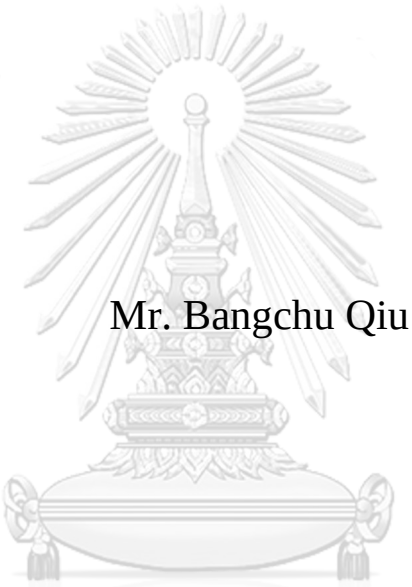
Assessing the Impact of China's FTAs on Trade Creation and Trade Diversion

Mr. Bangchu Qiu



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Thesis Title	Assessing the Impact of China's FTAs on Trade Creation and Trade Diversion
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บางชู ฉิว : ผลกระทบของความตกลงการค้าเสรีของจีนที่มีต่อการสร้างการค้าและการเบี่ยงเบนทางการค้า. (Assessing the Impact of China's FTAs on Trade Creation and Trade Diversion) อ.ที่ปรึกษาหลัก : ดนุพล อริยสัจจากร

งานวิจัยฉบับนี้มุ่งเน้นในการประเมินผลกระทบจากข้อตกลงการค้าเสรีระหว่างประเทศ (Free Trade Agreements: FTAs) ที่ประเทศจีนทำไว้กับประเทศคู่ค้า โดยผลกระทบดังกล่าวเป็นการประเมินผลในเชิงการสร้างการค้า (Trade Creation: TC) และผลในเชิงการเบี่ยงเบนการค้า (Trade Diversion: TD) ข้อมูลที่ใช้ในการศึกษาประกอบด้วยข้อมูลการค้าระหว่างประเทศรายปีของประเทศจีนกับประเทศคู่ค้า 32 ประเทศในช่วงระยะเวลา 25 ปี (1995-2019). แบบจำลองที่ใช้ในการศึกษาเป็นแบบจำลองแรงโน้มถ่วง (Gravity Model) โดยใช้วิธีการประมาณค่าด้วยกระบวนการกำลังสองน้อยที่สุด (ordinary least square (OLS)) และ Poisson Pseudo-Maximum Likelihood (PPML) ซึ่งวิธีการหลังใช้เพื่อลดปัญหา heteroscedasticity จากการประมาณค่า

ผลจากการศึกษาพบว่าการค้าของจีนได้รับผลได้ในเชิงการสร้างการค้า (TC) จากข้อตกลงการค้าเสรีอาเซียน-จีน (ACFTA) และการค้าหดตัวจากข้อตกลงการค้าเสรีจีน-ปากีสถาน (CPFTA) เมื่อใช้แบบจำลองในรูปแบบ time fixed effect model ในขณะที่เมื่อใช้แบบจำลองในรูปแบบ time & pair fixed effect model พบว่า 1) ข้อตกลงความร่วมมือทางเศรษฐกิจที่ใกล้ชิดของจีน-ฮ่องกง (MHCEPA) ให้ผลในการหดตัวทางการค้า 2) ข้อตกลงความร่วมมือทางเศรษฐกิจที่ใกล้ชิดของจีน-มาเก๊า (MMCEPA) ให้ผลในเชิงการสร้างการส่งออกของจีน 3) ข้อตกลงการค้าเสรีสิงคโปร์-จีน (SCFTA) และ ข้อตกลงการค้าเสรีจีน-ไอซ์แลนด์ (CIFTA) ส่งผลให้เกิดการเบี่ยงเบนในการส่งออกและทำให้การส่งออกหดตัว 4) ข้อตกลงการค้าเสรีจีน-คอสตา ริก้า (CCRFTA) ให้ผลในการเบี่ยงเบนในการนำเข้า 5) ข้อตกลงการค้าเสรีจีน-ชิลี (CCFTA) และ ข้อตกลงการค้าเสรีจีน-สวิตเซอร์แลนด์ (CSFTA) ก่อให้เกิดการสร้างการส่งออก 6) ข้อตกลงการค้าเสรีเปรู-จีน (PCFTA) ส่งผลให้เกิดการสร้างการนำเข้า 7) ข้อตกลงการค้าเสรีจีน-ออสเตรเลีย (CAFTA) ส่งผลให้เกิดการสร้างการค้าในกลุ่มประเทศสมาชิก และ 8) ข้อตกลงการค้าเสรีจีน-จอเจียร์ (CGFTA) ส่งผลให้เกิดการสร้างการค้าในกลุ่มประเทศสมาชิกประกอบกับการเบี่ยงเบนในการส่งออก จากภาพรวมผลกระทบที่เกิดขึ้นทั้งหมดพบว่าผลลัพท์สุทธิจากข้อตกลงการค้าเสรีของจีนเป็นบวก ดังนั้นจีนจึงควรรักษาความสัมพันธ์การค้าเสรีกับประเทศสมาชิกต่อไปโดยติดตามผลเชิงลบที่อาจเพิ่มมากขึ้นอย่างใกล้ชิดเพื่อหลีกเลี่ยงผลดังกล่าวที่อาจเกิดขึ้นในอนาคต

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Bangchu Qiu : Assessing the Impact of China's FTAs on Trade Creation and Trade Diversion. Advisor: Assoc. Prof. DANUPON ARIYASAJJAKORN, Ph.D.

This paper estimates trade creation and trade diversion effects of China's effective free trade agreements (FTAs) as of 2019. The annual trade data used in this study cover 32 economies with 25-year span (1995-2019). Using gravity type of model, trade creation and trade creation effects are estimated by applying ordinary least square (OLS) and Poisson Pseudo-Maximum Likelihood (PPML) techniques with various fixed effects. PPML is applied to deal with heteroscedasticity problem.

The results show a pure trade creation effect of ACFTA and a pure trade contraction effect of CPFTA in the time fixed model. In the time & pair fixed model, trade contraction effect of MHCEPA and expansion effect of extra-bloc exports and imports of MMCEPA. Export diversion and contraction effects of SCFTA. Export diversion effect of CIFTA and import diversion effect of CCRFTA. Pure trade creation in exports of CCFTA and CSFTA, pure trade creation in imports of PCFTA. Intra-bloc trade creation effect of CAFTA and intra-bloc trade creation and export diversion of CGFTA. The results suggest that China experiences net gains from those trade creation and trade diversion effects arisen from FTAs. Therefore, China should maintain FTA relation with its trading partners while paying attention closely to negative effects from trade diversion.

Field of Study:	International Economics and Finance	Student's Signature .....
Academic Year:	2020	Advisor's Signature .....

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It is my honor to study here in Thailand. I am grateful to the Chulalongkorn University for the opportunity to study. I have learned and benefited a lot from studying and living here to gain rich knowledge. With the knowledge I've learned, I will study harder and explore more. At this time, I'd like to express my sincere gratitude to all those who supported me. I really appreciate my advisor, Assoc. Prof. Danupon Ariyasajjakorn. It is his invaluable advice and guidance encouraged me to finish the thesis. And I also grateful to the thesis committee, Asst. Prof. Sineenat Sermcheep and Assoc. Prof. Siwapong Dheera-aumpon, for their invaluable helpful comments. Finally, what learn today what will achieve tomorrow, repaid the family, society and country with a grateful heart.

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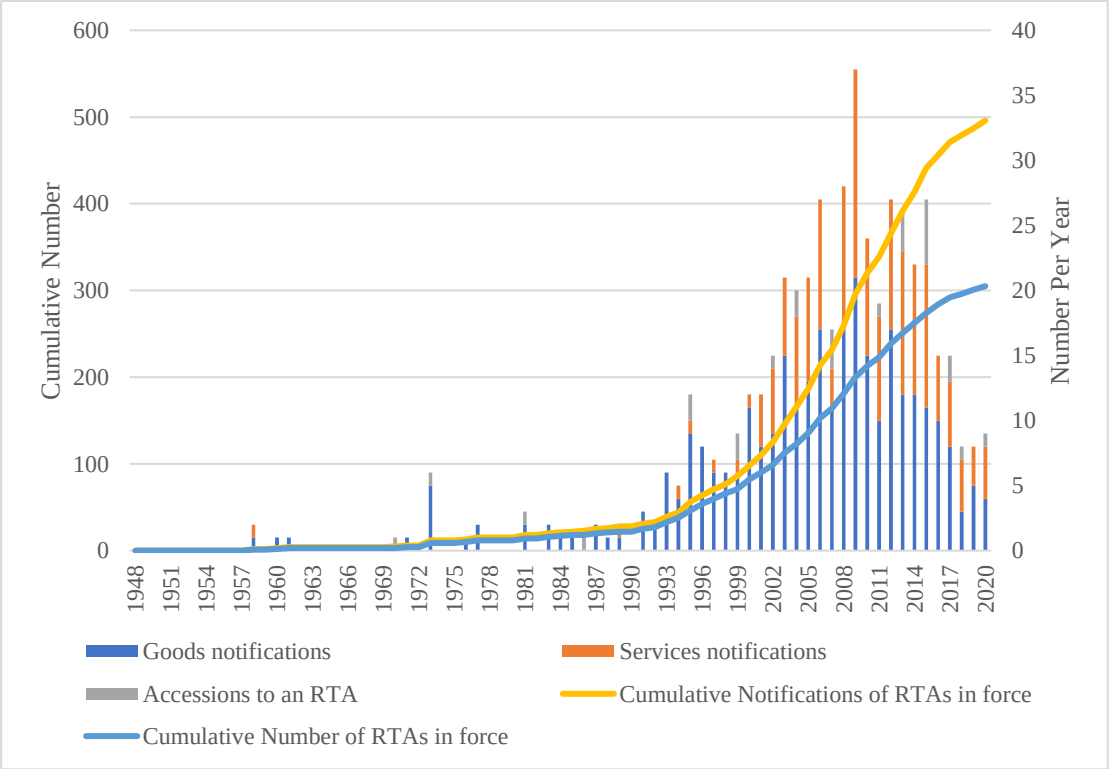
Chapter 1 Introduction

1.1 Overview

As the development of international division of labor and technology brought to every place in the whole world by multinational companies, international trade and economic integration between economies are gradually strengthened. Since we stepped in the 21st century, though the global financial crisis in 2008 and the de-globalization pressure lately, the overall trend of globalization and international trade is still rising. For the regional economic integration, no doubt there has been an obvious upward trend since the 1990s, a major trend of regional trade and economic integration promoting steady by worldly most important economies as the Figure 1 illustrated. According to the data from WTO, as of 17 January 2020, 303 RTAs were in force that correspond to 483 notifications from WTO members.[1]

Figure 1 RTAs in the World from1948 to 2020



Source: WTO

Among the regional integrations, the free trade agreement (FTA) is particularly focused. The set-up of FTAs is already gradually becoming mature, vast majority of WTO member countries have participated in one FTA at least or more. FTA is a pact

[1] https://www.wto.org/english/tratop_e/region_e/region_e.htm

between two or more countries or economies (including separate customs territory)[2] agreeing to establish free trade, forming a "free-trade area in which each country's goods can be shipped to the other without tariffs, but in which the countries set tariffs against the outside world independently" Krugman, Obstfeld, and Melitz (2018).[3] To promote the liberalization of goods and services, technology and capital among members by signing the FTA, the tariff and non-tariff barriers are mutually eliminated as well as most market access restrictions removed. Since China becomes the world's second largest economy nowadays, given its contribution, China is now central to necessary regional and also global economic development issues. Chinese government also regards FTA as a new effective way for further opening-up and accelerating the process of deepen reforms, the 17th National Congress of the Communist Party of China upgraded the construction of free trade zones to a national strategy.[4] The third Plenary Session of the 18th CPC Central Committee proposed to accelerate the implementation of FTA strategy to form a globally high standard FTA network based on ambient areas.[5] It's a sound plan to integrate into the global economy, strengthening the trade cooperation and dialogue with other major economies. By the end of 2019, China has 16 agreements been signed and implemented already.[6] However, China-Mauritius FTA (CMFTA) and China-Maldives FTA (MCFTA) are in force but not notified to the WTO yet.[7] In total, there are 14 FTAs (13 bilateral agreements and 1 multilateral) as Table 1.

Since bilateral and regional trade liberalization development became so prominent recent decades. It is so significant to assess what impacts or implications may leave on the international trade. Traditional international trade theories have focused on the explanation of the reasons and social welfare effects of the international trade. Gravity model is introduced firstly by Tinbergen (1962) and Pöyhönen (1963), they provided a new perspective to do relative analysis of international trade. The assessment of the substantial impact of RTAs on trade dates back to Viner (1950), who first introduced the ideas and notions of trade creation and trade diversion. The establishment of an FTA will cause the trade creation (TC) and trade diversion (TD) simultaneously to the trade partners internal and external as well. Social welfare of one economy increased as the trade cost economized by reduction of tariff and resource allocation improved by the saved cost as the trade shift/divert to low-cost FTA partner in the substitution of high-cost domestic production or external bloc, leading an improvement in resource allocation and potentially brings very positive welfare effects. While the trade diversion is a substitution of low-cost trade with partners that outside the free trade area, which raises the cost of trade then causes the social welfare losses accordingly. Therefore,

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[2] China has 16 agreements been implemented already until 2019, including Closer Economic and Partnership Arrangement (CEPA) between Chinese Mainland and Hong Kong & Macao (MHCEPA, MMCEPA). Hence, applying economies (separate customs territory) for Hong Kong and Macao and Taiwan here.
[3] Free Trade Area, definition from Krugman, Obstfeld, and Melitz (2018). P293.
[4] http://www.xinhuanet.com//politics/2014-12/06/c_1113546075.htm
[5] http://www.gov.cn/zhengce/content/2015-12/17/content_10424.htm
[6] http://fta.mofcom.gov.cn/english/index.shtml
[7] Check the notification at http://rtais.wto.org/UI/PublicAllRTAList.aspx

TC/TD subsequently became the core indicators of FTA social welfare analysis and effect evaluation. Most authors already paid their attention on the agriculture trade of China-ASEAN FTA and some focused on the China-Chile FTA and China-Korea FTA, but without consideration of a whole perspective that with such sufficient analysis of the trade effects and benefits that China gain from the FTAs. This paper will estimate the impact of FTAs on Chinese export flows. Gravity model estimated with various specifications applied to study the TC/TD. For the specifications, time & country specific/pair fixed effects included to capture the multilateral resistance terms (MRTs) argued by Anderson and Van Wincoop (2003). Poisson Pseudo-Maximum Likelihood (PPML) method included here to handle the problem of zero-value trade and heteroscedasticity.

Table 1 FTAs of China in force already

Free Trade Agreement (FTA)	Partner	Date of entry into force
Mainland-Hong Kong Closer Economic and Partnership Arrangement (MHCEPA)	Hong Kong	29/06/2003
Mainland-Macao Closer Economic and Partnership Arrangement (MMCEPA)	Macao	17/10/2003
China-ASEAN FTA (ACFTA)	ASEAN 10	01/01/2005
China-Chile FTA (CCFTA)	Chile	01/10/2006
China-Pakistan FTA (CPFTA)	Pakistan	01/07/2007
China-New Zealand FTA (CNFTA)	New Zealand	01/10/2008
China-Singapore FTA (SCFTA)	Singapore	01/01/2009
China-Peru FTA (PCFTA)	Peru	01/03/2010
China-Costa Rica FTA (CCRFTA)	Costa Rica	01/08/2011
China-Switzerland FTA (CSFTA)	Switzerland	01/07/2014
China-Iceland FTA (CIFTA)	Iceland	01/07/2014
China-Korea FTA (CKFTA)	Korea	20/12/2015
China-Australia FTA (CAFTA)	Australia	20/12/2015
China-Georgia FTA (CGFTA)	Georgia	01/01/2018

Note: Information taken from WTO, the Regional Trade Agreements Database

1.2 Objective

In recent decades, with the continuous development of free trade, many developing and developed countries have benefited from free trade. However, most research study on the aggregated or disaggregated goods trade in ACFTA, few has paid attention to a comprehensive study on whether China gain or lose from the entry of FTAs. Therefore, the main purpose of this study is to assess the impact of effective FTAs that China signed and implemented on exports focusing on the TC/TD effects. Hence, the objectives of this study can be refined as:

[1] Utilizing the gravity model to analyze the export flows of all effective FTAs that China participates in and find out the role of various variables in trade relations. Verify

the TC and TD effects from FTAs.
[2] Following the results of the gravity model estimation, give possible reasons then put forward policy recommendations for promoting the development of FTA trade for China.

1.3 Scope

The scope of this paper will be collected from 1995 to 2019, 25 years annual data at aggregated level. The reason why time-period starts from 1995 is to cover the period before the oldest FTA, Mainland-Macao Closer Economic and Partnership Arrangement, which got in force at 17-10-2003. In addition, this paper will also include Chinese top 15 exporting partners as well. Since some of them already singed FTA with China, the final dataset has 32 economies including China, Hong Kong, Macao, Chile, Pakistan, Thailand, Myanmar, Cambodia, Malaysia, Indonesia, Laos, Vietnam, Philippines, Brunei, Korea, Singapore, Georgia, New Zealand, Australia, Switzerland, Iceland, Costa Rica, Peru, USA, Japan, Germany, India, Taiwan, Netherlands, UK, Russia, Mexico.

1.4 Contribution

This main contribution of this paper as followings. First, based on reviews of previous papers, this paper may the first try to estimate the trade creation and trade diversion effects of all FTAs that China participated until 2019 since the previous papers mostly focused on China-ASEAN mostly. Hence, this paper can tell us the economic impact of the TC and TD effects on both sides of FTA members that how intra-bloc members' trade with each other and trade with extra-bloc were affected by FTAs. This paper covers all effective FTAs that China has by 2019, may provide such references to the policy whether China benefit from FTAs then should or not to participate in more free trade agreements. Second, this paper applied the widely used method-PPML to deal with zero-value trade and heteroscedasticity problem, which can also provide a reference to the study of gravity with PPML.

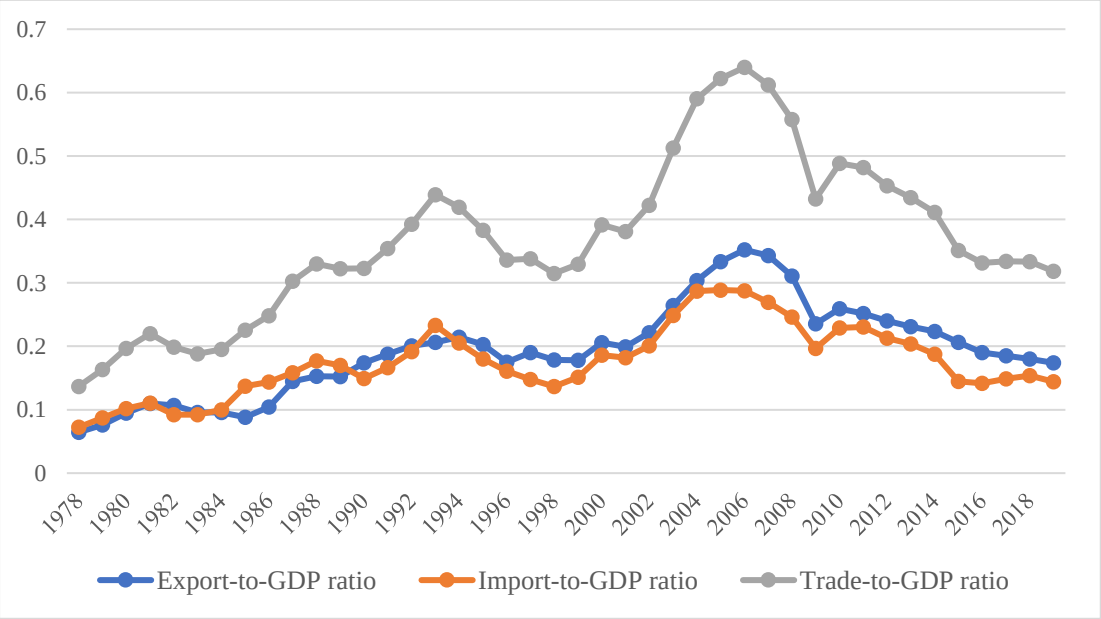
This paper will be organized as following. Section 1 makes a brief introduction of the whole paper. Section 2 describes the background of China's trade and free trade agreements. Section 3 provides the literature reviews. Section 4 shows the gravity model and specifications used in this paper. The estimation results will be discussed in the section 5, then the final section 6 provides the conclusions.

Chapter 2 Background of China's Trade and FTAs

2.1 Background of China's Trade

Since China's reform and opening up in 1978, China has maintained an average annual economic growth of nearly 8% for the past four decades of development. Additionally, China has also become the world's second largest economy. In terms of trade, China's total foreign trade reached 4.11 trillion US dollars, accounting for around 11.6% of the world's total foreign trade in 2017. Total trade volume is also growing at an average annual rate of about 12% higher the GDP growth rate. For the trade openness, China reached the peak near 64% in 2006, and then after the 2008 financial crisis it stabilized and declined with the changes in the domestic economic and trade structure and industrial structure. The export and import share to GDP data starts from 1994 also indicates that China's exports growing higher than the imports. It can be explained as China is a net exporter so the trade surplus over years has also brought China abundant international reserves. Foreign trade is already an important parameter for China's national economy, and the most favorable driver of China's development, ZHANG and Wu (2011).

