

Three Papers on Taiwanese Trade Policy and Politics:
Integration, Technology, and Democracy

by Je-Uei Jeffrey Kuo

M.A. in Economics, May 2016, Syracuse University
M.S. in International Business, May 2012, National Chengchi University
B.S. in Economics, May 2011, National Chengchi University

A Dissertation submitted to

The Faculty of
The Columbian College of Arts and Sciences
of The George Washington University
in partial fulfillment of the requirements
for the degree of Doctor of Philosophy in Economics

March 27, 2023

Dissertation directed by

Dr. Joseph Pelzman
Professor of Economics, International Affairs, and Law

The Columbian College of Arts and Sciences of The George Washington University certifies that Je-Uei Jeffrey Kuo has passed the Final Examination for the degree of Doctor of Philosophy as of March 27, 2023. This is the final and approved form of the dissertation.

Three Papers on Taiwanese Trade Policy and Politics:
Economic Integration, Technology, and Democracy

Je-Uei Jeffrey Kuo

Dissertation Research Committee:

Dr. Joseph Pelzman, Dissertation Director

Dr. Michael Moore, Committee Member

Dr. Steven Suranovic, Committee Member

© Copyright year degree conferred by Your Name
All rights reserved

Dedication

The author wishes to dedicate this dissertation to Je-Ting “Cindy” Kuo, who died from Arrhythmia in April 2022. For my parents, for your support and consideration. For my beloved country, Taiwan.

Abstract of Dissertation

Three Papers on Taiwanese Trade Policy and Politics: Economic Integration, Technology, and Democracy

This dissertation comprises three working papers examining economic integration, preferential trade agreements, and geoeconomics focusing on the heavily-trade-reliant country, Taiwan. In the first chapter of my dissertation, the Computational General Equilibrium (CGE) model is used to simulate potential policy shocks and estimate the trade bloc's opportunity costs to ease regional tensions. In the second chapter, I explain how Taiwan became one of the world's foremost chip manufacturing centers using the International Trade Network (ITN) graphical analysis. Lastly, to evaluate the heterogeneity of political inertia in Taiwan and how it changed after the Bilateral Trade Agreement with China was ratified, I employed regression discontinuity (RD) to test whether proximity to airports and tourist attractions plays a role in ideological realignment.

Costs of Political Compromise in the Trade Bloc*

Jeffrey Kuo[†]

March 02, 2023

Abstract

How much should a trade bloc be compensated for due to its role in the de-escalation of tensions? This paper examines the economic impacts that Taiwan joining the Regional Comprehensive Economic Partnership (RCEP) would have on the RCEP trade bloc, the United States, and China. Assuming Taiwan's exclusion is due to political reasons, we use the Computational General Equilibrium (CGE) model and Global Trade Analysis Project (GTAP) database to simulate the economic shock of Taiwan joining the RCEP. First, we identify and aggregate Taiwan's major trading partners, including China, the United States, and the RCEP countries. Then, we use the auxiliary program RunGTAP to simulate policy shocks that affect import tariffs. By analyzing the counterfactual economic impact of trade liberalization, we estimate the potential loss of the RCEP and the economic rationale for Taiwan's exclusion. The conclusion we arrive at shows the opportunity cost of the trade bloc's political compromise and could be generalized to other conflicted regions around the world.

Keywords: Economic Integration, Trade Forecasting and Simulation

JEL Code: F15, F17

Latest version: <https://jeffjkuo.github.io/CGE1>

*This version of the working paper is a preliminary draft. Please do not circulate without permission. The author sincerely thanks my dissertation supervisor, [Joseph Pelzman](#), for providing his valuable feedback. Also, the author thanks all participants and panelists at the workshops and conferences for their excellent suggestions. [R Markdown](#), [Posit Cloud](#), and [RunGTAP](#) render this paper. Codes are available upon request. All errors belong to the author.

[†]George Washington University, email: jeffkuo@gwu.edu, webpage: <https://jeffjkuo.github.io>

1 Introduction

Engaging in a preferential trade agreement (PTA) has always been a challenge for governments. This is because governments must balance the effects of trade creation on economic welfare and the potential redistribution of trade diversion (Lipsey, 1957). However, PTAs have broader impacts than simply affecting a country's economy and that of the trade block. PTAs can also change the diplomatic dynamics between countries. Vice versa, the decision to allow a country to join a trade block or PTA does not solely depend on economic incentives. Instead, it depends more on the diplomatic relationship and the political climate. But do political concessions have a price? Or how much does it cost for a trade block to exclude a influential trade counterpart from joining the block? These are the main questions this paper seeks to answer.

Economic integration is influenced by political tensions among the countries involved. Literature has highlighted that it is challenging for governments to sign trade agreements when they are experiencing escalating tensions (Acemoglu and Yared, 2010; Martin et al., 2008). However, there is scant literature on the estimation of the potential welfare losses of expulsion for tensions between states of this type. The case between Taiwan, China, and Southeast Asian countries is a suitable example. We believe we can at least get a ballpark idea of how much the political tensions are worth using the well-developed Computational General Equilibrium (CGE) model by running the counterfactual policy experiment. Rather than analyzing an already-implemented policy, we present simulations of experimental trade shock policies for Taiwan's joining the Regional Comprehensive Economic Partnership (RCEP).¹

Why is Taiwan, China, and the RCEP an interesting case? From an economic perspective, both Taiwan and the RCEP countries know and have an incentive to cooperate. Taiwan is the third largest trading partner for Southeast Asian countries after China and the U.S., and its capital-intensive technological export industries would be a complement to the relatively labor-intensive manufacturing sectors in

¹Regional Cooperation Economic Partnership (RCEP), a multinational trade agreement chartered by The Association of Southeast Asian Nations (ASEAN) and the five new members of the developed countries, including Australia, China, Japan, South Korea, and New Zealand. For more institutional details of RCEP, please refer to the official website of RCEP, <https://rcepsec.org/>

the RCEP countries. On the other hand, the current Taiwanese administration has advocated “New Southbound Policy (NSP)” since taking office in 2016’s general election. The fact that Taiwan is not currently part of the RCEP is obviously not optimal for economic equilibrium. But what are the causes?

There has been a wave of economic integration via signing PTAs among Asian countries since the formation of the Association of Southeast Asian Nations (ASEAN) (Baysan et al., 2006; Hashmi and Lee, 2008). Southeast Asia’s economic integration is ardent due to its geographical proximity and interwoven history. It is not uncommon to see emerging markets rely heavily on trade with the world (Reyes-Heroles et al., 2020). On the other hand, China, with approximately 1.4 billion population, naturally becomes the most significant market that other countries want to approach. However, after three decades since the beginning of trade liberalization, China has maintained its unique authoritarian political regime, and there is still no truce between the “People’s Republic of China (PRC)” and “Taiwan (Republic of China, ROC)”. Since ideological transformation is not occurring as the Chinese economy grows, the rest of the world begins to evaluate political concessions while sharing the market with China. Foreign firms and governments face economic coercion in China as a result of clashes between the Chinese government and foreign companies. Taiwan had a unique dilemma when choosing between the economic market or jeopardizing its sovereignty in this regard.

