BIRZEIT UNIVERSITY

A Partial and Counterfactual General Equilibrium Analysis For Three Different Trade Agreements Signed by China

تحليل التأثير الجزئي و آثار التوازن العام لثلاثة اتفاقيات تجارية حرة تم توقيعها مع الصين

Mai Ibrahim Yousef Zaghal

This Thesis was submitted in Partial Fulfilment of the requirements for the Master's Degree in Economics from the Faculty of Graduate Studies at Birzeit University

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Prepared by:
Mai Ibrahim Yousef Zaghal

Committee

Dr .Mohanad Ismael (Supervisor) ………………………
Dr .Tarek Sadeq ………………………
Dr .Adel Zagha ………………………

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List of abbreviation

ACFTA	Southeast Asian Nations- China Free Trade Agreement
AFTA	ASEAN Free Trade Area
ASEAN	Association of Southeast Asian Nations
BLN	Baseline
CES	Constant Elasticity of Substitution
CFL	Counterfactual
CPFTA	China- Pakistan Free Trade Agreement
EC	European Community
EU	The European Union
FEGLM	Fixed Effect Generalized Linear Models
FTA	Free Trade Agreement
GDP	Gross Domestic Product
GE	General Equilibrium
GeoDist	The Geographical Distance
GEPPML	General Equilibrium analysis with Poisson Pseudo Maximum Likelihood
GF	Gravitational Force
GTAP	Global Trade Analysis Project
IIT	Intra-Industry Trade
IMR	Inward Multilateral Resistance
ITPD-E	International Trade and Production Database for Estimation
MENA	Middle East and North Africa
MR	Multilateral Resistance
MRT	Multilateral Resistance Term
MTR	Multilateral Trade Resistance
NAFTA	North American Free Trade Agreement
NZCFTA	New Zealand- China Free Trade Agreement
HO model	Heckscher- Ohlin model
OMR	Outward Multilateral Resistance
PPML	Poisson Pseudo Maximum Likelihood
RTA	Regional Free Trade Agreement
TII	Trade Intensity Index
TRI	Trade Reciprocity index

Abstract

Globalization inflated an unprecedented growth in the world economy, fostered mostly by the Free Trade Agreements (FTAs). This study aims to assess the impact of these treaties on one of the largest economies, China. By dint of the gravity model, we examine the (a) partial effect and the (b) counterfactual general equilibrium (GE) effects of three FTAs, ASEAN- China FTA (ACFTA), China-Pakistan FTA (CPFTA), and New Zealand- China FTA (NZCFTA). Furthermore, this study analyzes the change in welfare, trade, and wages for these countries.
The FEGLM and GE gravity packages in R programming allowed us to examine global Panel data, for a period between 1990 and 2020. This unfolded into a one sector Armington-CES trade model.

The partial equilibrium effect of NZCFTA suggests that the FTA has a significant positive effect on both members, where on average the NZCFTA increases the trade between members by 80%. Whereas the CPFTA and the ACFTA showed a moderate increase in trade among their members. Nevertheless, the counterfactual general equilibrium analysis suggests that the welfare effects of the agreement are mostly negligible, especially for CPFTA. The results highlight that deeper integration among the ACFTA is crucial to bring about further welfare benefits to the member states.

Keyword: Gravity Model, FTA, ACFTA, CPFTA, NZCFT

تمهيد

أدت العولمة إلى نمو غير مسبوق في الاقتصاد العالمي ، والذي عززته في الغالب اتفاقيات التجارة الحرة. تهدف هذه الدراسة إلى تقييم تأثير اتفاقيات التجارة الحرة على الصين أحد أكبر الاقتصادات في العالم. من خلال استخدام نموذج الجاذبية ، قمنا بفحص (أ) التأثير الجزئي و(ب) آثار التوازن العام لثلاث اتفاقيات حرة، اتفاقية التجارة الحرة بين رابطة دول جنوب شرق آسيا والصين ، اتفاقية التجارة الحرة بين الصين وباكستان، اتفاقية التجارة الحرة بين الصين ونيوزيلندا. علاوة على ذلك، تحلل هذه الدراسة التغيير في الرفاهية والتجارة والأجور لهذه البلدان، حيث تم استخدام الحزم GE-Gravity، وFEGLM في لغة البرمجة R على بيانات المقطعية لفترة ما بين (١٩٩٠- ٢٠٢٠) بناء على نموذج تجاري قطاع واحد (Armington-CES).

يشير تحليل التأثير الجزئي للاتفاقيات أن اتفاقية التجارة الحرة بين الصين ونيوزيلندا لها تأثير إيجابي كبير على كلا العضوين ، حيث تزيد في المتوسط التجارة بين الأعضاء بنسبة 80 ٪، في حين أظهرت النتائج ان اتفاقية التجارة الحرة بين رابطة دول جنوب شرق آسيا والصين ، واتفاقية التجارة الحرة بين الصين وباكستان لها تأثير معتدل في زيادة التجارة بين الأعضاء. مع ذلك ، يشير سيناريو تحليل التوازن العام إلى أن تأثير تلك الاتفاقيات ضئيل على رفاهية دول الأعضاء. خصوصا في ما يتعلق اتفاقية التجارة الحرة بين الصين وباكستان. كما تسلط النتائج الضوء على ان دفع عمليه الدمج في اتفاقية التجارة الحرة بين رابطة دول جنوب شرق آسيا والصين يعد امراً حاسماً لتحقيق المزيد من مزايا الرفاهية للدول الأعضاء.

Chapter One: Introduction

1.1 Preface

There has been a significant increase of Free Trade Agreements (FTA) worldwide since the 1990s. According to the World Trade Organization (WTO), there are globally approximately 300 FTAs or Regional FTAs signed or under negotiation (Cimino-Isaacs and Fergusson, 2018). Since 2002, China has signed several FTAs to strengthen international economic cooperation. China's growth was essentially indigenous for many years, due to the country's isolation from the rest of the world. However, during the previous three decades, China has grown in importance as a part of the global trading system. China has become a significant exporter of merchandise trade, with China's entrance to the WTO being seen as a major milestone.

China began its Regional Free Trade Agreements (RTA) plan after joining the WTO in 2001. By 2022, China maintains 19 FTAs and is in negotiations with another 9 FTAs. Some of these FTAs have been signed with members from different regions, geographical areas, and with different levels of development.[1]

One of the first FTAs that China signed with a developed country was with New Zealand. Despite the fact that China and New Zealand are far apart, bilateral trade between the two countries is rapidly expanding. The FTA was signed in 2008, and its economic impact drew the attention of scholars, business leaders and the public

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

in both countries and around the world. The FTA includes mutual elimination of tariffs of each other's exports, allowing 96% of New Zealand's exports to China and all of China's exports to New Zealand to be free of tariffs by 2019 (M.F.A.T., 2019). Moreover, China has become the top trading partner of New Zealand, where 25% of New Zealand's total export destinations in 2018 were with China, while imports from China were valued by 20% of New Zealand's total imports.[2] Additionally, China has signed several FTAs with many developing countries, including Pakistan. China and Pakistan are close neighbors and have long maintained friendly, political, and economic relations. To strengthen these ties, China and Pakistan began negotiations on a free trade area in 2005, and reached an FTA in 2006, which entered into force in 2007.

The China-Pakistan FTA was divided into two phases, with Phase I ending in December 2012 and negotiations for Phase II beginning in July 2013. In the second phase, both countries are renegotiating the FTA as Pakistani manufacturers complained that the 2006 FTA had heavily favored China. Both sides have agreed on new principles to address concerns raised as a result of the China- Pakistan Free Trade Agreement (CPFTA) in 2006. By the end of 2015, imports from China to Pakistan reached around 25% ,up from a 9.7% in 2008. On the other hand, the percentage of Pakistan exports share in China reached 8.72% in 2015 ,up from a 2.99% in 2008 (Irshad, 2018). Following the adoption of the FTA, the trade imbalance has risen in favor of China. China has used the FTA in a sustainable

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[2] https://www.interest.co.nz/business/115554/nz-china-councils-don-mckinnon-says-trade-diversification-remains-important-ever-it

manner, taking use of around 57% of the available concessions. Following the introduction of the CPFTA, bilateral trade expanded by 325 % from 2008 to 2016. Chinese exports to Pakistan account for the majority of bilateral trade (Mukhtar, 2019). Furthermore, one the most important FTAs in the modern times is the one between the Association of Southeast Asian Nations (ASEAN) and the People's Republic of China, which geographically covers the ten ASEAN member states and the People's Republic of China, connecting two of the world's largest trading marketplaces.

The ASEAN- China FTA (ACFTA) has been in force since January 2010. Following the loosening of trade and investment barriers under the ACFTA, economic links between China and the ASEAN countries have become stronger. China-ASEAN trade has increased from US$292 billion in 2010 to US$475 billion in 2016. Hence, ASEAN is currently considered China's largest import source and third largest export destination after the United States and Hong Kong. Similarly, China is ASEAN's greatest source of imports and exports (Chiang, 2019).

This thesis contributes to our understanding of how FTAs increase the bilateral trade flows between the liberalizing members and to evaluate the partial and general equilibrium (GE) effect, where it is assumed to differ between and across FTAs.

1.2 Problem Statement

In the age of globalization, free trade agreements have significant effects on shaping countries' bilateral and multilateral relations, they also have impacts on the countries' trade status and social welfare. In addition to reducing or eliminating tariffs, FTAs also help address international challenges that would hinder the flow of goods and services; promote investment; and enhance the rules which organize the issues related to intellectual property, e-commerce, government procurement among others.

Furthermore, China is considered one of the most powerful economies and trade partners in the globalized world. Therefore, this study will explore the effects within and across FTAs in terms of impact on trade and welfare by taking three FTAs signed with China as case studies, the three FTAs are: China-New Zealand FTA, China- Pakistan FTA (CPFTA) and the ASEAN- China FTA (ACFTA).

The three case studies were selected with the aim of diversifying the cases to include, an underdeveloped country, a developed country, and an association of several countries. This will allow the study to compare the different results based on different variables.

To achieve this purpose, the study will address the following questions:

Main Questions:

1. What are the partial effects for each of the three different FTAs?
2. What are the changes in real wages, nominal wages, and welfare of the FTA members and non- members as a result of the China- ASEAN FTA, China- New Zealand, and China- Pakistan FTA?

Sub-questions:

1. Is there heterogeneity within and across the three different FTAs?

2. What are the different implications of a North- South, South- South FTA on bilateral trade flows of the countries' parties to the agreement?

1.3 Objectives of the study

The main objective of this study is to analyze the partial and general equilibrium comparative effects on three distinct FTAs, on their member, and non-member countries. The FTAs chosen for this study are China-ASEAN, China-New Zealand, and China-Pakistan. This study will examine the partial, conditional general equilibrium effect of the different free trade agreements. This implies evaluating the welfare, real wages, and nominal wage changes on member countries as well as non-member countries, within and across FTAs, as a result of altering trade policies following the signing of the FTAs.

1.4 Significance of the Study

Thus far, researches mainly focused on ensuring the use of the improvements of the robustness of the gravity model for analyzing trade flows among FTAs agreement on a group of countries, yet the empirical work that focuses on the effects of FTAs on trade flows, real wages, nominal wages, and welfare for a South- North and South- South FTAs is generally thin. Whereas examining the differences might provide significant insight into the International Trade Mechanisms for countries with various development status in these FTA.

Furthermore, the three different FTAs examined in this research were selected carefully to cover diverse geographical regions, with varying levels of the member countries’ development, and with the same time ranges in which they come into force.

Firstly, the Pakistan- China FTA was selected to present a case of a trade agreement between China and a developing country, and at the same time a South- South FTA, where both countries are considered developing countries according to “development classification” that is designed and updated by the United Nations. Nevertheless, the China-Pakistan FTA is a captivating case for an FTA since Pakistan has long had a trade deficit with China and the deficit was always increasing with time (Shah et al. 2020).

Secondly, The New Zealand-China Free Trade Agreement (NZCFTA), was selected to examine a free trade agreement between China and a non-Asian developed country. This FTA presents an intriguing case study of the effects of integrating two contrasting countries in South- North cooperation. New Zealand is a developed country, with a small population but high per capita income. China, on the other hand, is a developing country with a huge population and a relatively low per capita income. Both countries do not share a common language or similar culture and they are not close to each other geographically.

Thirdly, the China- ASEASN FTA was selected to examine the case of FTA signed between China and an association of countries. This FTA deserves special attention since it represents a significant step forward in East Asian economic integration. Taking into consideration that some of the RTA members already have an FTA with China (Chirathivat, 2002).

1.5 Methodology of the Study

This paper uses the Gravity model, a well-known econometric model in international trade; the name derives from its use of the gravitational force concept as an analogy to explain the volume of bilateral trade flows, and it was initially introduced by Tinbergen in 1962 (Shepherd, 2013). This empirical model is used for analyzing the trade flows between countries, by explaining a trade-related dependent variable using a combination of country-specific macroeconomic variables. Moreover, indicators of general market access variables and the costs of transportation between the two countries are often included.

In this paper we use the structural gravity models to estimates the general equilibrium (GE) effect and simulate counterfactual experiments. Of which, estimating the general equilibrium (GE) is a recent but growing trend. This is done by first, computing theory consistent estimates of the structural multilateral resistance terms of Anderson and van Wincoop (2003) from standard econometric gravity results. Second, simulating the GE effects from counterfactual experiments as a result of changing the trade costs after signing a FTA. The model is used on aggregate level trade. Moreover, the latest developments in the structural gravity literature are used to obtain estimates of bilateral trade costs and trade policies in the presence of exporter-time and importer-time fixed effects.