Figure 2 Trade-to-GDP ratio of China from 1978 to 2019

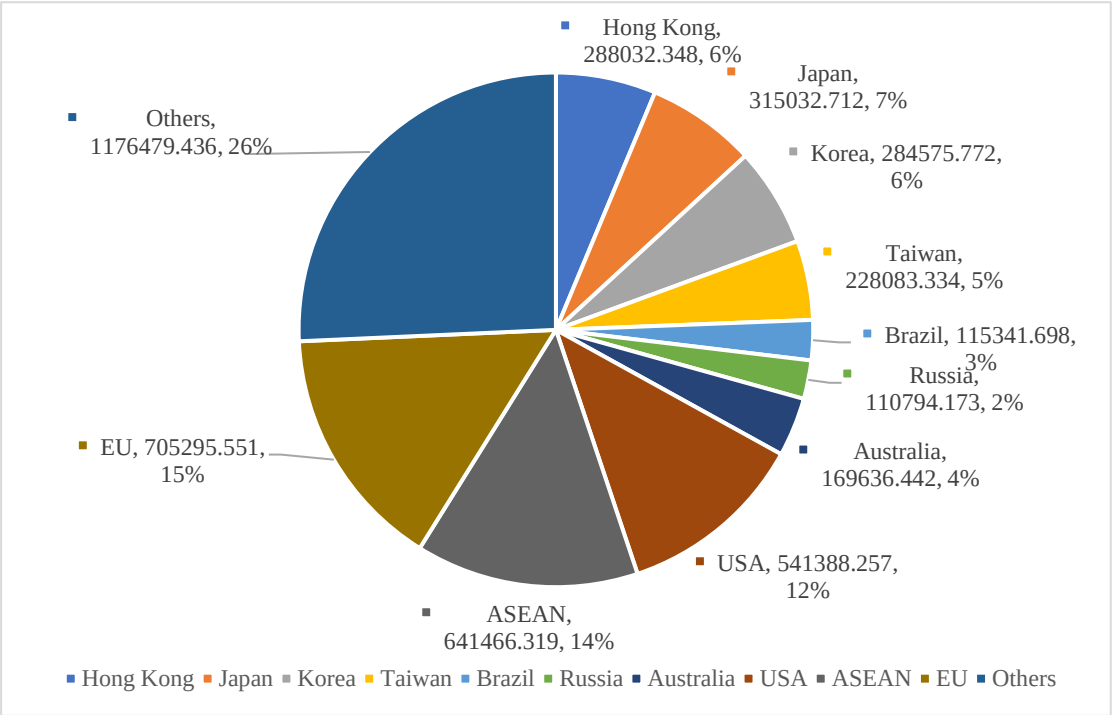


Source: Author's calculation by Export/Import data from the IMF, GDP data from World Bank.

As of 2019, China's total trade including imports and exports with the top three partners-EU, ASEAN and USA already account for 41% of the total volume. The growth rate of China's import and export with ASEAN in 2019 is 9.2%, which is higher

than the growth rate of the EU by 3.4% and higher than the growth rate of total import and export. From 2014 to 2019, China's import and export volume with ASEAN have an average annual growth rate of 4.9%, which is higher than the 1% annual average growth rate of China's total import and export volume.

Figure 3 Main Trading Partner of China in 2019



Source: Data from China Customs, trade volume in USD million.

For Chinese export products, interpreting from the revealed comparative advantage (RCA) perspective. The analysis of RCA based on the measurement of specific product's export performance, basically, assessing the export potential of economies. RCA index equation calculation as $RCA_{ij} = (X_{ij}/X_{jt}) / (X_{iw}/X_{wt})$, where X_{ij} and X_{jt} represent economy j's export value of product i and j's total export value at year t, X_{iw} and X_{wt} indicate the total export value of commodity i in the world and total export value in world at year t. Generally, if the value of RCA less than one indicates that the economy j has a revealed comparative disadvantage in product i, while the index of higher than one implies the economy supposed to has a revealed comparative advantage in export of product i. If index equal or close to one means a neutral advantage, however, there is no advantage or disadvantage. As the table 2 the revealed comparative advantage in machinery and electric products emerged in the past two decades. Although footwear, hides and skins, Textiles and Clothing still maintain an advantage, the advantages of these three products have been declining evidently related to changes in the economic structure. Basically, with the gradual manifestation of economic development results, the increase in GDP and the further increase in wages

will inevitably lead to an increase in labor costs and weaken the competitiveness of low-value-added industries. The index of low-value-added industries may be further stabilized and decreased.

Table 2 Revealed Comparative Advantage of China's Products

	1995	2000	2005	2010	2015	2018
Animal	0.7	0.66	0.4	0.33	0.28	0.27
Chemicals	0.46	0.4	0.36	0.45	0.48	0.54
Food Products	0.63	0.53	0.38	0.31	0.28	0.3
Footwear	8.1	6.96	4.83	4.05	2.97	2.63
Fuels	0.33	0.2	0.12	0.07	0.07	0.08
Hides and Skins	5.09	4.79	3.62	2.95	2.14	2.08
Mach and Elec	0.81	1.08	1.66	1.9	1.9	1.96
Metals	0.77	0.84	0.86	0.86	1.05	0.95
Minerals	0.78	0.6	0.38	0.15	0.14	0.12
Miscellaneous	1.9	1.71	1.48	1.36	1.25	1.4
Plastic or Rubber	0.7	0.81	0.7	0.72	0.79	0.85
Stone and Glass	0.62	0.69	0.78	0.65	0.5	0.51
Textiles and Clothing	3.26	2.96	2.67	2.71	2.22	2.1
Transportation	0.1	0.15	0.17	0.32	0.28	0.32
Vegetable	0.6	0.66	0.36	0.25	0.22	0.23
Wood	0.42	0.53	0.59	0.65	0.66	0.64

Source: WITS, World Integrated Trade Solution

As a supporting evidence for trade competitiveness of China's products in table 3, using the Trade Specialization index (TS) to calculate China's products.[8] TS ranged limited between -1 and 1 since this indicator excluded the impact of fluctuations in macroeconomic factors. By calculating the TS revealed that the value of chemicals, plastic or rubber, stone and glass, and Transportation close to zero represents the products' competitiveness near the world average level. As the same trend in RCA, Mach and Elec which gradually developed from weak competitiveness to strong advantage. However, the competitiveness and comparative advantage of food products and vegetables exports showing a downward trend due to the related quality hindered by technical barriers in foreign markets, which weaken the competitiveness of food products and vegetables.

[8] The Trade Specialization Index (TS) is one of the mostly used that to analyse international competitiveness of an industry. $Z_{ij} = (X_{ij} - M_{ij})/(X_{ij} + M_{ij})$ which range limited between - 1 and 1. Iapadre (2001), highly positive results are usually implied products is very competitive in both foreign and domestic markets.

Table 3 Trade Competitiveness of China's Products

	1995	2000	2005	2010	2015	2018
Animal	0.677	0.313	0.222	0.128	-0.002	-0.246
Chemicals	-0.105	-0.212	-0.227	-0.105	-0.027	-0.061
Food Products	0.412	0.481	0.528	0.336	0.158	0.106
Footwear	0.895	0.933	0.942	0.939	0.913	0.849
Fuels	0.019	-0.449	-0.568	-0.752	-0.753	-0.763
Hides and Skins	0.388	0.404	0.484	0.502	0.518	0.583
Mach and Elec	-0.258	-0.077	0.085	0.178	0.246	0.211
Metals	-0.003	-0.107	0.004	0.036	0.338	0.272
Minerals	-0.203	-0.481	-0.791	-0.937	-0.925	-0.933
Miscellaneous	0.389	0.424	0.153	0.118	0.315	0.235
Plastic or Rubber	-0.355	-0.346	-0.251	-0.236	0.039	0.055
Stone and Glass	0.548	0.402	0.443	0.391	-0.104	-0.008
Textiles and Clothing	0.388	0.497	0.642	0.741	0.788	0.772
Transportation	-0.149	0.184	0.177	0.151	0.045	0.013
Vegetable	-0.189	-0.017	-0.256	-0.447	-0.498	-0.462
Wood	-0.203	-0.405	-0.138	-0.141	-0.0432	-0.167

Source: Author's calculation by using WITS data, calculation keep the first three digits

2.2 Background of China's FTAs

China joined in FTA/RTA very late compared to the others (NAFTA 1994, AFTA 2002 etc.), but with the economic growth of China, its participation in FTA has gradually increased and relatively important. In general, FTA is the free trade agreement signed between specific two or more sovereign countries or customs territories. However, in order to distinguish from FTA related to sovereign countries, the Closer Economic Partnership Arrangement (CEPA) signed by Chinese mainland and Chinese Hong Kong/Macao is a kind of FTA under the "One country, Two systems" that mainland with separate customs territories, so the earliest FTA that China participated in can date back to the 2003. By 2020, China now, the second largest economy in GDP or the largest according to Purchasing Power Parity (PPP) with more than 23 trillion USD, and "the largest trading partner of more than 130 countries and regions in the world and one of the most important markets for major international multinational enterprises".[9] China has signed 18 FTAs with 14 already in force and notified to WTO, and also 8 new, 3 upgrade FTAs under negotiation.

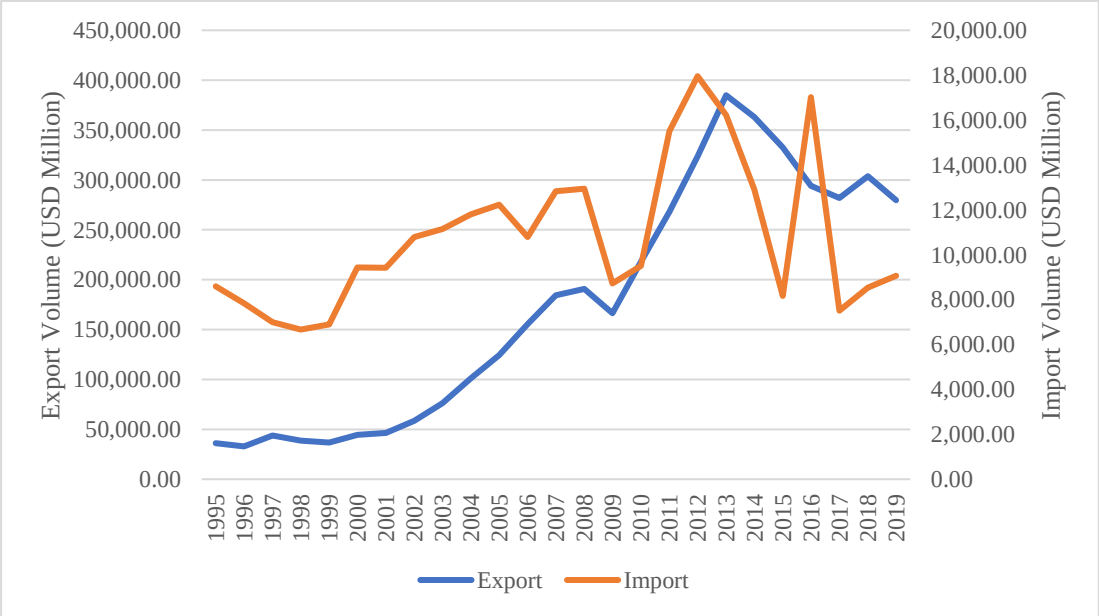
[9] http://www.xinhuanet.com/english/2020-08/31/c_139331358.htm

2.2.1 Mainland and Hong Kong/Macao CEPA

MHCEPA/MMCEPA refers to the Mainland and Hong Kong/Macao Closer Economic and Partnership Arrangement, were the first arrangements of FTA (can be viewed as FTA) China participated. In order to boost the economic development, strengthen the trade and economic link between Chinese Mainland and Chinese Hong Kong/Macao. Mainland signed the CEPA with the Special Administrative Region (SAR) of the Hong Kong and Macao respectively in 2003. These 2 CEPAs are successful applications of the "One Country, Two Systems" principle, which belongs to the Free Trade Agreement and the first FTA to be fully implemented for China. The main contents of CEPA include the gradual realization of the liberalization of trade in goods and services, the facilitation of trade and investment, and strengthening of economic and technological cooperation between the Chinese Mainland, Hong Kong and Macao. The Mainland has implemented zero tariffs on imported goods originating in Hong Kong and Macao in stages starting from 2004 according to CEPAs. Hong Kong and Macao continues to impose zero tariffs on all imported goods originating in the Mainland. According to the CEPA and its supplemental agreement, the Mainland has imposed zero tariffs on all imported products originating in Hong Kong and Macao in terms of trade in goods, starting from 2006.

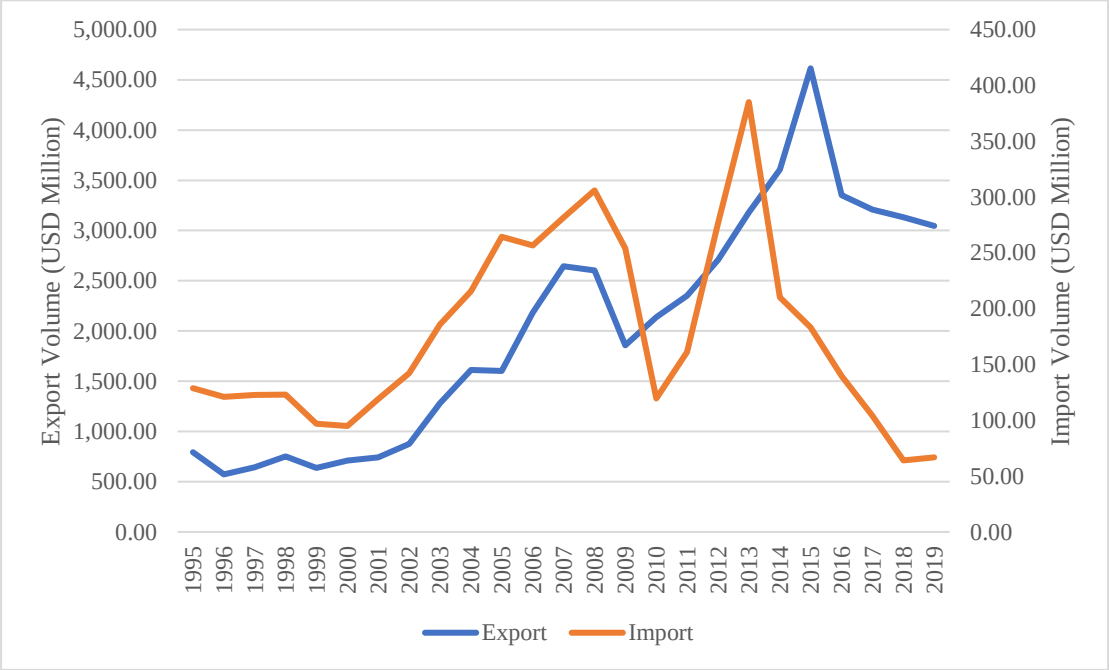
By 2019, Chinese Mainland exports to Hong Kong amounted to 279.616 billion dollars, accounting for 11.19% of the Mainland's total exports. And imports 9.056 billion dollars from Hong Kong. Mainland exports to Macao amounted to 3.047 billion dollars, and imports 66.84 million dollars from Macao. In 2019, Hong Kong is the second largest export market of Chinese Mainland.

Figure 4 Chinese Mainland-Hong Kong Export and Import Trade



Source: IMF data

Figure 5 Chinese Mainland-Macao Export and Import Trade



Source: IMF data

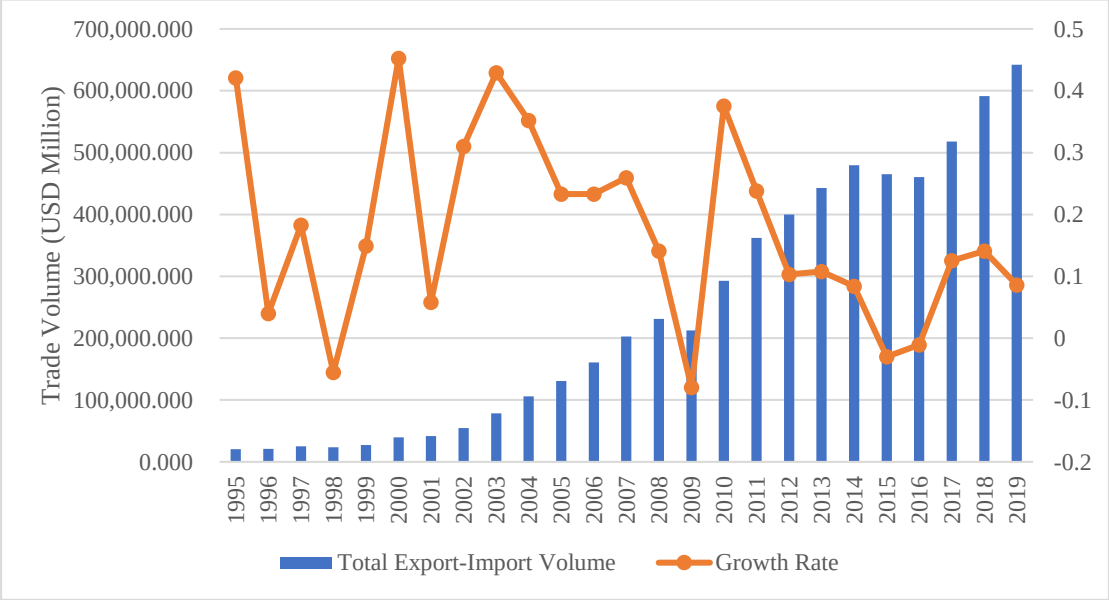
2.2.2 China-ASEAN FTA

China-ASEAN Free Trade Agreement abbreviated as ACFTA, which entered into force in 2005. The establishment of the ACFTA has enhanced the economic and trade relations between the two parties and has also contributed to the economic development of Asia and the world. The free trade area covers 11 countries (China and ASEAN-10), a huge economy with aggregated population of 2.05 billion and GDP of more than 17.5 trillion accounted near 20% of the world GDP by 2019. Since the 2010, more than 90% commodities of China and the 6 ASEAN countries (Brunei, Indonesia, Malaysia, the Philippines, Singapore and Thailand) have implemented zero and other countries will reach it in 2015 according to the agreement. ACFTA was the largest and most populous FTA in that age, and the first FTA China signed with other countries, which is a historic step in the course of cooperation between China and ASEAN, helps two sides trading partners develop comprehensive and their rapid friendly relations. And the main contribution of ACFTA includes the promotion of economic development, investment growth and trade creation.

As a milestone of Chinese economic development and cooperation, the bilateral trade volume between China and ASEAN increased from 20 billion in 1995 to more than 641 billion in 2019 with an average annual growth rate of over 30%. China is the most important trade partner of ASEAN, ranked the first place of exports/imports

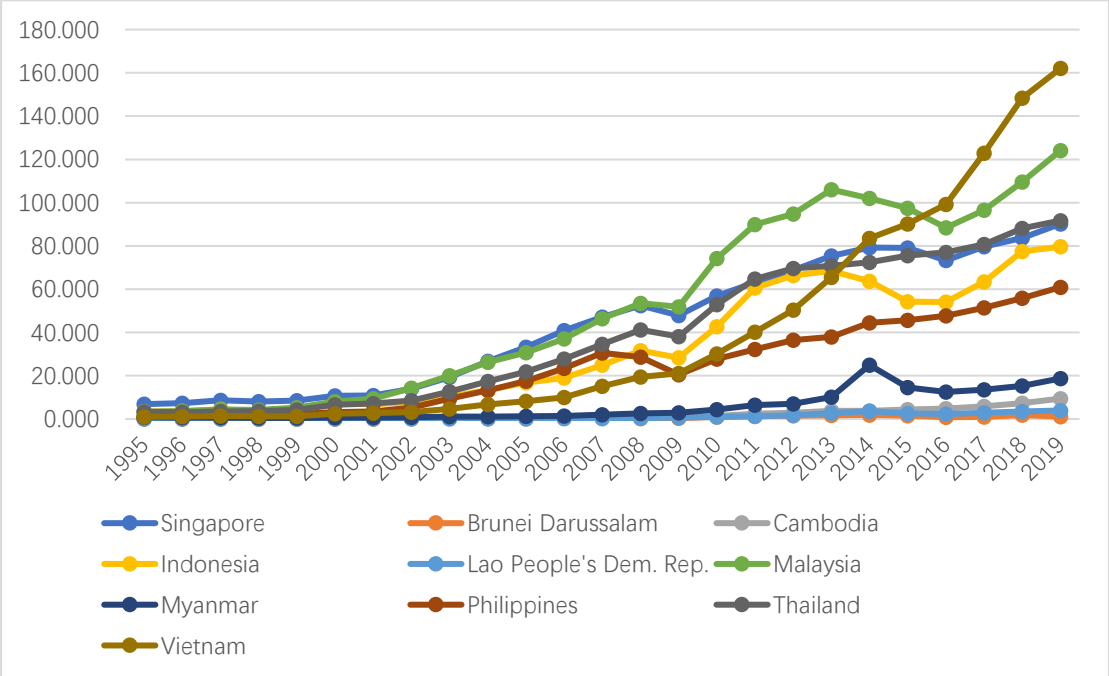
partner of most ASEAN countries in 2019, and ASEAN overtakes the EU to become China's top trading partner in first quarter of 2020.[10]

Figure 6 China-ASEAN Total Export-Import and Growth Rate



Source: IMF data

Figure 7 China Total Export-Import trade with ASEAN-10



Source: IMF data, trade volume in USD million

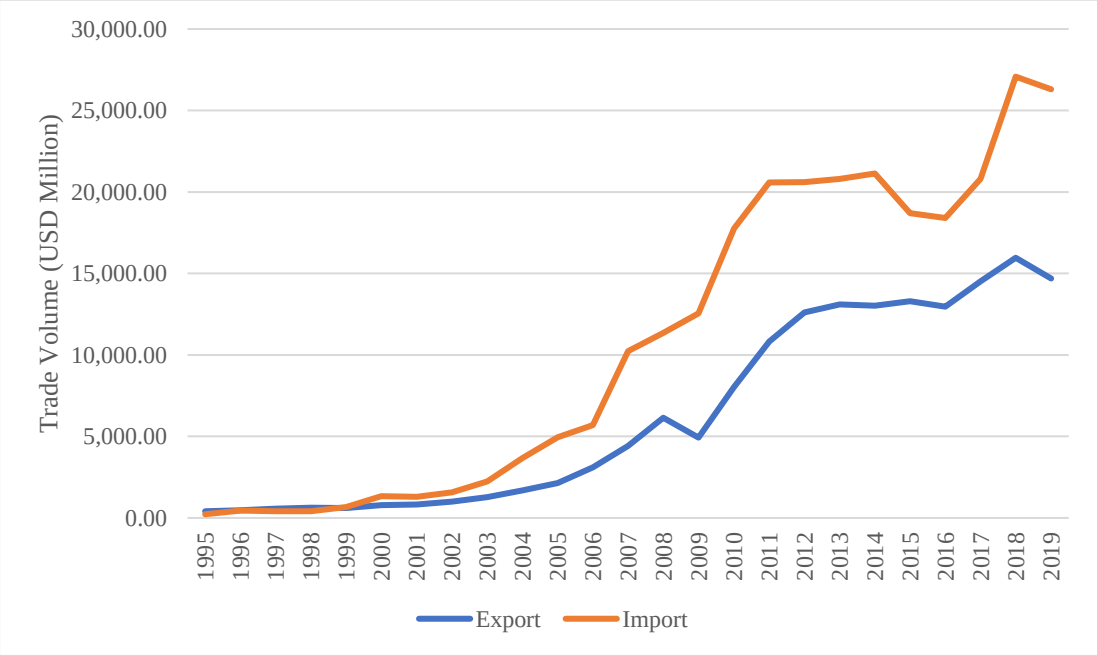
[10] https://www.aseanbriefing.com/news/asean-overtakes-eu-become-chinas-top-trading-partner-q1-2020/

2.2.3 China-Chile FTA

The free trade agreement between China and Chile entered into force in October 2006 and will gradually expend the zero-tariff treatment within 10 years to cover 97% products according to the agreement. In 2008, after three times reduction of tariff, China has already decreased tariffs on 7336 products accounting for 97.2% of China's total tariff lines and 98.1% for Chile's.[11] Since the implementation of the CCFTA in 2006, the trade and investment between the two countries have developed rapidly. Since 2012, China has grown to and has been kept as the Chile's largest trading partner, largest export market, and largest export market, and major source of imports, and Chile has become China's third largest trading partner in Latin America[12]. Chile is also the first Latin American country to sign an FTA with China, making important contributions to China's subsequent opening up of the South American market.