We are interested in Taiwan’s role in economic integration during the escalating U.S.-China tensions. Applying the Computable General Equilibrium (CGE) model and the GTAP database, we estimate the impact of Taiwan joining RCEP. The motivations are as follows. First, the administration in Taiwan has advocated the New Southbound Policy (NSP) since 2016, as the primary goal of NSP aims to reduce Taiwan’s economic reliability to China.² To achieve this goal of having more trade exposure to Southeast Asian countries, joining RCEP seems feasible. Secondly, the Taiwan issue has been at the core of the political conflicts between the U.S. and China since the Cold War. The tension between the U.S. and China continues to grow as China has become the most

²To reduce the economic reliability of China, the incumbent Tsai Ing-Wen administration pushed a “New Southbound Policy” as she was elected as Taiwanese President in the general election of 2016. We detail the NSP in Section 2.1.

significant global economic unit. It is unclear whether Taiwan's exclusion from the RCEP was due to politics, economics, or both. Lastly, we are interested in estimating how much the RCEP's political compromise costs. Since Taiwan's exporting industry also plays a vital role in the global value chain, the results of this study have the potential to be a useful benchmark for other high-tension or conflict regions in the world.

Taiwan has been critical of East Asian geopolitics and the US-China competition. Since Taiwan locates on the southeast coast of China, it has unreplaceable geographical and military interests for the U.S.-led democratic alliance to scout the power of growing China. Hence, Taiwan has been the hot spot for geopolitics and the front end of potential conflicts since the Cold War era ([Gray, 2011](#); [Hsieh, 2011](#)). Economically, firms headquartered in Taiwan have made their names in the wave of globalization by exporting consumer electronic goods and computer chips to the rest of the world since the 80s ([Brown and Linden, 2011](#); [Cheng, 2022](#); [Gereffi, 2019](#); [Kaynak and Kuan, 1993](#)). The advanced semiconductor industry in Taiwan has recently also shown its vital role in worldwide consumer electronics and the computer market ([Chen and Leong, 2022](#)). The impacts of the Taiwanese trade policies, especially dealing with China and the U.S., do not merely affect the welfare of the individuals and multinational firms in the Indo-Pacific region. The dynamics of the US-China-Taiwan relationship, the so-called precarious triangle, intertwined with the world instead ([Weidenbaum, 2000](#)).³

Due to the inherent complexity of the linkage between the domestic production sectors and foreign markets, it is not easy to estimate the impact of trade agreements objectively by using the empirical analysis under the partial equilibrium structure ([Plummer et al., 2011](#)). Not to mention if this supposedly economic-oriented decision is upgraded to the political level. Would it be better for the U.S. if Taiwan joined the RCEP and U.S. did not? Would China benefit or lose if Taiwan joined the RCEP? If Taiwan discontinues the FTA with China and enters the RCEP, would China encounter a benefit or loss in the welfare change? In this paper, we hope to use the CGE model

³We detail the U.S.-China-Taiwan relationship, the so-called Precarious Triangle in Section [2.3](#).

to provide a relatively objective and economic view to show the effects on China and the U.S. should Taiwan join the RCEP.

RCEP magnifies the imperativeness of Taiwan, as the Taiwan issue has once again become the primary platform for the U.S.-China political and economic competition. Hence, documenting the economic impacts of Taiwanese participation in the Regional Trade Agreement motivates this research. We focus on simulation of the results and analyzing the counterfactual policy impacts on China and the U.S. if Taiwan chooses to participate in RCEP, from which Taiwan is currently excluded. According to our results, the exclusion of Taiwan in the RCEP is not purely political; instead, there is an economic rationale behind it. We categorize the countries into five groups, i.e., China, the U.S., Taiwan, RCEP, and the Rest of the World, under the standard CGE model in the GTAP, which includes 56 sectors and 121 countries. Also, we utilize the latest version, version 10, of the GTAP database, setting 2014 as the reference year. Then, we simulate the experimental policy shock using the RunGTAP program to simulate the trade shocks and analyze welfare change and the economic impacts on the U.S. and China.⁴

There are two potential multilateral agreements in which Taiwan can participate. Except for RCEP, the Comprehensive and Progressive Trans-Pacific Partnership (CPTPP) was another regional trade agreement that Taiwan wanted to join.⁵ CPTPP, the once-U.S.-led regional trade agreement, was formerly known as the Trans-Pacific Partnership Agreement (TPP).⁶ The potential impact on the world of Taiwan's decision

⁴GTAP is formulated and solved using GEMPACK, a flexible system for solving Applied General Equilibrium (AGE) models. RunGTAP is a visual interface to various GEMPACK programs. RunGTAP allows the user to run simulations interactively in a Windows environment using the GTAP general equilibrium model.

⁵The CPTPP is a free trade agreement (FTA) between Australia, Brunei Darussalam, Canada, Chile, Japan, Malaysia, Mexico, Peru, New Zealand, Singapore, and Vietnam. The 11 countries signed the CPTPP on 8 March 2018 in Santiago, Chile. This agreement is a separate treaty that incorporates, by reference, the provisions of the TPP, a precedent treaty that was signed but not yet in force, except for a limited set of suspended conditions. The 11 countries have a shared vision of the CPTPP as a platform open to others to join if they can meet its high standards. In section 2.2, we detail the institutional background and the development of the RCEP and TPP.

⁶U.S. President Obama announced in November 2009 the plan of the Trans-Pacific Partnership. The United States intends to participate in the Trans-Pacific Partnership (TPP) negotiations to conclude an ambitious, next-generation Asia-Pacific trade agreement that reflects U.S. economic priorities and values. Through this agreement, the Obama Administration seeks to boost U.S. economic growth and support the creation and retention of high-quality American jobs by increasing exports in a region that includes some of the world's most robust economies and represents nearly 40 percent of global GDP. Please refers to the official website of TPP for more details, <https://ustr.gov/tpp/overview-of-the-TPP>

to join either trade agreement is enormous. However, only limited literature discusses the implications or analyzes counterfactuals. There is not much literature targeting Taiwan's impact using the CGE model, and none of them targeted the potential outcome in the U.S. and China. We focus on the effect on the U.S. and China should Taiwan join RCEP in this paper and leave the discussion of the CPTPP to the next project.