The analyses were done in R, specifically using the "ge_gravity" R package to solve for general equilibrium effects of changes in trade policies using a one sector Armington-CES trade model.

1.6 Scope of the Study

The scope of this study will be on the China- ASEAN FTA, China- New Zealand FTA, and the China- Pakistan FTA. The core contribution of this work is an econometric and simulation analysis that applies panel data to the gravity model. It will take into consideration the international trade flows which require data on bilateral trade of the FTAs, distance, and possibly additional determinants of bilateral trade such as contiguous borders and common language. The database covers the period from 1990 to 2020, where the analyses will be mainly done using the GE Gravity; FEGLM package in R programming language.

1.7 Study plan

This study is organized as follows: Chapter 2 reviews the literature. Chapter 3 introduces the theoretical framework which includes a description of the theories applied in this thesis. Chapter 4 presents a detailed description of the model and methodology. Chapter 5 covers the descriptive analysis. Chapter 6 examines the empirical results. Lastly, chapter 7 presents the conclusions and policy implications.

Chapter Two: Literature Review

Given the fast spread of FTAs during the 1990s, a growing number of studies have tried to use the gravity model to examine the impact of different FTAs. Tinbergen (1962) was the first scholar to examine the international trade flows using a gravity equation; the econometric approach included examining the impact of FTA on trade by using a dummy variable. His findings suggested that FTAs had insignificant "average treatment effects" on trade flows. Since then, results have been mixed. For example, Frankel et al. (1995), and Frankel (1997) examined the effects of major FTAs, such as the European Union (EU), The North American Free Trade Agreement (NAFTA), The Southern Common Market (MERCOSUR), and the ASEAN Free Trade Area (AFTA), and found significant positive effects on intra-FTA trade in the cases of MERCOSUR and AFTA but not in the cases of the EU or NAFTA. Aitken (1973), Abrams (1980), Brada and Mendez (1985) found the European Commission (EC) to have an economically and statistically significant effect on trade flows among members, whereas Bergstrand (1985) and Frankel et al.(1995) found an insignificant effect. One of the main reasons for the contradictory results is the lack of a theoretical foundation in using the gravity model. Thus, many studies that used the gravity model as a framework suffered from shortcomings that have been brought to light in recent years by leading scholars in the gravity model. Therefore, scholars such as Yotov (2016) wrote a user guide on the right way to use the gravity model, followed by Shepherd (2022) who states in his booklet that: *"fast forward to 2022, the landscape for gravity modeling has completely changed. It now is (or should be) impossible to publish a* *gravity model in a credible journal without a theoretical foundation*".

Therefore, papers that suffer from these shortcomings are unreliable and suffer from biased estimates and hence cannot show the real effect of an FTA. The methodology used in many research from the classic literature either fail to account for endogeneity or fail to control for multilateral resistances, or in certain cases, the database used to build the model does not include internal trade flows. The recent developments in the literature allowed the use of gravity in a way that is consistent with its theoretical foundations (e.g: Dai, Yotov, and Zylkin 2014, Baier, Yotov, and Zylkin 2019, Vaillant, Flores, and Moncarz 2020). For instance, Yotov (2021) highlighted almost 15 reasons why there is a need to use domestic trade flows in the gravity model. He explains that the direct reason for using intra- national trade is the change in international trade that comes at the expense of internal trade. Considering the same theoretical foundation, Baldwin and Taglioni (2006) has revealed how not to fall in what they call "the golden mistake" of which studies can get biased estimates due to the lack of control for multilateral resistances. Moreover, Egger and Nigai (2015) point out that the issue of endogeneity can be addressed by using a country- pair fixed effect. In addition, Silva and Tenreyro (2006) were the first to propose the need to use the PPML (Poisson pseudo-maximum likelihood) estimator to account for non-linearity and heteroscedasticity in the data as well as zero trade flows.

This thesis will address these shortcomings that are mentioned above and apply the gravity model based on recent research to give more accurate estimates. In addition this study capitalizes on the latest contributions of the partial and the general equilibrium effects literature which were first put forward by Anderson et al. (2015) and further developed by Yotov et al. (2016) and Baier, et al. (2019).

Moreover, studies that used the gravity model of international trade with PPML estimators with the recent literature, supports the hypothesis which indicates that FTAs have an average positive effect on the liberalizing members. In fact, Yotov and Zylkin (2019) have developed a novel methodology where they obtained estimates of different agreements of interest for each direction of trade, using a "two stage" estimation procedure for studying heterogeneity in the effects of FTAs. They use theory-guided indices to exploit variation for FTA partial effects. They assume that "trade frictions are induced by trade policies and domestic regulations, pairs of countries with higher levels of trade frictions ex- ante should have more potential for larger FTA partial effects ex- post, countries with less "market power" over their own terms of trade should grant relatively smaller concessions when they sign FTAs, because they are likely already close to their "politically optimal" set of trade policies. Based on the FTA sample, they concluded that FTAs have a statistically significant effect. In fact, 53.9% of the sample has a statistically significant positive partial effect. While examining how the same agreement can have different effects on the pairs of countries that signed the FTA, they found that most of the heterogeneity (two- third) happens within FTAs rather than across different FTAs (Baier et al. 2019).

This thesis will further address the potential different effects of a North- South FTA. Some attempts have been made to study the impact of FTAs between developed and developing countries (North– South agreements). Huijskens (2017) used the gravity model to analyze the trade data of developed and developing countries. The result suggests that the higher the two countries' development gets the more it will increase the effect of FTAs on trade flows. However, if the exporting country has a higher development status than the importing country, then the trade will increase. On the other hand, a lower development status for the exporting country and higher a development status for the importing country may lead to either an increase or decrease in the trade based on the relative difference in the level of development of the two countries. Cieslik and Hagemejer (2009) in their study on the EU–Middle East and North Africa (MENA) trade found that Euro-Mediterranean free trade agreements raises exports from the EU to MENA but not in the opposite direction. Trefler (2004) analyzed perhaps one of the most important North- South trade agreements, the North- American FTA (NAFTA), and found that the agreement had a positive and significant impact on Mexico’s trade. However, other studies by Carrere and De Melo (2004) show that Mexico’s access to the US market was very limited. Behar and Cirera-i-Crivillé (2011) used the gravity model in their analyses to distinguish between the three development statuses for countries involved in a FTA; the results were statistically significant, showing that FTA had a positive impact on trade in all the three cases. However, The North- South agreements showed much lower coefficients than South- South agreements.

As for the literature that evaluates the three FTAs that were selected as case studies, most of the research found an overall positive trade effect for the ASEAN- China Free Trade Agreement. For instance, Yang and Martinez-zarzoso (2013) in their research suggest that the aggregate data confirmed positivity and effectiveness of lowering and removing tariff barriers in ACFTA that contributed to the total trade volume between inter-bloc countries, as well as between intra-bloc and extra-bloc countries.

When the ACFTA effect is calculated for different products, there are remarkable trade creation and diversion effects in exports for manufactured commodities and chemical products, but not for agricultural raw materials, machinery, and transportation equipment. On the other hand, the Pakistan- China FTA effect has had mixed results. The CPFTA has had a direct impact on the exports and gross domestic product (GDP) growth of Pakistan. Mukhtar (2019) using two stages least square technique finds that the bilateral trade agreement has benefited both sides but with an immense skewness in favor of China since it was in a better position to utilize the concession available under the FTA, whereas Pakistan did not capitalize on the concessions under CPFTA in result of improper planning and consequently missed the opportunity to increase its exports to China. Moreover, a study that was carried out by the Pakistan Business Council reviled that exports from Pakistan to China were only focused on 350 products out of 7,550 products that were covered under the CPFTA (Afraz and Mukhrat, 2022).

As for the ex-post effect of the NZCFTA, Bano (2014) studied New Zealand and China relations over the 1980- 2012 period. The author uses three methodologies for this study to analyze the FTA impact: the Trade Intensity Index (TII), Trade Reciprocity Index (TRI) and Intra-Industry Trade (IIT). The data indicates the FTA between New Zealand and China in 2008 has led to a significant economic growth in trade for both countries. In contrast, Li, Shao and Chen (2008) have discussed the influences of the NZCFTA by constructing the Global Trade Analysis Project (GTAP) model and argued that China would suffer negative impacts on GDP and welfare, while New Zealand on the other hand would get positive impacts on GDP and welfare. China’s trade terms would deteriorate by 0.03 percent, while New Zealand's would improve by 0.3 percent. However, it appears that no study in the reviewed literature applies the general equilibrium comparative analysis.

Chapter Three: Theoretical Framework and the Model

3.1 Theoretical Framework

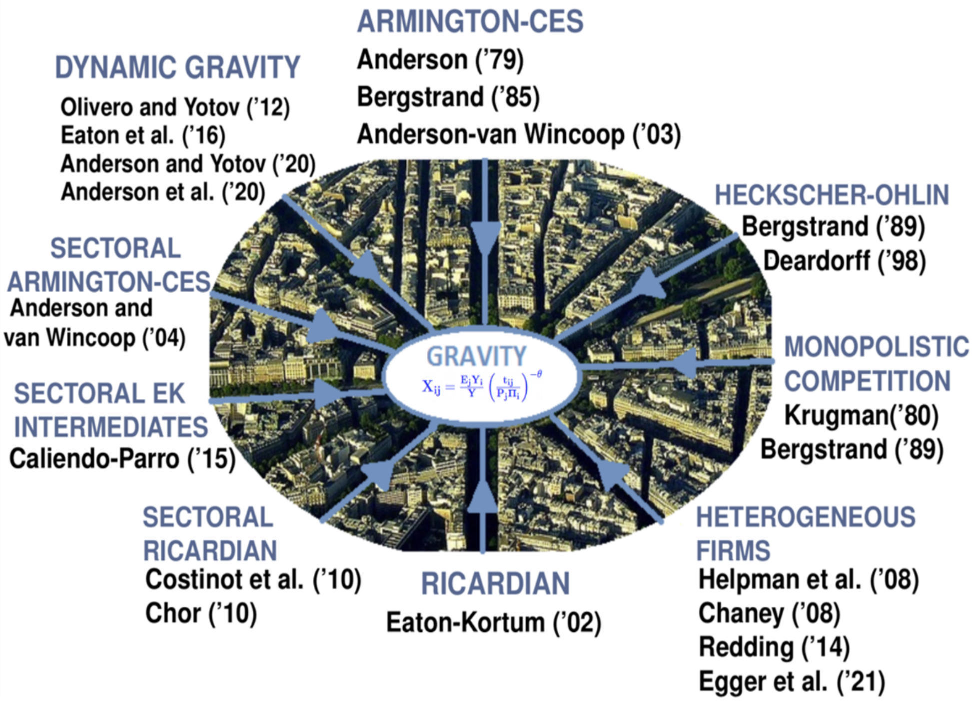
The gravity model of international trade is a structural model with a solid theoretical foundation. In fact, there are a variety of theoretical foundations such as Ricardian, monopolistic competition, Armington, perfect competition, and firm heterogeneity. All these theories can be driven from the same gravity model equation. For instance, Bergstrand (1985 and 1989) shows that a gravity model based on monopolistic competition theory, while Eaton and Kortum (2002) uses the Ricardian model to obtain the gravity model equation, and Melitz (2003) and Helpman et al. (2008) drives the gravity model using firm heterogeneity. Shepherd (2022) in his booklet shows how to derive the gravity model from the Armington, Ricardian, and Heterogeneous firm theories to get to the exact specification of the gravity model.

$$X_{ij} = cY_i^{\alpha}Y_j^{\beta}t_{ij}^{e} \qquad (3\text{-}1)$$

Where, X_{ij} is exports from country i to country j. On the right-hand side, we have a constant (c), and Y_i, Y_j are the GDP for the exporting and the importing countries, and trade costs t_{ij}.

Yotov in figure 1 used a map for Paris, to describe how most of trade theories leads to same gravity model equation ,In the same context of using the phrase “ All roads lead to Rome” which means that all methods leads to the same results.

Figure 1: All roads lead to... gravity



Source: Yotov, Y. V. (2022). Gravity at 60: A celebration of the workhorse model of trade

3.1.1 Theory of Comparative Advantage

In the late 18th century, Smith was the first to develop the concept of absolute advantage in his book "The Wealth of Nation" published in 1776, he indicated that countries should specialize in producing and selling goods in which have absolute advantage. However, Smith's theory was unable to explain why nations without an absolute advantage benefited from international trade. A century later, Ricardo represented "the comparative advantage theory" in his book "On the Principles of Political Economy, and Taxation" published in 1817. The basic model of international trade has been called the Ricardian trade model, after Ricardo. The model suggests that the differences in the productivity of labor, due to the differences in technology across countries, cause productive differences. The comparative advantage theory suggests that countries should specialize when they have a relative or absolute superiority in producing goods or services with lower opportunity cost. Thus, the theory of comparative advantage mainly explains the reason why countries engage in international trades (Starck, 2012). Furthermore, Costinot et al. (2012) have used structural gravity to develop a strict measure of comparative advantage. The general framework has been used to construct a gravity model where he was able to separate the technology in an accurate way, using an exporter fixed effect.

