)	0.07 (0.01)	-0.22 (0.01)	-3.32 (0.53)	-0.010 (0.001)	0.49
Level of openness	0.79 (1.66)	4.65 (0.75)	-15 (0.6)	125 (61)	-0.64 (0.10)	0.36

Notes: Regressant is log of openness (ratio of imports plus exports to GDP in %). Figures in parentheses are the standard error. Data from 158 countries, the year 1970 – 1998 with 2099 observations. Tariffs are import duties as a percentage of imports, taken from *World Development Indicator 2002*.

Source: (Rose, 2004).

However, through the gravity model, he also found that countries that are further apart traded less, albeit richer and broader countries tend to trade more, as suggested in the traditional gravity model. However, the paper also clearly stated that membership in WTO does not have any substantial effect on trade, stating membership in the WTO is found to have insignificant statistical results in increasing trade (Rose, 2004).

From Rose's empirical study on the WTO, there have been several follow-up studies using the same data set and empirical method, but with the revised specification of membership to further understand the impact of the multilateral trade agreement on a country's trade. It was found that a proper grouping of participants results in a highly positive, statistically significant, and economically substantiated result of the trade (Subramanian & Wei, 2006; Tomz, Goldstein, & Rivers, 2007).

However, both studies commented that the gravity model does not take dynamic adjustment processes into account.

To be more specific on the grouping, if all WTO members are to be treated the same, undifferentiated, the results found to be having a significant adverse effect on trade of the membership by about 22%. However, this is not the case as the WTO does have special treatment given to developing countries, making it essential for differentiation during regression. Such as, once developed countries and developing countries are differentiated, the coefficient of growth is positive and highly significant (Subramanian & Wei, 2006).

On the other hand, an estimation made by the IMF (2000) suggests that China's current account balance will first be positive at 0.2 billion US$ then turning negative over the early years of accession and ending at a highly positive account balance in 2005 as shown in Table 5. Nonetheless, high FDI from opening the economy should be able to outweigh the deterioration in the external current account balance.

Table 5 China: Estimate of Differences between WTO and Non-WTO Scenarios

	2001	2002	2003	2004	2005
Real GDP growth *(Percentage points)*	-0.3	0.1	0.6	0.6	0.8
Current account balance *(US$ bil)*	0.2	-5.7	-12.4	-21.0	-10.5

Source: IMF (2000).

The analytical work shows that, in general, China's WTO accession has brought a positive effect on its international welfare. Most models show that the WTO-induced tariff changes in China are not sizable as the change in tariff has faced significant lowering. However, in the long

term, China is expected to benefit from WTO accession in the long term as increased competition as an external impetus to the reformation of the domestic market, pointing to a positive net impact of Chinese consumers through efficiency gains and benefits (Rumbaugh & Blancher, 2004).

For further study of the implication of accession to the WTO on China's economy, Shadaeddin (2002) uses Global Trade Analysis Project (GTAP) models via the General Equilibrium models approach, focusing on the impact of tariff changes as the data are readily available as shown in Table 6. The simulation shows the direction of changes, however, with some unrealistic assumptions. The models often overlook the impact of accession. On one hand, the impact of accession on import could be underestimated. On the other hand, the impact on export could be overestimated.

Table 6 Tariff Reduction due to the Accession

	Tariff reduction due to the accession (%)	
	After five years	After two years
Chemical, rubber, & plastic products	42.8	27.6
Textiles	54.1	36.4
Manufactures	19	11.9
Machinery & equipment	50.7	45.7
Wood products	54.1	66
Motor vehicles	55	39.4
Metal	46.7	37.3
Metal products	23.6	21.2
Ferrous Metals	42.8	40.5
Minerals products	20.6	18.2
Food products	41.7	34.5
Beverages & tobacco products	81.9	74.2

Source: Shadaeddin (2002).

The mean shows there is some difference in terms of positive impact lags; on imports, it is immediate while it involves some lags on

exports, which are related to the gestation period for information and others. Next, China gains market access, albeit little, for exports in the first years upon entry by cutting barriers to its imports. It gives China additional market outlays if there is an excess of production capacity. Finally, the impact of removal or reduction of subsidies on exports is not considered despite the impact of tariff changes are calculated in the GTAP model. The model also assumes that the rapid sectoral shift in production capacity and employment has no impact on overall employment. By assuming labour will be ideally in line with the change of output and employment in the export sector are mostly untrue in reality.

To analyse the impact of WTO, most literature cited use the gravity model of trade, which is generally used as the baseline model to measure the bilateral trade relationship between two countries, the impact of policy issues, trade distortions, and many other uses. Traditionally, the gravity model uses a cross-section (CS) model and pooled cross-section (PCS) model for the regression of panel data. However, both CS and PCS models have been found to have biased estimates because heterogeneity should be controlled in the gravity model. Several tests have been done, and it was found that a fixed effect (FE) model specification is preferred by the gravity model (Cheng & Wall, 2005).