This paper is organized as follows. The following section reviews three critical institutional terms mentioned: the New Southbound Policy (NSP), the RCEP, and the Precarious Triangle. We document them and review the related literature. Subsection 2.2 will introduce the origin and the development of the RCEP. Then, Subsection 2.3 discusses a brief history of Taiwan's role in China-U.S. competition as we discuss the string of literature focusing on the so-called "Precarious Triangle," the U.S.-China-Taiwan relationship. Section 3.1 discusses the development background and the related literature on the CGE model and GTAP. Section 5 documents how the GTAP network updates the Input-Output Table from the countries worldwide. Using Taiwanese trade data as an example of how the GTAP database was constructed, we review the literature on how Taiwanese trade data was collected in GTAP. Section 4 discusses aggregation methods in the GTAP database and then introduces the experimental shock we apply in the RunGTAP model. We organize the experimental results in Section 6. Finally, in the last section, Section 7, we identify the results from graphs, conclude our findings, and discuss the possible extension and policy implications to wrap up the paper.

2 Policy Background

In Section 2, we review the details of three critical terminologies centering on this paper. Our goal is to provide a comprehensive overview of Taiwan's concurrent significant foreign policies and how they could potentially affect the political-economic equilibrium between the U.S. and China. The following Subsection 2.1 introduces New Southbound Policy (NSP). Then, in Subsection 2.2, we review the institutional

background of RCEP. Finally, Subsection 2.3 describes the Precarious Triangle, a term created in the 2000s to describe the relationship between the United States, China, and Taiwan.

2.1 New Southbound Policy (NSP)

To expand Taiwan's presence across the Indo-Pacific, incumbent Taiwanese President Tsai Ing-wen introduced the New Southbound Policy (NSP) to strengthen Taiwan's relationships with the countries that are geographically in the South of Taiwan, starting with her first term as Taiwanese President. The targeted nations are ten ASEAN countries and six states in South Asia, Australia, and New Zealand.⁷ This policy was introduced after Tsai led the Pro-Taiwanese-Independence Party, the Democratic Progressive Party (DPP), to victory in the presidential election in 2016. The NSP not only targets the economic and trade perspective but is also designed to increase the impacts of Taiwan's influence in Asia and enhance Taiwan's regional integration (Glaser et al., 2018). According to the official announcement of the NSP, the purpose of the NSP seeks to leverage Taiwan's cultural, educational, agricultural, and economic assets while maintaining a stable cross-Strait relationship with China.

Interestingly, NSP is not the first policy in Taiwanese history to explore opportunities with the Southeastern Asian countries. It follows similarly named guidelines in the 1990s, Southbound Policy, which operated under the previous administration between 1996-2008. The goal of the Southbound Policy was clear: counterstrike the wave of investment and trade in China during the late 90s and early 2000s. Under the Lee Tung-Hui region, just like the NSP, the Southbound Policy aimed to diversify Taiwan's economic reliability to Mainland China and divert them towards the South East Asian countries. However, due to the increasing volume of China's economic growth, the 1998 Asian Financial Crisis, and China's successful bid for membership in the World

⁷The 19th ASEAN Summit, under the Chairmanship's theme of "ASEAN Community in a Global Community of Nations," held in Bali on 17 November 2011, was chaired by the President of the Republic of Indonesia, Dr. Susilo Bambang Yudhoyono, as the Chair of ASEAN in 2011.

Trade Organization in 2001, the old Southbound policies did not achieve much. China has been the trade counterpart that Taiwan mainly relied on since then.

As Tsai indicates in her inaugural speech, the NSP's goal is to reinvigorate and diversify Taiwan's economy to the booming Southeast and South Asian markets. The Taiwan government opened a series of service centers, one for each of the 18 countries covered by the NSP, and instructed the Financial Supervisory Commission to set up a "southbound center" financing platform for Taiwanese businesses in need of capital injections. On the other hand, the government encourages multinational companies with a strong tie with Taiwan, including those headquartered in Mainland China, to relocate to Southeast or South Asia to take advantage of lower operating costs.

This paper aims to estimate the results if Taiwan joins RCEP. As of now, Taiwan is working closely with the Southeastern countries, and we want to know the economic impact on Taiwan's foremost trade counterparts if Taiwan is invited to join RCEP at any chance. Since this is a complete counterfactual policy analysis, we rely on the comprehensive model, GTAP, to run our policy experiments. We start to set the trade shock by reducing the tariffs uniformly on the importing goods from RCEP countries to Taiwan, and in this experiment, we do the same policy shock in the reverse direction too. Section 3.1 introduces the GTAP system and its economic model. We also review the development of the GTAP and the setting in this project for both model and data. Then, after configuring the environment in the GTAP model and database, we can calculate the potential welfare change and economic shocks toward China, the US, Taiwan, and the whole RCEP, if Taiwan becomes a member.

2.2 Regional Comprehensive Economic Partnership (RCEP)

RCEP was initially built on the Association of Southeastern Asian Nations (ASEAN) proposal to add more Asian states. It was known as "ASEAN + 3" with the invitation of China, Japan, and South Korea, and "ASEAN + 5" counting Australia and New Zealand. As a regular preferential trade agreement, RCEP is an economic contract to govern the policy tools of the international trades among their member states. They are cutting

trade barriers, such as tariffs, subsidies, and technical trade barriers. As indicated in its bylaws, the goal of RCEP is to boost the trade flows among the member states so that the firms and the residents can take advantage of the less costly and more diversified goods ([Shimizu, 2021](#)).

In November 2011, at the 19th Association of Southeast Asian Nations (ASEAN) Annual Meeting held in Bali, Indonesia, the idea of Regional Comprehensive Economic Partnership (RCEP) was first introduced.⁸ The official RCEP negotiations were initiated during the 21st ASEAN Summit in Cambodia the following year. By November 2019, All participating countries aim to finalize and sign a deal.

The RCEP is a proposed preferential and regional trade agreement between the member states of the ASEAN and their free trade agreement (FTA) partners. Include Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Singapore, Thailand, Vietnam, China, Japan, India, South Korea, Australia, and New Zealand. Altogether, the sixteen countries negotiating the RCEP account for a third of the world's GDP and almost half the world's population, with the combined GDPs of China and India alone making up more than half of that.

Following the convention of multilateralism, the RCEP aims to lower international trade barriers in goods and services and protect intellectual property among the member states. RCEP aims to create an integrated market with sixteen countries, making it easier for products and services of each of these countries to be available to sell across this region. The preliminary negotiation topic between the countries is the following: trade in goods and services, investment, intellectual property, dispute settlement, e-commerce, small and medium enterprises, and economic cooperation.

RCEP is not the only sizeable regional integration project in Asia-Pacific. The US-led Trans-Pacific Partnership Agreement (TPP) was also brewing in progress in the 2010s, proposed by Barack Obama's administration. According to the announcement of the White House at that time, TPP is a trade agreement targeting eleven other Asian-Pacific countries, including Canada and Mexico, to eliminate over 18,000 taxes that

⁸The 19th ASEAN Summit, under the Chairmanship's theme of "ASEAN Community in a Global Community of Nations," held in Bali on November 17, 2011, was chaired by the President of the Republic of Indonesia, Dr. Susilo Bambang Yudhoyono, as the Chair of ASEAN in 2011.

those countries put on U.S.-made products. However, the TPP does not include the most significant trade partner of the U.S., China, due to political reasons. Hence, it is well-believed that China pushed to form the RCEP in 2012 to counter the TPP. Since then, the RCEP has become a powerful tool for China to counter the U.S. endeavor to prevent Beijing from building up its trading blocks.