3.1.2 The Heckscher-Ohlin (HO) Model

The Heckscher-Ohlin model (HO model), also known as the Factor Proportion Theory of International Trade, was developed Heckscher and Ohlin (1991). The model has adjusted the simple Ricardian model by adding capital as another factor of production besides labor; the HO model is a perfect competition model which suggests that each country holds a specific factor endowment that can be either relatively capital or labor abundant. Its production can either be of relatively capital or labor intensive. A relativity “capital-abundant” country will export “capital-intensive” products, and a relativity “labor- abundant” country will export “labor-intensive” products. Concurrently, each country will import goods that are insufficient or that use the countries' relatively scarce factors. In fact, the model mostly explains inter-industry trade (Rautala, 2015). This theory argues that developed countries will probably have more capital rather than labor and developing countries will probably have more labor-abundance (Anggoro, 2018). Thus, to demonstrate how the gravity equation can be driven from the HO model, Bergstrand (1989) developed a general equilibrium model with two differentiated-product industries.

3.1.3 Monopolistic Competition Model

Edward Chamberlin in 1933 developed the theory of monopolistic competition, and at the same time Joan Robinson developed the imperfect competition theory (Khan, 2011). However, Robinson gave only the graphical analyses for the monopolistic competition model, and it was not until the 1970s that a mathematical formulation for the Chamberlinian model was given by Lancaster (1974, 1979), Spence (1976) and Dixit and Stiglitz (1977) with a tractable formalization (Neary, 2004). Paul Krugman (1979) adopted a trade model with monopolistic competition based on a Dixit and Stiglitz (1977) aggregation of firm-level varieties and proposed a theory behind the reason why countries engage in trade even if they have similar technology and similar factors endowments, Krugman introduced the economies of scale into trade theory, showing that the production at a larger scale can be achieved at a lower cost.

3.1.4 New Trade Theory

New trade theory was established in the 1980's by plentiful researchers such as Krugman, Lancaster, Helpman, Markusen and many others. While the motivation behind the development of the new trade theory arises from the fact that classical theories only attempt to explain the reasons why different nations trade with each other, it fails to explain why nations with similar factors of endowments trade with each other, such as the intra-industrial trade between countries with similar economies. However, the new trade theory attempts to explain the world's trade based on the logical corollary of economies of scale, imperfect competition and product differentiation thereby it weakens the classical assumptions of perfect competition and constant return to scale (Krugman and Obstfeld, 2003). The new trade theory can successfully explain why countries trade with each other all over the world, but it cannot simply answer the size of that trade.

3.1.5 Armington Assumption

The Model was initially introduced by Anderson (1979) demonstrating how each country produces various and distinct goods, but consumers would prefer to consume certain goods from all countries, regardless of price. In such cases utility based on constant elasticity of substitution (CES). On both the demand side and on the production side, and under perfect competition, assuming labor as the only factor of production, and countries would have unique goods. Thus, the trade costs take the form of an iceberg. Therefore, using these assumptions it is possible to derive the gravity model equation from the Armington- CES framework.

3.1.6 Firm Heterogeneity

Melitz (2003) was the first to introduce and look at firm heterogeneity in productivity, based on general equilibrium, monopolistic competition models. Afterwards, Helpman et al. (2008) developed a model while building on the work of Melitz in 2003. In their model, firms face fixed and variable costs of exporting. This value of trade costs can reduce the amount that a firm in the origin country exports. On the other hand, fixed trade costs are strongly connected with zero trade costs. It confirmed that firm production varies, however only the most productive enterprises will profit from exporting. Furthermore, this model has the ability to explain uneven trade flows between country pairs. Helpman et al. (2008) developed a two-stage procedure that can be used to develop this model (with consistent estimates of the value of trade). The extent of enterprises' entry into an export market, which is an unobserved variable in the gravity equation, is estimated using a fixed effects probit equation in the first step of estimation, which creates what, is called *"incidental parameters pr*oblems". The first stage gives a gravity model with positive trade values, and these results are used in the second stage to solve the problem occurred from the omitting zero trade flows by correcting the sample selection bias. Moreover, the unobserved share of firms selecting into the export market can be further be estimated.

3.2 The Gravity Model

The gravity model has become a popular econometric model that is used to explain bilateral trade flows between two countries that cannot be solved by other economic theories. The aim of this section is to provide an evolution of the first and earliest foundation of the trade gravity theory until recent times. Thus, we start by giving a historical perspective on the roots of the gravity theory. Lastly, we demonstrate how to derive the partial and general equilibrium effect of FTAs using the gravity model.

3.2.1 The Ontology of the Gravity Equation (1885-1962)

This equation was first introduced by Newton (1687) in his book “The Law of Universal Gravitation”. According to Newton the gravitational force GF_{ij} between two masses M_i and M_j is indirectly proportional to the product of their masses and inversely proportional to the square of the distance D_{ij}that separates them (Newton, 1687).

$$GF_{ij} = \frac{M_i M_j}{{D_{ij}}^2} \quad (3\text{-}2)$$

Hence, Newton was the first one to use the gravity equation in physics. Later on, many researchers were inspired by his work and used it to explain international trade flows, and because of the similarity of the equation to Newton’s law; it was given the name “gravity model”, although the gravity model replaces masses with GDP and objects with countries (Shahriar, 2019).

3.2.2 Beginning of the Traditional Gravity Model (1862-1966)

The first gravity model of international trade was presented by Tinbergen in 1962; the first winner of the Nobel Memorial Prize in Economics in 1969, where he used a mathematical analogies between economics and physics, based on the Newton’s universal law of gravitation, he described the patterns of bilateral aggregate trade flows between two countries A and B, as *“proportional to the gross national products of those countries and inversely proportional to the distance between them”* (Tinbergen,1962: Chaney, 2018). Initially, Linder (1961) suggests that countries with more similar demand are more likely to trade more with one another.

Tinbergen (1962) used the gravity model to analyze foreign trade flows, but all of their papers were purely empirical, in which they only gave the initiative justification for using the model, and the theoretical justification for describing trade flows using the gravity equation was insufficient. Later, many researchers provided a variety of rigorous theoretical foundations, noteworthy the work of Pulliainen (1963), and Linnemann (1966), in which they attempted to estimate the model using different sets of variables and conditions, leading to the further development of the empirical foundations for the gravity equation.

3.2.3 The Theoretical Foundations of the Gravity Model (1966-2003)

"The emergency of the new trade theory in the late 1970s and early 1980s started a trend where the gravity model passed from having too few theoretical foundations to having too many" (Baldwin and Taglioni, 2006).

James E. Anderson (1979) was the first to drive a theoretical justification for the gravity model by country-of-origin assumption, commonly referred to as the Armington assumption and Elasticity of Substitution preferences (Anderson, 2011) Armington (1969), wrote his article "A theory of Demand for products, distinguished by place of production", accordingly, the fundamental assumptions of his paper argue that each good can be differentiated by their place of production. He also suggests that the same goods produced in different nations are assumed to be imperfect substitutes in demand (Armington, 1969). Anderson has shown that the gravity model can demonstrate trade flows by the economic sizes of the country. His work helped explain the existence of income variables in the gravity equation

(Starck, 2012). However, Anderson paper did not have a great influence until a series of papers published by Bergstrand (1985, 1989, and 1990) where he adopted the approach of Anderson, and pointed out the importance of adding the GDP deflators to account for price indexes in the gravity model. Bergstrand (1989) on the other hand, used the new trade theory of the monopolistic competition model as a microeconomic approach to derive the gravity model to provide a theoretical justification for the model. In his work, the firm's type product differentiation replaces the Armington assumption. Helpman and Krugman (1987) focused on comparative advantages with the assumption of monopolistic competition, and on the Heckscher-Ohlin and Ricardian framework to analyze the gravity model. Helpman (1987) established the link between the gravity model and the monopolistic competition model of new trade theory (Helpman, 1987). Deardorff's (1998) pointed out the consistency of the gravity model of various trade models such as the increasing returns to scales, the HO model, and the Ricardian model. In his work he refers to the ability of the gravity model to explain trade flows stating that: "*I suspect that just about any plausible model of trade would yield something very like the gravity equation*" (Deardorff, 1998). In Anderson and van Wincoop (2001, 2003) the gravity model is essentially a demand function. Meanwhile, Eaton and Kortum (2002) derive in a modern version of a similar gravity equation to Anderson under the Armington assumption of trade driven by Ricardian comparative advantages (Rautala, 2015).

3.2.4 The Revival of the Gravity Model (2003- present)

The theory- consistent gravity model of aggregate trade that is based on the work of Anderson in 1979, on specifying the expenditure function to be a CES function that has been modified and refined by Anderson and Van Wincoop (2003) and can be written as follows:

$$\frac{X_{ij}}{E_j} = \left(\frac{\beta_i p_i t_{ij}}{P_j}\right)^{1-\sigma} \quad (3\text{-}3)$$

Where X_{ij} is exports from country i to j, and P_j is the CES price index, E_j is the total expenditure in j, σ denotes the CES parameter, β_i is the distribution parameter for varieties shipped from i, P_i is their factory gate price and $t_{ij} > 1$ is the trade cost factor between origin i and destination j (Anderson, 2010). The CES consumer price index is given by:

$$P_j = [\textstyle\sum_i (\beta_i p_i t_{ij})^{1-\sigma}]^{\frac{1}{1-\sigma}} \quad (3\text{-}4)$$

The other building block in the structural gravity model is market clearance: at delivered prices $Y_i = \sum_j x_{ij}$ which denotes the value of world output, multiplying both sides of (3 -3) by E_j and summing over j yields then defining the denominator as $\pi_i^{1-\sigma} = \sum_j \left(\frac{t_{ij}}{P_j}\right)^{1-\sigma} E_j/_Y$ gives the following:

$$\beta_i {p_i}^{1-\sigma} = \frac{Y_i/_Y}{{\pi_i}^{1-\sigma}} \quad (3\text{-}5)$$

Thus, substituting into (3 - 3) and (3 -4) yields the structural gravity model:

Direct Partial Effect (PE):

$$X_{ij} = \frac{Y_i E_j}{Y} \left(\frac{t_{ij}}{\pi_i P_j}\right)^{1-\sigma} \quad (3\text{-}6)$$

General Equilibrium:

$$\pi_i^{1-\sigma} = \sum_j \left(\frac{t_{ij}}{P_j}\right)^{1-\sigma} \frac{E_j}{Y} \tag{3-7}$$

$$P_j^{1-\sigma} = \sum_i \left(\frac{t_{ij}}{\pi_i}\right)^{1-\sigma} \frac{Y_i}{Y} \tag{3-8}$$

Here, X_{ij} are bilateral trade flows from exporting country i to importing country j. Y_i denotes the value of total production in i, and Y is world output. Equation (3-6) predicts that international trade (gravitational force) between two countries (objects) increases with the product of their sizes (masses) and decreases with the trade costs (the square of distance) between them.

π_i, P_j in (3-7) and (3-8) denote the structural outward and inward multilateral resistance terms that take into consideration the fact that bilateral trade between two countries is affected not only by their sizes and bilateral trade expenses, but also by how isolated or remote each country is from the rest of the globe. Thus, the degree of competition that exporters must contend with is captured by the outward multilateral resistance (OMR) and the dependence of imports into country 'i' from country j on trade costs across all potential suppliers is captured by inward multilateral resistance (IMR).

However, the Multilateral Trade Resistance (MTRs) are omitted variables from the intuitive model. As they are unobservable and cannot be collected by national statistical institutions as numerical data, thus MTRs is not directly included in the model. The interpretation of low MTRs is that the country is remote from world markets. Thus, remoteness can be determined by physical factors such as long distance from large markets as well as policy factors such as high trade costs (Yotov et al. 2016). The time indexes were omitted from equations for simplicity. Thus, variables in the equations can vary over time.

Researchers have used different methods to capture the MTRs effect; Anderson and van Wincoop (2003) estimated The MTRs using 'remoteness indexes' which are weighted averages of bilateral distance, with GDPs serving as weights (Egger et al. 2020). The approach used in this thesis follows the steps of Olivero and Yotov (2012), where they advise to account for MTRs by using the exporter-time and importer-time fixed effects in a dynamic gravity estimation framework with panel data.

3.2.5 General Equilibrium Effects

This thesis examines the general equilibrium responses of trade flows to changes in trade costs, along with the welfare and efficiency gains from FTAs following the method in Baier, Yotov, and Zylkin (2019) , where we can estimate the general equilibrium effects of an FTA and simulate counterfactual experiments. Obtaining the General equilibrium estimates involve solving equations with the theoretical gravity equation of international trade:

$$X_{ij} = \frac{A_i w_i^{-\theta} \delta_{ij}^{-\theta}}{\sum_i A_i w_i^{-\theta} \delta_{ij}^{-\theta}} E_j \tag{3-9}$$

In the Equation, the exports from country i to j directly depend on A_i, where for the exporting country, A is the technological parameters, and w_i is the wages paid in exporter country, E_j is expenditure in country j, and trade cost are iceberg δ_{ij} from shipping goods from export to import country, the trade elasticity is captured by

θ and it is constant and $\theta > 1$. As can be seen from the equation, the costs are relative to all factors of cost that sum from all other exporters (the sum of costs is in the denominator). Assuming that the factor of production is only labor under perfect competition; therefore, the expenditure can be written in the following equation:

$$E_i = w_j L_j + O_j \tag{3-10}$$

In the equation w_j is wage, the exogenous trade balance is O_j , and the Labor is L_j. In the general equilibrium model, labor income should be equal to shipments of a country across all destinations ($Y_i = w_i L_i = \sum_j X_{ij}$). As a result of Equations (3-9) and (3-10), the total output of country i can be written as:

$$w_i L_i = \sum_j \frac{A_i w_i^{-\theta} \delta_{ij}^{-\theta}}{\sum_i A_i w_i^{-\theta} \delta_{ij}^{-\theta}} \left(w_j L_j + O_j\right) \tag{3-11}$$

The equation $P_j = [\sum_i A_i w_i^{-\theta} \delta_{ij}^{-\theta}]^{-\frac{1}{\theta}}$was first introduced by Anderson and van Wincoop (2003) as the inward multilateral resistance. And $\sum_j \frac{A_i w_i^{-\theta} \delta_{ij}^{-\theta}}{\sum_i A_i w_i^{-\theta} \delta_{ij}^{-\theta}}$ is the share of j's total expenditure on goods that is produced in the exporting country. The final step is to solve these equations. If we denote the changes in wage (w), then w (f) is the function w′ ($\widehat{w}_i = w'_i / w_i$) . In which changes in Wage can be written as follows:

$$Y_i \widehat{w}_i = \widehat{w}_i^{-\theta} \sum_j \frac{\pi_{ij} e^{\beta FTA_{ij}}}{\widehat{P}_{ij}^{-\theta}} (Y_i \widehat{w}_j + D_j) \tag{3-12}$$

Now after calculating equation (3-12), GE changes in terms of total trade, welfare, wages, and real wages can be now be calculated.