Overall, the literature mostly agrees that WTO accession gives a positive impact on China. A significant change of trade pattern has been observed throughout the accession, contributing to substantial economic growth since then. Most literature used the traditional gravity model of trade to estimate the impact, which is restricted as a fixed effect model omits time-invariant variables. Grouping of trading partners is vital to avoid error in estimation as tariff rates are different, hence the difference in trade pattern will cost insignificance in statistics. Nevertheless, the impact of WTO accession is underestimated by the models, as WTO

accession not only covers trade, but the services and the secondary labour market as well.

3. Data and Methodology

The methodology of this study is based on the Gravity Model of Trade to analyse the impact of WTO accession on China's export market using panel data analysis. The relationship between the accession and China's export market is studied to allow further understanding of its impact to trade composition pre- and post-accession to WTO.

As shown in Table 7, trade data are retrieved from the World Integrated Trade Solution (WITS). WITS is developed by the World Bank in collaboration with the United Nations Conference on Trade and Development (UNCTAD), together with consultation from the International Trade Center, United Nations Statistical Division (UNSD) and the WTO. WITS is an online platform that allows users to retrieve trade and tariffs related information. The database comes from several sources:

(a) UNSD Commodity Trade (UN Comtrade) – whereby trade exports and imports data, from summary to detailed commodity breakdown, of more than 170 countries are provided.
(b) UNCTAD Trade Analysis Information System (TRAINS) – where tariffs and non-tariff measures and data are recorded in the most detailed Commodity Description and Coding System (HS0
(c) WTO's Integrated Database (IDB) – Data between partner countries and Most Favoured Nation (MFN) and commodities with preferential tariffs are available at the most detailed commodity level of the national tariffs.

(d) World Bank, and the Center for International Business, Tuck School of Business at Dartmouth College Global Preferential Trade Agreements Database – Preferential trade agreements (PTAs) around the world are provided, including those that have not been updated to the WTO.

Other than that, the mean geographical distance between two trade countries and dummy variables are taken from Centre d'Études Prospectives et d'Informations Internationales (CEPII). Data from 1992 to 2016 are obtained to show the structural break from the accession which happened in 2001.

3.1. Gravity Model of Trade

One of the most successful and widely used empirical international trade models is the gravity model, introduced by Jan Tinbergen (1962). It predicts bilateral aggregate trade flows between two countries, mostly using GDP measurements and geographical distance between the two countries. The formula is based on Newton's universal gravitational law where trade flows between two countries, A and B, are proportional to the gross domestic product of the countries and inversely proportional to the geographical distance between them (Shepherd, 2016) (Chaney, 2013). Generally, a gravity model assumes that the volume of trade between any two economies will be directly proportional to the product of their economic masses, measured by GDP, and inversely proportional to the distance between them. (Eaton & Tamura, 1994)

$$T_{A,B} \propto \frac{(GDP_A)^{\alpha}(GDP_B)^{\beta}}{(Dist_{AB})^{\delta}} \qquad (1)$$

For this study, the gravity model used will be as follows:

Export:

$$Lnx_{ab} = \beta_0 + \beta_1 lndist_{abt} + \beta_2 lnFDI_{ait} + \beta_3 lngdp_{ait} + \beta_4 lngdp_{bit} + \beta_5 lngpc_{ait}$$
$$+ \beta_6 lngpc_{bit} + \beta_7 border_{ab} + \beta_8 island_b + \varepsilon_{ab}$$

(2)

Import:

$$Lny_{ab} = \beta_0 + \beta_1 lndist_{abit} + \beta_2 lnFDI_{ait} + \beta_3 lngdp_{ait} + \beta_4 lngdp_{bit} + \beta_5 lngpc_{ait}$$
$$+ \beta_6 lngpc_{bit} + \beta_7 border_{ab} + \beta_8 island_b + \varepsilon_{ab}$$

(3)

where the variables used are shown in Table 7.

Table 7 Definition of Variables

Variables	Description	Sources
a	Exporting country and importing country, in this case, China	
b	Importing and exporting countries; 5 countries selected are the United States, Japan, Germany, Hong Kong, and Malaysia. Countries are selected based on some of the highest trade value with China.	WITS
	Exporting country;	
x_{ab}	Export to China from other countries (US$)	WITS
y_{ab}	Import from China to other countries (US$)	WITS
$lndist_{ab}$	Natural logarithm of mean geographical distance between two countries (km)	CEPII
$lnFDI_t$	Natural logarithm of inflow foreign direct investment (current US$) at time t	World Bank
$lngdp_t$	Natural logarithm of the gross domestic product of the country (constant 2010 US$) at time t	WITS
$lngpc_t$	Natural logarithm of gross domestic product per capita (constant 2010 US$ per capita) at time t	WITS
$border$	Binary variable denoting if the countries share a land border (0,1); if they share, 1, and none, 0.	CEPII
$island$	Binary variable denoting if the country is an island (0,1); if the country is an island, 1, and not an island, 0.	CEPII
i	$i = 1,2…N$	
ε_{ab}	Stochastic error term	

The analysis is applied to trade flows of China with the annual data on five selected countries. They are the United States, Japan, Germany, Hong Kong, and Malaysia the export to these countries is highest in the following categories: advanced countries, European Union, and NIEs (newly industrialized economies).