However, U.S. President Donald Trump discontinued the Obama administration's policy and withdrew from the TPP on January 30, 2017.⁹ The remaining countries in the original TPP negotiated a new trade agreement called Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP), which incorporated most of the provisions of the TPP and entered into force on December 30, 2018. The progress and the future of CPTPP were not clear since then.

2.3 Precarious Triangle

Dittmer (1981) is the first study using the term “strategic triangle” in the literature. Instead of describing the U.S.-China-Taiwan relationship, the author applies it to the U.S.-China-U.S.S.R. relationship. This paper also provides the game-theoretic perspective of the political competitions between three countries. The concept of a “strategic triangle” is helpful in an analysis of the internal logic of the relationship between the United States, the Soviet Union, and China. The preconditions for a triangular relationship are that each player recognizes the strategic salience of the three principles. The relationship between any two will be affected by each player's connection to the third. Dittmer (1981) defines three distinct pattern dynamics in the triangle: the menage a trois, consisting of mutually positive relationships among all three; the stable marriage, consisting of a bilateral relationship excluding the third. And the romantic triangle consists of one pivot player playing off two suitors. Each of these pattern dynamics has specific rules of rational play. The shift from one pattern dynamic to another is a function of the players' attempts to freeze a given configuration through a commitment to a treaty or a common ideology. In this paper,

⁹The letter indicating the United States officially withdraws from the Trans-Pacific Partnership Agreement. [Link to the Official Letter of U.S. Trade Representative](#)

we argue the “strategic triangle” could also be applied to the situation between Taiwan, China, and the U.S when it comes to regional integration.

The US-China-Taiwan relationship is inherently complex ([Zagoria, 2011](#)); hence, it was named Precarious Triangle ([Weidenbaum, 2000](#)). Since World War II, Taiwan has been a regional security hot spot due to its unique location and historical inheritance between powerful countries such as the U.S. and China. Jue ([2016](#)) summarizes the diplomatic history and U.S.’s China strategy after the end of the Chinese Civil War. The authors used his experiences as a U.S. foreign delegate to Taiwan starting from Mao Zedong’s era and Zhou Enlai’s “One China” policy proposal.

In the post-war era, the U.S. had treated the island as an ally against Chinese communism at the frontline, and it was the U.S. ([Hsieh, 2020](#)). Navy fleets that secured the infant times of the R.O.C. were established in Taiwan. However, this bilateral relationship was not all smooth. The Chiang family and Kuomintang-led authoritarian regimes once distanced the island from the U.S. The U.S. leaned on China since a solid ally to balance the Soviet Union was eagerly needed in the far east during the Cold War ([Baldwin et al., 1995](#)).

On the flip side, the China-Taiwan relationship also has a long and complex history. In short, until today, China has deemed Taiwan a renegade province since the Chinese Civil War broke out, even though Taiwan has the essential components of being a sovereign country and gradually transformed into a mature democracy since the 90s.¹⁰

Through the lens of international trade, both U.S. and China play crucial roles in business with Taiwan ([Kan and Morrison, 2013](#)). U.S. goods and services trade with Taiwan totaled an estimated 105.9 billion U.S. dollars in 2020, where exports were 39.1 billion and imports were 66.7 billion. The U.S. goods and services trade deficit with Taiwan was 27.6 billion in 2020. On the other hand, in 2020, Taiwan exported approximately 102.5 billion U.S. dollars’ worth of goods to mainland China, increasing from around 91.8 billion U.S. dollars in the previous year.

¹⁰For example, in Taiwan, the presidents are directly elected by the legal constituents across political cycles, government officials with fixed tenure, the congressional members representing different electoral districts on the island, the autonomous military, and the currencies back by its central bank.

3 Methodology

We use the CGE Model as the primary methodology to conduct the policy experiment and calculate the shock of the economic impact. Both database and the standard CGE model under the Global Trade Analysis Project (GTAP) played a critical role in this paper. Hence, in Section 3.1, we review the literature relating to the GTAP and the CGE model ecosystem. We conclude this section by providing an overview graph of the GTAP system. In Section 3.2, we follow Brockmeier (2001) to delineate the structure of the General Equilibrium model in the open economy assumption and document the general accounting relationship between the representative agents in the system.

3.1 Global Trade Analysis Project (GTAP)

The Global Trade Analysis Project (GTAP) is a system combining updated trade data and an economic model. The entire system was initially invented and documented in Hertel (1997). Due to its powerful functionality and comprehensiveness in modeling the country's global trade activities, GTAP has become an effective policy-analysis tool for trade policy shocks. GTAP is also widely used in the counterfactual analysis of simulating the outcome of regional integration. The standard GTAP model included a multi-region, multi-sector CGE model written in the GEMPACK programming language. In GTAP 10, there are 65 sectors and 141 regions. GTAP also had an up-to-date global trade database maintained by the GTAP users worldwide. And the RunGTAP program is the Graphical User Interface (GUI) for the GTAP system. RunGTAP helps the users to collect the data, operate the experiment shocks, preview the results of post-shock equilibrium, and view the code in GEMPACK.

We show an overview of the GTAP environment in Figure 1. As we see in Figure 1, to simulate the outcome of Taiwan joining RCEP as part of the Newly-imposed Southbound Policies, we need to acquire three main components in the system: Data, Model, and Experiment. In this paper, we first use the GTAP 10 database as our primary data resource, based on the Input-Output Tables published by governments worldwide. Secondly, we follow the standard GTAPv7 General Equilibrium model

setting for the model part. The standard GTAPv7 has been widely used to capture the open economy. In addition, we do not change the closure or the default sets of exogenous and endogenous variables to construct the model economy. Finally, we add the shock on the importing tariffs of the goods between Taiwan and RCEP countries to wrap up the simulation exercise.

Corong et al. (2017) provides complete documentation for version 7 of the standard Global Trade Analysis Project (GTAP) model. As it concludes, GTAP is a comprehensive static, global, and general equilibrium model resting on an input-output accounting framework. Moreover, GTAP is also a database that includes international economic activities worldwide. We rely on the RunGTAP to run the policy experiment, which is the virtual interface for the users to use the GTAP more easily. Pearson et al. (2018) gives several examples of hands-on computing that the users can carry out to familiarize themselves with the RunGTAP and GEMPACK software.¹¹

Young and Huff (1996) uses the GTAP database and RunGTAP shock simulating program to analyze the initiative trade agreement in the Pacific Rim dated back to the 1980s, the Asia Pacific Economic Cooperation (APEC) group. The 12 member states founded the APEC with the goal of is to promote multilateral trade reform and facilitating Asian trade. Aguiar et al. (2019) highlights the numerous improvements to the GTAP database, version 10 (also referred to as GTAP 10). GTAP 10 database describes the world economy for four reference years (2004, 2007, 2011, and 2014) and distinguishes 65 sectors, up from 57 in the previous release, in each of the 141 countries. The 121 countries in the GTAP 10 database account for 98% of the world's GDP and 92% of the world population. The GTAP 10 database reports production, intermediate and final uses, international trade and transport margins, and taxes subsidies for each country. GTAP 10 database underlies most applied global general equilibrium models.