After calculating for the general equilibrium effect, the output is as follows:

General equilibrium wages effect:

$$\mathrm{W_i} = {}^{\hat{E}_i}\!/_{\hat{P}_i} \tag{3-13}$$

General equilibrium real wages effect:

$$r\widehat{W}_i = {}^{\widehat{w}_i}\!/_{\hat{P}_i} \tag{3-14}$$

General equilibrium total trade impact:

$$\hat{X}_i = \sum_j \frac{\widehat{w}_i{}^{-\theta} e^{\beta FTA_{ij}}}{\hat{P}_j{}^{-\theta}} \hat{E}_j \tag{3-15}$$

Chapter Four: Data and Methodology

4.1 Data Source

Following Dai et al. (2014) and Anderson & Yotov (2016) the sample of this paper was expanded to include intra-national trade flows data, in addition to international trade flows. For this purpose, the US International Trade Commission's ITPD-E database was used, which includes intra-national trade flows. The idea of including intra-national trade is that FTA's may be shifting trade from domestic to international sales and, as a result, a downward bias will likely occur if FTA is being estimated using international trade only. The RTAs database was obtained from the French "Centre d'Etudes Prospectives et d'Informations Internationales" (CEPII) gravity database that was released in 2021. The database in this research covers approximately 243 countries and all their trading partners for the period of 1990- 2020. Finally, the CEPII GeoDist database is used to obtain all standard gravity variables such as distance, contiguous borders, common language, and colonial ties.

4.2 Econometric Issues

4.2.1 Zero Trade Flows

Zero trade flows are one of the major econometric issues related to estimating the gravity model. Since Tinbergen's first application of the gravity model in 1962 and up until recent years, the gravity equations with all its different uses have been widely estimated by OLS. However, because trade values are transformed into a logarithmic form while using OLS approach, eliminating all zero observations from the sample has resulted in biased findings, as Baldwin and Harrigan (2007) demonstrate that zero trade flows are possible due to poor trade between small and distant countries where tariffs and trade costs are high (Dianniar, 2013). Therefore, the widely used method of estimating the gravity model by OLS assumes that the zeros are randomly distributed, in which omitting these value observations does not have an effect, since they expect that these observations are not so informative. However, in the recent literature deleting these zero trade flows is highly not recommended by most scholars (Larch and Yotov, 2016).

The ideal solution to zero trade flows proposed in recent literature by gravity model specialists such as Yotov and Zylkin (2016) is to estimate the gravity model in a non-linear form using the Poisson Pseudo Maximum Likelihood estimator. Santos Silva and Tenreyro (2006, 2011) proposed the PPML estimator method for dealing with zero trade observations, PPML operates very well even when there is a high fraction of zeroes, as demonstrated by a Monte Carlo simulation.(Piermartini and Yotov, 2016).

4.2.2 Heteroskedasticity of Trade Data

It is well known that heteroskedasticity frequently affects trade data. The issue is significant because, as Santos Silva and Tenreyro pointed out (2006) *"in the presence of heteroskedasticity the estimates of the effects of trade costs and trade policy are not only biased but also inconsistent when gravity is estimated in log-*

linear form with the OLS estimator" (Piermartini and Yotov, 2016). This subject will be discussed in depth in section 4.3.1. As mentioned above, the use of the PPML estimator method can solve the problem with zero trade observations and account for heteroskedasticity bias.

4.2.3 Endogeneity of Trade Policy

Endogeneity issues often exist in trade data because trade policies are often correlated with an unobservable trade cost. Thus, in gravity models the issue may arise when estimating the impact of changes in trade policies, such as signing a new FTA, the simple explanation is that countries that signed an agreement are more likely to have a significant trade with each other and are more likely to be trading partners. If this is the case, then the gravity model may contain a correlation between the error term and the FTA dummy variable in the gravity equation because unobserved characteristics of some pairs of countries explain why countries with higher level of trade would most likely sign an FTA (Bacchetta et al. 2012).

Baier and Bergstrand (2007) argued that many studies assumed that FTA dummies are exogenous random variables. Thus, the empirical studies failed to account for endogeneity and failed to demonstrate the positive effects of FTAs on trade flows among member countries. Baier and Bergstrand (2007) suggested first-differentiating bilateral trade flows or using country-pair fixed effects in panel trade data, in order to account for or to eliminate. As highlighted in Yotov et al. (2016). There are two main reasons why it is highly advocated to use the country-pair fixed effects in gravity estimations. First, as previously stated, it absorbs any time-varying bilateral trade policy variables' potential endogeneity .e.g. free trade agreements. Second, any unobservable time invariant trade cost factor will be accounted for using the country-pair fixed. Having said that, using a pair fixed effects variable is the preferred choice for this thesis.

4.2.4 Multilateral Resistances (MRs)

The Multilateral Resistances are theoretically constructed in the gravity model. Therefore, they should be properly controlled in the model. If the researcher does not control for the MRs, this can lead to what Baldwin and Taglioni (2006) called “the golden mistake” (Yotov et al. 2016). Therefore, this thesis will control for the MRs in a proper way, where it is illustrated in the next section the econometric solution to proxy for the MRs.

4.2.5 Adjustment to Trade Policy Changes

It is reasonable to expect that a change in trade policy will not result in an immediate change in trade, as the adjustment is likely to take time. Therefore, it is important to adjust the data in a proper way to be able to observe this change. where it is illustrated in the next section the econometric solution to adjust for changes in trade policy.

4.3 Econometrics solutions

4.3.1 The Poisson Pseudo-Maximum Likelihood Estimator

The early traditional approach of estimating the gravity model equation was by applying the standard procedure of taking the natural logarithm of all the variables in the equation to generate a log linear gravity equation and then estimating the model with the ordinary least squares regression, more specifically building on Anderson and van Wincoop (2003) approach. However, in recent years many scholars have written about the issues of applying the OLS with the logged linearized gravity model. Santos Silva and Tenreyro (2006) demented in their paper that estimating the log-linearized gravity equation by least squares (OLS) could lead to significant bias. First, taking the log-log linear model makes it clear that the error term will take the logarithms form too. If heteroscedasticity is present in the error term, this can easily violate the first assumption of OLS, thus the OLS will give inconsistent parameter estimates, and in practice this may occur a lot. As, E (ln [εijt]) E (ln[y] ≠ ln (E[y]) since the variance error is included in the independent variables, the variance of the error term will depend on at least one of variables. Consequently, E (ln [εijt]) depends on the variance of the error term. Arvis and Shepherd (2013) and Fally (2015) conclude that the PPML estimator is best suited to applications of gravity models. Anderson, Larch and Yotov (2015) explain how the theory of consistent general equilibrium effects can be estimated by a PPML. Second, because of nonexistence of the natural log of zero, the log-linear model omits the zero-trade observations. The removal of zero-trade observations may lead to bias (Larson et al., 2018).

There are third-country effects of changes in trade costs. Viner's well-known analysis, for example, shows a clear potential for third country effects which mainly occur due to the trade diversion that occurs after signing an FTA.

4.3.2 Panel Data

Panel data is increasingly being used in gravity modeling (e.g. Melitz, 2007; Yotov 2016, and many others). Since the panel specification is far superior because the additional time series data points provide more degrees of freedom, which tends to give more accurate estimates. Panel data has the distinct advantage of allowing the modeling of variable evolution through time and space. Therefore, unobserved heterogeneity that is consequence of omitted variables can be controlled for using panel data. Thus, not controlling for these omitted variables can give bias results (Baltagi, 2008).

Furthermore, with panel data, country specific effects can be added as dummy variables to examine the time invariant unobserved trade effects. Moreover, it is easier to estimate the gravity model using panel data with fixed effect. However, using the exporter, importer and pair fixed effect in the gravity model means removing some theoretically important variables from the gravity equation such as common language, distance, contiguous borders, where we cannot establish the effect of these variables.

4.3.3 Multilateral Resistances (MRs)

According to the multilateral resistances, two nations will trade more with one another on average the more remote they are from the rest of the globe. Anderson and van Wincoop who published the famous paper "Gravity with Gravitas: A Solution to the Border Puzzle" in 2003 show the importance of using the MTRS, where the coefficients that determinates the trade flow will be biased if the unobservable MTRs is not controlled by properly. Hummels (2001) and Feenstra (2004) used an econometric treatment, of a country fixed effect, for both of the exporter and importer. Even though their treatment is powerful from an economic standpoint. However, the national institution impact cannot be identified by the country-specific fixed effects since the national institution impact is also a country-specific and thus perfectly collinear with the fixed effects. Researchers have used two different approaches to overcome this identification challenge. Some scholars, such as Anderson and Marcouiller (2002) and lvarez et al. (2018), have constructed bilateral institution variables as a combination of importer and exporter institutional indexes. This approach has the advantage of respecting the structural properties of the gravity model by allowing estimation with the appropriate set of exporter and importer fixed effects. However, the impact of national institutions on international trade cannot be directly identified using this method, for that reason, the interpretation of estimates of the impact of (bilateral) institutions on trade presents a challenge. At the cost of improperly accounting for the Multilateral Resistance Terms, other studies, such as Francois and Manchin (2013) have been able to assess the direct influence of national institutions on international trade. As a result, the estimates from these studies are most likely biased and under criticism.

The multilateral resistance terms π_{it} ,and P_{jt} are theoretical constructs and, as such, they are not directly observable. Hence, If not appropriately controlled for, there will be an omitted variable bias, as it was referred to by Baldwin and Taglioni (2006) as the "Gold Medal Mistake".

4.3.4 Allow for Adjustment in Trade Flows

Instead of using data pooled over consecutive years, it is recommended to use panel data with intervals (Yotov et al. 2016). Olivero and Yotov (2012) explain in their paper how using a 3- , 4- , and 5- year time interval gives similar results. Therefore, this thesis uses a 3 year interval to allow for the adjustment of changes in trade policy.

4.3.5 Include Intra-national Trade Flows

There are many reasons that demonstrate why intra- national trade must be included in the gravity model; this paper will only mention some of the main reasons why it is necessary to include intra- national trade. First, we include them for the model to be consistent with the gravity theoretical foundation. Second, Yotov and Zylkin (2014) make it clear that there is a trade diversion that affects intra-national trade because of FTAs. Moreover, using the intra-national trade helps in identifying the non-discriminatory trade policies. Nevertheless, it helps to capture the effect of globalization. With that being said, this thesis will use intra-national trade data along with international data in our database in this research (Piermartini and Yotov, 2016).

4.3.6 Include Time-Varying Fixed Effects

As recommended by Anderson and van Wincoop (2003), in this paper we will use an exporter-time and importer time fixed effects mainly to control for the unobservable multilateral resistances.

4.3.7 Include Pair Fixed Effects

As recommended by Anderson and Yotov (2014), this paper will use the pair fixed effect to solve the issue of endogeneity of RTA. Moreover, the observable and unobservable time-invariant that is directly related to trade cost can be also controlled by using the pair- fixed effect.

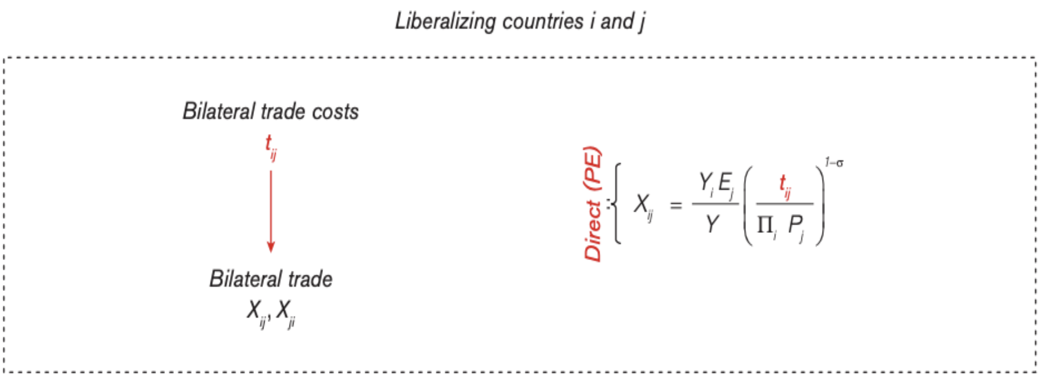
4.3 Methodology

This section describes both the regression specification and the empirical estimation strategy. As previously stated, this paper employs the gravity model using panel data. It uses Poisson-Pseudo Maximum Likelihood (PPML) with multiple high-dimensional fixed effects. The empirical strategy is based on the work of Anderson and van Wincoop (2003), Head and Mayer (2014), and Yotov et al (2016). The paper implements a structural gravity model that explains bilateral trade flows of exporters based on transaction costs and economic size, while controlling for MTRs and endogeneity issues. We follow the standard procedure in the literature using the methodology proposed by Santos Silva and Tenreyro (2006), i.e., a Pseudo-Poisson maximum likelihood estimating procedure, which allows properly dealing with zero trade values. Additionally, following Yotov (2012), and Larch et al. (2018), In order to account for any additional trade creation effects, the paper take into account the decision to sell abroad rather than domestically. This approach fits the purpose of this research, since it's the best practice solution to translate the gravity system given by equations (3-6)- (3-8) into the following empirical specification that is used to estimate the partial and general equilibrium effect of the three FTAs.