According to the IMF data, the total trade volume of China and Chile in 2006 was 8.798 billion USD, and 43.04 billion USD in 2018 with an average annual growth rate of over 14%. In 2019, China exports to Chile in the amount of 14.687 billion USD while Chile exports to China amounted 22.692 billion USD accounting for near 32.5% of Chile's total exports.

Figure 8 China-Chile Export and Import Trade



Source: IMF data

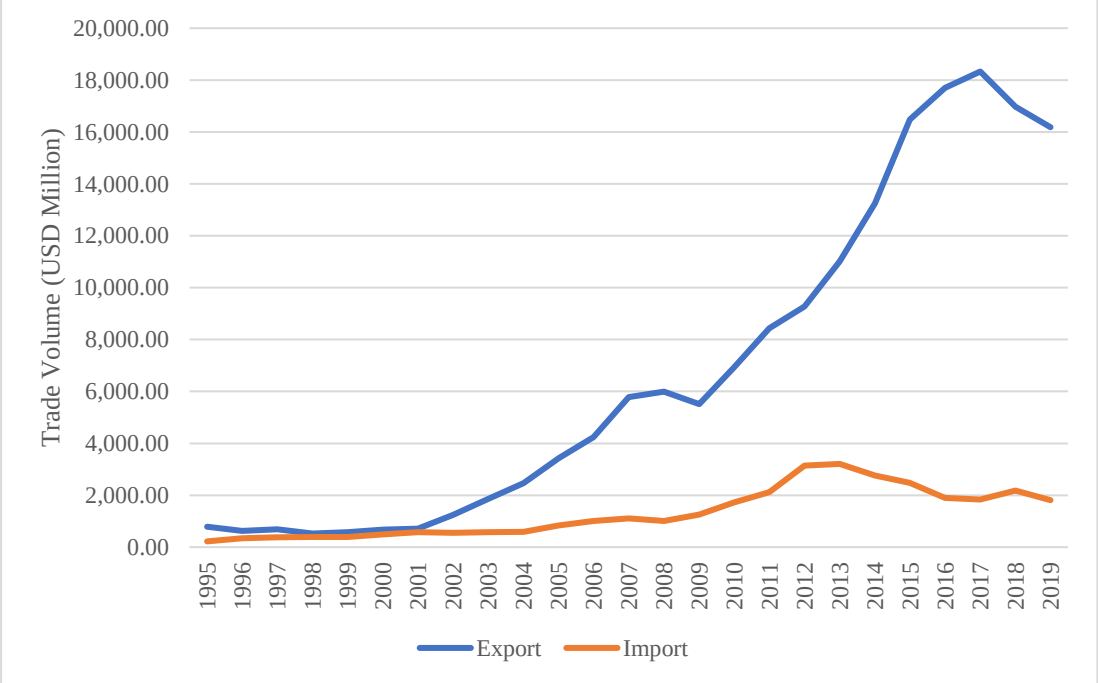
[11] 'Remarkable results achieved after two years implementation of China-Chile FTA' http://fta.mofcom.gov.cn/article/chinachile/chilenews/201609/33336_1.html

[12] http://www.gov.cn/zhengce/2017-11/12/content_5239022.htm

2.2.4 China-Pakistan FTA

China-Pakistan FTA (CPFTA), two countries reached the agreement in November 2006, and took effect in July 2007. The agreement on Trade in Service of the China-Pakistan FTA which entered into force since October 2009. The implementation of the CPFTA allows the two countries to share the benefits of economic development to a large extent, especially in the field of bilateral trade which is the fastest. With the deepening of bilateral cooperation between China and Pakistan, bilateral trade between China and Pakistan has developed rapidly. By 2018, according to the statistics of Pakistan, "China has become Pakistan's largest trading partner for four consecutive years, the largest source of import and the third largest export destination".[13] According to the IMF data, in 2007, Pakistan exports to China 0.6 billion USD accounting 3.45% of total exports and 4 billion USD imports accounting 12% of total imports, whereas 2 billion USD accounting 8.6% in exports and 12 billion USD accounting 24% of total imports. China-Pakistan trade is developing rapidly but still more room for potential economic cooperation. Now, China is the largest trading partner of Pakistan and became Pakistan's largest source of imports for the first time in 2014 and remains until 2019.

Figure 9 China-Pakistan Export and Import Trade



Source: IMF data

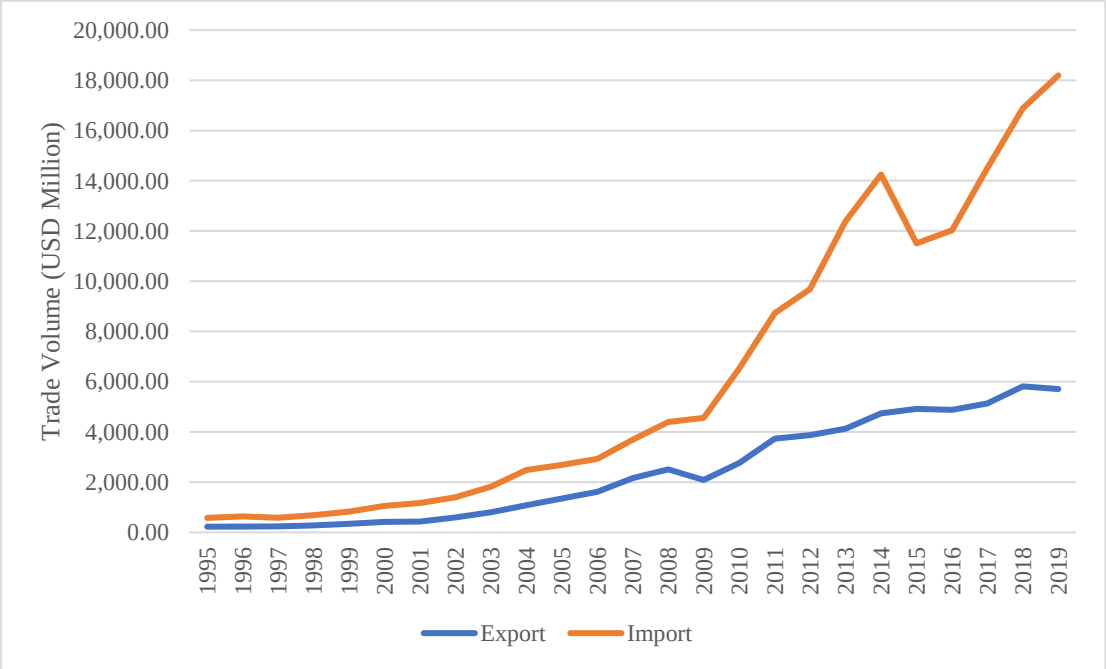
[13] http://english.mofcom.gov.cn/article/statistic/lanmubb/ASEAN/201810/20181002795331.shtml

2.2.5 China-New Zealand FTA

China-New Zealand FTA (CNFTA), signed in April 2008 and entered into force on October 1, 2008. The agreement covers the fields of goods trade, service trade, investment, and issues such as multilateral trade, and regional security. It is the first comprehensive free trade agreement signed between China and other countries as well as the first FTA that China signs with a developed country. Since the CNFTA came into effect in October 2008, bilateral trade between China and New Zealand has grown rapidly. According to the agreement, New Zealand will reduce all tariffs on products that imported from China to zero before 2016, and 63.6% products have achieved zero tariff since the FTA become effective. And China reduced most tariffs on imports from New Zealand includes 24.3% achieve zero tariff since FTA came into force.[14] New Zealand and China have a strong economic complementarity that the trade between China and New Zealand in the field of agriculture and animal whereas imports mechanical and electrical products from China with respect to the RCA index.

After the implementation of the CNFTA, China-New Zealand bilateral trade share increased from 0.2% to 0.4% of China's total trade with New Zealand. China took over the Australia became the biggest imports partner of New Zealand since 2011 and the 8.5 billion USD imports from China accounting 20% near twice of the Australia in 2019 with exports to China accounted for 27% of its total exports.

Figure 10 China-New Zealand Export and Import Trade



Source: IMF data

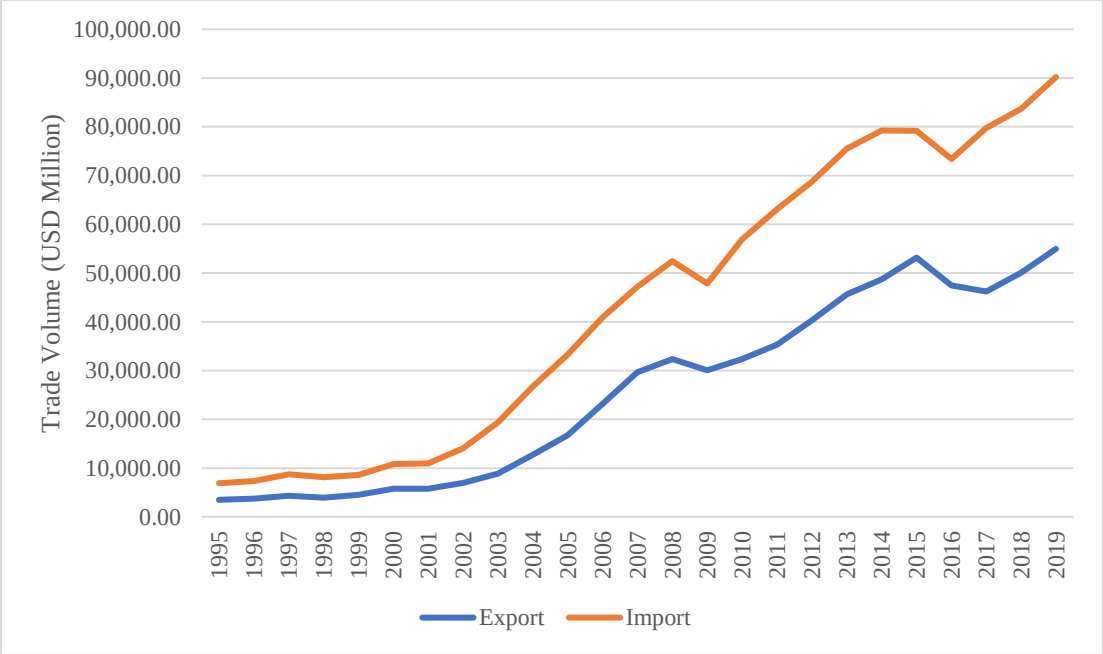
[14] http://www.gov.cn/gzdt/2008-04/07/content_938238.htm

2.2.6 China-Singapore FTA

The China-Singapore FTA (CSFTA) negotiations started in August 2006 and signed successfully on October 23, 2008. It is a very comprehensive FTA that includes goods and service trade. Under the FTA, China and Singapore will take a further accelerated process of bilateral trade liberalization and economic cooperation. China and Singapore will further strengthen cooperation in goods and service trade, investment, customs procedures, technical barriers to trade, personnel exchanges, sanitation and phytosanitary. Singapore promised to reduce all tariffs on imported products from China since January 2009 the FTA into force, and China promised to achieve zero tariffs on 97.1% of imported products from Singapore before January 2012 according to the agreement and 87.5% of them have achieved zero tariffs since the CSFTA came into force.[15]

Singapore's top trading partners in goods are mainly concentrated in the southeast Asia, and China is Singapore's largest trading partner in goods, the largest export market and the largest source of imports by 2020. The total trade volume of China and Singapore in 2009 was 47.8 billion USD, and 90 billion USD in 2019 with an average annual growth rate over 6% according to data from IMF. In 2019, China exports to Singapore in the amount of 55 billion USD while Singapore exports to China amounted 51.6 billion USD accounting for 13.2% of Singapore's total exports.

Figure 11 China-Singapore Export and Import Trade



Source: IMF data

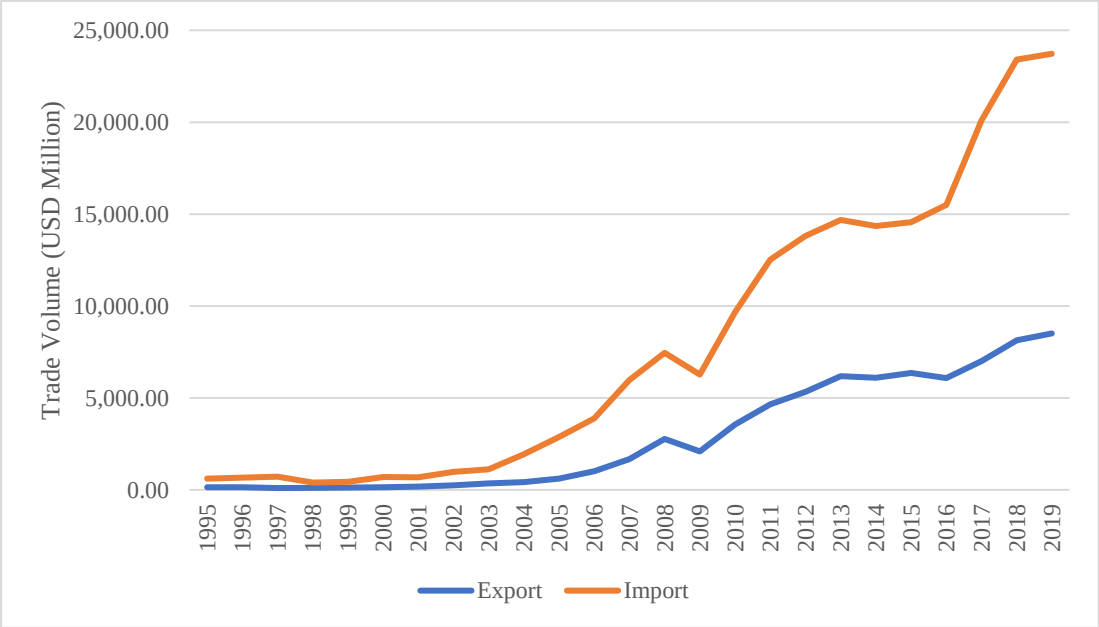
[15] http://fta.mofcom.gov.cn/article/zhengwugk/200810/26721_1.html

2.2.7 China-Peru FTA

The China-Peru FTA (PCFTA) is the first comprehensive FTA that China has signed with Latin American countries in April 2009 and came into force in March 2010. The PCFTA will further strengthen the traditional friendship and enhance the economic cooperation between two countries, which covers goods and service trade, investment, technical barriers to trade, customs procedure, intellectual property rights and trade cooperation, etc. According to the PCFTA, China and Peru will implement zero tariffs on more than 90% of their products in stages. The first category of products implemented zero tariffs in the year after the implementation of the PCFTA accounting for 61.19% and 62.71% of the total tariff items in China and Peru respectively, and the second category of products has gradually dropped to zero within 5 years of the entry and the tariffs of the third category of products were gradually reduced to zero within 10 years after implementation of the PCFTA.[16]

After the establishment of the PCFTA, bilateral trade relations have shown an obviously rapid development between China and Peru. China surpassed the USA to become the largest trading partner and the largest export partner of Peru in 2011, then China surpassed the USA to become Peru's largest import partner in 2014. Peru's exports share to China increased from 15.5% in 2010 to 29% in 2020, and imports increased from 17% to 25%. Peru's total trade to China in the amount of 24 billion USD accounting 27% of Peru's total trade.

Figure 12 China-Peru Export and Import Trade



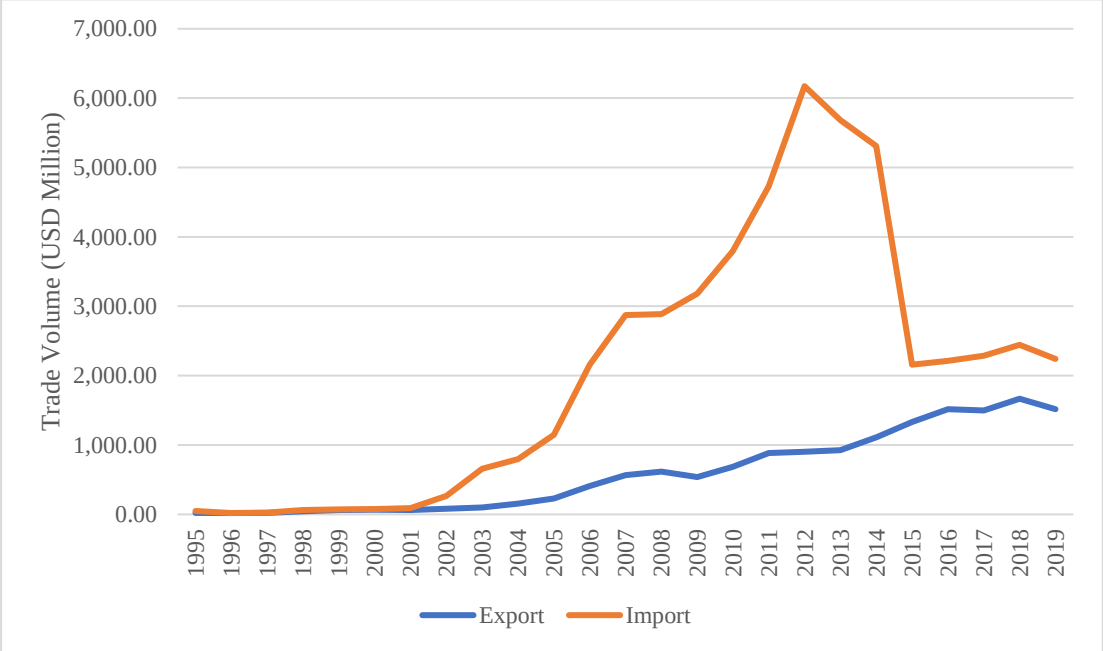
Source: IMF data

[16] http://fta.mofcom.gov.cn/article/chinabilu/bilunews/200904/692_1.html

2.2.8 China-Costa Rica FTA

The China-Costa Rica FTA (CCRFTA) is a comprehensive FTA and covers a relatively high level of trade openness. CCRFTA came into effective in Aug 2011. In terms of goods trade, China and Costa Rica will implement zero tariffs on more than 90% of their products in stage respectively according to the agreement. For Costa Rica, the main export destinations are the USA, Netherlands, Belgium, Guatemala, Panama while the largest imports source countries are the USA, China and Mexico. Costa Rica is China 's second largest trading partner in the Central America while China is the second largest trading partner of Costa Rica. According to the IMF data, in 2010, the bilateral trade volume between China and Costa Rica reached 38 billion USD, of which exports were 687 million USD and imports were 3.11 billion USD. After the implementation of CCRFTA since 2011, the exports have been grown rapidly but the imports shown a short increase then drop to the 0.8 billion USD in 2015. However, Costa Rica has gradually become one of China's main investment and trading partner in the Central America recent years is unquestionable. The import from China accounted for 7% of total imports but 13.6% in 2018.

Figure 13 China-Costa Rica Export and Import Trade



Source: IMF data

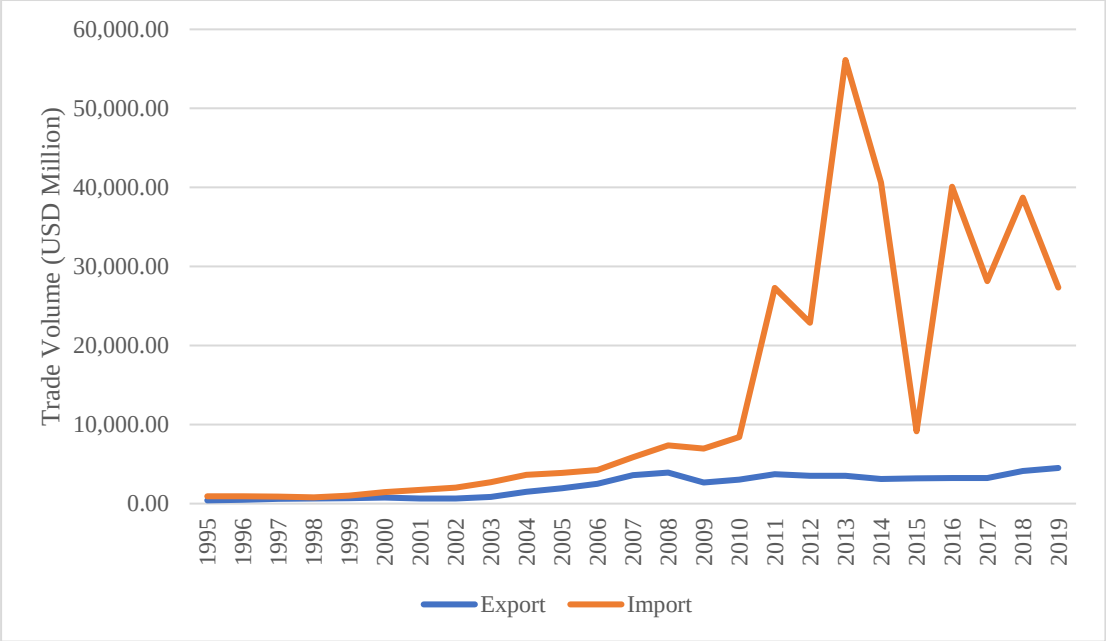
2.2.9 China-Switzerland FTA

The China-Switzerland FTA (CSFTA) is the first FTA that signed between China and European developed economies, and CSFTA is also one of the most comprehensive

FTA that China has reached in recent years. The main products that China exports to Switzerland are mechanical and electrical products, high-tech products, clothing and cultural commodities, and Switzerland has decreased tariffs on textiles, clothing, mechanical and metal products etc., due to the agreement. After the CSFTA came into effect in 2014, Switzerland immediately implements zero tariffs on 99.7% of Chinese exports, and China will eventually implement zero tariffs on 84.2% of Switzerland's exports according to the agreement.[17] Switzerland's main trading partner is the European Union, which accounted for more than half of its total foreign trade in 2018. However, as the single economy, Switzerland's top 5 trading partners in 2018 are Germany, USA, Italy, France, China, UK. In 2019, China is the fourth largest export partner and the sixth import partner of Switzerland.