In this paper, we apply the CGE model to focus on Taiwan-China-U.S. economic co-competition, regional integration, and potentially building up the new preferential trade

¹¹For more details about RunGTAP and GEMPACK software, please refer to the official documentation of RunGTAP. <https://www.gtap.agecon.purdue.edu/products/rungtap/default.asp>

agreement. There is abundant literature on regional integration in the East Asian regions, mainly focusing on China and Taiwan. We make our further practical analysis based on this literature string. Wang (1997) investigates the impact of China's and Taiwan's accession to the World Trade Organization (WTO) on the U.S. and world agricultural trade using a twelve-region, fourteen-sector CGE model for world trade and production. The simulation results show that integrating China and Taiwan into the global trading system could induce more competition for labor-intensive products and reduce prices. It could drive up the demand for capital and skill-intensive manufactured goods, thus further improving industrial countries' terms of trade.

And quite a few papers use the CGE model to analyze the ECFA. Lee et al. (2011) concludes that in terms of total trade value, the ECFA liberalization would induce a trade creation effect across the Strait of more than 30 billion in the U.S. dollar. There is an increase of 26.04 billion U.S. dollars in exports to China, which is much higher than imports from China, approximately equal to 4.67 billion U.S. dollars. Huang and Soong (2016) introduces the ECFA's aim and discusses its implications for future economic relations between China and Taiwan while reviewing overall and specific statistics of international trade data and investment flows.

Many papers have also applied the CGE models to East Asian regional integration from the perspective of the U.S. Petri et al. (2012) estimates that world income would rise by 295 billion USD per year on the TPP track and by 1.9 trillion if the tracks ultimately combine to yield region-wide free trade.

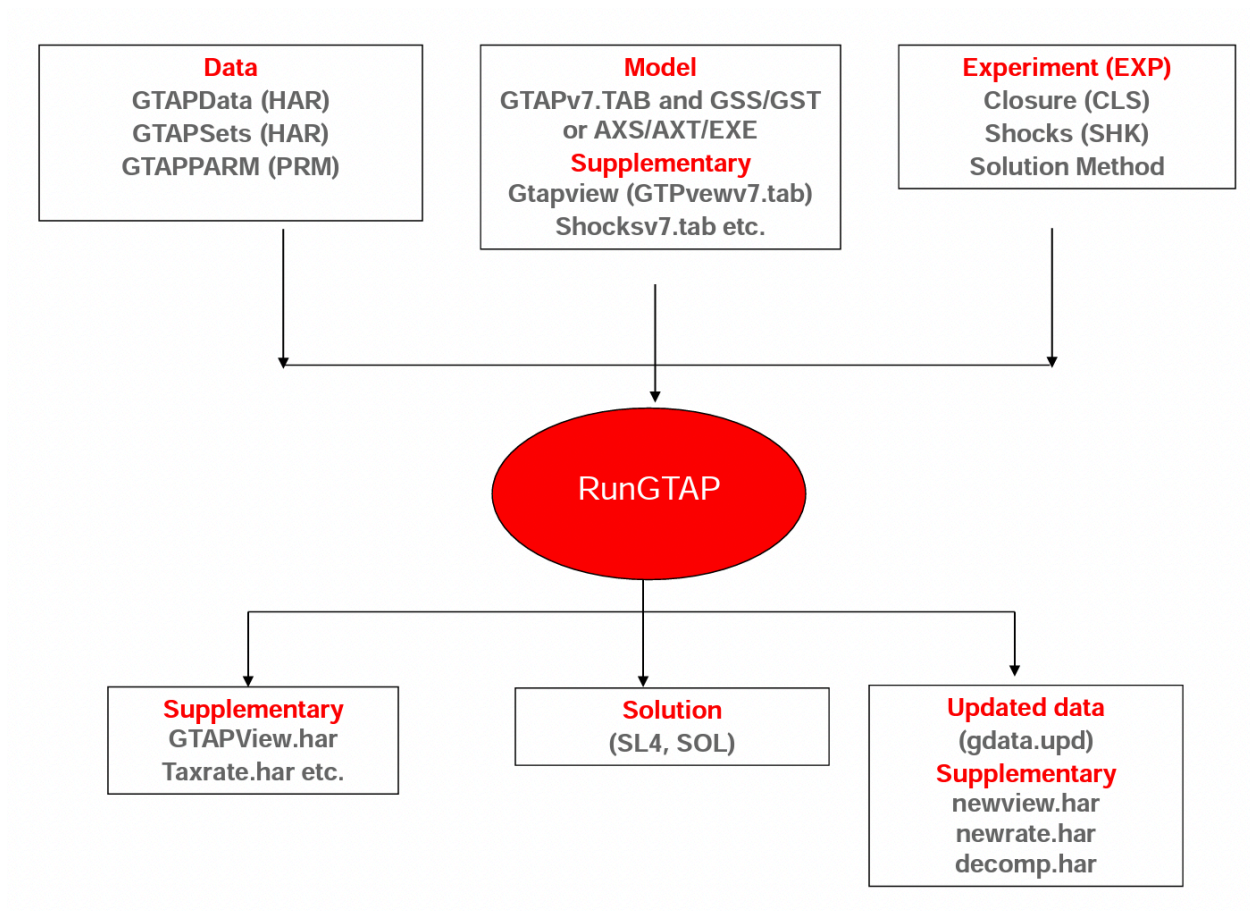


Figure 1: GTAP System

3.2 Global Accounting

Following Brockmeier (2001), we use a graph to illustrate the structure of the default model in the GTAP. Figure 2 shows the global accounting categories and their labels in GTAP. The direction of the arrows represents the capital flows, and the square represents the economic agents. The linkage between the sectors captures the default general equilibrium model within an open economy.

We start by assuming a regional household is associated with each country or composite region of GTAP. This regional household collects all incomes generated in the economy and spending on the d. The *per capita* utility function of this household follows the Cobb-Douglas format, and this representative household exhausted all its incomes into three forms of final demand, which include *Private Household Expenditures* (PRIVEXP), *Government Expenditures* (GOVEXP), and *Savings* (SAVE). The *Value of Output at Agent's prices* (VOA) is paid by producers to use endowment commodities for the regional household. The domestic consumption made by the Private Household is denoted by the *Value of Domestic Private Household Purchases, evaluated at the Agent's price* (VDPA). In GTAP, the consumption behavior of the private household was captured by the Constant Difference of Elasticity (CDE) implicit expenditure function, which is less general but more flexible than the commonly used Constant Elasticity of Substitution (CES) function. Hertel et al. (1990) argues that it is easier to calibrate the model by using data on income and own-price elasticities of demand.