We relate China's and selected countries' exports, imports, inward FDI, GDP, GDP per capita, and distance between two countries. Variables *gpc* capture the effect of country size on trade flows and investment positions, as in the standard gravity framework. The variable *gpc* also serves as a proxy for the country's capital-labour ratio and the potential for Intra-industry trade (Helpman, 1987). Border and island are introduced as dummy variables as they should affect the ease of trading between the countries and do not vary over time.

As WTO accession happened on 11 December 2001, a structurabreak is predicted to happen from 2002 instead. In the empirical analysis in this study, the models have been estimated with Pooled Ordinary Least Squares (POLS) method. However, it rejects the null hypothesis of F-test, rejecting the null hypothesis of jointly equal country-specific effect, suggesting the POLS method is not suitable for gravity model. Hence, alternatives such as a random effect (RE) and fixed effect (FE) model are used to estimate country-specific effects. For both approaches, there are advantages and disadvantages.

For the case of RE, there are no dimensionality constraints as such in FE, and able to include policy variables with collinearity in FE. However, it assumes that multilateral trade resistance (MTR) must be generally distributed across countries with a given standard deviation, else RE estimates will not be consistent.

For FE, the estimates are always consistent, even if the actual model is RE, but it does pose some problems when dummy variables are

involved. High computational costs are involved, resulting in the variable to be omitted during computation.

To overcome this issue, Hausman Taylor (HT) estimation model is used to estimate time-invariant variables and dummy variables. Three models POLS, RE and FE, are regressed, followed by Breusch-Pagan Lagrange Multiplier (LM) test and Hausman test to determine if the fixed or random effect is more appropriate for the model.

3.2. Panel Data Regression

When there is a large amount of data with a combination of time series and cross-sectional data (multidimensional), panel data regression is chosen as it allows observations on the same units, which are in this paper GDP, FDI, GDP per capita, and annual bilateral trade data. There are two types of panel data, balanced and unbalanced panel data. Balanced data are used in this paper to avoid random effect error term in the equation as seen in unbalanced data because it may be problematic when the error term exerts the significant effect of the term, as well as inflating the error term, which will affect regression result.

Few benefits can be accounted for using panel data regression. Firstly, controlling individual heterogeneity can be done as there are chances of unobserved heterogeneity across individual variables. The consequences of unobserved heterogeneity are that it will influence the variable of interest, and the correlation between observed explanatory variables will cause the estimated effects of these variables to be biased. By using panel data, taking differences concerning [pic]-averages and dummy variables will help to control heterogeneity within the model.

Next, more information data set can be included in the model due to the pooling of individual and time dimensions, resulting in a larger sample size. Panel data offer cross-sectional variation between units, which is much larger compared to time series, which only offers a

variation within units. When the data are more varied, there will be less collinearity as is often the case in time series.

There are different panel data estimation methods, such as pooled Ordinary Least Squares (POLS), fixed effect model (FE), and random effect model (RE). Type of model suitable to regress the data are dependent on the type of data and result from F-test, LM test, and Hausman test.

3.3. Pooled Ordinary Least Squares. Fixed Effect and Random Effect Model

POLS ignores the panel nature of the data and treat the error term as an identically and independently distributed disturbances that are uncorrelated with variables in this case. Data are pooled, and OLS is used to estimate the model without any additional estimation technique required. Remarkably, POLS uses all variations in the data, which may result in heterogeneity bias. It essentially postulates that both the intercept and the slope are the same across units and times. However, these assumptions might be restrictive as there are often reasons the intercept or slope may be different across units and time.

Assuming each unit has its intercepts, while restricting the slope to be homogenous, such effect is included in the FE and RE. To accommodate such heterogeneity, error term ε is decomposed into two independent components or composite error term as shown in the equation below:

$$\varepsilon_{it} = \lambda_i + u_{it} \qquad\qquad (4)$$

where λ_i is the individual specific effect or unobserved heterogeneity as mentioned above, and it is time-invariant, making it unnecessary to use the time index. RE is where λ_i is assumed drawn independently from

some probability distribution while FE suggests it as a constant.

In RE, λ_i is assumed to be a random variable with mean and variance zero, and more crucially uncorrelated with the regressor. The special effect is characterized as random. We assume λ_i is part of the composite error term ε_{it}. ε_{it} is serially correlated within a unit, and because of this, autocorrelation OLS will be inefficient, and OLS standard errors will be invalid.

On the other hand, FE is called upon when the individual-specific effects are assumed to be individual specific intercepts to be estimated when the covariance between the individual specifics. In FE, only the constant varies, the slope for each remains the same. The fixed effect estimator proceeds by removing λ_i from the model and then running OLS on the resulting model. There are two versions of FE, within-groups FE, and least squares dummy variables (LSDV) FE.

In within-group FE, only the mean from each observation is subtracted, then OLS is carried out on the transformed model. It is named within transformation as the model uses the only variation in the data. However, since the FE estimator relies on the within variations, the effects of time-invariant variables cannot be identified.