According to the IMF data, Switzerland total trade with China was 31 billion USD in 2014 accounting for 5% of total and 45 billion USD 7.7% of total. The exports from China to Switzerland shown a slowly and slightly upward trend but the imports decreased in the year of 2014, the year CSFTA in force, then up and down in the recent years from 2016 to 2019.

Figure 14 China-Switzerland Export and Import Trade



Source: IMF data

2.2.10 China-Iceland FTA

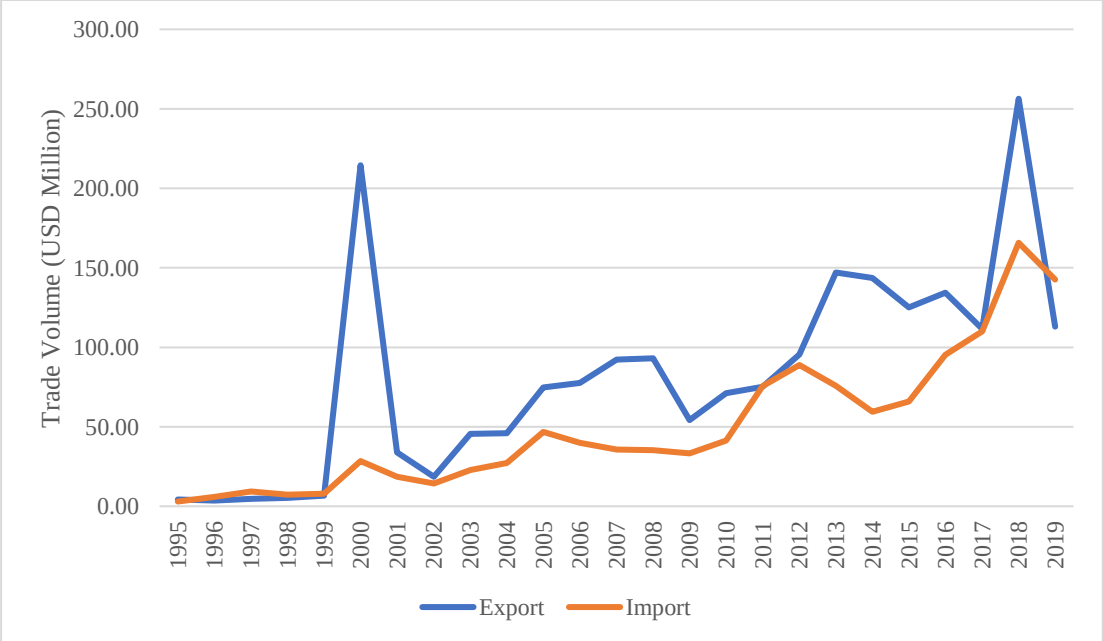
China-Iceland FTA (CIFTA) signed in April 2013 and got into force in July 2014,

[17] Information from China FTA Network
http://fta.mofcom.gov.cn/article/chinaswitz/chinaswitznews/201308/13095_1.html

which is the first FTA China negotiated with developed European countries and Iceland also the first to recognize China as a full market economy. For the past decades, China-Iceland economic and trade cooperation has developed rapidly, and China has been Iceland's largest trading partner in Asia for many consecutive years since 2006. For Iceland, Iceland is heavily dependent on imports somehow and Iceland has been running a trade deficit in recent years. Iceland's trade deficit in 2014 was about 322 million USD, but by the end of 2018 had reached 1408 million USD according to IMF data. Iceland's economy is highly dependent on foreign trade, it has a total foreign trade that accounts for near 50% of GDP in 2018. In 2018, Iceland's top 3 export partners were Netherlands, UK, Spain and import partners were Norway, Germany, China.

According to the IMF data, the Iceland-China total trade volume was only 26 million USD accounting for 0.07% of Iceland's total foreign trade in 1995, and 822 million USD for 6% in 2018 near 30-times growth level. China has been Iceland's largest trading partner in Asia for 13 consecutive years since 2006 and the seventh largest trading partner of Iceland in the world. Bilateral trade between China and Iceland still has a great room for potential development.

Figure 15 China-Iceland Export and Import Trade



Source: IMF data

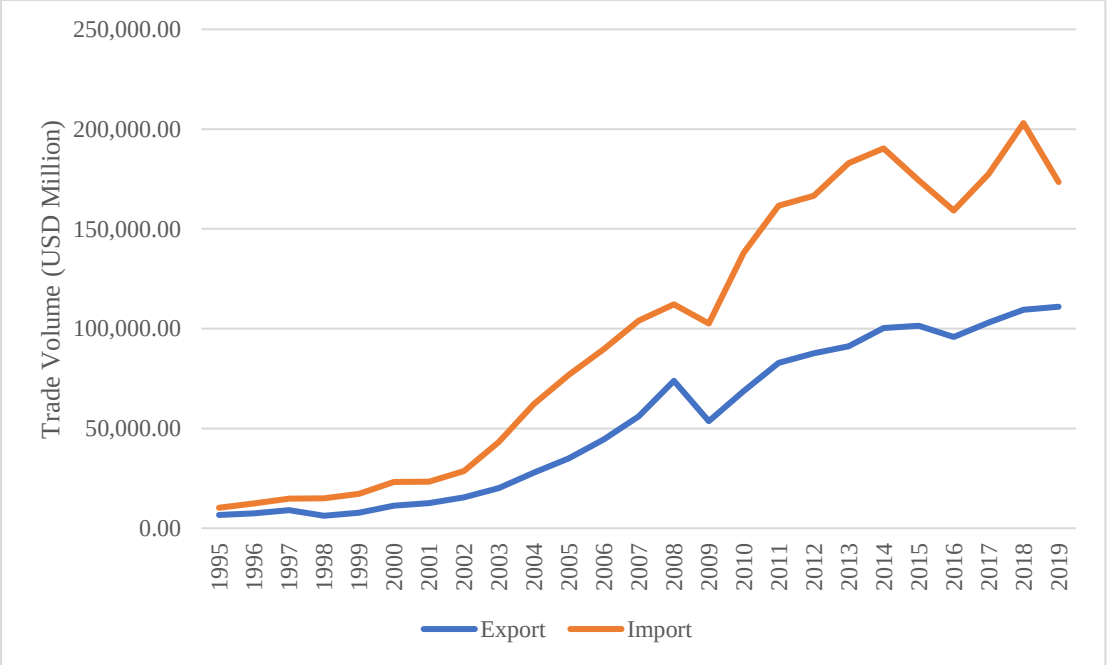
2.2.11 China-Korea FTA

China-Korea FTA (CKFTA) negotiations were started in May 2012, signed in June 2015 after 14 rounds negotiations and entered into force in December 2015. The CKFTA is a comprehensive and high-level FTA with the largest volume of country-to-

country bilateral trade and the most comprehensive scope signed by China as of 2015 that the scope covers many areas including goods and service trade, financial services, e-commerce, investments, technical barriers to trade, customs procedure, intellectual property, environmental and economic cooperation etc. It is also the FTA of China signed with single economy in Northeast Asia. And according to the CKFTA, the bilateral trade liberalization in goods exceeds 90% of the tariff items and 85% of the trade volume. Seven times tariff reductions have been implemented since the CKFTA came into force and the coverage rate of zero-tariff trade volume has reached over 55% according to the official data.[18]

According to the IMF data, China is the largest trade partner of South Korea ranked both top first partner in terms of exports and imports. And Korea's total trade with China reached 268 billion USD in 2018 accounting for Korea's 23% of total foreign trade and the same proportion in 2019.

Figure 16 China-Korea Export and Import Trade



Source: IMF data

2.2.12 China-Australia FTA

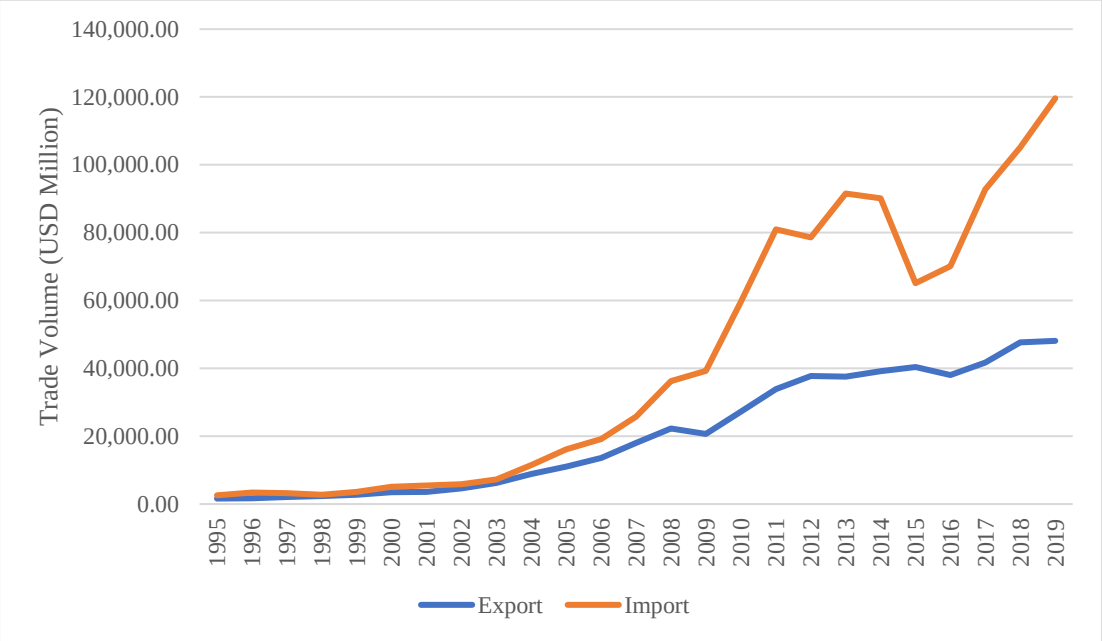
In 2005, China and Australia lunched the negotiation of China-Australia FTA (CAFTA). In June 2015, China and Australia signed the free trade agreement and the CAFTA came into effect in December 2015. CAFTA, one of the highest standard FTA

[18] CKFTA taken effect more than 5 years and coverage of zero-tariff reached over 55%. http://fta.mofcom.gov.cn/article/fzdongtai/202101/44399_1.html

of trade and investment liberalization, covers goods & services trade and investment, and other fields like e-commerce, government procurement, intellectual property etc. In terms of goods, 85.4% of the export trade volume in products for both sides realized zero-tariff since the day CAFTA came into force. After the tariff-reduction transitional period, Australia will eventually achieve the 100% zero-tariff coverage of trade volume and tariff items. And China will reach zero-tariff tariff items and trade volume accounting for 96.8% and 97%, respectively.[19]

China-Australia economic and trade relations have been maintaining developed under a very strong momentum. As of 2019, China has become Australia's largest trading partner, largest export market, and largest source of imports for 10 consecutive years. According to the data of IMF, China's trade with Australia reached more than 3.6% of China's total foreign trade in 2019 while the Australia-China total trade was 109 billion USD accounted for higher than 27% of its total foreign trade in 2015, and the proportion of trade with China already over 32% in 2019.

Figure 17 China-Australia Export and Import Trade



Source: IMF data

2.2.13 China-Georgia FTA

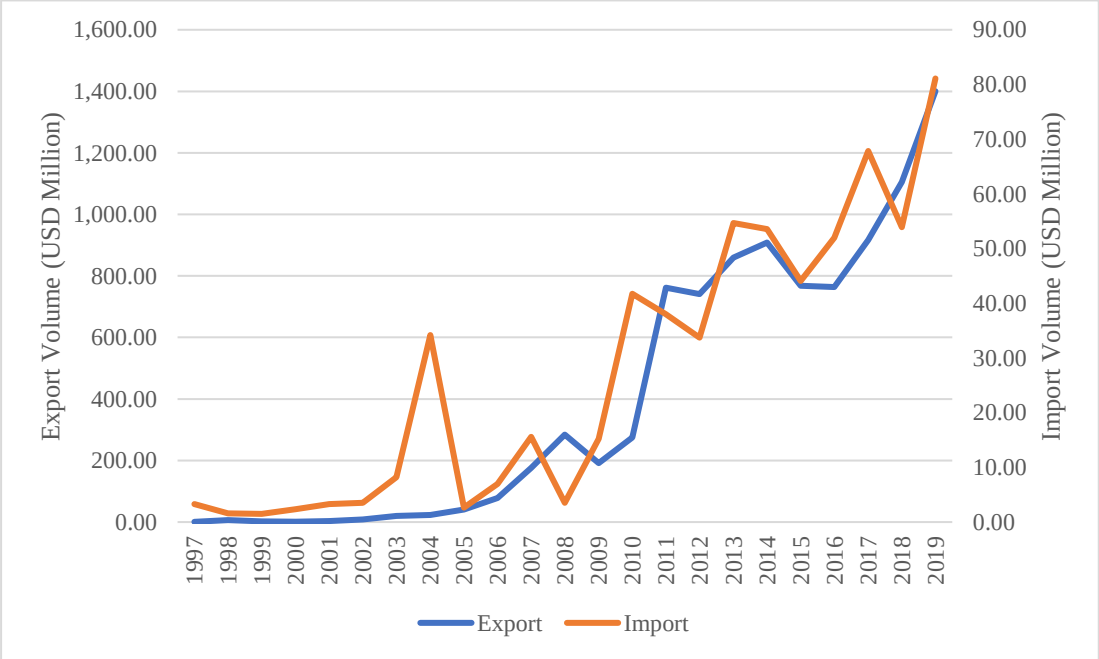
The China-Georgia FTA (CGFTA), which started negotiations in December 2015 and completed in October 2016. And on January 1, 2018, the CGFTA formally took effect. The CGFTA became the first FTA negotiation that China has completed in

[19] Information from Ministry of Commerce, China
http://www.mofcom.gov.cn/article/ae/ai/201506/20150601015183.shtml

Eurasia region. The signing of FTA with Georgia is a great significance to advance the strategy of the free trade zone and implement the "One Belt, One Road" initiative. Recent years, the trade between China and Georgia has developed rapidly, and the scale of trade and investment cooperation has continued to expand. In 2016, China was Georgia's fifth largest trading partner and affected by the negotiation of CGFTA, China became the third largest partner of Georgia in 2017. According to the CGFTA, in terms of trade in goods, Georgia will immediately implement zero tariffs on 96.5% of China's products, covering 99.6% of Georgia's total imports volume from China. China implemented zero tariffs on 93.9% of Georgia's products, covering 93.8% of total imports volume from Georgia, of which 90.9% products immediately implement zero tariffs. The remaining 3% products' tariff will be gradually reduced to zero in 5 years.[20]

According to the IMF data, China's trade with Georgia has been increasing yearly. Although the import data fluctuates greatly in some years, the overall trend is still growing. The foundation of China's trade with the Georgia is obvious.

Figure 18 China-Georgia Export and Import Trade



Source: IMF data

[20] Information gets from: http://fta.mofcom.gov.cn/inforimages/201801/20180102090633444.pdf

Chapter 3 literature Reviews

3.1 Development of Gravity Model

Tinbergen (1962), who the first to analyze the international trade flows utilizing the gravity equation. Pöyhönen (1963) employed gravity equation in the research of international trade based on Tinbergen's study using international trade among 10 European countries in 1958, stated that national economy and trade policy both have impacts on trade and as the paper revealed determination of the boundaries of economic area and price information such structural characteristics will definitely affect our notion of the geographical distribution of export trade. Although the researchers introduced the gravity equation into the field of trade flows and the equation has gradually expanded even to include the study on immigration or foreign direct investment flows etc., the theoretical foundation research of the gravity model and the improvement for specifications are more prominent.

Theoretical support of gravity model arises from 1970s. As the research of Armington (1969) assumed that the products are differentiated by its' origin from the buyer's perspective. Following this point, Anderson (1979) developed the formal theoretical foundation by introducing the Constant Elasticity of Substitution (CES) preferences and he suggested that the gravity model can be derived from the expenditure systems but limited within economies where the structure of trade goods and trade taxations are quite similar due to the perfect product specialization. However, Bergstrand (1985) applied CES and Armington assumption also the GDP deflator to approximate the price index, then he found that the goods were not that perfect substitution. Then Bergstrand (1989) developed his previous study to the monopolistic competition, and goods differentiation extended to firms rather than countries. Since the results gain from the Armington assumption that the goods differentiated by places of origin, which implies countries only produce one kind of good then the trade happens only because the diversity of prices. Contrary, Helpman and Krugman (1985) controlled the changes in price which implies the export happens because the varieties rather than the prices. Deardorff (1998) found the gravity can be derived from the traditional trade theory by view of factors. Ricardian structure with intermediate goods by Eaton and Kortum (2002). Evenett and Keller (2002) stated that the gravity can be derived from H-O model and IRS model. Helpman, Melitz, and Rubinstein (2008) proved the gravity theoretical foundation with heterogeneous firm. In summary, gravity model has a solid enough explanatory capability on the parameters affecting the international trade flows and based on its abundant theoretical foundations, gravity model has been widely used to evaluate the implications of factors affecting the bilateral trade flows due to the varying objectives of interest.

With the continuous improvement of the theoretical foundation, the accuracy of

the research is needed refers to regression unbiased or not. Mátyás (1997) introduced three fixed effects, which are country-fixed (exporter/ importer) and time effects and suggested that the traditional cross section estimates without these country-specific effects may provide biased results. And Matyas (1998) suggested that long-term data can allow the estimation unbiased and solve the endogeneity problem. In the research of Rose and Van Wincoop (2001), they applied the country fixed effects to assess the effects of monetary unions on bilateral trade, revealed that currency union can reduces bilateral trade barriers. Glick and Rose (2002) applied panel analysis to assess the time-series effects of a currency union (CU) by introducing the random effects and fixed effects. Egger and Pfaffermayr (2003) argued that time, exporter and importer effects also the time invariant effect should be included in the panel study. Based on CES expenditure system, Anderson and Van Wincoop (2003) introduced country-specific dummies into the gravity model to solve the border puzzle, and they firstly argued that the multilateral resistance factors need to be considered in analysis to obtain unbiased and consistent estimations. As the biased estimates may get without controlling for the multilateral resistance terms (MRTs). In order to achieve unbiased estimates, Baldwin and Taglioni (2006) generalized the MRTs to allow for the panel study and introduced country-specific dummies into model as proxies for the MRTs, as shown by their study, the issue of MRTs can be tackled by introducing time-varying dummies. Compared with the former research which lacks the time dimension, time-varying exporter/importer fixed effects can be introduced into equation to solve this problem. Baier and Bergstrand (2007) applied time effects, country effects and country-pair fixed effects in their study. Their findings show that to assess the trade effect by using panel data with fixed effects can obtain stable estimates of FTAs instead of standard cross-section methods with ‘instrumental variables and control functions’. Magee (2008) estimated the effects of RTAs on trade flows by introducing a new measure that country pair, exporter/importer-year fixed effects all included in equation. He claimed that regional agreements, RTAs have significant anticipatory effects on trade flows before the set-up of RTA, but a significant drawback of equation to apply exporter/importer-year fixed effects in this paper is the TD cannot be included and even the specific interest of some factors. Kepaptsoglou, Karlaftis, and Tsamboulas (2010) reviewed the related empirical literatures on gravity model in the period of 1999-2009. They found that the fixed effects (FE) model usually gave a better result than the random effects (RE) model for the gravity.

3.2 Trade Creation and Diversion in FTAs

With reference to the impact of trade creation and diversion on trade flows. Viner (1950), however, the first to argue that the customs union (CU) not only promotes the free trade between the partners in one agreement but also hinders the free trade between CU members and non-CU economies. The coexistence of the trade creation (TC) and

trade diversion (TD) leads an ambiguous social welfare. Therefore, the relative results between the TC effect and TD effect determines to what extent a country and trading partners will gain from the agreements. Nevertheless, Balassa (1967) analyzed through the elasticity of demand imports and gave a definition differ from the former by introducing the "gross trade creation" and "gross trade diversion". Export trade diversion notion firstly appeared in Endoh (1999). Magee (2004) integrates the notions of TC/TD and trade expansion (TE) into the analysis of trade flows.

3.2.1 Trade Creation and Diversion Theoretical Analysis

The generic term 'trade creation' and 'trade diversion' were first introduced by Viner (1950). It is still an effective tool for analyzing the gains and losses of free trade areas and customs unions. Basic notion of TC and TD based on the tariff theory and the description of trade effects derived from Viner and scholars subsequently built the conceptual framework of relative empirical studies, as following figures from 19 to 21.