1. The Direct (Partial Equilibrium, PE) Effect

Partial equilibrium effect by definition means that the changes in trade policy have a direct effect only on the liberalizing members. Therefore, this can be seen as one of the limitations of the partial equilibrium effect, because it assumes that there is no effect on other countries due to change in trade policy. Thus, signing an FTA, which will lead to decreasing or removing bilateral trade costs between two liberalizing countries, can be seen as the most powerful effect on bilateral trade between two countries who aim to liberalize trade between them. In shown in figure 2, the change in trade cost is captured by a proxy t_{ij}, while holding the inward multilateral resistance (P_j), outward multilateral resistance (π_i), expenditure (E_j), and output (Y_i) constant. The partial (PE) effect will be obtained by equation (3- 6).

Figure 2: Partial Equilibrium equation (Yotov et al., 2016)

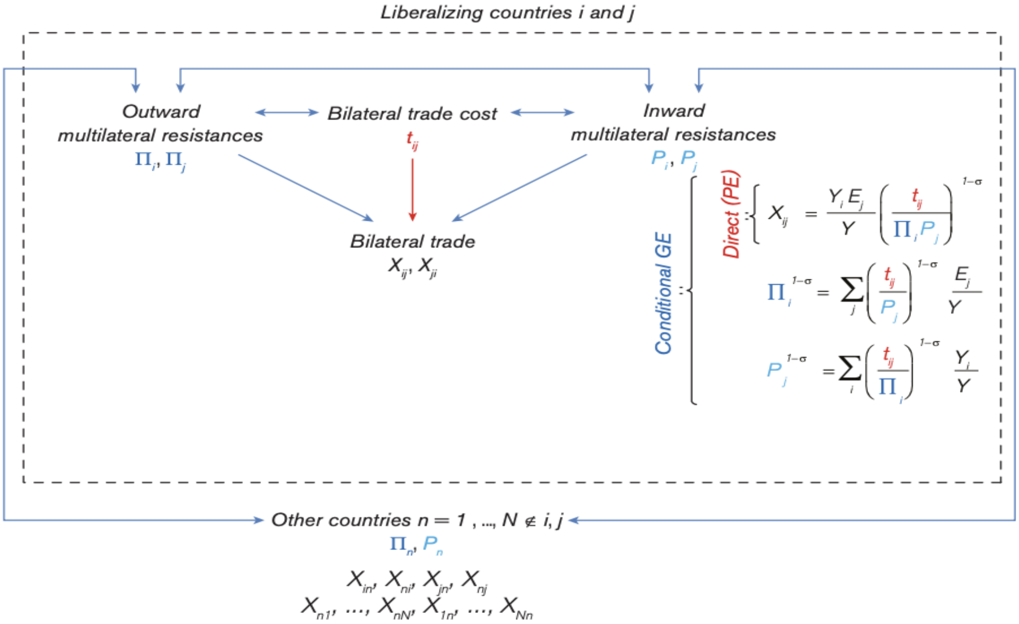


Source: Yotov, Y. V., Piermartini, R., & Larch, M. (2016). *An Advanced Guide to Trade Policy Analysis: The Structural Gravity Model*. WTO iLibrary.

2. The Conditional General Equilibrium Effect

This paper will use the conditional GE effect approach to measure the counterfactual effect of the three FTAs (China- ASEAN FTA, China- New Zealand FTA and China- Pakistan) that are already in force. As a result, conditional gravity is used to either examine changes in trade policy, such as the signing of a new trade agreement, or examining an existing agreement that is already in force. That being said, we will examine the three trade agreements that are already included in the baseline RTA variable. So, my counterfactual approach is to measure the welfare change if those FTAs didn't exist. As shown in figure 3, the approach is considered a "conditional approach" because the outputs (Y_i) and expenditures (E_j) remain unchanged after the trade liberalization between the members. On the other hand, we refer to this approach as a general equilibrium, since via the general equilibrium multilateral resistance terms (π_i, P_j), we can allow the effect of trade liberalization between two countries i and j to spread (Larch and Yotov, 2016).

Figure 3: Conditional General Equilibrium (Yotov et al., 2016)



Source: Yotov, Y. V., Piermartini, R., & Larch, M. (2016). *An Advanced Guide to Trade Policy Analysis: The Structural Gravity Model*. WTO iLibrary.

The model will be constructed following the below steps:

Step 1: Contrast Baseline General Equilibrium

Following equations (3-6), (3-7), and (3-8), X_{ijt} represents the trade flows from exporting country i to importing country j, and t_{ij} is the vector of trade cost, following Silva and Tenreyro (2006) the model can be estimated using a PPML estimator as follows:

$$X_{ijt} = exp^{(\beta t_{ijt}+\emptyset_{it}+\emptyset_{jt})} + \varepsilon_{ijt} \quad (4\text{-}1)$$

In this paper the variables that were used to proxy for bilateral trade cost t_{ij} are as in equation (3-6), the bilateral distance between countries, RTAs, contiguous borders, and common language. $Dist_{ij}$ represents the distance between country i and country j (center to center), $Contig_{ij}$ takes the value “1” if the two countries i and j are contiguous (sharing a common border) and “0” otherwise, $Comlang_{ij}$ takes the value “1” if the two countries i and j have a common language and “0” otherwise, β is the vector of coefficients. Moreover, $RTA_{ij,t}$ is the dummy for the existence of a RTA between countries i and j in year t and takes the value “1” if it exists and “0” otherwise. The $\emptyset_{it}$, $\emptyset_{jt}$ represent the importer fixed effect that accounts for the inward multilateral resistance (IMR) term by creating dummy variables from the interaction between the importers and the year variable for all the importers and years in our sample , the exporter fixed effect that accounts for outward multilateral Resistances (OMR) by creating dummy variables from the interaction between the exporter and the year variable for all the exporters and years in our sample ,and ε_{ijt} is the disturbance or error term. The “BLN” term in the equation stands for baseline.

$$t_{ij,t}^{BLN} = exp^{(\beta_1 ln\, Dist_{ij} \; + \beta_2 Contig_{ij} \; + \; \beta_3 comlang_{ij} \; + ...+ \lambda\, RTA_{ij,t} \;)} + \; \varepsilon_{ijt} \qquad (4\text{- }2)$$

By construction $Y_{i,t} = \sum_j X_{ij,t}$, and $X_{j,t} = \sum_i Y_{ij,t}$

Step 2: Conditional Gravity and General equilibrium Indexes.

This step allows changes in IMR and OMR, while the changes in outputs and expenditures are kept unchanged. This allows us to examine the changes in welfare due to changes in trade policy while keeping everything else unchanged, in equation (4-3), CFL denotes counterfactual value.

$$X_{ijt} = exp^{(t_{ij}^{CFL} + \emptyset_{it}^{CFL} + \emptyset_{jt}^{CFL})} + \; \varepsilon_{ijt} \qquad (4\text{- }3)$$

Where the trade cost in the counterfactual scenario is:

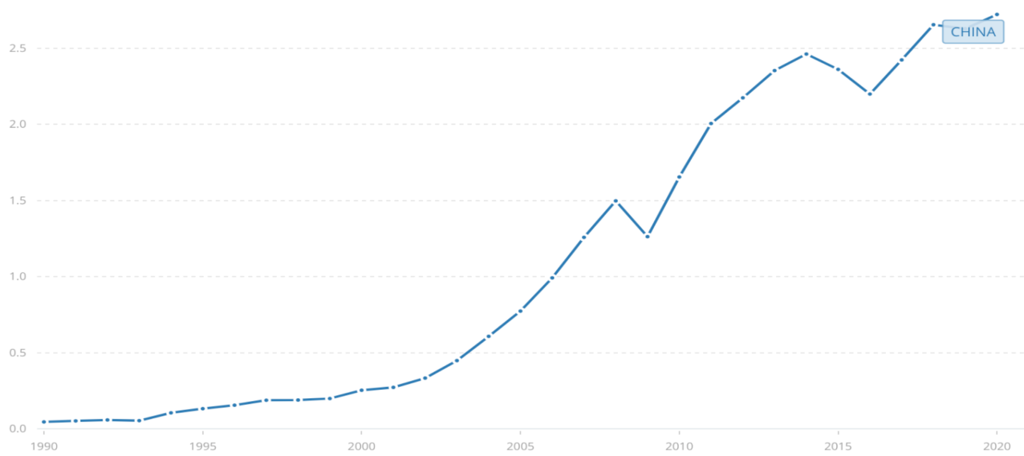
$$t_{ijt}^{CFL} = exp^{(\beta_1 ln\, Dist_{ij} \;\; + \beta_2 Contig_{ij} \;\; + \; \beta_3 comlang_{ij} \;\; + \lambda RTA_{ijt}^{CFL})} + \; \varepsilon_{ijt} \qquad (4\text{-}\ 4)$$

t_{ij} is the trade cost vector of counterfactual trade policy covariates. In order to construct the "conditional" GE estimates of the multilateral resistances we use the new estimated fixed effects from the counterfactual analysis of gravity estimation, while keeping the original data on outputs and expenditure unchanged. The obtained GE indexes can be compared to the baseline GE indexes, i.e., the percentage change in welfare in the counterfactual scenario (e.g., when no FTA exists) compared to the baseline (e.g., when FTA is in the scene). This allows us to track changes in real wage, export or import and multilateral resistances, and changes in welfare.

Chapter Five: Descriptive Analysis

China’s foreign trade has seen a significant increase word widely, especially after China's accession to the WTO in 2001, as seen in figure 4 , China’s exports of goods and services in US dollar has increased from 44.93 billion dollar in 1990 to 2.72 trillion in 2020.

Figure 4: Growth in China’s exports in goods and services from 1990 to 2020

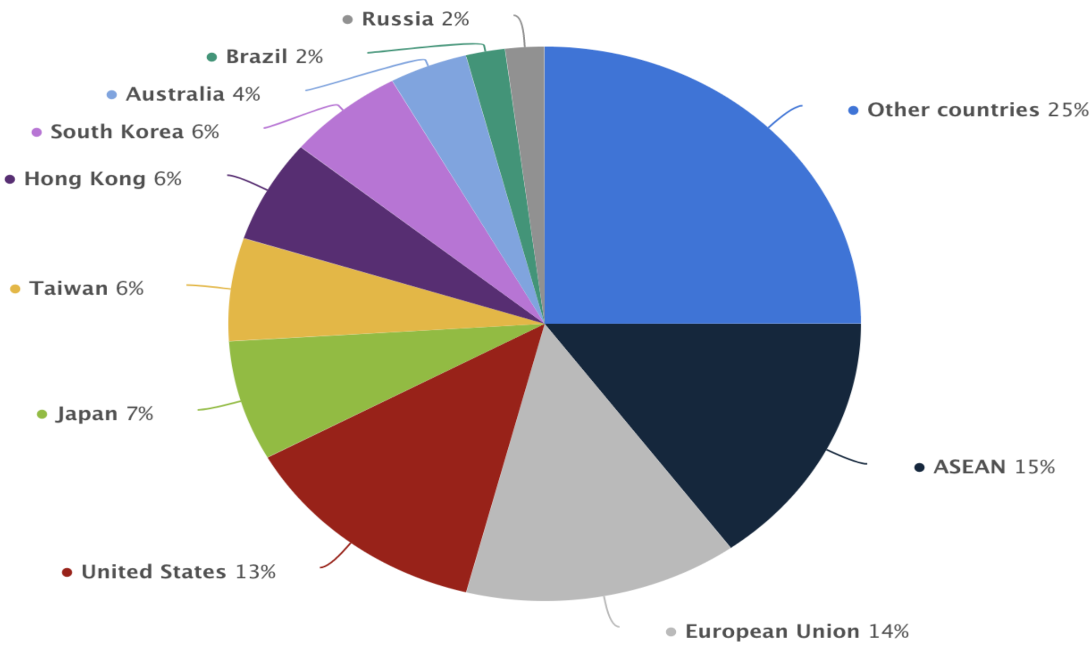


Source: World Bank national accounts data, and OECD National Accounts data files.

China has over 100-trading partners. In 2020, China’s overall exports to the world accounted for 14.1% of the total global exports. Whereas, China's top 15 trading partners accounted for around 65% of China’s total exports. The top trading partners are the United States, representing 17.2% of China’s total exports, Hong Kong(10.3%), Japan(5%), South Korea(4.5%), Vietnam(4.2%), Germany(3.4%), Netherlands(3%), India(2.9%), United Kingdom(2.6%), Taiwan(2.3%), Malaysia(2.2%), Thailand(2.1%), Mexico(2%), Australia(2%), Russia(2%) (OEC, 2022).

Moreover, ASEAN has become the largest trading partner for China. As shown in figure 5, ASEAN, the EU, the US, Japan, and South Korea are China's top five trading partners by 2020.