LSDV FE, on the other hand, the unobserved effect is brought explicitly into the model and being treated as the coefficient of the individual-specific dummy variable. However, if there are a large number of individuals, using the LSDV FE may not be the best choice as it is not a practical proposition, given the need for a large number of dummy variables. An alternative way of obtaining the FE estimator is to estimate the original untransformed model with a different intercept for each unit, or by including dummy variables, but it may cause the tendency of losing a degree of freedom.

3.4. Hausman Taylor Estimation Model

Traditionally, the correlation between variables that causes biased and inconsistent estimates of parameters are being overcome by eliminating the individual effect in the sample by changing the data from individual means into deviations. The setback of this method or known as within-group or fixed effects estimators is that all time-invariant variables are eliminated. Besides that, it may not be fully efficient as it ignores variations across the sample. In 1981, Hausman and Taylor proposed an instrumental estimator for panel data regression models where the special effect has possibilities to correlate with some of the regressors. It treats the problem of correlation between explanatory variables and latent individual effects. The HT model combines the consistency of an FE model with the efficiency and applicability of a RE model. In RE, it assumes exogeneity of the regressor, but in fact, there may be some regressors that are endogenous to the model, and HT can be adjusted to deal with the endogeneity. The model is given by:

$$y_{it} = \beta_0 + \beta_1 X_{it}^1 + \beta_2 X_{it}^2 + \gamma_1 Z_i^1 + \gamma_2 Z_i^2 + \alpha_i + \eta_{it} \qquad (5)$$

where α_i is the country-specific component, β, and γ are coefficients associated with time-variant and time-invariant variables, and η_{it} is the error with the assumption of no correlation with other variables included in the specification.

Making use of time-varying variables in two ways – to estimate their coefficients and to serve as an instrument for endogenous time-invariant variables, allows identification and efficient estimation of both β and γ. In the HT method, exogenous variables serve as their instrumental variables. Within the transformation of the exogenous individual-and-time, varying variables serve as instrumental variables for the endogenous individual-and-time varying variables. Individual

means of the exogenous individual-and-time varying variables are used as instrumental variables for endogenous time-invariant regressor.

The benefit of Hausman-Taylor model is the ability to control for individual-specific effects from pooling time-series and cross-section data, that are possibly unobservable and may be correlated with other included variables in the specification of an economic relationship, without paying the high price for allowing the variables to be correlated with individual-specific heterogeneity (Hausman & Taylor, 1981).

4. Results

4.1. Panel Data Regression

As the accession took place on 11 December 2001, the trade pattern will change from 2002 onwards. POLS, RE, FE, and HT, are done for both periods, before and after WTO accession. Table 8 the descriptive statistics. It is observed that the export figure is higher than import (7.58 > 7.39); China's GDP is higher than its trading partners (12.49>12.18) but lower GDP per capita as compared to its trading partners (3.38 < 4.44).

Table 8 Descriptive Statistics 1992 – 2016

	lnX_{ab}	lnY_{ab}	$lndist_{ab}$	$lnFDI_a$	$lngdp_a$	$lngdp_b$	$lngpc_a$	$lngpc_b$
Mean	7.582	7.393	3.641	10.922	12.491	12.182	3.382	4.442
Median	7.643	7.385	3.546	10.833	12.359	12.504	3.248	4.582
Max	8.613	8.289	4.067	11.464	13.049	13.227	3.910	4.718
Min	5.810	5.919	3.249	10.048	12.015	10.989	2.949	3.710
Std. Dev.	0.659	0.529	0.290	0.386	0.334	0.778	0.315	0.295

From the results in Table 9 and 10, R-squared value for both periods is 98.2% and 98.8%, respectively, showing the explanatory variables account for over 98% of the observed variation in the data. F-statistics from POLS regression show that all the regressors are not simultaneously zero, showing a certain degree of endogeneity, hence rejecting the null hypothesis of the F-test of jointly equal country-specific effect, confirming POLS method is not suitable for the model.

Since POLS regression is rejected, RE, FE, and HT methods are considered. LM test is used to determine if there is a random effect under the null hypothesis of *Var*(u) = 0. The test statistics showed that the null hypothesis is not rejected, signifying the gravity model is more efficient using the FE model. Hausman test with the null hypothesis that the difference in the coefficients is not systematic is then run again to confirm the results from the LM test. The results again showed that the FE model is more efficient than the RE model by rejecting the null hypothesis.

Nevertheless, from a conceptual view, the FE model seems to be more appropriate since the countries are not randomly drawn from a larger population, but from a predetermined sample, a pool of countries of highest trade relationship with China. However, the drawback of the FE model is that time-invariant variables and dummy variables are omitted as FE models assume no collinearity, and there is the existence of the dummy variable trap. Hence, the HT test is carried out, with *gpc* as a time-variant exogenous variable, *FDI*, and *GDP* as a time-variant endogenous variable, while *dist*, *border*, *island* are time-invariant exogenous variables, and estimation results are reported and analyzed based on the HT method.