Government domestic purchases are denoted as *Value of Domestic Government purchases* (VDGA), evaluated at the Agent's prices. A Cobb-Douglas sub-utility function is employed in GTAP so that the expenditure shares are constant across all commodities. The model also assumes the savings are completely exhausted on the investment (NETINV).

Then, we focus on the economy's production side and explore the accounting relationship of the firms in GTAP. The firms and the regional household, together with its three final goods, now become a simple model of a closed economy. The producers

receive payments for selling consumer goods to the private households (VDPA) and the government (VDGA), intermediate inputs to other producers (*Value of Domestic Firm Purchases, evaluated at Agents' prices* , VDFA), and investment goods to the saving sectors (NETINV). By zero profit assumption, the revenues must be exhausted on expenditures for intermediate inputs (VDFA) and primary factors of production (VOA).

In addition to the consumers and producers, GTAP also includes the role of the government in the model. TAXES flow from the private household, firms, and government to the regional household. TAXES include taxes and subsidies, denoted as net tax revenues. In GTAP, tax revenues and subsidy expenditures are computed by comparing the value of a given transaction, evaluated at agents and market prices. If there is a discrepancy between two values, the difference must be equal to the tax or subsidy correspondingly.

Then, we focus on the bottom of Figure 2. We could model the open economy by adding a new sector called “Rest of World,” and the value flows relating to these agents. The producers in the open economy not only sell the goods to the domestic market, but they also sell the goods to the “Rest of the World.” VXMD denotes these exports. Moreover, under the open-economy framework, the producers spend their revenues not only on buying the domestically produced intermediate inputs but also on imported intermediate inputs, VIFA. The firms in the open economy have to pay the tax on imported inputs to the regional household.

The GTAP model assumes the Armington assumptions hold. This means that the economic agents could distinguish imported goods by their origin and explains intra-industry trade of similar products. The imported merchandise is assumed to be separable from domestically produced goods and combined in the nest in the production tree. The elasticity of substitution in this input nest is equal across all uses. Under the open economy, the firms decide first on sourcing their imports based on the resulting composite import price. The firms then determine the optimal mix of imported and domestic goods. The “Rest of the World” gets payments for selling their goods for private consumption, government, and firms. These revenues will be

spent on commodities exported from one region to the “Rest of the World,” denoted as VXMD, and on import taxes, MTAX, and exporting taxes XTAX paid to the regional household.

3.3 Trade Policy Tools

Figure 2 can also show the interventions on exports of commodity i from region r to region s . This export supply represents the sales to region s , net of export supplies to all other regions included in GTAP. The power of the export tax can be calculated as the ratio of the *Value of exports of commodity i from region r to regions, valued at the exporter's domestic market, by destination price* (VXMD(i, r, s)) to the *Value of exports of commodity i from region r to regions, valued at the world prices, by destination* (VSWD(i, r, s)). In equation,

$$TXS(i, r, s) = \frac{VXMD(i, r, s)}{VSWD(i, r, s)}$$

If TXS is smaller than one, it means there exists an export tax. Hence, the domestic price (PM) and fob(PFOB) price of goods could solidify the following linkage.

$$PM = \frac{PFOB}{TXS}$$

Likewise, an import tax drives a wedge between domestic and CIF prices. The power of the *ad valorem* import tax, TMS, is calculated as the ratio of the *Value of Imports of commodity i from region s to region r , at Market prices, by Source* (VIMS(i, s, r)) to the *Value of Imports of commodity i from region s to region r , Word prices, by Source price* (VIWS(i, s, r)). That is,

$$TMS(i, r, s) = \frac{VIMS(i, s, r)}{VIWS(i, s, r)}$$

Again, the following equation shows the price linkage between the domestic price and importing price,

$$PMS = \frac{PCIF}{TMS}$$

This paper focuses on how joining the regional agreement would affect. So we relied heavily on adjusting the import tax (TMS) on the goods.

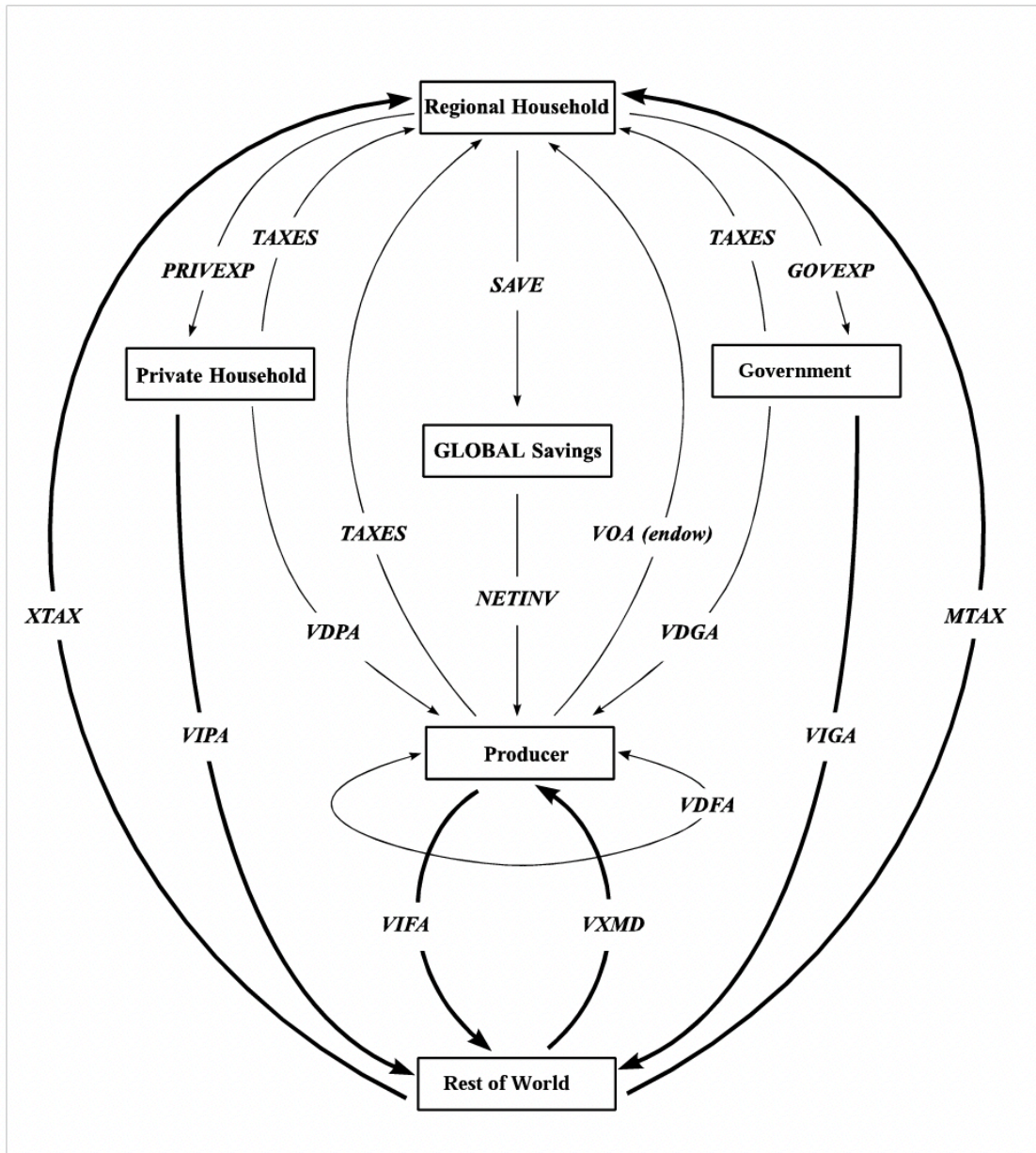


Figure 2: Multi Region Open Economy Model, Brockmeier (1996)