Trade creation occurs when one economy gains more trade with other member economies and increase in economic welfare from entering FTAs due to the reduction of the international trade tariff. The diagram of trade creation as listed below, Figure 19 Trade Creation.[21]

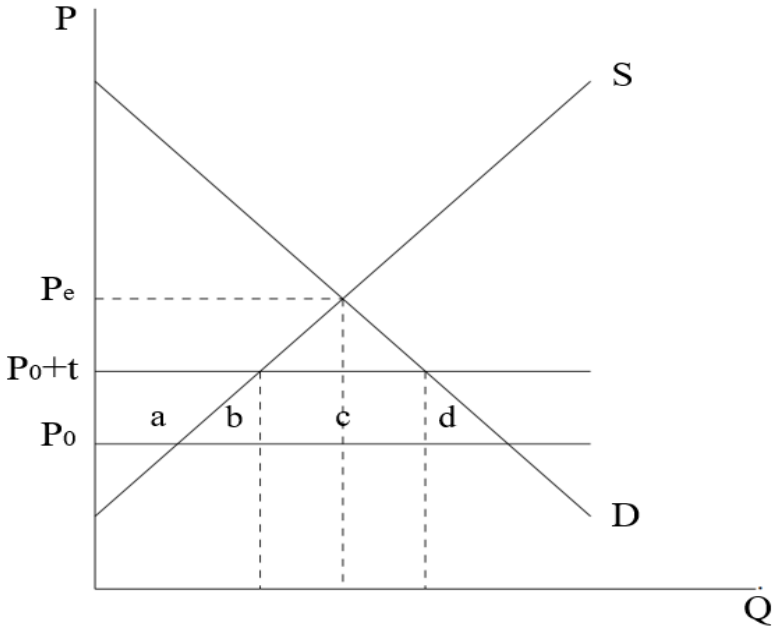


Figure 19 Trade Creation

Assume there are 2 economies, A and B. Economy A import goods from Economy B at P0 +t before the trade agreement, then after A and B formed FTA, price down to the P0.

[21] The following Figures 19 to 21 are drawn by author via software WinEdt 10 and PPT.

Therefore, the consumer surplus for economy A increased the area a+b+c+d, producer surplus decreased area a, then the government lose the tariff revenue c. As a result, the net welfare gains area b+d. Trade diversion occurs when one economy imports from a less effective economy rather than the other much more effective ones due to the formation of FTA. Sometimes, that more effective one always be the non-FTA member, so the trade with less effective one could cause the loss of welfare. Listed below illustrated the diagram of trade diversion, Figure 20.

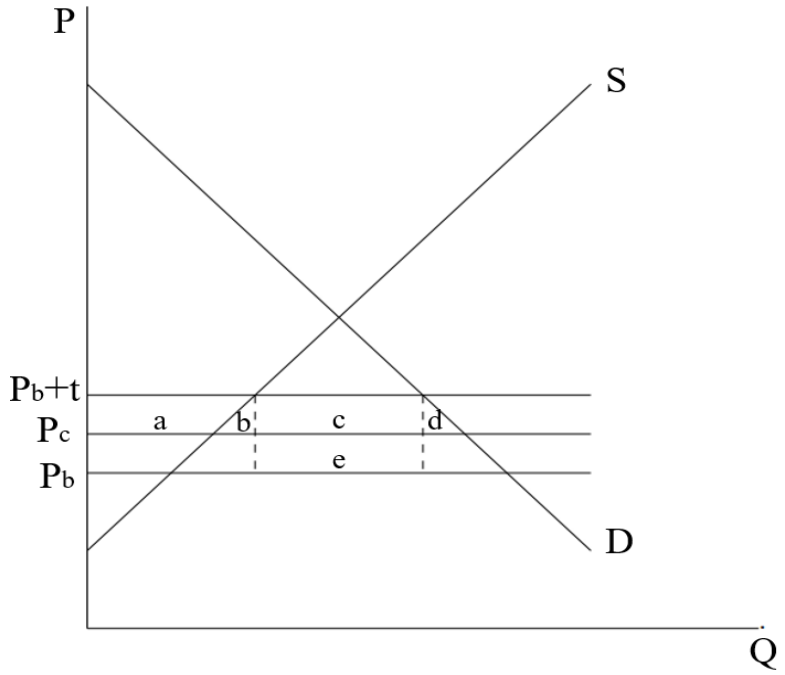


Figure 20 Trade Diversion

Assume there are 3 economies A and B and C. A trade with B and C, which B is that more effective non-FTA member and C is less effective member in FTA. Then, A make FTA with C, the price of imports decreased from Pb+t to Pc, Pc greater than Pb also means the cost of importing from C is higher than from B. Hence, after the FTA between A and C, the consumer surplus of A will increase a+b+c+d, the producer surplus loses the area a, but the government tariff revenue will lose the area c+e, so the net welfare of A is b+d-e. Once the b+d less than e, the net effect of trade diversion will be negative.

3.2.2 Trade Creation and Diversion Trade Flows Analysis

Since the gravity have been applied to study the determination of trade flows. Due to the trade creation occurs along with lower cost in export/import with intra-bloc partner instead of high tariff non-FTA members, it turns to the FTA helps to boost the

bilateral trade but also improve the economic resources allocation. Hence, the analysis of TC and TD effects on trade flows captured through the gravity became an indicator to see the changes in social welfare. Therefore, Magee (2004) illustrated that the trade flows' basic frame of the trade creation and diversion as Figure 21 illustrated below.

Assume here are three economies X, Y and Z. X make FTA with Y at time T1. The line AB shows the trade flow (TF) from X to Y before the implementation of FTA and BD is the actual trade flow after FTA established, the dashed line BC refers to the predict trade level in the absence of FTA. Hence, the difference between point C and point D illustrated the trade expansion effect (TE) between two FTA members X and Y. The same idea, when trading with Z the non-FTA member, line EFH is the real trade flows from X to Z, while the dashed line FG means the trade level in the absence of FTA. Hence, the difference between G and H refers to the trade diversion (TD) caused by FTA. The trade effect TE and TD are same as the concepts from 4.1, so the net trade creation effect of an FTA could be TC=TE-TD.

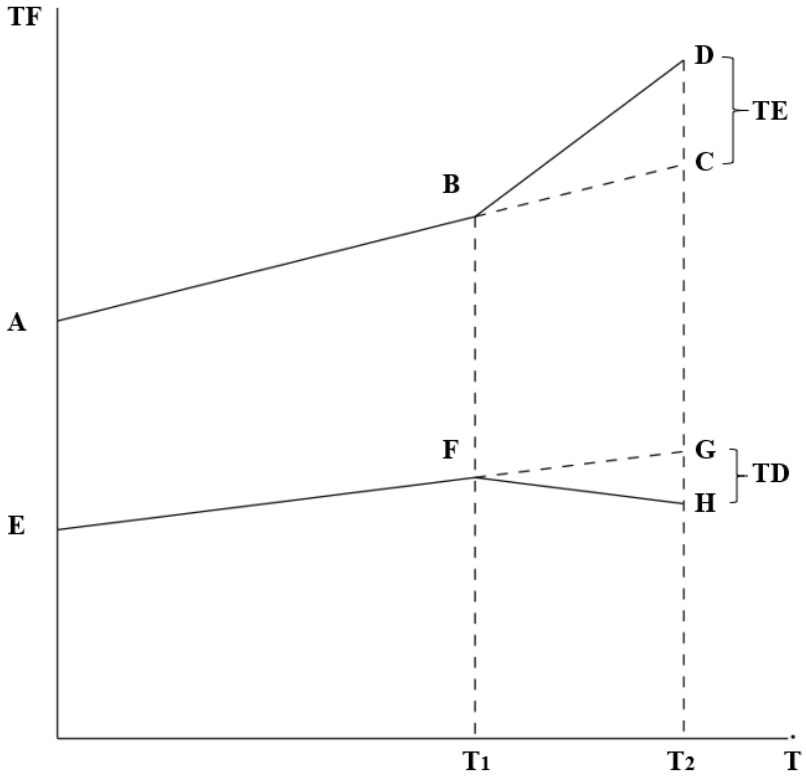


Figure 21 Trade Creation and Diversion Effect in Gravity

3.2.3 Empirical studies of Trade Creation and Diversion

With the gradual progress of related research, the issue of trade creation/diversion has already been extended to FTA. Haveman and Hummels (1998) estimated the trade

effects-TC and TD of the European Free Trade Area (EFTA) and European Community (EC) through the standard methodology, they find the multilateral trade under EC increased for both members and non-EC members and also half members divert their trade to the inter-bloc. A new term “export trade diversion” which firstly appeared in Endoh (1999) also different from Viner and Balassa, it starts from the view of exports that shift from non-members to members. He analyzed the actual effects of European Economic Community (EEC), Latin American Free Trade Association (LAFTA) and Council of Mutual Economic Assistance (CMEA) on international trade from 1960 to 1994, results show that EEC has a positive TC effect and a negative TD effect. The coefficients of the LAFTA dummies are statistically significant and all negative, so the LAFTA has a negative TC effect and TD effect. The coefficients of the CMEA trade creation dummies are statistically significant and all positive, but TD dummies of CMEA are statistically significant and all negative, which means CMEA has a trade creation effect and a trade diversion effect. Chirathivat (2002) assess the impact of CAFTA on some trading products, revealing that the CAFTA brings trade creation for both sides, and the trade creation effect could offset the diversion effect since this diversion is very slight comparing to China. Roberts (2004) attempted to test the appropriateness of the gravity model to the proposed CAFTA, and revealed that on the multilateral trading environment, insignificant effects of the potential TC and TD may be the result of the integration of ASEAN and China, no potential trade creations will be occurred. But for the policy implications, less developed economies will benefit from the integration when more developed ones play a crucial positive role. Abraham and Van Hove (2005) employed gravity model to estimate trade flows from 1992 to 2000 of ASEAN and APEC both in fixed and random effect model. They find that for ASEAN there are no significant results, but it’s demonstrated from the results that APEC does not divert trade from non-members to members. ASEAN and APEC have small effect on Asia-Pacific but the participation of China brings a large export potentials, trade creation will be large for all members in RTAs. The establishment of ASEAN 10+3 (ASEAN with China, Japan and Korea) is a promising strategy for the future trade liberalization. Carrère (2006) used gravity model to assess the ex-post RTAs in a static panel framework included 130 countries export data from 1962 to 1996 following the Vinerian specification of trade effects, as author suggested that three dummy variables for each RTA considered representing the TC effect and TD effects in terms of export/import. The study verified that regional trade agreements have a positive effect on intra-bloc trade, however, at the cost of other countries’ interests (evidence of trade diversion). Koo, Kennedy, and Skripnitchenko (2006) applied gravity model to estimate the effect of preferential trade arrangements (PTAs) on agricultural trade. The study accounted for 131 PTAs and 4 were chosen as representative of different parts of the world. The results indicated that overall effects of regional preferential trade agreements (RPTAs) are positive and significant, increasing bilateral trade among members through both inter- and intra-industry trade. Zhou (2007) estimated the TC effect and TD effect in ACFTA through the gravity model

focused on the potential endogenous variable-WTO dummy variable. From the estimation of the endogenous model, illustrated that WTO has creation fold effect and strong trade diversion effect on export model in the region. Bhattacharya and Bhattacharyay (2007) estimated the likely increases or losses in terms of import between China and India under preferential trading arrangements or free trade agreements different situations via gravity model with country-specific effects. The paper provided hypothetical and indicative implications for China and India to what extent tariffs should be reduced, author claimed that compared to China, India's potential gain is relatively less in the short term because of its higher tariffs. But the gain of India will be higher than China in the long term once its tariff reduced. For the explanation of China's economic role in international merchandise trade at aggregate level bilateral trade as Edmonds, La Croix, and Li (2008) proposed. Egger and Larch (2008) examined the determinants of a pair of countries involve in a bilateral PTA, pointed out that whether a country joins a new FTA depends on the original FTA they have with a third country, third-country effects. Magee (2008) estimates the effects of RTAs on trade flows following the Vinerian specification of integration effects and result reveals that there're clear anticipatory effects of RTAs and CUs generates the largest intra-bloc trade creation than FTAs, the effect continue working for up to 11 years after the establishment of RTA. Martínez-Zarzoso, Felicitas, and Horsewood (2009) estimated the effects of 6 PTAs in the period from 1980 to 1999 on members and non-members by applying the static and dynamic gravity model, and they were the first to introduce the time-varying multilateral resistance terms to estimate Vinerian specifications under the framework of the system-GMM procedure. Their results indicated that PTAs in 1990s' wave of regionalism led larger positive creation effects for developed nations. Sun and Reed (2010) introduced typical OLS and PPML three-way fixed effects model in gravity equation to estimate trade effects of 4 agreements on agricultural exports. ASEAN-China the PTAs, EU-15, EU25 and SADC agreements have created huge increases in agricultural trade among the trading members, and significant diversion effect of EU-15, export creation effect of SADC that increased agricultural exports to non-member countries. For the NAFTA, NAFTA with no trade creation but only export diversion effect attributed to this agreement. The research supported that PPML is preferred to OLS after RESET test. Ekanayake, Mukherjee, and Veeramacheneni (2010) assessed the TC and TDs effect of RTAs in Asia covering 19 countries' annual data from 1980 to 2009 by applying country dummies to capture country-specific fixed effects. Sheng, Tang, and Xu (2012) analyzed the impact of ACFTA for total trade with an extended gravity model and found out both the total trade and intra-industry trade increased substantially result from the ACFTA. In the study of Yang and Martinez-Zarzoso (2014), gravity model with a panel of 31 economies over the period from 1995 to 2010 estimated by different specifications, exporter- and importer-year fixed and pair fixed effects introduced, to avoid endogeneity bias caused by multilateral resistance terms. They estimated the impact of the China-ASEAN FTA (ACFTA) on exports, using aggregated and disaggregated annual export data including

agricultural, manufactured goods, within manufactures for chemical products, machinery products, transport equipment products. The results indicated that ACFTA can bring a solid and significant creation effect. For the regression of disaggregated data, the significant and positive net creation effect of ACFTA discovered in all subject-agricultural and manufactured goods, Chemical products, machinery and transport equipment. Hayakawa, Ito, and Kimura (2016) decomposed the trade creation effect of RTA into tariff reduction and non-tariff barriers effects, estimated RTAs' trade effect utilizing the most disaggregated tariff line-level trade data with more than 30 million observations. The results implied that a significant positive effect on trade creation due to tariff reduction is greater than the impact of removing non-tariff barriers for the whole sample, whereas for the trade among low-income economies, the trade creation effect of reducing tariffs and removing non-tariff barriers is large, while weak among high-income economies.

The table "Summary of Previous Empirical Studies of Gravity Model on International Trade" covers previous papers about TC/TD from 1998 to 2020 will be shown in the Appendix A. Previous studies have discussed about the basic theoretical foundation and development of the gravity model and the choices of specifications in model. Subsequent studies on gravity model also focused on the FTA and trade effects, but it seems like most of them have only studied 'large' scale FTAs mainly related to the America, Europe, and China with ASEAN. Therefore, in this paper, the focus will be on China, the kernel, to study the impact of FTAs on these partners and non-members.

Chapter 4 Research Methods

4.1 Reason of Choosing Gravity Model

Gravity model, a model with efficient explanatory power that has been widely used in research on the impacts and implications of existing agreements or trade prediction of RTA under negotiation. Gravity model, along with abundant theoretical

foundations, has logically self-consistent explanatory power on the parameters that could affecting the international trade flows and achieved success in many fields, can provide answers to different interests. Many studies have already shown that the economic size, distance, population, institutional arrangements all are the significant factors, and the role of economic aggregate is particularly significant. Why the gravity model works effective? As said by Paul R. Krugman "Large economies tend to spend large amounts on imports because they have large incomes. They also tend to attract large shares of other countries' spending because they produce a wide range of products. So, when other things equal, the trade between any two economies is larger—the larger is either economy", Krugman, Obstfeld, and Melitz (2018).[22] China, as the second largest economy, it's economic size and population are both large to focus and analyze, after the reform and opening up, Chinese market has become more international and always in line with the world. From a trade perspective, institutional arrangements as well, China has always pursued an open strategy of mutual benefit and win-win, it has not conflicted with major western economies. For such a huge trade pattern in China, gravity model is a good choice whether analyzing past data or predicting future trade potential.

4.2 Econometric Specifications

The gravity model, a very useful model to analyze the trade and immigration flows, as well as FDI flows, it can be dated back to the Tinbergen (1962) who first introduced this model to study the trade flows. The gravity model can explain the relevance of geographical factors and bilateral trade, the bilateral trade is directly correlate to the economic size of each other and inversely proportional to the geographical distance. Its frame based on the Newton's law of gravitation, so named it the gravity model. The basic equation of gravity as listed next line:

$$TF_{ij} = \alpha Y_i^{\beta_1} Y_j^{\beta_2} Dist_{ij}^{\beta_3} \quad (1)$$

In this basic equation, trade between economy i and j is positively related to the size of the economy itself, and negatively related to the distance (transportation cost). Where TF denotes the bilateral trade flows between i and j and Yi Yj refers to the GDP of economy i and j respectively, Dist refers to the geographical distance between the two economies. After time series and relative explanatory variables or dummies added, it can be expressed as a standard augmented gravity form:

$$X_{ijt} = \alpha Y_{it}^{\beta_1} Y_{jt}^{\beta_2} Dist_{ij}^{\beta_3} E_{ijt}^{\beta 4} \mu_{ijt} \quad (2)$$

[22] Krugman, Obstfeld, and Melitz (2018), P35.

Where the X refers to the bilateral trade flows from i to j, E refers to the explanatory variables that matched up, μ is the error terms. As we discussed at part 3-scope, there're 32 economies in this paper: China, Hong Kong, Macao, Chile, Pakistan, Thailand, Myanmar, Cambodia, Malaysia, Indonesia, Laos, Vietnam, Philippines, Brunei, Korea, Singapore, Georgia, New Zealand, Australia, Switzerland, Iceland, Costa Rica, Peru, USA, Japan, Germany, India, Taiwan, Netherlands, UK, Russia, Mexico. For the FTAs will estimate in the paper. Although there are 16 FTAs for China already been signed and implemented, only 14 effective FTAs (the China-Mauritius FTA and China-Maldives FTA in force but not notified to WTO yet) includes. Hence, 14 FTAs will be analyzed in our paper as listed below (ascending order).

[1] Mainland-Hong Kong Closer Economic and Partnership Arrangement (MHCEPA)
[2] Mainland-Macao Closer Economic and Partnership Arrangement (MMCEPA)
[3] China-ASEAN FTA (ACFTA)
[4] China-Chile FTA (CCFTA)
[5] China-Pakistan FTA (CPFTA)
[6] China-New Zealand FTA (CNFTA)
[7] China-Singapore FTA (SCFTA)
[8] China-Peru FTA (PCFTA)
[9] China-Costa Rica FTA (CCRFTA)
[10] China-Switzerland FTA (CSFTA)
[11] China-Iceland FTA (CIFTA)
[12] China-Korea FTA (CKFTA)
[13] China-Australia FTA (CAFTA)
[14] China-Georgia FTA (CGFTA)

Therefore, since the Xijt means the i export to j at t, we will have the data of China export to these 31 economies, and the China also can be the importer then 31 export to China, so when the i=1 it represents China, j=1 Hong Kong, j=2 Macao, j=…, j=31 Mexico, j=32 China; when j=32 China, these 31 export to China, i=2 Hong Kong, i=3 Macao, i=…, i=32 Mexico. As a result, we will have 24800 observations (25*31*32) for our equations.