Table 9 Panel Data Regression Result (Export), years 1992 – 2001

Variables	POLS	RE	FE	HT
$lndist_{ab}$	0.738 (2.267)	0.736 (2.267)	Omitted	0.464 (2.281)
$lnFDI_a$	0.591 (0.200)	0.588 (0.200)	0.779 (0.177)	0.720 (0.182)
$lngdp_a$	0.104 (30.445)	0.096 (30.445)	0.236 (27.308)	0.180 (27.944)
$lngdp_b$	0.260 (0.879)	0.254 (0.879)	0.152 (1.052)	0.388 (1.015)
$lngpc_a$	0.097 (34.304)	0.089 (34.304)*	0.222 (30.778)	0.168 (31.492)
$lngpc_b$	0.052 (0.635)	0.045 (0.635)**	0.017 (1.528)**	0.073 (1.382)
$border$	0.029 (0.680)**	0.024 (0.680)**	Omitted	0.861 (1.003)
$island$	0.461 (1.030)	0.457 (1.030)	Omitted	0.388 (1.068)
c	0.111 (266.281)	0.103 (266.281)	0.229 (238.649)	0.186 (244.227)
No. of obs.	50	50	50	50
R-squared	0.982			
F-stats	276.33			
LM test		1.000 (0.00)		
Hausman test			0.026 (12.77)**	

Table 10 Panel Data Regression Result (Export), years 2002 – 2016

Variables	POLS	RE	FE	HT
$lndist_{ab}$	0.001 (.759)***	0.001 (0.759)***	Omitted	0.001 (0.775)***
$lnFDI_a$	0.001 (0.084)***	0.001 (0.084)*((	0.001 (0.087)***	0.001 (0.084)***
$lngdp_a$	0.111 (0.084)	0.106 (0.084)	0.151 (5.737)	0.108 (5.602)
$lngdp_b$	0.000 (0.260)***	0.001 (0.260)*((	0.001 (0.558)***	0.001 (0.287)***
$lngpc_a$	0.117 (5.810)	0.112 (5.810)	0.158 (5.955)	0.114 (5.816)
$lngpc_b$	0.001 (0.122)***	0.001 (0.122)***	0.047 (0.785)**	0.001 (0.230)***
$border$	0.001 (0.179)***	0.001 (0.179)***	Omitted	0.001 (0.216)***
$island$	0.001 (0.339)***	0.001 (0.339)***	Omitted	0.001 (0.345)***
c	0.085 (50.915)*	0.081 (50.915)*	0.065 (52.137)*	0.083 (50.981)*
No. of obs.	75	75	75	75
R-squared	0.988			
F-stats	667.65			
LM test		1.000 (0.00)		
Hausman test			0.001 (41.36)*	

Table 11 Panel Data Regression Result (Import), years 1992 – 2001

Variables	POLS	RE	FE	HT
$lndist_{ab}$	0.311 (3.635)	0.305 (3.635)	Omitted	0.423 (3.695)
$lnFDI_a$	0.172 (0.321)	0.165 (0.321)	0.222 (0.306)	0.188 (0.311)
$lngdp_a$	0.138 (48.819)	0.131 (48.819)	0.262 (47.125)	0.188 (47.606)
$lngdp_b$	0.159 (1.409)	0.151 (1.409)	0.637 (1.816)	0.793 (1.648)
$lngpc_a$	0.135 (55.007)	0.127 (55.007)	0.258 (53.111)	0.184 (53.648)
$lngpc_b$	0.190 (1.018)	0.182 (1.018)	0.103 (2.637)	0.387 (2.095)
$border$	0.196 (1.090)	0.189 (1.090)	Omitted	0.990 (1.483)
$island$	0.456 (1.651)	0.452 (1.651)	Omitted	0.513 (1.698)
c	0.138 (426.982)	0.130 (426.982)	0.264 (411.828)	0.184 (416.135)
No. of obs.	50	50	50	50
R-squared	0.906			
F-stats	9.13			
LM test		1.000 (0.00)		
Hausman test			0.3552 (5.52)	

Table 12 Panel Data Regression Result (Import), year 2002 – 2016

Variables	POLS	RE	FE	HT
$lndist_{ab}$	0.286 (1.343)	0.282 (1.343)	Omitted	0.214 (1.816)
$lnFDI_a$	0.005 (0.149)***	0.005 (0.149)* **	0.001 (0.129)***	0.001 (0.132)***
$lngdp_a$	0.715 (9.912)	0.714 (9.912)	0.146 (8.530)	0.195 (8.697)
$lngdp_b$	0.747 (0.459)	0.746 (0.459)	0.000 (0.829)***	0.001 (0.799)***
$lngpc_a$	0.740 (10.290)	0.739 (10.290)	0.157 (8.856)	0.209 (9.028)
$lngpc_b$	0.563 (0.215)	0.561 (0.215)	0.001 (1.168)***	0.001 (1.107)***
$border$	0.006 (0.316)* **	0.005 (0.316)* **	Omitted	0.028 (0.957)**
$island$	0.112 (0.599)	0.108 (0.599)	Omitted	0.658 (0.867)
c	0.707 (90.177)	0.706 (90.177)	0.096 (77.532)*	0.173 (79.432)
No. of obs.	75	75	75	75
R-squared	0.948			
F-stats	150.99			
LM test		1.000 (0.00)		
Hausman test			0.001 (25.09)***	

Notes to Tables 9, 10, 11, 12: *, **, *** denote statistical significance at 10%, 5%, 1% respectively. Figure in parentheses denotes standard error of the variable.