4 Simulation Setup

4.1 Regional Aggregation

Since we focus on analyzing the outcome of the U.S. and China if Taiwan joins RCEP in this study, we separate the U.S., China, and Taiwan in the regional aggregation in the GTAP model. By singling out Taiwan, we could analyze the policy shock of Taiwan's government's intention and how it would happen if joining RCEP became a reality. By doing so, we could explore the shock, particularly from the standpoint of Taiwan. And from the perspective of the Taiwanese government, participating in the RCEP or other regional agreements is always a good option. Until July 2022, RCEP has been ratified by twelve countries, i.e., Australia, New Zealand, Brunei Darussalam, Cambodia, China, Japan, Laos, Malaysia, the Republic of Korea, Singapore, Thailand, and Vietnam. We group them into the RCEP group in the GTAP aggregation scenario, plus China, Taiwan, the U.S., and the Rest of the World becomes the five main groups in the setting. China includes the two Special Administrative Regions, Hong Kong and Macau. Table 1 summarizes the aggregation mapping of the GTAP regions code used in this paper. The GTAP code of the countries can be found in Appendix.

4.2 Sectoral Aggregation

Since we currently use the Limited Executive Image Version of the GEMPACK software, we could only run a maximum of ten sectors in the RunGTAP model, according to the GEMPACK's license holder. Hence, we categorize the industries into ten larger sectors and tally them in the table, Table 2. The ten large sectors are Grains and Corps, Livestock and Met Products, Mining and Extraction, Processed Food, Textile and Clothing, Light Manufacturing, Heavy Manufacturing, Utilities and Construction, Transport and Communication, and Other Services. In the future, as we can acquire the unlimited version of the GEMPACK license, we will try to expand this study to more detailed sectoral mapping. The following table, Table 2, shows the industrial groups we have, which is the default aggregation that runs in the GTAP model. Though the

current categories are general, once the GEMPACK limitation is solved, we can single out the industries we are particularly interested in; now, we will leave it to the next stage of the project. The Appendix details more about the mapping and the description of the sectors.

Table 1: Mapping of Regional Aggregation

No.	New.Code	Region.Description	Comprising.old.regions
1	USA	United States of America	usa
2	China	China and Hong Kong	chn hkg
3	Taiwan	Taiwan	tw
4	RCEP	RCEP Members w/o China	aus nzl jpn kor brn khm idn lao mys phl sgp tha vnm xse
5	RestofWorld	Rest of World	xoc mng xea bgd ind npl pak lka xsa can mex xna arg bol bra chl col ecu pry per ury ven xsm cri gtm hnd nic pan slv xca dom jam pri tto xcb aut bel bgr hrv cyp cze dnk est fin fra deu grc hun irl ita lva ltu lux mlt nld pol prt rou svk svn esp swe gbr che nor xef alb blr rus ukr xee xer kaz kgz tjk xsu arm aze geo bhr irn isr jor kwt omq qat sau tur are xws egy mar tun xnf ben bfa cmr civ gha gin nga sen tgo xwf xcf xac eth ken mdg mwi mus moz rwa tza uga zmb zwe xec bwa nam zaf xsc xtw

Table 2: Mapping of Sectoral Aggregation

No.	Code	Sectoral.Description	Composition
1	GrainsCrops	Grains and Crops	pdr wht gro v_f osd c_b pfb ocr pcr
2	MeatLstk	Livestock and Meat Products	ctl oap rmk wol cmt omt
3	Extraction	Mining and Extraction	frs fsh coa oil gas oxt
4	ProcFood	Processed Food	vol mil sgr ofd b_t
5	TextWapp	Textiles and Clothing	tex wap
6	LightMnfc	Light Manufacturing	lea lum ppp fmp mvh otn omf
7	HeavyMnfc	Heavy Manufacturing	p_c chm bph rpp nmm i_s nfm ele eeq ome
8	Util_Cons	Utilities and Construction	ely gdt wtr cns
9	TransComm	Transport and Communication	trd afs otp wtp atp whs cmn
10	OthServices	Other Services	ofi ins rsa obs ros osg edu hht dwe

4.3 Policy Experiment

The main shock we are looking into is the import tariffs. The exogenous variable we control is “tms,” which is the “importing tax of goods” label in the GTAP system. Though the constitution and regulations of each preferential trade agreement are different, the goal of joining a trade block or signing preferential trade agreements should be to reduce the trade barriers and lower the import tariffs often documented in the preamble of the treaties. Hence, lowering the import tariff of the goods imported from the trade counterpart is a viable policy experiment. Reciprocally, exporting goods from Taiwan to the member states in the RCEP should encounter identical policy shocks.

To keep our result clean and straightforward, we do not make any other changes in the setting of sector and endowment changes in the GTAP in this project. We follow the default setting of the CLOSURE tab in RunGTAP. We will leave the heterogeneous shock to a specific sector in the next project.

We targeted the “importing tax of the goods” in the SHOCK setting in the GTAP to lower the current importing tax rates on the goods from the potential trade counterpart. So if the RCEP accepted Taiwan, the tariffs the importing goods from the RCEP member states would drop, and on the other hand, the exporting Taiwanese goods to the RCEP member countries would be required to be eliminated the importing tax too.

We run the policy shock experiment for this scenario in the RunGTAP program following the defaulting default general equilibrium model in the GTAP. Specifically, we lower the tariffs of all importing goods from the RCEP member states to Taiwan and the other way around, starting from the power of change from 0% to 100%. In the following section, we report the welfare Equivalent Variation (EV) results and the Value of the GDP (VGDP) change between the three targeted countries we are most interested in this paper, China, Taiwan, and the US.

5 Data

GTAP not only defines the General Equilibrium model but also is an extensive global database based on the input-output table published regularly by the governments. In the previous section 3.1, we reviewed the model and accounting relationship between sectors, which led to building up a multi-sector, multi-regions, General Equilibrium model. In Section 4, we explained the setting of the aggregation scenario. Now, we focus on the data side in the GTAP and review the data resources based on our regional and sectoral aggregation. In this Section 5, we introduced the data resource and the trade data relating to Taiwan that we could extract from GTAP. We use them to explain how GTAP combined the General Equilibrium model with the global trade data. Appendix A.2 shows all the regions included in the GTAP database 10, which currently consists of 141 regions and 65 sectors, based on the reference year 2014.