Figure 5: Distribution of Chinese foreign trade in 2020, divided by top trading partners



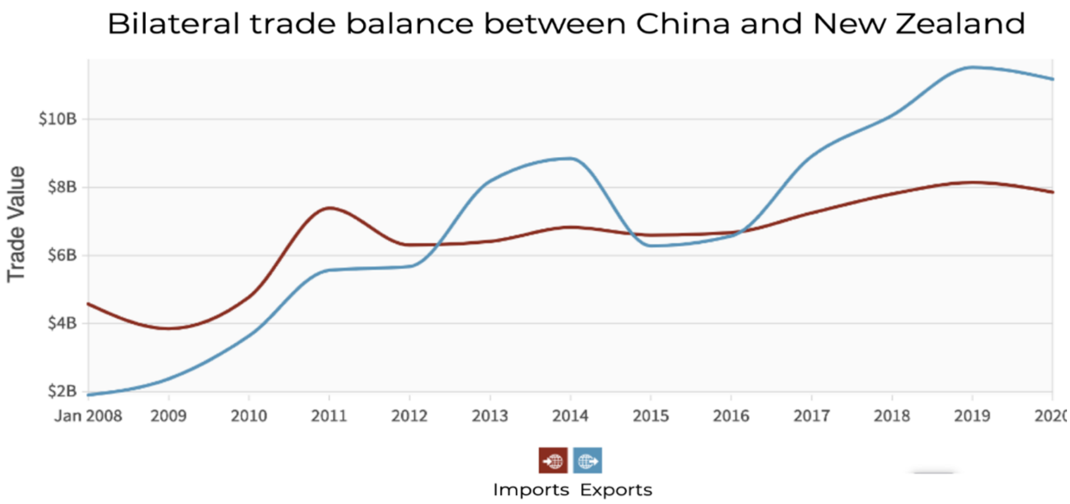
Source: World Bank national accounts data, and OECD National Accounts data files.

In this paper, we will evaluate three FTAs: China- New Zealand, China- Pakistan, and China- ASEAN. In terms of the first FTA, China is one of many countries' largest trading partners. China is both New Zealand's and Australia's largest trading partner. China has been New Zealand's top trading partner since 2017, and the second-biggest trading partner since 2013.[3] As shown in figure 6 trade exports (blue

[3]https://www.stats.govt.nz/news/china-top-trade-partner-for-2019

line) have quadrupled after signing the FTA between New Zealand and China in 2008.

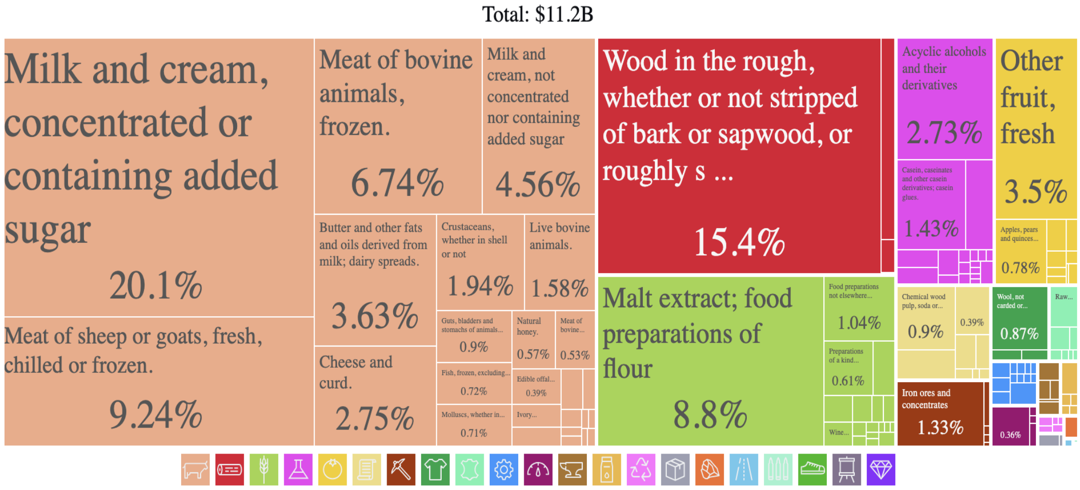
Figure 6: Bilateral trade balance between China and New Zealand



Source: World Bank national accounts data, and OECD National Accounts data files.

The tree map figure 7 displays New Zealand's major goods exports to China in 2020. This consists mainly of meat products, dairy, wood products, preparations of cereals, and flour.

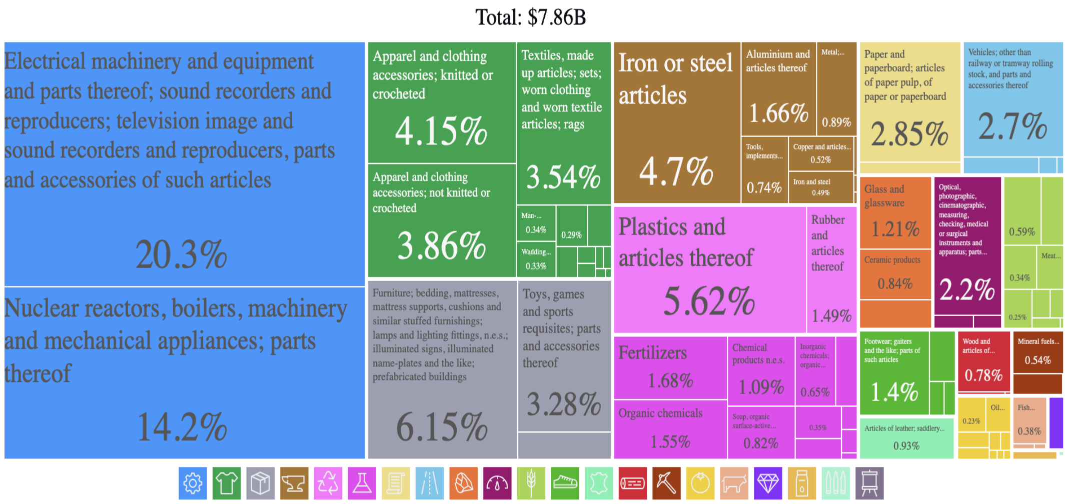
Figure 7: Tree map for New Zealand exports to China in 2020



Source: WITS World Bank: http://wits.worldbank.org

On the other hand, China exports to New Zealand are mainly electronics, machinery, clothing, and furniture as demonstrated in figure 8.

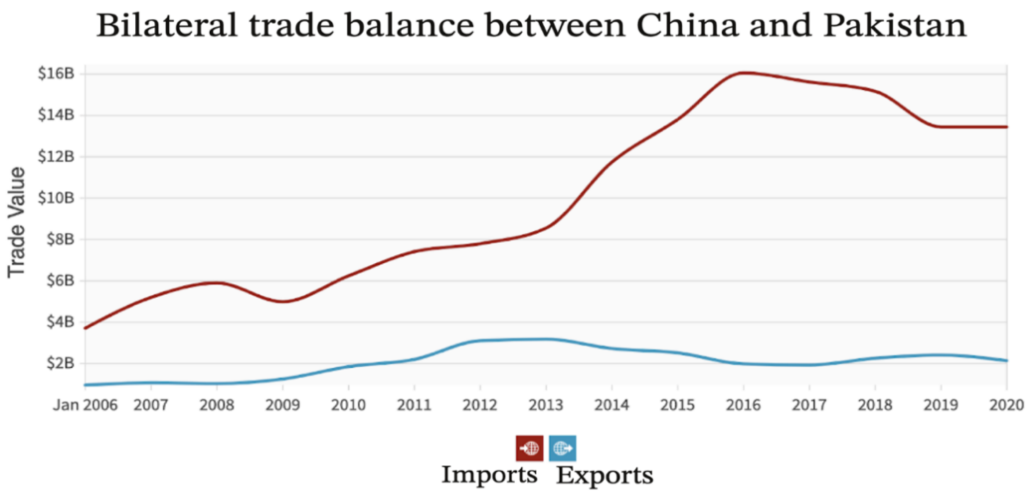
Figure 8: Tree map for China exports to New Zealand in 2020



Source: WITS World Bank: http://wits.worldbank.org

The China- Pakistan FTA which came into force in July 2007 was done in two phases. The CPFTA has increased the trade between China and Pakistan; however, it also increased the Pakistan trade deficit with China. The increase in Pakistan imports from China, and Pakistan exports to China corresponded with an increase in trade deficit, since the increase in imports was greater than the increase in exports to China (Shah et al. 2020), as shown in figure 9.

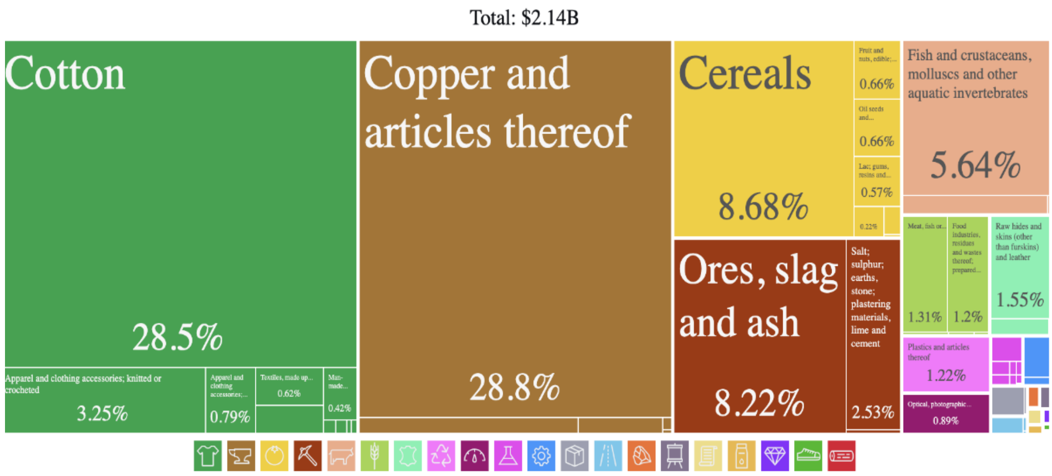
Figure 9: Bilateral trade balance between China and Pakistan (2006-2020)



Source: World Bank national accounts data, and OECD National Accounts data files.

The imports from Pakistan to China are mainly cotton, copper and different textile products, as demonstrated in the below Figure 10.

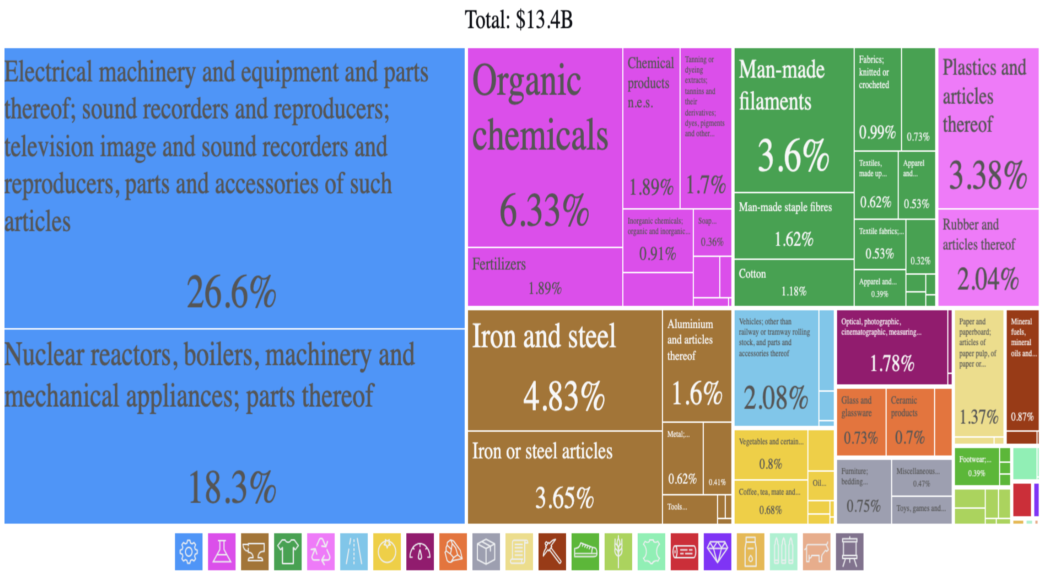
Figure 10: Tree map for Pakistan exports to China in 2020



Source: WITS World Bank: http://wits.worldbank.org

On the other hand, China exports to Pakistan are mostly electrical and machinery equipment, chemicals, phones, iron, steel, and garments, as well as different textile products, as shown in the below Figure 11. Hence, this widened Pakistan's trade deficit with China (Shah et al.2020).