4.2. Discussion

Comparing Table 9 and 10, looking at the last column at HT estimator, it is observed that after WTO accession from 2002 onwards, the export can be explained by all factors except GDP per capita and its GDP. In other words, as shown in Table 10, FDI, GDP of trading partners, and borders are some of the crucial factors.   Similarly, in Table 12, in the Post-WTO accession, it is observed that the import can be explained by all factors except GDP per capita, its GDP, and the distance.

Overall, results based on the analysis shown that the event of WTO accession gives a significant impact on China's market. Before WTO accession, none of the economic indicator shows any significance to export. As the tariff rate is high, the demand for China's products is low. Besides, before the WTO, China has been a closed, centrally planned economy with minimal trade.

After WTO accession, from the result, it can be observed that FDI brought a significant change to China's export. The membership of WTO forces China to become an open economy with transparent policies, which, in return, has enabled foreign investors to have more confidence to invest in China.

As seen in Figure 3, China's FDI inflow has had a dramatic increase after opening their economy in the world, although with some lags that could be caused by China's commitment to reduce its average tariff rate to 10 percent by 2005 instead of 2002, for proper observation before entering the market. According to the investment development path (IDP) theory, FDI, both inwards and outwards of a country is correlated with its stages of economic development. Over the time, as the firm

becomes progressively internationalized, the firm will become more of a function of the international economic structure instead of only domestically (Dunning & Narula, 1993).

Figure 3 China – FDI Inflow (current US$)
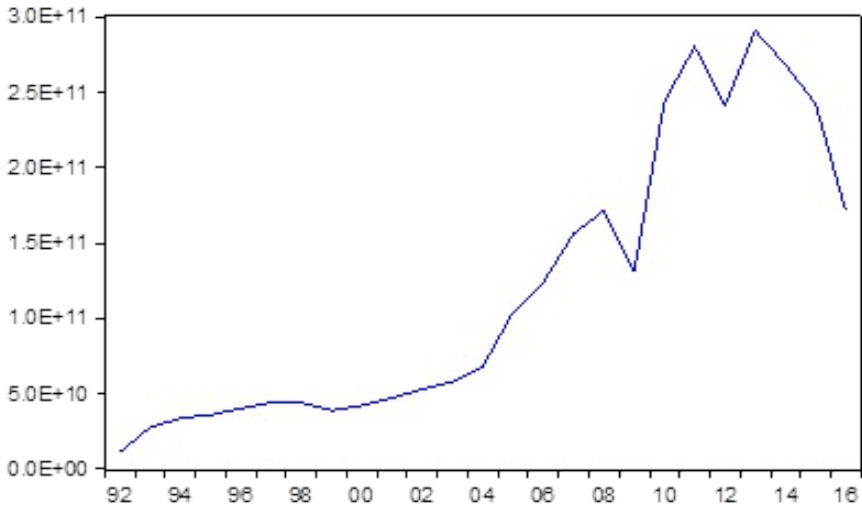
Besides that, significant reduction of tariff is also one of the contributing factors that attract manufacturers to invest in the possible one of the greatest economic powerhouse to-be, given its large population and cheap labour as well. In contrast to Rose's estimate for the coefficient of FDI, the coefficient of FDI turned from -0.065 to 0.621, which suggests the increase of inflow FDI to China as a consequence of WTO membership and more significant normalization of the Chinese economy. The positive coefficient on FDI also signifies the FDI inflow is providing both backward and forward linkages in Chinese trade; foreign investors import raw input to be processed in China and export for added-value products.

Although statistically, China's GDP is insignificant to its exports, GDP of other countries tested appears to have a significant relationship with China's export, which implies that the market share of trade has been increasing in the world, especially with most developed countries such as the United States and Japan (Bussiere & Schnatz, 2006).

In the traditional gravity model, two of the variables that have a substantial effect on the bilateral trade are distance and economic sizes. Despite countries that share the same border may not necessarily trade more with each other, but in general, distance has been an essential determinant in standard gravity model estimates, only with some exceptions such as India-Pakistan, Israel-Syria, and others. However, the distance and adjacency effect is so strong that the statistics appear highly significant even when no account is taken for antagonist pairs (Frankel, 1997).

China's development in trade and growth in FDI has undoubtedly changed the composition of the export product over time. Figure 4 shows that before WTO accession, consumer goods made the most significant portion of the export product and the smallest portion of capital goods.