Excluding the common variables such as GDP of exporter/importer, Population of exporter/importer and Distance, the explanatory variables or dummies used in the right-hand side of the equation are different in each paper. In this paper, gravity equation will be extended as (3) listed below and assess the trade effects utilizing the FTA dummy variables in terms of the export and import to capture the FTA effects. Then the equation taking logs and adding related explanatory variables:

$$lnX_{ijt} = \alpha + \beta_1 lnGDP_{it} + \beta_2 lnGDP_{jt} + \beta_3 lnDist_{ij} + \beta_4 lnPop_{it} + \beta_5 lnPop_{jt} + \beta_6 Lang_{ij} + \beta_7 Bor_{ij} + \beta_8 SIM_{ijt} + \beta_9 RFE_{ijt} + \rho_1 \sum FTA\_ij_{ijt}^{k} + \rho_2 \sum FTA\_i_{ijt}^{k} + \rho_3 \sum FTA\_j_{ijt}^{k} + \mu_{ijt} \quad (3)$$

Where the ln denotes the natural logarithms, X_ijt as the dependent variable denotes the exports from economy i to j at time t. The export flows from an economy to another one is always measured as Free on Board (FOB) and imports measured as Cost of Insurance and Freight (CIF), if we use the imports as the dependent variable in our equation, an inevitable problem we face could be the CIF data may bring us biased estimates since the CIF includes the cost may correlated to the explanatory variables in the right-hand side. Hence, we apply the exports as the dependent variable.[23] GDP_it and GDP_jt are the GDP of two economies at time t respectively. As the proxy for economy size of each economy, the GDP expected to be positive due to that the GDP also represents the economic size and purchase power of one economy, the higher GDP leads the higher domestic demand and consumption. Pop_it and Pop_jt are the population of i and j, but the coefficient of Pop is still ambiguous. If larger population of the exporter along with a higher domestic demand caused by higher population, population of an economy grows will also extend domestic demand then enlarge the domestic market, as the economic scale increases, the domestic division of labor could be improved somehow, the exports and imports appear an ambiguous effect finally due to the uncertainty of demands. What's more, the population sometimes also depends on the age conditions of each country relatively, like when the proportion of the old is too high of a region will inevitably show a high import demand rather than high export demand. Dist refers to the geographical distance between the two economies. It used to represent the costs of transportation, so it's expected to be negative due to the longer distance the more freight should pay. The dummy Lang is expected to be positive since the shared official language can reduce the communication cost also helps to boost the process of trade negotiations. It equals 1 when economy i and j shared common official language, 0 otherwise. Variable Bor refers to the common border which takes the value 1 if two economies share a common border, 0 otherwise. The shared border also expected to be positive as the same idea of distance, shared border can enhance the bilateral trade by replace of high transaction cost one. Excludes the basic variables, relative similarity in size and relative factor endowment differences of trading countries also included to capture changes in intra-industry and inter-industry trade. The economic size of one economy is measured through the GDP and Pop two variables. The variable SIM is the similarity index, which measures the similarity in size of the two trading economies. The variable SIM is expected to be positive since increased

[23] FOB=Purchase Cost+ Domestic Expenses+ Net Profit. CIF=FOB+ Overseas Shipping Cost+ Foreign Insurance. Due to the cost of overseas freight will affect the gravity model since the model has its own cost item, so apply the Exports as our dependent variable.

similarity in terms of GDP means the similarity in the scale of product diversity of a specific country in the differentiated product sector has increased. Due to consumers' preference for bigger variety will also yield an increased trade volume as Breuss and Egger (1999) argued. Following Egger (2002), Serlenga and Shin (2007) and Ekanayake, Mukherjee, and Veeramacheneni (2010), it defined as:

$$SIM_{ijt} = ln\left[1 - \left(\frac{GDP_{it}}{GDP_{it}+GDP_{jt}}\right)^2 - \left(\frac{GDP_{jt}}{GDP_{it}+GDP_{jt}}\right)^2\right] \quad (4)$$

The expected sign of SIM is positive and also supported by the study of Ekanayake, Mukherjee, and Veeramacheneni (2010). They claimed that similarity in size can expand trade volume, which suggests the intra-industry trade is the major of the total trade between two partners. The variable RFE which measures the difference in countries' relative factor endowments. According to Egger (2002), it defined as the absolute value of the difference between natural logarithm of per capita GDP, higher RFE, larger difference between two economies. The coefficient of RFE may ambiguous because the higher RFE, the higher volume of inter-industry trade but lower share of the intra-industry trade as Serlenga and Shin (2007) argued, and increased RFE will make the importer trade monopolistically competitive products less as Kabir and Salim (2010) proposed. However, here's also another different explanation of RFE as Ekanayake, Mukherjee, and Veeramacheneni (2010) argued to use the RFE to figure out the technology differences between economies in trading structures. The RFE expected to be positive as the trade flows are related positively to the inter-industry differences in technical advancement. We followed previous relative papers as Egger (2002), Serlenga and Shin (2007), Kabir and Salim (2010) and Ekanayake, Mukherjee, and Veeramacheneni (2010) to define the RFE as:

$$RFE_{ijt} = \left|ln\left(\frac{GDP_{it}}{POP_{it}}\right) - ln\left(\frac{GDP_{jt}}{POP_{jt}}\right)\right| \quad (5)$$

The FTA_ij, FTA_i and FTA_j are the dummy variables that represent the differential trade effects in FTAs. FTA dummy represents short form of one FTA from [1] to [14], the little superscript *k* used here only to distinguish the sum-up form is gathering different FTAs not all FTA creation variable sharing the same name 'FTA_ij', for instance, when FTA represents the ACFTA then the FTA_i FTA_j will be the ACFTA_i and ACFTA_j in that equation. FTA_ij takes the value of 1 when the economy i and j in the same FTA, if not the value will be 0. For instance, China export to Thailand, the value of FTA_ij will be 0 before the ACFTA in force, because they were not trade in one FTA, but after the ACFTA in force the value will be 1 since China (exporter i) trade with Thailand (importer j) and vice versa, Thailand export to China. When China trade (in ACFTA) with Japan (not in the ACFTA) the value will be 0 also.

In addition, positive and significant coefficient of FTA_ij indicates the trade creation effect and increases in intra-regional trade volume due to the FTA, this kind of increase exceeds the volume in the absence of FTA (normal trade level). According to the tariff theory and the economic integration, integration can be regarded as the increase in market size, which also combine with a lower tariff on import. Therefore, the imports (exports) increased from (to) members, this positive FTA_ij refers to the increase in intra-bloc exports. FTA_i takes the value of 1 when exporter i belongs to FTA but the trading partner not. For example, China as exporter i which belongs to ACFTA, but the USA not in ACFTA, so the value of FTA_i will be 1. What if j is Thailand that also in the ACFTA, then the value will be 0. It means the exports to non-members will be affected by the FTA China joined. Significant and positive FTA_i represents the trade creation effect in exports that regional integration of i and j shifted exports from FTA member to non-FTA members. It means after China took part in it, this FTA brings a positive effect that export expansion for China to non-member. However, significantly negative coefficient of FTA_i represents the export diversion effect that a decrease in exports from FTA members to non-FTA members. It means a negative effect that export contraction for China to non-member after China join this FTA. FTA_j takes the value of 1 when the j as importer in FTA but the exporter not in. For instance, China as an importer j in ACFTA, but exporter i-USA not in ACFTA, the value will be 1, what if the i represents Thailand which in ACFTA, then the value will be 0. It means the imports from non-member will affected by this FTA China entered. And the significantly positive coefficient of FTA_j represents the trade creation effect in imports that FTA boosted imports from non-FTA members to FTA members. It means after China took part in an FTA, this FTA leads a positive effect that import expansion for China from non-member due to the FTA. Conversely, the negative sign means the trade diversion in terms of imports, so the imports from non-member will diminished after joining the FTA. It means a negative effect that import contraction for China from non-member after China join this FTA. We will estimate the FTAs' effects on trade by applying all FTA trade effects in this paper, to test the TC/TD through the view of China as the core to estimate the previous FTAs and find whether trade creation or diversion were found. The equation (3) without controlling the multilateral resistance terms (MRTs) may be biased as Anderson and Van Wincoop (2003) argued. In order to capture the MRTs, various fixed effects-time, country-specific/pair fixed effects included in this paper. Hence, we estimate three specifications, equation (6-8).

$$lnX_{ijt} = \alpha + \beta_1 lnGDP_{it} + \beta_2 lnGDP_{jt} + \beta_3 lnDist_{ij} + \beta_4 lnPop_{it} + \beta_5 lnPop_{jt} + \beta_6 Lang_{ij} + \beta_7 Bor_{ij} + \beta_8 SIM_{ijt} + \beta_9 RFE_{ijt} + \rho_1 \sum FTA\_ij_{ijt}^{k} + \rho_2 \sum FTA\_i_{ijt}^{k} + \rho_3 \sum FTA\_j_{ijt}^{k} + \tau_t + \mu_{ijt} \quad (6)$$

Where the τ_t refers to the time effects, controls for the volatility in trade flows causing by yearly changes.

$$lnX_{ijt} = \alpha + \beta_1 lnGDP_{it} + \beta_2 lnGDP_{jt} + \beta_3 lnDist_{ij} + \beta_4 lnPop_{it} + \beta_5 lnPop_{jt} + \beta_6 Lang_{ij} + \beta_7 Bor_{ij} + \beta_8 SIM_{ijt} + \beta_9 RFE_{ijt} + \rho_1 \sum FTA\_ij_{ijt}^k + \rho_2 \sum FTA\_i_{ijt}^k + \rho_3 \sum FTA\_j_{ijt}^k + \tau_t + \varphi_i + \varphi_j + \mu_{ijt} \quad (7)$$

Where the φ_i φ_j represents the exporter, importer fixed effect respectively hoping to control for the country-specific factors like infrastructure and other unobserved specific shocks as well. This specification also widely used in previous papers like Ekanayake, Mukherjee, and Veeramacheneni (2010) and Jagdambe and Kannan (2020). However, time with country-fixed can only partly avoid omitted variables problem as Yang and Martinez-Zarzoso (2014).

$$lnX_{ijt} = \alpha + \beta_1 lnGDP_{it} + \beta_2 lnGDP_{jt} + \beta_3 lnPop_{it} + \beta_4 lnPop_{jt} + \beta_5 SIM_{ijt} + \beta_6 RFE_{ijt} + \rho_1 \sum FTA\_ij_{ijt}^k + \rho_2 \sum FTA\_i_{ijt}^k + \rho_3 \sum FTA\_j_{ijt}^k + \tau_t + \varphi_{ij} + \mu_{ijt} \quad (8)$$

Where the φ_{ij} refers to the country-pair fixed effect that used to avoid problem of endogeneity that origin from the trading pairs. All the dyad invariant factors such as distance, common border or language that equals one certain number every year, so these variables in this paper will be dropped in the last equation. And the time & pair fixed effects model is the widest used in the past decade like Sun and Reed (2010), Yang and Martinez-Zarzoso (2014) and Khurana and Nauriyal (2017). Time & pair fixed effects model is a cut above the other two models, as argued by Egger and Pfaffermayr (2003) and Baldwin and Taglioni (2006). So we shall take priority to the regression results of this model. Country-time & pair fixed effects model suggested by Baier and Bergstrand (2007) to control the unobserved time-varying MRTs is not included in this paper since the country-time fixed (exporter-year/importer-year fixed) model failed to estimate intra- and extra- impacts of FTA and impact of some specific variables of interest. Diversion variables cannot be included in the equation as Magee (2008) stated.

However, as these FTAs and their relative countries and regions are added in this paper, it is inevitable that some exports data of developing economies might be zero or just missing (viewed as zero), which is the well-known ‘zero trade issue’. In the gravity model, zeros are not allowed in the log- form, so the zero value will be dropped out of the estimation when regressing the OLS. There’re numbers of discussion about dealing with the zero-trade issue, typically three methods following. First, the zeros can just drop in OLS. However, this method is correct only when the zeros are randomly distributed (random missing or random rounding errors) since the so-called missing

data may contains information related to the trade firms why they tend to trade nothing to one certain place due to the local trade policy or other restrictions. The second way is to add 1 before taking logarithm, ln(X+1), but this method should be avoided since the results cannot be explained by the units of measurement and the coefficient of gravity due to the loss of elasticity as Head and Mayer (2014) noted. The third approach is the Poisson Pseudo-Maximum Likelihood (PPML) which is widely used this ten years and it can be introduced to the levels of trade that can avoid dropping zero-trade also dealing with the heteroskedasticity as Silva and Tenreyro (2006) argued. In the study of Sun and Reed (2010), they proposed the PPML with fixed effects is preferred to OLS when dealing with the zero trade issues. So we follow the Sun and Reed (2010), Jagdambe and Kannan (2020), the equation with PPML written as equation (10)

$$X_{ijt} = exp[\alpha + \beta_1 lnGDP_{it} + \beta_2 lnGDP_{jt} + \beta_3 lnDist_{ij} + \beta_4 lnPop_{it} + \beta_5 lnPop_{jt} + \beta_6 Lang_{ij} + \beta_7 Bor_{ij} + \beta_8 SIM_{ijt} + \beta_9 RFE_{ijt} + \rho_1 \sum FTA_{ij}{}^{k}_{ijt} + \rho_2 \sum FTA_{i}{}^{k}_{ijt} + \rho_3 \sum FTA_{j}{}^{k}_{ijt} + \varepsilon_{fixed} + \mu_{ijt}] \quad (9)$$

Where the ε_{fixed} refers to the relative fixed effects according to different specifications. Distance, common border and language variables will be dropped same as equation (8) when pair fixed added.

4.3 Assessment of Trade Creation and Diversion

In order to assess to what extent, how one FTA affected the trade flows as previous studies used imports as the independent variable to create a definition of TC and TD, the mechanism is the difference between the actual level and predicted level in the absence of a RTA within the intra-or extra- bloc, like Magee (2008) gave the definition of trade expansion (TE) and trade diversion (TD) then the trade creation occurs when TC=TE-TD. Since our equations are the kind of specification follow the Viner's specification of TC/TD, and we use the exports as the dependent variable. Our specification like equation (3) figured, the coefficients ρ1 ρ2 ρ3 can measures to what extent that bilateral intra-bloc trade increased more than predicted level in the absence of FTA when i j both in it, to what extent members' exports higher the predicted level to the non-members, and to what extent the exports from non-members to members are higher than the predicted level. Therefore, the intra-bloc trade can figure out using the ρ1, the total intra-bloc members' exports can be measured as ρ1+ρ2 then the total non-members' exports to members is the ρ1+ρ3. Derived from Martínez-Zarzoso, Felicitas, and Horsewood (2009) have summarized the possible outcomes of trade effects in an FTA as the table 4.

Table 4 Interpretation of trade effects of an FTA

Coefficient	Extra-bloc	Exports (ρ2)		Imports (ρ3)	
Intra-bloc	Sign	+	-	+	-
ρ1	+	Pure TC(X)	TC+XD (ρ1›ρ2) XD (ρ1‹ρ2)	Pure TC(M)	TC+MD (ρ1›ρ3) MD (ρ1‹ρ3)
ρ1	-	XE	XD+XC	ME	MD+MC

Source: Martínez-Zarzoso, I., et al. (2009).

In the table 4, only the coefficients are significant at 1% can be used to calculate the average treatment effect (ATE) and net effect then interpret exporter/importer effect. Since the ρ1 represents the intra-bloc trade, ρ2 represents members exports to non-members, ρ3 represents the exports from non-member to members.

(1) ρ1 >0 ρ2 >0 means the export expansion both intra- and outside bloc, representing a pure trade creation effect for the intra-exporters. Pure trade creation effect in exports, therefore, Pure TC(X).

(2) ρ1 >-ρ2>0 means the increased share within members higher than the decreased share to non-members, so the net effect still positive, export expansion inside FTA but at the cost of the exports share to non-members. It can be regarded as export diversion from non-member to get higher members' export. Intra-bloc trade creation effect plus export diversion, TC+XD.

(3) -ρ2>ρ1>0 means though the exports volume increased but less than the decreased in non-member field. It is the export diversion that may relate to some unobserved factors that at the expense of much part external share. Export expansion in intra-market with higher non-members' export diversion leading to an export diversion eventually, XD.

(4) ρ1>0 ρ3>0 means both the intra-import and the imports from non-members are higher than normal level, it is the import creation for intra-importers. Pure import creation for importers, pure trade creation in imports, Pure TC(M).

(5) ρ1>-ρ3>0 means the intra-imports increased but less from outside. It is an import diversion effect that create import within intra-bloc but at the cost of diversion from non-members. Import expansion in intra-market with lower non-members' import diversion, intra-bloc trade creation plus import diversion, TC+MD.

(6) -ρ3>ρ1>0 means the decreased share from non-members is even higher than the increased within FTA, representing import diversion from non-members to members. Import expansion in intra-market with higher non-members' import diversion result in import diversion only finally, MD.

(7) ρ1<0 ρ2>0means the intra-decreased part less than the increased share in extra-bloc,

it means the expansion of exports in the extra-market. Export expansion in extra-market with lower members' export diversion result in expansion of extra-bloc exports eventually, XE.
(8) $\rho1<0$ $\rho2<0$ means both decrease in the intra- and extra- exports. The pure export diversion for the intra-exporters. Intra-bloc trade contraction plus export diversion, XC+XD.
(9) $\rho1<0$ $\rho3>0$ means the imports from non-members increased and higher than the decreased within intra-bloc, it's the expansion of imports from the extra-market, import diversion from members to non-members. Import expansion in extra-market with lower members' import diversion, expansion of extra-bloc imports, ME.
(10) $\rho1<0$ $\rho3<0$ means both intra- and extra- imports declined, the pure import diversion for intra-importers. Intra-bloc imports contraction effect plus import diversion, MC+MD.

4.4 Data Sources

In this paper, 32 economies (China, Hong Kong, Macao, Chile, Pakistan, Thailand, Myanmar, Cambodia, Malaysia, Indonesia, Laos, Vietnam, Philippines, Brunei, Korea, Singapore, Georgia, New Zealand, Australia, Switzerland, Iceland, Costa Rica, Peru, USA, Japan, Germany, India, Taiwan, Netherlands, UK, Russia, Mexico) included covering 25-year bilateral exports from 1995 to 2019 at aggregated level with 24800 observations [32*31*25]. The basic data, GDP (in nominal USD) and population obtained from the IMF and World Bank. Data of distance between capitals in km, common language and border dummy variables available at CEPII database. Annual export data taken from the IMF Direction of Trade Statistics (DOTS). However, the data of Taiwan province missed for some reasons. Hence, the missing data of Taiwan get from Ministry of Finance, Taiwan.

Chapter 5 Main Results and Discussion

Estimate results of OLS and PPML with various fixed effects are presented in the table 5. The results of time fixed only model representing in the column (1-2), time & exporter/importer fixed model in column (3-4) and the time & pair fixed model in column (5-6). Do the summary (table 8) and analysis of FTA dummies in time & pair fixed effects model is superior to the other two models. Since the results varying widely between the OLS and PPML, this paper applied heteroskedasticity-robust Regression Equation Specification Error Test (RESET) for OLS and PPML model as Silva and Tenreyro (2006) suggested and the relative p-values that reported in the last line of table 5 confirms the same conclusion as Silva and Tenreyro (2006), Sun and Reed (2010) and

Khurana and Nauriyal (2017) that OLS specifications are inappropriate since the RESET relative p-values of all OLS specifications equals zero in this model and the RESET result of PPML specifications all passed 1% which revealed the PPML specifications are more reliable than the OLS, PPML is trustworthy.[24]

For basic variables, the coefficients of GDP for both i and j were positive and significant at 1% level in all equations as expected. The coefficients of population were all negative but significant at 1% level only in the first three columns. The negative coefficients of population can be explained as domestic demand exceeds export demand that larger population, larger domestic market as well as higher factor endowments and larger domestic market input and output. Then resulting a division of labor specialization, reduce the dependence on international specialization as Yang and Martinez-Zarzoso (2014). The negative population of exporter here indicates exporter's population has a stronger domestic absorption effect in terms of exports, but author do believe it is not meaning exporter (China) needs to change the strategy in driving domestic consumption demand and import-oriented. Conversely, China should enhance the international competitiveness of products, refer to the RCA and TS index in chapter 2 especially food products and vegetables are not really pretty good. The distance was significantly negative as expected. The language and border dummies were significantly positive as expected. However, the coefficients of the SIM and FER were only significant at 10% level in the PPML specifications.

For the kernel of this paper, key variables-FTA dummies, the summary of FTA dummies in PPML model gathered in the table 6 to table 9. Since the estimation is in the logarithm form, the trade effects of any variable calculated and interpreted as, for example, statistically positive ACFTA dummy in column (2), time fixed effect model, means intra-bloc trade creation effect that ACFTA increased the welfare of China and ASEAN simultaneously, and the average treatment effect is 179.27% higher than normal trade level [exp(1.027)-1].[25] Statistically positive ACFTA_i indicates a positive export diversion effect that the ACFTA also helps to increase the social welfare for extra-bloc economies. The statistically positive ACFTA_j indicates the import expansion that increasing exports from non-FTA member to FTA members. Hence, a pure trade creation of ACFTA was found in time fixed model. According to the estimation results, as Baldwin and Taglioni (2006) claimed that the pair and time fixed effects model is superior to the other two (time fixed, time & country fixed), this paper will spend more time on the results from pair fixed model but also consider the results from other two as reference. Considering the FTA that have been implemented in the past can be divided into 5 geographical classifications.

[24] Heteroscedasticity robust Regression Specification Error Test (RESET) tests for functional misspecification of each OLS and PPML models in this paper. The model is not rejected when it passed the test, relative p-values over 0.01, no rejection of a null hypothesis, indicates this model is appropriate specification. Whereas the rejection of a null hypothesis indicates that misspecification has been detected. Tests in OLS regression all equals 0 meaning the OLS regression is inappropriate in this paper.

[25] The average treatment effect (ATE) denotes to the difference of trade flows between the two members whether they share an FTA or not.