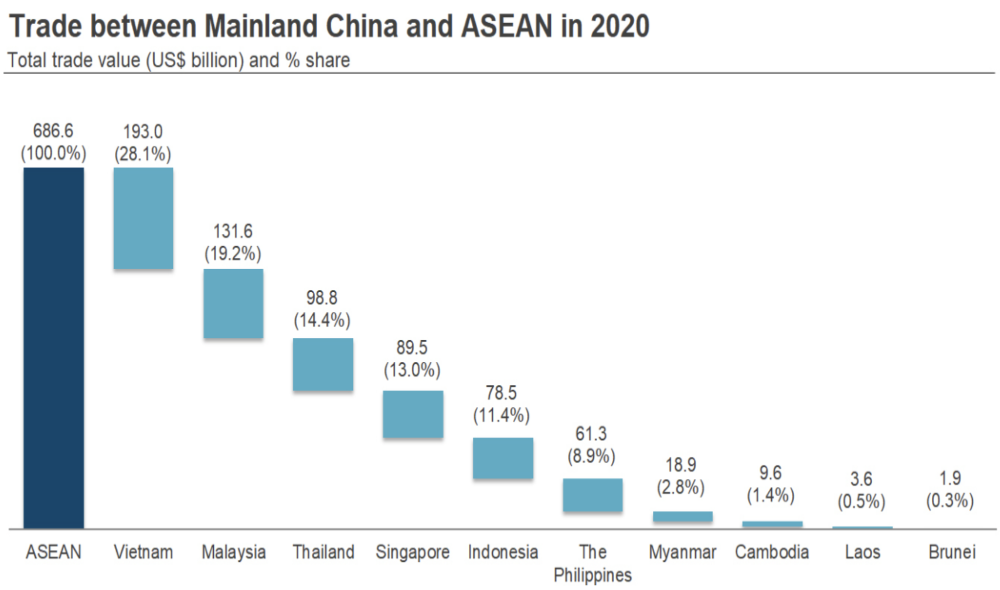
Figure 11: Tree map for China exports to Pakistan in 2020



Source: WITS World Bank: http://wits.worldbank.org

The ACFTA was established in 1993, signed in 2004, and put into effect in July 2005. The member countries of the agreement are China, Malaysia, Indonesia, Brunei, Singapore, Thailand, and the Philippines. Moreover, Myanmar, Laos, Vietnam, and Cambodia join the agreement as well in a later stage but not until 2015. The percentage of trade between ASEAN and China is shown in Figure 12.

Figure 12 : Trade between mainland China and ASEAN in 2020

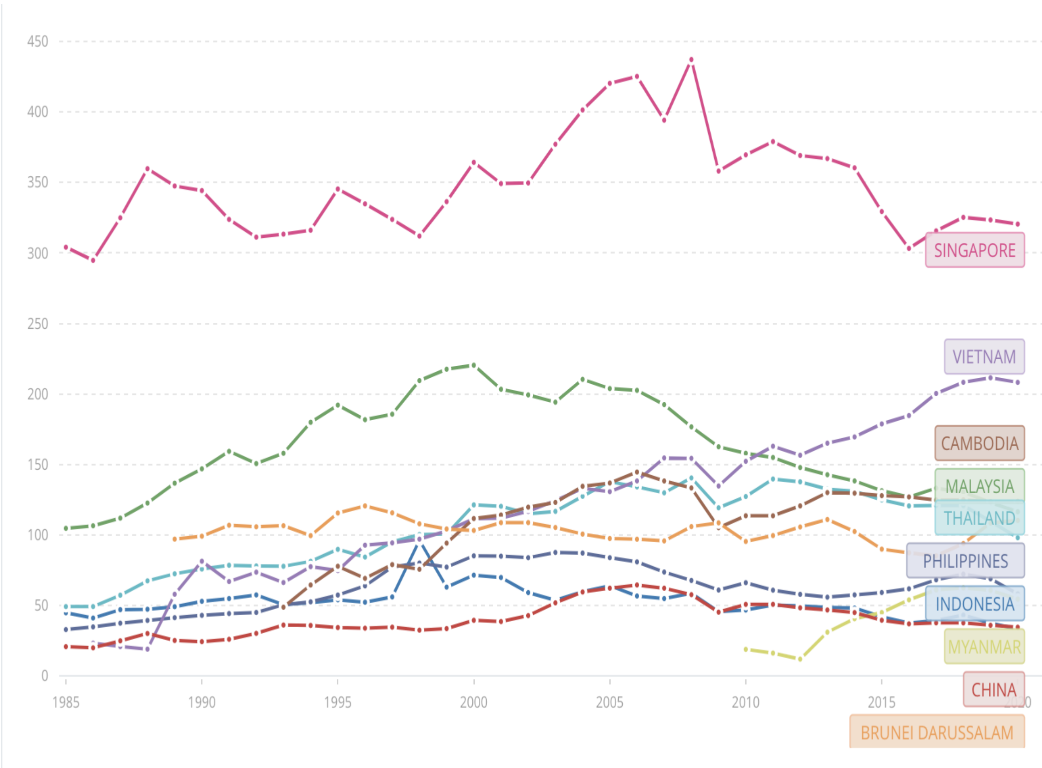


Source: HKTDC research

An effort by the ASEAN members was made to make the ACFTA look more comprehensive and tempting, especially when it is compared to other FTAs. The ACFTA aims to go beyond the typical FTAs that include a specific coverage of goods and services. Thus, ACFTA included a wider sector, with a large number of members. While consistently increasing the sector coverage, and increasing the number of nations participating, and frequently advanced tariff reductions, and exceeding the earlier obligations (Sukegawa, 2021).

In general, the increase in international trade, where countries are adopting an open economy, and signing new FTAs, led to an increase in trade ratio from GDP in the past 20 years. Figure 13 presents GDP data relevant to the countries that are of interest for this research from the period of 1985 until 2020, the data source is the World Bank. The graph shows an upward increase in the ratio in most of the counties except for Malaysia and Singapore.

Figure 13 : (trade % from GDP) Trade is the sum of exports and imports of goods and services measured as a share of GDP for years (1960 - 2020)



Source: World Bank national accounts data, and OECD National Accounts data files.

Chapter Six: Empirical Results

The estimation of a gravity model requires merging large databases from different data sources. Even though analyzing the FTAs among FTA members is the estimation's primary goal, it is advised to include as many countries as possible to obtain accurate estimates. The gravity database for this thesis consists of 243 countries as well as all their trading partners.

1. Estimation of Baseline Gravity and Indexes

Table 1 shows the estimated trade cost coefficients used in the preliminary step to evaluate the conditional effect of the trade policy variable. The estimated RTA coefficient (exp [0.34] − 1 =34) indicates that RTA increases the bilateral trade between two countries by around 34 %. Our obtained estimations of the RTA effect are quite close to those obtained by Hossain (2018).

The results in table 1 for the estimates are consistent with the prior expectations, where the distance is assumed to have a negative effect on trade, β_1 = -0.69. On the other hand, the effect of having contiguous borders is also positive and highly significant, β_2 = 0.59 Where our estimates suggest that having a common border on average will increase trade by 80%. Our obtained estimates on common borders and distance effect are close to the results obtained by Head and Mayer (2014). Furthermore, the common language estimate is β_3 = 0.091 which suggests that having a common language contributes to increasing the trade by a small percentage of around 10%.

Table 1: Estimating the baseline gravity and indexes for RTA using Fitting the Fixed Effect Generalized Linear Model (FEGLM) based on the below specifications

Variables	Estimates	Std. Error	Z value	Pr(> |z|)
RTA	$3.719e^{-01}$	$6.083e^{-06}$	61135	$< 2e^{-16}$ ***
Ln_dist	$-6.985e^{-01}$	$2.695e^{-06}$	-259194	$< 2e^{-16}$ ***
Comlang_off	$9.154e^{-02}$	$6.198e^{-06}$	14769	$< 2e^{-16}$ ***
contig	$5.997e^{-01}$	$5.921e^{-06}$	101289	$< 2e^{-16}$ ***

2. Partial Equilibrium Effect of the Three FTAs

We are interested in the effect of the three FTAs ex- post, the FTAs will be captured by a value of one for each pair of countries that have signed the FTA starting from the year that FTA went into force. Moreover, the independent variables included the importer and exporter to control the multilateral resistance as discussed above. Where there is no need to add the distance and non-observable country pair factors since it is captured by the pair fixed effect.

As was mentioned previously in the methodology, it is recommended to use a 3-year time interval to allow for adjustment in trade flows as a result of changes in trade policy. We ran the models three times, one for each FTA, using the generalized linear models with many high-dimensional fixed effects (FEGLM) model:

$$X_{ij} = exp(^{\beta_0 + \ \ \beta_1\, ACFTA_{ijt} + \emptyset_{it} + \emptyset_{jt} + \emptyset_{ij}\,)} + \ \varepsilon_{ijt} \qquad (6\text{- }1)$$

In model (6- 1) ACFTA is an indicator that takes the value of one for all pairs of countries that have signed the FTA, starting from the year when the ASEAN- China FTA went into force for each one of the members and zero otherwise.

Table 2 shows the Partial equilibrium effect of ASEAN- China FTA is (exp [0.176] − 1 =19.24%) which means that ACFTA leads to a 19% increase in the bilateral trade between the two countries.

Table 2: Partial equilibrium effect of ASEAN- China FTA with continuous variable for years (1990 - 2020)

Variables	**Estimates**	**Std. Error**	**Z value**	**Pr(> |z|)**
ACFTA	$1.766e^{-01}$	$3.235e^{-05}$	5459	$< 2e^{-16}$ ***

However, as shown in table 3, using a 3 years interval starting from (1990 , 1993, 1996,.... 2020) to allow for Adjustment in Trade Flows decreases the coefficient of ASEAN- China by only 0.5. (exp [0.17] − 1 =18.5%) which means that ACFTA leads to a 18.5 % increase in the bilateral trade between the two countries.

Table 3: Partial equilibrium effect of ASEAN- China FTA using 3- years interval

Variables	**Estimates**	**Std. Error**	**Z value**	**Pr(> |z|)**
ACFTA	0.1703965	0.0000544	3132	$< 2e^{-16}$ ***

As for estimating the partial effect of NZCFTA we used the following model

$$X_{ij} = exp(^{\beta_0 + \beta_1 \text{NZCFTA}_{ijt} + \emptyset_{it} + \emptyset_{jt} + \emptyset_{ij}}) + \varepsilon_{ijt} \quad (6\text{- }2)$$

In model (6- 2) NZCFTA is an indicator that takes the value of one for all pairs of countries that has signed the FTA, starting from the year when the NZCFTA went into force and zero otherwise. As shown in table 4, the coefficient of NZCFTA is (exp [0.59] − 1 =80.9%) which means that NZCFTA leads to a 80.9 % increase in the bilateral trade between the two countries.

Table 4: Partial equilibrium effect of NZCFTA using a continuous variable for years (1990 - 2020)

Variables	Estimates	Std. Error	Z value	Pr(> |z|)
NZCFTA	0.5929328	0.0004618	1284	$< 2e^{-16}$ ***

However, using a 3 years interval starting from (1990, 1993, 1996... 2020) as shown in table 5, the coefficient of NZCFTA decreases, (exp [0.588] − 1 =80%) which means that NZCFTA leads to a 80 % increase in the bilateral trade between the two countries.

Table 5: Partial FTA Effect of the NZCFTA using a 3- years interval

Variables	Estimates	Std. Error	Z value	Pr(> |z|)
NZCFTA	0.5887442	0.0002454	2399	$< 2e^{-16}$ ***

As for estimating the partial effect of CPFTA we used the following model

$$X_{ij} = exp(^{\beta_0 + \beta_1 \text{CPFTA}_{ijt} + \emptyset_{it} + \emptyset_{jt} + \emptyset_{ij}}) + \varepsilon_{ijt} \qquad (6\text{- }3)$$

Of which CPFTA In model (6- 3) is an indicator that takes the value of one for all pairs of countries that have signed the FTA, starting from the year when the CPFTA went into force and zero otherwise. The Partial Effect of Pakistan- China FTA is shown in Table 6 , the coefficient of CPFTA is (exp [0.231] − 1 =25.9%) which means that CPFTA leads to a 26% increase in the bilateral trade between the two countries.

Table 6: Partial Effect of Pakistan- China FTA using a continuous variable for years (1990 - 2020)

Variables	Estimates	Std. Error	Z value	Pr(> |z|)
CPFTA	0.2319888	0.0001439	1612	$< 2e^{-16}$ ***

However, using a 3 years interval starting from (1990 , 1993, 1996,.... 2020), as shown in table 7 ,the coefficient of CPFTA is (exp [0.21] − 1 =23.3%) which means that CPFTA leads to a 23% increase in the bilateral trade between the two countries.

Table 7: Partial FTA Effect of Pakistan- China FTA using a 3- year's interval

Variables	Estimates	Std. Error	Z value	Pr(> |z|)
CPFTA	0.2105536	0.0002308	912.2	$< 2e^{-16}$ ***

All The results are statistically significant. As mentioned above, the coefficient indicates how much trade increased on average between the members that signed the FTA, while maintaining all endogenous variables constant in the model. These results indicate that, among the three signed FTAs, NZCFTA has the highest partial positive effect.

3. Conditional General Equilibrium Effect of Three FTAs

To estimate the GE Effect of the FTAs, we construct the conditional gravity model after removing the specific FTA from the RTA variable for each one of the three FTAs:

$$X_{ij} = exp^{(\beta_1 ln\, Dist_{ij} \;\; + \beta_2 Contig_{ij} \;\; + \; \beta_3 comlang_{ij} \;\; + \lambda\, RTA - AFTA_{ijt}^{ctf} \;\; + \emptyset_{it}^{CFL} + \emptyset_{jt}^{CFL})} + \varepsilon_{ijt} \quad (6\text{- }7)$$

The FEGLM procedure requires defining the hypothetical removal of the FTA, all estimates are constrained to baseline estimates, Outputs and expenditure are held constant, and changes are made only on multilateral resistance and on trade policy variables. Shepherd (2022) advises researcher who are using the gravity model for simulation, not to use econometrics to identify the value of elasticity, and suggests that when good estimates from the literature are available, there is usually nothing to be gained from re-estimating these values, and he refers to re-estimating the elasticity of substitution for the gravity model simulation as “reinventing a high-quality wheel”. Therefore, we assume an elasticity $\delta = 4$, following the recommendation of the scholars in the literature. Thus, Simonovska and Waugh (2014) have estimated the trade elasticity on different models using a simulation method, and their finding suggested that it is best to use an elasticity of four. Moreover, other scholars calibrate the elasticity of substitution across varieties of four in their papers (see Eaton and Kortum, 2002, Baier, Yotov, and Zylkin, 2019). Using the year 2020 as the baseline since it is the last year in the gravity database. First the R package (FEGLM) is used for econometrics, second the GE gravity package is used for simulation. The package inputs are mainly the trade cost shock. Furthermore, we need to add the trade elasticity, along with adding a set of identifier variables. The package Output is the changes in trade flows, wages, and welfare for all countries in the world.