Figure 4 China's Export Product Share (%), years 1992 – 2016
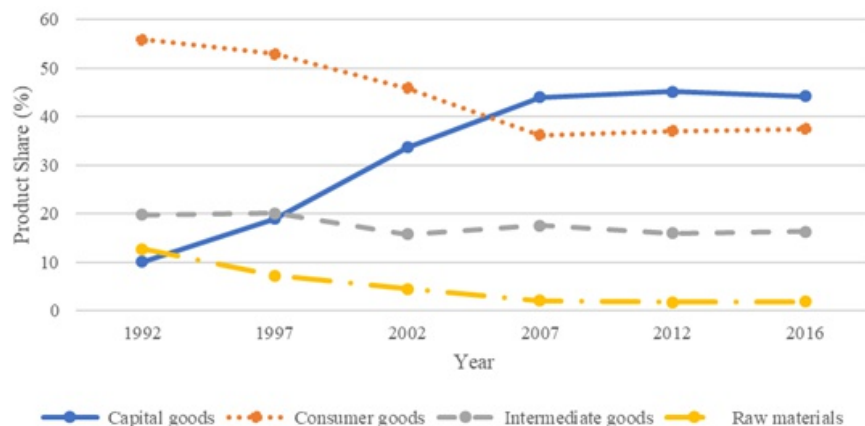
As shown in Figure 4, the export composition has changed from mainly consumer goods to capital goods, from agriculture to electronics, and such. This trend is confirmed by import data as the import of raw materials increased for processing, and intermediate goods are decreasing, as shown in Figure 5.

Figure 5 China's Import Product Share (%), years 1992 – 2016
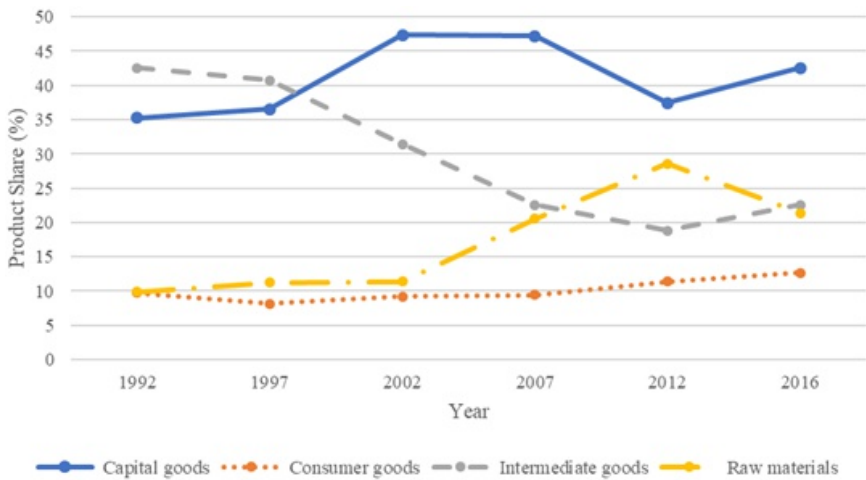
For example, WTO accession also granted China unrestricted access to textile and clothing export markets under the Uruguay Round Agreement on Textiles and Clothing (ATC) as one of its consequences (Rumbaugh & Blancher, 2004). Especially, NIEs (newly industrialized economies) gain from China's expanding trade as their trade pattern is complementary to China, and benefits of processing trade by exporting intermediate components and products to China. However, China is moving up the value-added chain and domestic production of components; it could pose a direct competition to other economies and

sustain some adjustment costs. In the case of Malaysia, labour-intensive exports such as electrical and electronics manufacturing have seen a drop from the 1990s, aside from insufficiently skilled labour issue in Malaysia, cheap labour in China is also one of the factors contributing to the threat (Loke, 2008).

However, without expanding market access overseas from the WTO, the above result will not be possible. As other WTO members grant China MFN treatment, restrictions on imports from China have been removed by several trading partners. Access to a foreign market is made more accessible. Overall, accession to WTO shows a positive impact on China's export and should provide long term benefits as growth has been substantial since accession due to change of trade pattern and reforms.

5. Conclusion

Significant implications have been shown by China's accession to WTO, not only for China's economy, but as well as its trading partners. It is expected to have favourable implications for China's export in the long run. The benefits will flow to most of its trading partners, given China's growth is sustained. Processing trade has undoubtedly contributed substantially, along with imports for domestic use. More importantly, multinational companies have been investing in China in order to meet local demand and for manufacturing as well, as tariff has been significantly lowered.

While WTO accession gives a positive impact on Chinese export, for specific sectors, it could pose competitive threats to countries, especially in producing labour-intensive products, resulting in adjustments of these economies. For example, low- and middle-income economies will face adverse impact as a more significant portion of FDI

going to China instead of ASEAN countries. It is found that the WTO has brought a positive impact on China's export in the long term, primarily due to the high inflow of FDI after the accession. The impact was extended to the change in export composition; It is found that the export composition has changed from mainly consumer goods to capital goods, from agriculture to electronics.