Table 5 Regression Results of Gravity Model

	(1) OLS (t)	(2) PPML (t)	(3) OLS (t, i, j)	(4) PPML (t, i, j)	(5) OLS (t, ij)	(6) PPML (t, ij)
lnGDP_it	1.278***	0.833***	0.615***	0.673***	0.626***	0.650***
	(0.0329)	(0.0441)	(0.0797)	(0.0776)	(0.0717)	(0.0761)
lnGDP_jt	1.150***	0.899***	0.914***	0.726***	0.931***	0.732***
	(0.0341)	(0.0589)	(0.0665)	(0.0705)	(0.0659)	(0.0654)
lnPop_it	-0.103***	-0.168***	-2.192***	-0.406	-1.925***	-0.304
	(0.0359)	(0.0417)	(0.401)	(0.465)	(0.374)	(0.463)
lnPop_jt	-0.101***	-0.150***	-1.525***	-0.393	-1.216***	-0.428
	(0.0331)	(0.0393)	(0.352)	(0.470)	(0.339)	(0.453)
lnDist_ij	-1.098***	-0.604***	-1.028***	-0.693***		
	(0.0573)	(0.0396)	(0.0536)	(0.0339)		
Lang_ij	0.606***	0.119	0.327***	0.00442		
	(0.107)	(0.120)	(0.103)	(0.0827)		
Bor_ij	0.753***	0.846***	1.069***	0.699***		
	(0.242)	(0.179)	(0.226)	(0.117)		
SIM_ijt	0.148***	-0.0691*	-0.122***	-0.0551*	-0.0313	-0.0413
	(0.0251)	(0.0364)	(0.0283)	(0.0297)	(0.0448)	(0.0348)
FER_ijt	-0.0844***	0.0397*	0.0699***	0.0315*	0.0179	0.0237
	(0.0144)	(0.0208)	(0.0161)	(0.0169)	(0.0256)	(0.0199)
MHCEPA_ij	3.182***	2.652***	0.887***	0.00874	0.292	-0.472***
	(0.328)	(0.245)	(0.275)	(0.268)	(0.357)	(0.143)

Continued

Table 5 Continued

	(1) OLS (t)	(2) PPML (t)	(3) OLS (t, i, j)	(4) PPML (t, i, j)	(5) OLS (t, ij)	(6) PPML (t, ij)
MHCEPA_i	1.677***	1.099***	0.551***	-0.311*	0.552***	-0.188
	(0.148)	(0.131)	(0.135)	(0.189)	(0.138)	(0.129)
MHCEPA_j	1.392***	1.339***	0.537***	-0.119	0.577***	0.184*
	(0.211)	(0.159)	(0.129)	(0.147)	(0.134)	(0.110)
MMCEPA_ij	-3.709***	-3.196***	-0.795*	0.984***	-2.209***	-0.801***
	(0.342)	(0.770)	(0.429)	(0.355)	(0.197)	(0.288)
MMCEPA_i	-2.901***	-0.568***	-1.124***	0.725***	-1.139***	0.778***
	(0.232)	(0.197)	(0.208)	(0.191)	(0.208)	(0.139)
MMCEPA_j	-2.009***	-0.916***	-0.383**	0.496***	-0.389**	0.471***
	(0.242)	(0.196)	(0.187)	(0.184)	(0.189)	(0.136)
ACFTA_ij	1.117***	1.027***	0.299***	-0.219**	0.188*	-0.135
	(0.169)	(0.158)	(0.106)	(0.101)	(0.0978)	(0.0964)
ACFTA_i	0.799***	0.553***	0.185*	-0.0311	0.349***	-0.0844
	(0.135)	(0.126)	(0.0958)	(0.0750)	(0.0902)	(0.0658)
ACFTA_j	0.287**	0.592***	-0.285***	-0.0360	-0.0842	-0.119**
	(0.114)	(0.126)	(0.0878)	(0.0647)	(0.0739)	(0.0566)
CCFTA_ij	3.068***	1.209***	1.973***	1.416***	0.646***	0.585***
	(0.419)	(0.195)	(0.296)	(0.249)	(0.125)	(0.0698)
CCFTA_i	0.769***	0.229*	0.264*	0.136***	0.429***	0.160***
	(0.209)	(0.135)	(0.140)	(0.0414)	(0.119)	(0.0404)
CCFTA_j	0.296	-0.0840	-0.174	0.0255	-0.0244	0.0892*
	(0.243)	(0.110)	(0.175)	(0.0608)	(0.149)	(0.0500)

Continued

Table 5 Continued

	(1) OLS (t)	(2) PPML (t)	(3) OLS (t, i, j)	(4) PPML (t, i, j)	(5) OLS (t, ij)	(6) PPML (t, ij)
CPFTA_ij	-1.671***	-1.512***	-0.163	-0.0217	0.116	0.186*
	(0.414)	(0.485)	(0.538)	(0.260)	(0.140)	(0.0983)
CPFTA_i	-0.927***	-0.546***	0.0432	-0.0284	-0.0302	0.00235
	(0.223)	(0.139)	(0.151)	(0.0323)	(0.150)	(0.0311)
CPFTA_j	-0.912***	-0.397***	0.0707	-0.00339	0.0582	-0.0351
	(0.250)	(0.122)	(0.124)	(0.0423)	(0.118)	(0.0366)
CNFTA_ij	1.752***	-0.362	0.372	-0.0105	0.116	0.369*
	(0.407)	(0.245)	(0.262)	(0.332)	(0.143)	(0.200)
CNFTA_i	0.777***	-0.178	0.0934	-0.0427	0.0652	-0.0482
	(0.148)	(0.117)	(0.0747)	(0.0465)	(0.0719)	(0.0460)
CNFTA_j	0.348*	-0.176*	0.0306	-0.0784	0.00304	-0.0919
	(0.199)	(0.106)	(0.132)	(0.0524)	(0.135)	(0.0567)
SCFTA_ij	1.258***	0.840***	-0.772***	-0.359***	-0.471***	-0.408***
	(0.275)	(0.253)	(0.218)	(0.133)	(0.120)	(0.0960)
SCFTA_i	0.806***	0.534***	-0.182*	-0.177**	-0.203**	-0.218***
	(0.196)	(0.163)	(0.0959)	(0.0787)	(0.0822)	(0.0748)
SCFTA_j	0.721***	0.365***	-0.0233	-0.199**	-0.115	-0.183**
	(0.178)	(0.132)	(0.105)	(0.0786)	(0.0991)	(0.0762)
PCFTA_ij	1.928***	0.420*	2.130***	1.386***	0.635***	0.560***
	(0.562)	(0.244)	(0.374)	(0.253)	(0.232)	(0.0753)
PCFTA_i	-0.0152	-0.253**	0.183	0.0577	0.332***	0.100**
	(0.234)	(0.103)	(0.136)	(0.0435)	(0.124)	(0.0441)

Continued

Table 5 Continued

	(1) OLS (t)	(2) PPML (t)	(3) OLS (t, i, j)	(4) PPML (t, i, j)	(5) OLS (t, ij)	(6) PPML (t, ij)
PCFTA_j	0.0566	-0.235***	0.129	0.143***	0.225*	0.158***
	(0.205)	(0.0804)	(0.159)	(0.0536)	(0.133)	(0.0518)
CCRFTA_ij	0.430*	-1.199**	0.320	-0.558*	-0.496	-0.458
	(0.232)	(0.529)	(0.381)	(0.296)	(0.383)	(0.525)
CCRFTA_i	-0.372*	-0.149**	-0.136	-0.0648*	-0.139	-0.0523
	(0.212)	(0.0651)	(0.128)	(0.0347)	(0.129)	(0.0338)
CCRFTA_j	0.143	-0.163***	0.0650	-0.168***	0.0387	-0.180***
	(0.184)	(0.0518)	(0.171)	(0.0336)	(0.145)	(0.0318)
CSFTA_ij	-0.128	-0.740	-0.174	0.202	0.0140	0.662***
	(0.843)	(0.552)	(0.658)	(0.529)	(0.458)	(0.221)
CSFTA_i	0.435**	-0.143	0.243***	0.408***	0.180**	0.323***
	(0.179)	(0.186)	(0.0822)	(0.107)	(0.0773)	(0.0828)
CSFTA_j	-0.151	-0.345***	0.0226	0.00265	-0.0291	0.00967
	(0.197)	(0.117)	(0.123)	(0.0937)	(0.120)	(0.0865)
CIFTA_ij	-1.256***	-2.951***	-0.163	-1.618***	-0.209*	-0.269
	(0.402)	(0.232)	(0.285)	(0.264)	(0.122)	(0.196)
CIFTA_i	-0.881***	-0.102	0.0538	-0.400***	0.170	-0.292***
	(0.276)	(0.183)	(0.148)	(0.113)	(0.127)	(0.0912)
CIFTA_j	-0.991***	0.121	-0.335**	-0.0461	-0.219	-0.0808
	(0.215)	(0.125)	(0.163)	(0.1000)	(0.161)	(0.0940)
CKFTA_ij	-0.659	0.315	-1.401***	-0.187	-0.702***	-0.116**
	(0.429)	(0.209)	(0.287)	(0.123)	(0.133)	(0.0588)

Continued

Table 5 Continued

	(1) OLS (t)	(2) PPML (t)	(3) OLS (t, i, j)	(4) PPML (t, i, j)	(5) OLS (t, ij)	(6) PPML (t, ij)
CKFTA_i	0.546***	0.361**	-0.258***	0.0956	-0.299***	-0.0197
	(0.159)	(0.158)	(0.0815)	(0.0819)	(0.0750)	(0.0608)
CKFTA_j	0.402**	0.171	0.0246	0.100	-0.00474	-0.00429
	(0.174)	(0.109)	(0.124)	(0.0952)	(0.124)	(0.0536)
CAFTA_ij	0.797	0.500	0.748*	0.371	-0.0130	0.165***
	(0.577)	(0.349)	(0.405)	(0.239)	(0.178)	(0.0624)
CAFTA_i	-0.0322	-0.184	-0.0925	-0.142**	-0.113	-0.0664
	(0.180)	(0.165)	(0.106)	(0.0721)	(0.104)	(0.0544)
CAFTA_j	0.0602	-0.193*	-0.0663	-0.188**	-0.0822	-0.0794*
	(0.186)	(0.116)	(0.110)	(0.0933)	(0.109)	(0.0462)
CGFTA_ij	1.084***	-0.898*	1.661***	0.572***	1.330***	0.487***
	(0.201)	(0.517)	(0.407)	(0.192)	(0.137)	(0.0907)
CGFTA_i	-0.636***	-0.165***	0.338**	-0.0946***	0.377***	-0.0829***
	(0.176)	(0.0387)	(0.135)	(0.0324)	(0.129)	(0.0319)
CGFTA_j	0.431***	-0.0550	0.181	-0.0166	0.290**	-0.0195
	(0.140)	(0.0446)	(0.130)	(0.0404)	(0.114)	(0.0381)
_cons	-24.03***	-11.56***	8.691***	-8.279**	11.05**	-9.725***
	(0.836)	(1.315)	(3.320)	(3.581)	(5.484)	(3.054)
N	23277	24800	23277	24800	23277	24625
R^2	0.798	0.792	0.872	0.905	0.950	0.981
RESET p-values	0.000	0.705	0.000	0.346	0.000	0.533

Note: Huber–White's robust standard errors in parentheses. *** significant at 1% level, ** significant at 5% level, * significant at 10% level.

Table 6 Summary of FTA dummies in PPML (Time only)

	FTA_ij	FTA_i	FTA_j	Exporter effect	Importer effect	ATE %	Net effect %
MHCEPA	2.652***	1.099***	1.339***	Pure TC(X)	Pure TC(M)	1318.23%	16138.98%
MMCEPA	-3.196***	-0.568***	-0.916***	XD+XC	MD+MC	-95.91%	-99.07%
ACFTA	1.027***	0.553***	0.592***	Pure TC(X)	Pure TC(M)	179.26%	777.58%
CCFTA	1.209***	0.229*	-0.0840	TC		235.01%	235.01%
CPFTA	-1.512***	-0.546***	-0.397***	XD+XC	MD+MC	-77.95%	-91.41%
CNFTA	-0.362	-0.178	-0.176*				
SCFTA	0.840***	0.534***	0.365***	Pure TC(X)	Pure TC(M)	131.63%	469.16%
PCFTA	0.420*	-0.253**	-0.235***		MD		-20.94%
CCRFTA	-1.199**	-0.149**	-0.163***		MD		-15.04%
CSFTA	-0.740	-0.143	-0.345***		MD		-29.17%
CIFTA	-2.951***	-0.102	0.121	XC		-94.77%	-94.77%
CKFTA	0.315	0.361**	0.171				
CAFTA	0.500	-0.184	-0.193*				
CGFTA	-0.898*	-0.165***	-0.0550	XD			-15.21%

Note: Coefficients that are significant at 1% level (***) can be used to calculate the trade effects. The exporter/importer effect following the table 4. In this table, Pure TC(X) and Pure TC(M) denote the pure trade creation effect in exports and imports, respectively. XD and MD represent export and import diversion, respectively. XC and MC represent contraction of intra-bloc exports and imports, respectively. TC denote intra-bloc trade creation effect. ATE: Average Treatment Effect.

Table 7 Summary of FTA dummies in PPML (Time & Country)

	FTA_ij	FTA_i	FTA_j	Exporter effect	Importer effect	ATE %	Net effect %
MHCEPA	0.00874	-0.311*	-0.119				
MMCEPA	0.984***	0.725***	0.496***	Pure TC(X)	Pure TC(M)	167.51%	807.02%
ACFTA	-0.219**	-0.0311	-0.0360				
CCFTA	1.416***	0.136***	0.0255	Pure TC(X)		312.06%	372.09%
CPFTA	-0.0217	-0.0284	-0.00339				
CNFTA	-0.0105	-0.0427	-0.0784				
SCFTA	-0.359***	-0.177**	-0.199**	XC		-30.16%	-30.16%
PCFTA	1.386***	0.0577	0.143***	TC	Pure TC(M)	299.88%	361.35%
CCRFTA	-0.558*	-0.0648*	-0.168***		MD		-15.46%
CSFTA	0.202	0.408***	0.00265	TC(X)			50.38%
CIFTA	-1.618***	-0.400***	-0.0461	XD+XC		-80.17%	-86.71%
CKFTA	-0.187	0.0956	0.100				
CAFTA	0.371	-0.142**	-0.188**				
CGFTA	0.572***	-0.0946***	-0.0166	TC+XD		77.18%	61.18%

Note: Coefficients that are significant at 1% level (***) can be used to calculate the trade effects. The exporter/importer effect following the table 4. In this table, Pure TC(X) and Pure TC(M) denote the pure trade creation effect in exports and imports, respectively. XD and MD represent export and import diversion, respectively. XC represents contraction of intra-bloc exports. TC(X) refers to TC effect in exports (X). TC denote intra-bloc trade creation effect. ATE: Average Treatment Effect.

Table 8 Summary of FTA dummies in PPML (Time & Pair)

	FTA_ij	FTA_i	FTA_j	Exporter effect	Importer effect	ATE %	Net effect %
MHCEPA	-0.472***	-0.188	0.184*	XC		-37.62%	-37.62%
MMCEPA	-0.801***	0.778***	0.471***	XE	ME	-55.11%	56.52%
ACFTA	-0.135	-0.0844	-0.119**				
CCFTA	0.585***	0.160***	0.0892*	Pure TC(X)		79.50%	110.64%
CPFTA	0.186*	0.00235	-0.0351				
CNFTA	0.369*	-0.0482	-0.0919				
SCFTA	-0.408***	-0.218***	-0.183**	XD+XC		-33.50%	-46.53%
PCFTA	0.560***	0.100**	0.158***	TC	Pure TC(M)	75.07%	105.03%
CCRFTA	-0.458	-0.0523	-0.180***		MD		-16.47%
CSFTA	0.662***	0.323***	0.00967	Pure TC(X)		93.87%	167.78%
CIFTA	-0.269	-0.292***	-0.0808	XD			-25.32%
CKFTA	-0.116**	-0.0197	-0.00429				
CAFTA	0.165***	-0.0664	-0.0794*	TC		17.94%	17.94%
CGFTA	0.487***	-0.0829***	-0.0195	TC+XD		62.74%	49.80%

Note: Coefficients that are significant at 1% level (***) can be used to calculate the trade effects. The exporter/importer effect following the table 4. In this table, Pure TC(X) and Pure TC(M) denote the pure trade creation effect in exports and imports, respectively. XD and MD represent export and import diversion, respectively. XC represents contraction of intra-bloc exports. XE and ME represent expansion of exports and imports to extra-bloc, respectively. TC denote intra-bloc trade creation effect. ATE: Average Treatment Effect.

5.1 Results and discussions about CEPA

Under the pair & time fixed model, in the case of Closer Economic and Partnership Arrangement (CEPA), results show significantly negative coefficient of MHCEPA_ij and MMCEPA_ij, representing the trade contraction effect with -37.62% [exp(-0.472)-1] and -55.11% [exp(-0.801)-1] ATE for MHCEPA and MMCEPA respectively. Indicating the intra-bloc social welfare lost accordingly that Mainland and Hongkong & Macao suffer from the CEPA at least for this scope, while more interesting thing is the results in table 6. Although all PPML passed RESET test, ATE of MHCEPA is 1318.23% and net effect even reach at 16138.98% higher than the expected normal level of trade in time fixed model, which is tremendously more massive than the realistic trade level, dubious and unauthentic. Positive MMCEPA_i and MMCEPA_j both significant at 1% level, indicates welfare gain for the extra-bloc economies as expansion of extra-bloc exports and imports. The net effect of MMCEPA is still positive means the MMCEPA boost the total trade but at the cost of some intra-bloc welfare lost.

There is no corresponding paper in gravity model for China's CEPA, for the regression of CEPAs, but Mainland and Hong Kong have already formed a beneficial economic and trade cooperation relationship. Hong Kong as a new and exclusive window of foreign trade to major western economies especially when the west block down the investment and trade to China. Mainland's total exports to Hong Kong are always in the forefront over years. Most of the products produced in the Mainland are re-exported to other countries through Hong Kong. However, the long-term trade cooperation relationship has already become a reality in historical reasons, and it may be difficult for the set-up of a better trade arrangements (CEPA) to achieve such decisive and high-yield results, additionally China gradually recognizes the important development strategic position of the free trade zones, as well as the maturing FTA cooperation and negotiation framework, it is likely to gain similar negative effects when the trade share shift to other frameworks. Additionally, according to the trade data from TOP 50 world container ports[26], obvious downward trend for trade volume in port of Hong Kong and upward trend for the most of other Chinese ports from 2014 to 2018. For the MMCEPA, the trade contraction effect was interesting but also as expected since the foreign trade was not Macao's sources of economic growth. Calculated via IMF data, Export-to-GDP ratio of Macao has dropped from 37.79% in 2000 to 2.82% in 2015. The Import-to-GDP ratio dropped from 33.5% in 2000 to 23.37% in 2015 and Trade-to-GDP ratio of Macao has dropped from 71.35% in 2000 to 26.1% in 2015. However, the positive net effect of MMCEPA is still telling FTA works.

5.2 Results and discussions about FTA with Asian countries

In the time fixed effect model, regression results show that all CPFTA dummies negative and significant at 1% level. The CPFTA has a pure trade contraction effect the ATE of CPFTA is -77.95% [exp(-1.512)-1] lower than normal level, social welfare for China and Pakistan, and trade diversion effects in CPFTA means social welfare lost

[26] https://www.worldshipping.org/about-the-industry/global-trade/top-50-world-container-ports

also for extra-bloc economies, this finding in line with the study of Qunfei and Yuelan (2011) that CPFTA didn't play it role as expected. One plausible reason of negative CPFTA trade effects is though China-Pakistan FTA entry into force in 2007 and bilateral trade volume has also increased yearly, Pakistan is still facing severely internal and external challenges. CPFTA entry into force in 2007, financial crisis then global recession in 2008. Pakistan's recovery of economic foundation yet still fragile as argued by Qunfei and Yuelan (2011). For Pakistan, make efforts in elimination of tariff and non-tariff barriers, improve the market environment and help exporting companies seize the FTA opportunities, reducing production costs and try to enhance the international competitiveness of commodities. China and Pakistan may accelerate the construction of Special Economic Zones (SEZs) under the framework of China–Pakistan Economic Corridor (CPEC). ACFTA has a pure trade creation effect in exports and imports, all ACFTA dummies positive and significant at 1% level. The ATE effect of ACFTA is 179.27% [exp(1.027)-1] higher than normal expected level of trade and positive effect of ACFTA_i and ACFTA_j indicate that ACFTA boost intra-bloc trade and also for the trade with extra-bloc economies, welfare gain for China and ASEAN and non-ACFTA economies. In addition, finding of ACFTA trade effect (ATE) is similar to Yang and Martinez-Zarzoso (2014), the trade effect of ACFTA under country/pair fixed model will get insignificant results when estimating with many FTAs/RTAs also in line with Sun and Reed (2010), the insignificant result in pair fixed model also supported the finding of Roberts (2004) that no potential trade effects will have in ACFTA. However, trade creation of ACFTA in time fixed model in line with Yang and Martinez-Zarzoso (2014) and Sheng, Tang, and Xu (2012) and Sun and Reed (2010) that China and ASEAN and even countries from extra-bloc may benefits from ACFTA. Among the results, the ACFTA trade effect is the highest in ATE and Net effect, the ASEAN and China both playing important roles of regional and global trade. According to a report of Euler Hermes about world's economic center of gravity (WECG), report stated that "WECG has been moving eastwards towards Asia since 2002, and WECG could be located around the confluence of China, India and Pakistan by 2030".[27] Regional Comprehensive Economic Partnership (RCEP), the biggest FTA signed on 15 Nov 2020 which covers ASEAN-10 and China, South Korea, Japan, New Zealand and Australia. RCEP also a new opportunity for China and other major Asian economies. RCEP may help to integrate trade effects of ACFTA, CNFTA and CAFTA to improve creation effects if members can make full use of comparative advantages respectively, enhance and keep the overall position in the GVC, China should also be prepared to deal with potential trade diversions caused by RCEP.

In the case of SCFTA, statistically significant negative SCFTA_ij and SCFTA_i were found in the pair fixed model and country fixed model. The result of SCFTA in pair fixed model reveals export diversion and intra-bloc export contraction, ATE of SCFTA is -33.50% [exp(-0.408)-1] lower than the expected normal levels of trade, which indicates the trade contraction (social welfare lost) for China, negative SCFTA_i means negative exports diversion effect. For the result of SCFTA is very interesting and really beyond imagination, the possible reason is hard to give and hardly find a paper analyzed the SCFTA trade effect but since the Singapore is an important trade, financial, and shipping center in the Asia-Pacific region in the long-run also a significant position of geopolitics. Singapore is playing an important role in the whole

[27] https://www.eulerhermes.com/en_global/news-insights/economic-insights/the-world-is-moving-east-fast.html

Asia and even the world. Export companies from various countries have come to Singapore to set up regional headquarters and regards Singapore as a drawboard to enter the Asian market. The possible reason why SCFTA negative effect for China may come from the companies' behaviors and the model specification may decide SCFTA effects already absorbed by ASEAN-China FTA or others. Addition, given the Singapore internal factors like scarce in natural resources and factor endowments, its negative effect due to external unobserved factors extensively. There is also one plausible possibility that trade became negative to the incompletable implementations and utilization of FTA, however, hardly conclude based on the data and model now but also a good point to figure out and do further research of SCFTA inter- and intra- industry goods trade etc. For the CKFTA, time fixed and time & pair fixed models show positive CKFTA_i and negative CKFTA_ij respectively but only significant at 5% level. In the case of CGFTA, trade or implementation effect of CGFTA is still too early to assess but what is certain is that the intra-bloc creation effect manifested at least for the two years of implementation. Statistically significant positive CGFTA_ij indicates an intra-bloc creation with ATE of 62.74% [exp(0.478)-1], social welfare gain for China and Georgia. Statistically negative CGFTA_i means export diversion effect, which indicates the social welfare decreases for the extra-bloc economies. Therefore, the trade creation of CGFTA at the cost of trade diversion of economies outside the FTA.

5.3 Results and discussions about FTA with Latin American countries

For the CCFTA, results show that CCFTA_ij and CCFTA_i have positive coefficient and significant at 1% level implies that a pure trade creation effect in exports, social welfare gain for both intra-bloc and also for the economies outside the FTA, ATE of CCFTA is 79.50% [exp(0.585)-1] higher than the expected from normal levels of trade, China and Chile both benefit from CCFTA. In the case of PCFTA and CCRFTA, pure trade creation in terms of imports was suggested as positive coefficients of PCFTA_ij and PCFTA_j, ATE effect of PCFTA is 75.07% higher than expected normal trade level [exp(0.560)-1] indicating China and Peru benefit from PCFTA, and positive PCFTA_j reveals an up-ward trend of imports from extra-bloc non-FTA members. Only a significantly negative CCRFTA_j represents import diversion of CCRFTA, -16.47% lower than expected level of imports from extra-bloc [exp(-0.18)-1]. Pure TC(X) of CCFTA, pure TC(M) of PCFTA and MD of CCRFTA, FTA with Latin America countries, China is still seeking to promote trade and economic cooperation with Latin America, to catch the opportunity of the stable development of economic relationship then establish free trade, so that China can enter the big Latin America markets. The early stage of cooperation with Latin America seems already achieved good prospects for development. Perhaps further entry of Latin America market to expand scope of trade cooperation to such countries rich in resources as Mexico and Brazil.