Table 8: GE Gravity results for ASEAN and China FTA

Iso code	**Country**	**ASEAN China FTA members**	**Welfare change**	**Real wage change**	**Nominal wage change**	**Price index change**
THA	Thailand	1	-0.057	-0.0506	-0.015	0.031
PHL	Philippines	1	-0.057	-0.0625	-0.014	0.042
VNM	Vietnam	1	-0.054	-0.0610	-0.014	0.040
IDN	Indonesia	1	-0.051	-0.0578	-0.019	0.034
MYS	Malaysia	1	-0.050	-0.0549	-0.016	0.034
MMR	Myanmar	1	-0.048	-0.0529	-0.014	0.034
KHM	Cambodia	1	-0.037	-0.0383	-0.004	0.031
LAO	Laos	1	-0.032	-0.0302	-0.012	0.015
CHN	China	1	-0.025	-0.0196	-0.007	0.011
AUS	Australia	0	0.010	0.0081	0.005	-0.002
KOR	KOREA	0	0.016	0.0123	0.010	-0.002
AGO	Angola	0	0.017	0.0059	0.005	-0.001
SGP	Singapore	0	0.019	0.0161	0.011	-0.003
NRU	Nauru	0	0.036	0.0155	0.019	0.004

For the ACFTA effect, the removal of ACFTA has a negative effect on all of the members' welfare and real wages except for Singapore.

As for Singapore, it would be a fruitful area for further work to investigate the effect of Singapore and China FTA, since from 2008 there is an ongoing FTA between the two countries, and this FTA is considered an important economic cooperation since it was the first trade agreement signed between an Asian country and China. Moreover, Scholars suggests that the negative outcome of a FTA on countries can be interrupted in term of trade diversion and trade creation effect. Therefore, the findings from examining the ACFTA general equilibrium effect that shows a negative effect on Singapore from the ACFTA provides insights for future research in the area, to investigate if the ACFTA trade creation effect is smaller than the trade diversion effect. Furthermore, the results from the counterfactual scenario confirms that if ACFTA had not been signed, it would have caused an average loss of 0.057 % to Thailand and Philippines' welfare, while China's welfare will be affected by 0.025 % as shown in table 8. On the other hand, some non-member countries showed a positive effect of removing the FTA, such as Nauru, Korea, Australia, and Angola. Scholars suggests that the negative outcome of a FTA on non-members countries can be interrupted in term of trade diversion, where trade liberalization between members, such as signing a FTA, can have a negative effect on non- members since they lose their market share in member countries (Yotov and al., 2016).

Therefore, a deeper understanding of these countries economic relation can provide a an answer on why these countries would be effected positively if ASEAN-China FTA did not exist. Thus, Angola is China's top African trading partner in terms of oil production. Brunei Darussalam and Malaysia, both ASEAN-China FTA members, are considered as significant oil and gas producers. As mentioned above, considerably more work will need to be done to establish a clear insight on the effect of these economic relations on the trade flow between Angola and China (McClanahan et al. 2014).

Finally, estimating the GE Effect on CPFTA shows that the removal of the CPFTA has a negligible negative effect only on Pakistan Welfare and real wages.

Table 9: *GE Gravity results for Pakistan and China FTA*

Iso Code	Country	CPFTA members	Change in trade	Welfare change	Real wage change	Nominal wage change	Price index change
PAK	Pakistan	1	0.48	-0.03	-0.04	-0.01	0.03
CHN	China	1	86.35	0.00	0.00	0.00	0.00
COL	Colombia	0	0.21	0.00	0.00	0.00	0.00

As it was indicated previously in this paper, the existing literature implies that CPFTA increased the deficit between Pakistan and China; hence the FTA between the two parties is more fruitful toward China rather than Pakistan. The results from the Counterfactual GE in Table 9 reveals that if the CPFTA did not exist, China's welfare would not be affected at all, however Pakistan's welfare would be reduced by 0.03%. On the other hand, the bilateral trade for China and Pakistan will decrease by 86.3 %, 0.48 % respectively. As for estimating the GE Effect on NZCFTA, the removal of the NZCFTA has a negative effect on the two members’ welfare and real wages.

Table 10: GE Gravity results for New Zealand and China FTA

Iso Code	Country	NZFTA members	Change in trade	Welfare change	Real wage change	Nominal wage change	Price index change
NZL	New Zealand	1	55.1	-0.038	-0.035	-0.018	0.015
CHN	China	1	23.5	-0.001	-0.001	0.000	0.001
WSM	Samoa	0	0.00	0.002	0.003	0.001	-0.002
FJI	Fiji	0	0.00	0.004	0.004	0.000	-0.004
ASM	American Samoa	0	0.00	0.004	0.004	0.000	-0.005
TON	Tonga	0	0.00	0.009	0.008	0.002	-0.005

As for the NZCFTA effect, the removal of NZCFTA has a negative effect on New Zealand and Chinas' trade, welfare, and real wages. However, New Zealand trade and welfare is affected at a higher rate than China as shown in Table 10. Bilateral trade between New Zealand and China would have declined by 55% and 23%, respectively. On the other hand, there is a positive effect on some of the Pacific Islands in the Counterfactual scenario if NZFTA did not exist. The countries with positive effects under the mentioned scenario are Fiji, Tanga, Samoa, and American Samoa. Both Samoa and American Samoa were previously part of Samoan Island, but due to competing interests from the United States, Britain, and Germany, the island was divided into Samoa and American Samoa in 1899. Initially, both under the German protectorate, and later on New Zealand Occupied Western Samoa in

1914, and only in 1962, the country gained independence. Therefore, even though the effect of NZCFTA on the welfare for both Samoa and American Samoa is almost negligible, A future study investigating the NZCFTA effect on Samoa and American Samoa would be very interesting, where it is recommended that the future study takes into account the history between these countries.

Chapter Seven: Conclusions and Policy Recommendations

7.1 Conclusions

This paper had the objective of examining the partial and general equilibrium effect of ACFTA, CPFTA, and NZCFTA. The partial effect of the agreements was calculated using a FEGLM model. Furthermore, Tom Zylkin GE gravity Package was used to calculate the conditional general equilibrium to estimate the changes in trade, welfare, and wage as a result of the FTAs. The findings of evaluating these FTAs revealed varying affects across FTAs and among FTAs members. This research tackles the shortcomings in the limited literature that studies these FTAs by using a gravity model approach.[4] The paper found that the PE estimates of NZCFTA had a significant effect on New Zealand and China; where on average NZCFTA increases the trade between members by 80%. However, the GE effect shows no significant change in terms of increasing welfare and wages. However, as a consequence of the conditional scenario of removing the NZCFTA bilateral trade, New Zealand would be affected on a higher level than China, as bilateral trade between New Zealand and China would have declined by 55% and 23%, respectively. The PE estimate of CPFTA and ACFTA shows a moderate effect on increasing trade among members. ACFTA and CPFTA had a PE of 23 %, 18.5% respectively. However, ACFTA is a much deeper trade agreement. As a

[4] Zylkin, T. Help file for ge_gravity.

consequence, the GE effect shows a positive and negative effect on both member and non-members of ACFTA. Thus, results suggest, Singapore (an ACFTA member) trade and welfare is better off without the agreement. Nevertheless, non-members of ACFTA such as Nauru, Korea, Australia, and Angola show a positive effect on welfare with the counterfactual scenario of not signing the agreement. This can be understood in terms of trade diversion, where it is one of the main reasons for the negative estimates that were obtained for all of the countries outside ACFTA, yet these effects as expected are minor.

7.2 Policy Recommendations

After evaluating the study cases of three signed and imposed FTAs, the results suggest some important policy recommendations. Mainly, there is a "heterogeneity" effect across and between FTAs. Thus, countries negotiating future FTAs should develop a model comparable to the one employed in the paper to assess and evaluate the whole effect of the agreement, and not only the promotion of trade between members. Nonetheless, the effects of the new FTAs should be evaluated by countries that are not party to the agreement. These countries should study and evaluate the impact of these FTAs on their future trade with the signed FTA members, particularly, if these countries do not have an existing FTA with the members of the newly signed agreement, and especially because these FTAs may have negative effects on non-member countries.

Another key issue concerns the heterogeneity in the effects of FTAs between countries with different levels of development, such as Pakistan and China. In which the weaker member should be careful to avoid increasing the trade deficit, and thus not obtaining significant gains from the proposed FTA.

Lastly, the analysis might be extended to include trade in services and foreign investment that are covered under FTAs, providing a more comprehensive insight into the effects of FTAs. Hence, trade in services is becoming an important objective in promoting new FTAs. For instance, in 2021, NZCFTA was upgraded to include more trade in services, with three groups of services added to the original agreement that covered three new sectors, including environmental, real estate, and educational services.[5]

[5] https://www.beehive.govt.nz/release/china-fta-upgrade-enters-force-april

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Annex

Model 1: Estimating the baseline gravity and indexes for RTA using Fitting the Fixed Effect Generalized Linear Model (FEGLM) based on the below specifications

```
poisson - log link

trade ~ rta + ln_dist + comlang_off + contig | exp_year + imp_year

Estimates:
             Estimate Std. error z value Pr(> |z|)
rta          3.719e-01  6.083e-06   61135    <2e-16 ***
ln_dist     -6.985e-01  2.695e-06 -259194    <2e-16 ***
comlang_off  9.154e-02  6.198e-06   14769    <2e-16 ***
contig       5.997e-01  5.921e-06  101289    <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

residual deviance= 1.5804e+11,
null deviance= 2.925e+12,
n= 1223013, l= [6026, 6301]

( 658779 observation(s) deleted due to perfect classification )

Number of Fisher Scoring Iterations: 11
```

Model 2: Partial equilibrium effect of ASEAN- China FTA with continuous variable for years (1990 - 2020)

```
poisson - log link

trade ~ ASEAN_China_FTA | exp_year + imp_year + pair

Estimates:
                 Estimate Std. error z value Pr(> |z|)
ASEAN_China_FTA 1.766e-01  3.235e-05    5459    <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

residual deviance= 2.2518e+10,
null deviance= 2.8181e+12,
n= 1055300, l= [6026, 6301, 37514]

( 834268 observation(s) deleted due to perfect classification )

Number of Fisher Scoring Iterations: 12
```

Model 3: Partial equilibrium effect of ASEAN- China FTA using 3- years interval starting from (1990 , 1993, 1996,.... 2020) (R screenshot)

```
poisson - log link

trade ~ ASEAN_China_FTA | exp_year + imp_year + pair

Estimates:
                 Estimate Std. error z value Pr(> |z|)
ASEAN_China_FTA 0.1703965  0.0000544    3132    <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

residual deviance= 8025060739.82,
null deviance= 9.9656e+11,
n= 343780, l= [2122, 2226, 34588]

( 305759 observation(s) deleted due to perfect classification )

Number of Fisher Scoring Iterations: 12
```

Model 4: Partial equilibrium effect of NZCFTA using a continuous variable for years (1990 - 2020) (R screenshot)

```
poisson - log link

trade ~ NZFTA | exp_year + imp_year + pair

Estimates:
       Estimate Std. error z value Pr(> |z|)
NZFTA 0.5929328  0.0004618    1284    <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

residual deviance= 8033085178.58,
null deviance= 9.9656e+11,
n= 343780, l= [2122, 2226, 34588]

( 305759 observation(s) deleted due to perfect classification )

Number of Fisher Scoring Iterations: 12
```

Model 5: Partial FTA Effect of the NZCFTA using a 3- years interval starting from (1990, 1993, 1996... 2020)(R screenshot)

```
poisson - log link

trade ~ NZFTA | exp_year + imp_year + pair

Estimates:
       Estimate Std. error z value Pr(> |z|)
NZFTA 0.5887442  0.0002454    2399    <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

residual deviance= 2.2542e+10,
null deviance= 2.8181e+12,
n= 1055300, l= [6026, 6301, 37514]

( 834268 observation(s) deleted due to perfect classification )

Number of Fisher Scoring Iterations: 12
```

Model 6: Partial FTA Effect of Pakistan- China FTA using a continuous variable for years (1990 - 2020) (R screenshot)

```
poisson - log link

trade ~ CPFTA | exp_year + imp_year + pair

Estimates:
       Estimate Std. error z value Pr(> |z|)
CPFTA 0.2319888  0.0001439    1612    <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

residual deviance= 2.2546e+10,
null deviance= 2.8181e+12,
n= 1055300, l= [6026, 6301, 37514]

( 834268 observation(s) deleted due to perfect classification )

Number of Fisher Scoring Iterations: 12
```

Model 7: Partial FTA Effect of Pakistan- China FTA using a 3- years interval starting from (1990, 1993, 1996,.. 2020) (R screenshot)

```
poisson - log link

trade ~ CPFTA | exp_year + imp_year + pair

Estimates:
       Estimate Std. error z value Pr(> |z|)
CPFTA 0.2105536  0.0002308   912.2    <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

residual deviance= 8034130134.08,
null deviance= 9.9656e+11,
n= 343780, l= [2122, 2226, 34588]

( 305759 observation(s) deleted due to perfect classification )

Number of Fisher Scoring Iterations: 12
```