Notes

*   Goh Weysyee (吴薇诗) completed her Master of Economics at the University of Malaya. Her research interest is in applied econometrics and macroeconomics. *<Email: mica.gws@gmail.com>*

**   Dr Lau Wee-Yeap (劉偉業) is Associate Professor and Deputy Dean at the Faculty of Economics and Administration, University of Malaya. He was a Monbusho Scholar for his postgraduate studies at Graduate School of Economics, Osaka University, and Visiting Scholar at Risk Management Institute, National University of Singapore. Currently, he is Associate Research Fellow of Malaysian Institute of Economic Research (MIER) and Honorary Secretary of the Malaysian Economic Association (MEA). *<Email: wylau@um.edu.my>*

References

Amiti, M. and C. Freund (2010). The anatomy of China's export growth. In: R.C. Feenstra and S.-J. Wei (eds.), *China's growing role in world trade* (pp. 35-56). University of Chicago Press.

Blazey, P. and P. Govini (2006). "The song remains the same" – The status of the rule of law in China. Macquarie *Journal of Business Law*, 3, pp. 47-61.

Bussiere, M., and B. Schnatz (2006). Evaluating China's Integration In World Trade With A Gravity Model-Based Benchmark. *Working Paper Series*, No. 693. European Central Bank.

CEPII (26 March 2018). Databases and models. Retrieved from Centre d'Études Prospectives et d'Informations Internationales (CEPII), *http://www.cepii.fr/ CEPII/en/bdd_modele/bdd_ modele.asp*

Chaney, T. (2013). The gravity equation In international trade: An explanation. *Journal of Political Economy*, 126(1), pp. 150-177.

Cheng, I.-H. and H.J. Wall (2005). Controlling for heterogeneity in gravity models of trade and integration. *Federal Reserve Bank of St. Louis Review*, 87(1), pp. 49-63.

Clarke, D.C. (2003). China's legal system and the WTO: Prospects for compliance. *Washington University Global Studies Law Review*, 2(1), pp. 97-117.

Dean, J.M., K. Fung and Z. Wang (2007). *Measuring vertical specialization in Chinese trade. Office of Economics*. Washington, DC: US International Trade Commission.

Dunning, J.H. and R. Narula (1993). *Transpacific foreign direct investment and the investment development path: The record assessed*. Maastricht, Netherlands: University of Limburg.

Eaton, J. and A. Tamura (1994). Bilateralism and regionalism in Japanese and US trade and direct foreign investment patterns. *Journal of the Japanese and International Economies*.8(4)), pp. 478-510,

Esplugues, C.A. (2011). *China's accession to WTO*. The University of Valencia.

European Commission (October 2003). *Overview of the terms of China's accession to WTO*. Retrieved 8 March 2018, from European Commission of Trade: *http://trade.ec.europa.eu/doclib/docs/2003/october/tradoc_11195 5.pdf*

Frankel, J.A. (1997). *Regional trade blocs in the world economic system*. Peterson Institute of International Economics.

Halverson, K. (2004). China's WTO accession: Economic, legal and political implications. *Interrelationships: International Economic Law and Developing Countries*, 27(2), pp. 319-370.

Hausman, J.A. and W.E. Taylor (November 1981). Panel data and unobservable individual effects. *Econometrica*, 49(6), pp. 1377-1398.

Helpman, E. (1987). Imperfect competition and international trade: Evidence from fourteen industrial countries. *Journal of the Japanese and International Economies*, 1(1), pp. 62-81.

Hsu, S. (21 February 2017). China takes another step towards a service economy. Retrieved 3 May 2018, from *Forbes*, *https://www.forbes.com/ sites/sarahsu/2017/02/21/china-takes-another-step-towards-a-service-economy/#58baa21728c1*

IMF (2000). *World Economic Outlook*.

Li, S., Z. Wang, F. Huo and X. Lin (2000). *WTO: China and the world* (in Chinese language). Beijing: China Development Publishing Company.

Loke, W.H. (2008). Malaysia and China: Comparative advantages in selected manufacturing goods. Globalization and Economic Policy (GEP) Workshop. The University of Malaya.

Mayeda, G. (2005). A normative perspective of legal harmonization: China's accession to WTO. *University of British Columbia Law Review*, 38(1), pp. 83-122.

Rose, A.K. (2004). Do we really know that the WTO increases trade? *American Economic Review*, 94(1), pp. 98-114.

Rumbaugh, T. and N. Blancher (2004). *China: International trade and WTO accession*. IMF.

Shadaeddin, S. (2002). Some implications of accession to WTO for China's economy. *International Journal of Development Issues*, 1(2), pp. 93-128.

Shepherd, B. (2016). *The gravity model of international trade: A user guide*. United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP).

Subramanian, A. and S.-J. Wei (2006). The WTO promotes trade, strongly but unevenly. *Journal of International Economics*, 72(1), pp. 151-175.

Tomz, M., J.L. Goldstein and D. Rivers (2007). Do we really know that the WTO increases trade? Comment. *American Economic Review*, 97(5), pp. 2005-2018.

World Trade Organization (WTO) (2001). Decision of 10 November 2001 - Accession of the People's Republic of China. (WT/L/432).

WTO (2012). China in the WTO: Past, present and future. Retrieved from WTO, *https://www.wto.org/english/thewto_e/acc_e/s7lu_e.pdf*

Policy Commentary