5.4 Results and discussions about FTA with European countries

For the CSFTA, China-Switzerland FTA, positive CSFTA_ij and CSFTA_i concluded to a pure trade creation in terms of export, ATE effect is 93.87% that higher than normal trade level [exp(0.662)-1] and net effect is 167.78%, indicates China and Switzerland both benefit from CSFTA (social welfare increased after the set-up of FTA). In the case of CIFTA, negative coefficient of CIFTA_i and significant at 1% level implies that export diversion effect of CIFTA that a decrease -25.32% [exp(-0.292)-1] in exports from China and Iceland to others. The set-up of FTA with Iceland and Switzerland promoted the sustainable development of bilateral trade and economic cooperation also significance for the deepening trade and investment under multilateral economic framework with EU simultaneously. Good trade cooperation with Switzerland and Iceland will construct the foundation for China to open up the European market.

5.5 Results and discussions about FTA with Oceanian countries

For the CAFTA, China and Australia, result show a statistically significant positive CAFTA_ij which representing intra-bloc trade creation effect that ATE effect of 17.94% [exp(0.156)-1] higher than normal trade imply increase in social welfare for China and Australia. However, the negative CAFTA_j only significant at 10% level. The result of CAFTA suggests China and Australia both benefited from the FTA due to the FTA, even the net effect is related low but trade between China and Australia should be maintained and improved. For the CNFTA, China-New Zealand FTA, only positive CNFTA_ij significant at 10% level in pair fixed model, time fixed and country fixed model also failed to capture the trade effects of CNFTA. Therefore, no evidence for any creation or diversion was found in CNFTA. China-Australia FTA presented a good perspective for trade and economic cooperation, though the trade effects of CNFTA is still ambiguous but as the only 2 advanced countries in Oceania, good trade foundation with China still need to be maintained for both Australia and New Zealand.

Table 9 Summary of FTA dummies

	FTA_ij	FTA_i	FTA_j	Exporter effect	Importer effect	ATE %	Net effect %
MHCEPA	-0.472***	-0.188	0.184*	XC		-37.62%	-37.62%
MMCEPA	-0.801***	0.778***	0.471***	XE	ME	-55.11%	56.52%
ACFTA	1.027***	0.553***	0.592***	Pure TC(X)	Pure TC(M)	179.27%	777.58%
CCFTA	0.585***	0.160***	0.0892*	Pure TC(X)		79.50%	110.64%
CPFTA	-1.512***	-0.546***	-0.397***	XD+XC	MD+MC	-77.95%	-91.41%
CNFTA	0.369*	-0.0482	-0.0919				
SCFTA	-0.408***	-0.218***	-0.183**	XD+XC		-33.50%	-46.53%
PCFTA	0.560***	0.100**	0.158***	TC	Pure TC(M)	75.07%	105.03%
CCRFTA	-0.458	-0.0523	-0.180***		MD		-16.47%
CSFTA	0.662***	0.323***	0.00967	Pure TC(X)		93.87%	167.78%
CIFTA	-0.269	-0.292***	-0.0808	XD			-25.32%
CKFTA	-0.116**	-0.0197	-0.00429				
CAFTA	0.165***	-0.0664	-0.0794*	TC		17.94%	17.94%
CGFTA	0.487***	-0.0829***	-0.0195	TC+XD		62.74%	49.80%

Note: Coefficients that are significant at 1% level (***) can be used to calculate the trade effects. The exporter/importer effect following the table 4. In this table, Pure TC(X) and Pure TC(M) denote the pure trade creation effect in exports and imports, respectively. XD and MD denote export diversion and import diversion, respectively. XC and MC represent contraction of intra-bloc exports and imports, respectively. XE and ME represent expansion of exports and imports to extra-bloc, respectively. TC denote intra-bloc trade creation effect. Results of ACFTA and CPFTA used time fixed model. ATE: Average Treatment Effect.

Since the ACFTA, CPFTA, CNFTA and CKFTA not be captured in the pair/country fixed model, the next table 9 do the summary of all FTA dummies added the results of ACFTA and CPFTA from time fixed model. In summary, in the time & pair fixed model, trade contraction effect of MHCEPA, export diversion and contraction effects of SCFTA, export diversion effect of CIFTA, import diversion effect of CCRFTA were found. Expansion effect of extra-bloc exports and imports of MMCEPA, pure trade creation in exports of CCFTA and CSFTA, pure trade creation in imports of PCFTA, intra-bloc trade creation effect of CAFTA and intra-bloc trade creation and export diversion of CGFTA. In the time fixed model, a pure trade creation effect of ACFTA and pure trade contraction effect of CPFTA were found.

According to the table 9, most FTAs have positive average treatment effect and net creation effect even much larger than the negative ones. According to the average treatment effect results, China's social welfare benefit from 6 FTAs (ACFTA, CCFTA, PCFTA, CSFTA, CAFTA and CGFTA) directly and loss of social welfare within 4 FTAs (MHCEPA, MMCEPA, CPFTA and SCFTA). For the net trade creation effect in terms of total exports, the total exports increased associated to 7 FTAs (MMCEPA, ACFTA, CCFTA, PCFTA, CSFTA and CGFTA) greater than the decreased correlated to 5 FTAs (MHCEPA, CPFTA, SCFTA, CCRFTA and CIFTA). Besides, though we are analyzing the trade creation and diversion effects of an FTA, the FTA utilization is still one of the most challenge that many countries or areas facing. According to the 2015 global trade management survey, only 30% companies can make full use of all FTAs that available to them (70 percent companies not fully utilizing FTAs), and 23 percent when scope expanded in 2016. The survey argues the challenges that hinder the full use of FTAs are complexity of rules of origin, gathering required documentation, and the lack of internal expertise.[28] According to the survey, the FTA utilization of Asia just at 21 percent lower than the Latin America which at 37 percent. And the FTA utilization rate (UR) is also a big challenge for China, as some Chinese researchers argued that the UR of China's FTAs are relatively low. Such as the UR of China-Peru FTA is 11.5%, UR of China-Singapore FTA is 16.3%, UR of China-New Zealand FTA is 9.2%, UR of China-Pakistan FTA is 16.1%, UR of China-Chile FTA is 19.7%, UR of China-ASEAN FTA is 35.6% the only one higher than 30%, UR of Mainland-Macao CEPA is 7.8% and Mainland-Hong Kong CEPA is 24.8%.[29] Although there are many FTAs signed by China at present, the utilization rate of FTAs by Chinese enterprises is relatively low, resulting in the fact that the FTAs have been reached have not fully played their role.

[28] Global trade management survey by Thomson Reuters and KPMG International.
https://assets.kpmg/content/dam/kpmg/pdf/2015/11/2015-global-trade-management-survey.pdf
https://assets.kpmg/content/dam/kpmg/xx/pdf/2016/10/2016-global-trade-management-survey-from-thomson-reuters-and-kpmg-international.pdf

[29] Yuzhu Wang and Minghui Shen. 2011. 'Research on the Implementation Effect of China-ASEAN FTA', International Economic Cooperation, 9. Maybe the larger creation effect of ACFTA comes from its highest UR.
http://www.ncpssd.org/Literature/readurl.aspx?id=35241535&type=1

Chapter 6 Conclusion and Further Research

6.1 Main Conclusions

In order to analyze the impacts of FTAs that China has signed and implemented already, the gravity model was introduced in this paper. And the gravity model estimating by applying the OLS and PPML method with three specifications-time fixed effect only, time & exporter/importer fixed effects and time & pair fixed effects model. Since the scope of this paper covers 32 economies annual export data from 1995 to 2019, including many developing economies that for some reasons missing more than one thousand trade value in this paper, estimating by PPML is preferred to the OLS when dealing with the zeros and heteroscedasticity. And the heteroscedasticity robust Regression Specification Error Test (RESET) also supports the previous paper that PPML is more appropriate than the OLS method. The time fixed and individual/pair fixed effect included to capture the time shocks and country-specific unobserved characteristics or dyad unobserved factors. According to the estimation results, coefficients of GDP for both i and j were positive and significant at 1% level as expected. The coefficients of population were negative in all regressions. The distance was significantly negative as expected. The language and border dummies were positive as expected. Coefficients of the SIM and FER were only significant at 10% level. A pure trade creation effect of ACFTA and a pure trade contraction effect of CPFTA were found in the time fixed only model. In the time & pair fixed model, trade contraction effect of MHCEPA, export diversion and contraction effects of SCFTA, export diversion effect of CIFTA, import diversion effect of CCRFTA were found. Expansion effect of extra-bloc exports and imports of MMCEPA, pure trade creation in exports of CCFTA and CSFTA, pure trade creation in imports of PCFTA, intra-bloc trade creation effect of CAFTA and intra-bloc trade creation and export diversion of CGFTA. According to above results, China's FTA agreements lead to greater positive trade creation effect than negative trade diversion effect. The calculation of average treatment effect (ATE) and net effects show that FTAs seem to benefit China's economy and welfare as a whole.

6.2 Policy Implications

These results suggest that China has benefited from trade creation because of FTAs. However, China and partners may need to improve the trade environment and strengthen the economic cooperation with each other under the frame of FTA that existed.

[1] Based on the view of basic variables: China, the second largest economy, has a good GDP foundation for economic and trade cooperation compared with other developing countries, China may need to choose FTA targets carefully. RCEP (Regional Comprehensive Economic Partnership) and BIT (Bilateral Investment Treaty) both are the excellent prospects for development cooperation, China may sign FTA with EU in the future after full cooperation of BIT in a long-term perspective. However, no matter the largest FTA ever or the possible future FTA with EU, negative population effect on exports should also be taken seriously when changing trade policy respectively.

[2] Based on the findings of FTA dummies: The largest creation effect among all

China's FTA is the ACFTA also the only one Plurilateral Agreement of China until 2019. The ATE and net effect of ACFTA also suggested that China and ASEAN should keep then enhance trade and economic cooperation with each other. It is early to say sign more Plurilateral FTA, like an FTA with EU, could be a good choice since ACFTA is the only one Plurilateral agreement but the hugest ATE and net effect still telling us a good story. When considering different FTA markets from a geographical point of view, it is not difficult to find that China's trade with Asia, Europe, Oceania, and Latin America all have larger creation than diversion effects for the time being at least. Nevertheless, results of CEPAs just suggested that Hong Kong was or is losing its trade advantages based on the regression results, China may need to adjust the industrial structure or consider the upgraded version of CEPA.

[3] China should try to improve the international competitiveness of its various products and reducing non-tariff barriers with trading partners. Due to the lack of experience in FTA cooperation in the early years and its own poor foundations for each FTA member, previous FTAs does not create much creation effects. China may still need industrial optimization and upgrading in future FTA cooperation. China and FTA trading partners can benefit more from FTAs if partners promote the FTA utilization by providing latest information of FTA or local trade policy to exporting companies and reducing the cost of gathering required documentation (FTA certificates of origin).

6.3 Further Research

[1] Model specifications and variables improvement. Exporter-year/Importer year fixed effects may be included in the further research for one single FTA after modification. Time-varying fixed effects model not included here due to the drawback as Magee (2008) claimed, trade diversion dummy cannot be accounted in this model and also the impact of some specific variables of interest. However, it is still one way to estimate and provide such a reference in this subject at least. Dispense with the variables that failed to explain. Variables such as exchange rate and infrastructure are supposed to be good choices to analyze impact factors of trade between China and other economies.

[2] Improve the model to find out the effects of CNFTA and CKFTA then try to estimate disaggregated trade of each FTA.

[3] Trade creation and diversion and trade potential issues of RCEP also be the next top priority since trade effects of RCEP are still ambiguous. As the biggest FTA that includes ASEAN-10 plus China, Australia, New Zealand, Japan and South Korea (ACFTA, CAFTA, CNFTA and CKFTA).

Appendix A

Table 10 Summary of Previous Empirical Studies of Gravity Model on International Trade

Authors	Field	Variables (Excluded basic three)	Methods	Main Findings
Haveman and Hummels (1998)	European Community (EC), European FTA (EFTA)	Adjacency, Language, region 1, region 2	Standard Gravity with controlling for the omitted variables bias problem by adding multilateral trade directly.	Trade creation of EC for both intra- and extra- bloc.
Endoh (1999)	European Economic Community (EEC), Latin American Free Trade Association (LAFTA), Council of Mutual Economic Assistance (CMEA)	Population, Adjacency, Language, FTA^1_{ij}, FTA^2_{ij}, FTA^3_{ij}	OLS	Trade creation of EEC and CMEA, positive diversion of CMEA. Trade contraction of LAFTA and diversion of EEC and LAFTA.
Rose (2000)	Currency Union Economic and Monetary Union (EMU)	GDP per capita, Contiguity, Language, Colony, FTA_{ij}, CU_{ij}, Exchange rate	OLS	EMU have positive trade effect on bilateral trade.
Rose and Van Wincoop (2001)	EMU	CU, real GDP, real GDP per capita, language, border, FTA dummies, colony, Ex-colonizer, Political union dummy.	OLS	EMU have positive effect on both bilateral trade and welfare.

Clausing (2001)	Canada-US FTA(CUSFTA)	Tariff changes	OLS Year dummy	Trade creation of CUSFTA. Little evidence of diversion.
Soloaga and Wintersb (2001)	ANDEAN Community, CACM, LAIA, MERCOSUR, NAFTA, AFTA, GULF Cooperation Council, EFTA, EU	Population, Remoteness, land area, Border, Island, language, 3 PTA dummies	Tobit Time fixed	Export-diversion in EU and EFTA. Positive intra-bloc trade of LAFTA. Negative intra-bloc trade effect of AFTS.
Egger (2002)	EU/OECD	Bilateral Sum of GDP, Similarity, Relative Factor Endowments, Real Exchange Rate, Exporter/Importer Viability of Contracts, Exporter/Importer Rule of Law, Border, Language	Fixed/Random Model, Hausman-Taylor, AR(1), Time and bilateral effects	Traditional time-averaged cross-section gravity is misspecified. Cautiously comparing different time dimension estimation results. No way in predictions of trade potential.
Glick and Rose (2002)	Currency Union	Currency union dummy, GDP per capita, language, border, RTA dummies, country landlocked, number of islands, land areas, three colony dummies.	Panel/Cross sectional OLS fixed effects, GLS random effects	For pairs that join or leave the currency union, trade volume doubled or halved.

Filippini and Molini (2003)	East Asia Latin American	Population, Technological differences, region	OLS Fixed model	The technological distance is not a substantial barrier but also motivate economies to pursue and compete with more advanced economies.
Egger and Pfaffermayr (2003)	Proper specification	Population, Foreign currency reserves, Exchange rate, Border, Language	OLS Time and bilateral(pair) fixed effects	Exporter/Importer & time fixed and pair fixed effects should be included in gravity.
Martínez-Zarzoso and Nowak-Lehmann (2003)	Mercosur-EU FTA	Population, EU dummy, Mercosur dummy, Individual infrastructure, Income per capita, Exchange rate, Border, Language	Panel/Cross sectional OLS Two-way fixed	Positive intra-bloc trade effects. (not main object of the paper) Only evidence of exporter infrastructure can foster trade. Hence, no spillover effect or benefits were found for investors to invest to importer's infrastructure, cannot improve trade.

Roberts (2004)	China-ASEAN FTA (CAFTA/ACFTA)	GDP per capita, FTA dummy	OLS	No potential trade creation and diversion effects were found in ACFTA.
Rose (2004)	WTO effect on trade (GATT, GSP)	Population, Language, Border, Landlocked, Islands, Colonies	OLS Time fixed	Little evidence for GATT and not strong effect of GSP.
Egger (2004)	EU, EFTA, NAFTA	Bilateral GDP, Similarity index, Relative capital-labor ratio, High-skilled to low-skilled labor ratio, Transport costs, Exporter/Importer viability of contracts, Exporter/Importer rule of law, Exporter/Importer trade barriers	Hausman and Taylor OLS Exporter-time Importer-time Exporter-importer	Regional trade integration has no short-run impact on trade but a long-run creation effect.
Abraham and Van Hove (2005)	China ASEAN APEC Potential trade	population, real exchange rate, distance, Language (English, Chinese and Spanish)	OLS Exporter/Importer fixed	The establishment of an ASEAN+3(China, Japan and Korea) is a promising strategy. Large export potentials in RTAs for China's entrance.

Sohn (2005)	South Korea Trade potential of RTA	GDP per capita, trade complementarity, APEC	OLS	Significant unrealized trade potentials among Korea and China and Japan.
Carrère (2006)	EU, ANDEAN, NAFTA, CACM, MERCOSUR, ASEAN, LAIA	GDP per capita, population, border, landlocked country, level of infrastructure, exchange rates	Cross Section/Panel data OLS Bilateral & time fixed effects	Most of RTAs will cause trade creation but also along with trade diversion (decrease in imports and or exports with ROW)
Baier and Bergstrand (2007)	Trade effect ATE (average treatment effect)	Border, Language, FTA membership	Panel/Cross section OLS Fixed/Random fixed Pair & time fixed	Standard cross-section gravity estimation is biased. TE(ATE) is trustworthy.
Koo, Kennedy, and Skripnitchenko (2006)	AFTA, CAN, EU, NAFTA	Arable land, Border, Language, currency, colony, landlocked, 2 PTA dummies	Cross section OLS White's estimator	RPTAs have positive trade creation and diversion effects on agriculture trade. Trade creation of AFTA, diversion of CAN and NAFTA.

Bhattacharya and Bhattacharyay (2007)	India-China trade cooperation	GNP, GNP per capita, tariff rate, real exchange rate	GLS Random effects	Forming an FTA between China and India is beneficial for China, but disadvantageous to India.
Lee and Park (2007)	East Asia	GDP per capita, distance, country surface area, border, language, colonizer, colony, currency union, tariff, trade facilitation	OLS Random/Fixed model Country-specific/pair fixed effects	RTA of East Asia will create more trade among members if three conditions considered already.
Jayasinghe and Sarker (2008)	NAFTA	Population	Panel/Cross section OLS/GLS Fixed/Random model	NAFTA boost intra-bloc trade but decrease the trade with ROW.
Magee (2008)	RTAs CUs FTAs PTAs	Population, colony, adjacent, land area, common language	OLS fixed model Pair, time fixed Exporter/importer-year fixed effects.	Clear anticipatory effects of RTAs and effect continue for years. CUs generate the hugest long-run trade creation effect.
Lambert and McKoy (2009)	PTAs	Border, Language, Colony, GDP per capita, Arable land, Labor force	OLS	Trade creation of PTAs in agricultural goods.
Martínez-Zarzoso,	EU, NAFTA, CACM,	Language, Adjacent,	OLS	Trade creation of EU,

Felicitas, and Horsewood (2009)	CARICOM, MAGREB, EUMED	Islands	Time, exporter/importer, pair fixed model. Time varying fixed (country-and-time fixed) GMM	NAFTA, and CACM, import trade diversion of EU and export diversion of EUROMED.
Ekanayake, Mukherjee, and Veeramacheneni (2010)	ASEAN, BA, ECO, SAARC	RFE, SIM, border, language, colony	OLS Time & Country-specific fixed	Trade creation effect of ASEAN, BA, and SAARC.
Kabir and Salim (2010)	BIMSTEC	relative factor endowment, similarity index, real exchange rate, border, language	OLS Fixed/Random model	Positive trade effect of BIMSTEC.
Sun and Reed (2010)	ACFTA, COMESA, EU, NAFTA, SADC	Language, Border, Colony	OLS/PPML Fixed model Time, country-specific, pair fixed effects model. Classical three-way model	Agricultural trade creation of ACFTA, EU-15 and EU-25 and SADC. Import diversion of EU-15. Export creation of SADC.
Mölders and Volz (2011)	East Asia	Language, Border, Population, WTO FTA various stages	OLS FE/RE Pooled OLS, GLS, Tobit, Poisson,negative-binomial	Anticipatory of bilateral FTAs.
Sheng, Tang, and Xu (2012)	ACFTA	Two WTO dummies, Language, Border, Islands	OLS Pooled, Random, country-specific/pair fixed	Substantial trade creation for China and ASEAN.

Yang and Martinez-Zarzoso (2014)	ACFTA	Population, Border, Language	OLS MPML Random/Fixed model, Time & pair fixed, Country-and-time fixed	Substantial trade creation effect of ACFTA for both aggregated exports and disaggregated level.
Kahouli and Maktouf (2015)	EU-15, Economic and Monetary Union, the Arab Maghreb Union and AGADIR Agreement	DIFGDP, Population, Similarity index, exchange rate, Language, Border, Global financial crisis, Colony	OLS FE/RE	Trade creation of EU and EMU and AGADIR.
Kumar and Ahmed (2015)	SAFTA	Tariff rate, Border, Language, population, relative factor endowments	OLS Random model	Trade creation of SAFTA
Parra, Martínez-Zarzoso, and Suárez-Burguet (2016)	MENA EUROMED EFTAMED USAMED TURMED GAFTA AGADIR TUREU ISRCAN ISRMEX and JORSGP	Trade creation dummy of FTAs respectively	OLS Pair & Country-and-time fixed	N-S-FTAs more beneficial in terms of exports for MENA countries than S-S-FTAs
Khurana and Nauriyal (2017)	AIFTA	GDP per capita, language, border, colony	OLS/PPML Three-way model	A pure trade diversion effect of AIFTA.

Jagdambe and Kannan (2020)	AIFTA MERCOSUR EU-15, SAPTA, and NAFTA	Language, Border	OLS/PPML Time, Country-specific fixed	Trade creation effect of AIFTA, MERCOSUR, and EU-15 AIFTA, SAPTA, and NAFTA have larger creation than diversion.

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