5.1 Input-Output Table

According to Lin and Hsu (2015), Taiwan's initial input-output (I-O) table is derived from the "Input-Output Table of Taiwan" provided by the Directorate-General of Budget, Accounting, and Statistics (DGBAS).¹²

DGBAS is the bureau governed by the Executive Yuan of Taiwan, the principal agency responsible for collecting and organizing economic data. The original 2006 input-output table in the GTAP 9 database includes 554 by 166 sectors, valued in millions of New Taiwan Dollars, at the current producer's prices.

According to the DGBAS database, two tables are available: a transactions table for domestic goods and services and a transactions table for imported goods and

¹²The Directorate General of Budget, Accounting and Statistics (DGBAS) of the Executive Yuan, handles the national budget, accounting, and statistics affairs, representing the government of the Republic of China (Taiwan). It has existed for over 90 years and has been reorganized numerous times since its inception. In April 1931, the DGBAS of the Nationalist Government was established. In May 1948, after the Constitution was enacted, the DGBAS of the Nationalist Government was elevated to the Ministry of Budget, Accounting, and Statistics. It was placed under the Executive Yuan with a minister of state as its head. As the country developed rapidly, the Organization Act of the Executive Yuan's Directorate General of Budget, Accounting, and Statistics was revised. It came into force in November 1973 and was revised in May 1983. In line with the Executive Yuan's restructuring policy, the DGBAS was reorganized on February 6, 2012. The functions of the departments have been reviewed, and one affiliated institute (Electronic Data Processing Center) was merged.

services. The final demand matrix in the transactions table of domestic products and imports includes private consumption expenditure, government consumption expenditure, gross private fixed capital formation, change in stocks, and exports. The value-added matrix in the transactions table at producer's prices includes compensation of employees, operating surplus, depreciation of fixed capital, indirect taxes, and (less) subsidies. Depreciation of fixed capital was added to the operating surplus to obtain a vector of capital utilization.

The GTAP Data Base is a consistent representation of the world economy for a pre-determined reference year. Underlying the database, there are several data sources, including, among others: national input-output (I-O) tables, trade, macroeconomic, energy, and protection data. The underlying input-output tables are heterogeneous in sources, methodology, base years, and sectoral detail, and thus for achieving consistency, substantial efforts are made to make the disparate sources comparable. For these reasons, the objective of the GTAP Data Base is not to provide I-O tables but to facilitate the operation of economic simulation models ensuring users a consistent set of economic facts. Some users interested in particular Social Accounting Matrices (SAMs) use utilities written by researchers in the network to extract them. Users building I-O tables based on this information do that at their own risk and are assumed to understand the limitations imposed by the database construction process.

The GTAP Data Base is not a relational database of economic variables ([Aguiar et al., 2019](#)). Users interested in macroeconomic and trade data only for comparative purposes are better served by sources such as the World Bank Development Indicators (WDI), the International Monetary Fund (IMF) financial statistics, or the Food and Agriculture Organization (FAO) statistics, to name a few. The data in the GTAP Data Base accurately depicts the magnitudes of economic variables, but they are presented in terms of the aggregates that serve Computable General Equilibrium (CGE) modeling.

5.2 Trade Data

Several trade data centered on Taiwan are presented in this subsection to describe the characteristics of Taiwan's market and its dependence on trade. The variables we highlight here are the trade commodities valued by local prices, the exporting value $VXMD_{i,r,s}$, and importing value $VIMS_{i,r,s}$. Then are the trade flows value, exporting and importing, valued by the world market price, $VXWD_{i,r,s}$, and $VIWS_{i,r,s}$. From all the data tables listed here, we can see that China, the U.S., and RCEP are Taiwan's three largest trade partners.

$VXMD_{i,r,s}$ represents the value of exports of a tradable commodity i from source r to destination s , evaluated at exporter's market prices. In the model, the representation is as follows,

$$VXMD_{i,r,s} = PM_{i,r} * QXS_{i,r,s}$$

where $i = \text{TRAD_COMM}$; $r = \text{REG}$; $s = \text{REG}$, $PM_{i,r}$ is the market price of non-saving commodity i in region r , and $QXS_{i,r,s}$ is the quantity of exports of tradable commodity i from source r to destination s . Table 6 shows the data in GTAP.

$VIMS_{i,r,s}$ represents the value of imports of a tradable commodity i from source r to destination s , evaluated at importer's market prices.

$$VIMS_{i,r,s} = PMS_{i,r} * QXS_{i,r,s}$$

where $i = \text{TRAD_COMM}$; $r = \text{REG}$; $s = \text{REG}$. $PMS_{i,r}$ is the market price by the source of tradable commodity i imported from source r to destination s , and $QXS_{i,r,s}$ is the quantity of exports of tradable commodity i from source r to destination s . Table 4 shows the data in GTAP based on our regional and sectoral aggregation settings.

The $VXWD$ and $VIWS$ follow the same logic. Instead of using the domestic market price to evaluate the trade flow, these two terms were calculated by the world market price. Specifically, $VXWD_{i,r,s}$ values exports of tradable commodity i from source r to

destination s , evaluated at world (FOB) prices, and VIWS $_{i,r,s}$ values imports of tradable commodity i from source r to destination s , measured at world (CIF) prices. That is,

$$VXWD_{i,r,s} = PFOB_{i,r,s} * QXS_{i,r,s}$$

$$VIWS_{i,r,s} = PCIF_{i,r,s} * QXS_{i,r,s}$$

Table 3: Value of Exports from Taiwan at Destination Prices (VXMD[i, Taiwan, d])

VXMD	USA	China	Taiwan	RCEP	Rest of World
1 GrainsCrops	85.45	132.35	0	174.36	85.28
2 MeatLstk	30.84	70.55	0	271.35	34.98
3 Extraction	9.11	273.81	0	231.73	73.86
4 ProcFood	396.36	816.83	0	1538.37	449.30
5 TextWapp	1109.80	3584.23	0	4702.37	3272.98
6 LightMnfc	8605.41	4549.87	0	7238.38	12889.85
7 HeavyMnfc	25010.71	132049.44	0	77231.91	40242.29
8 Util_Cons	192.48	118.06	0	113.00	438.62
9 TransComm	2395.28	1469.41	0	1406.42	5456.56
10 OthServices	3500.85	2147.63	0	2055.57	7975.10

Table 4: Value of Imports to Taiwan at Source Prices (VIMS[i, s, Taiwan])

VIMS	USA	China	Taiwan	RCEP	Rest of World
1 GrainsCrops	2241.28	238.23	0	723.61	1805.02
2 MeatLstk	721.80	139.81	0	674.64	410.53
3 Extraction	84.78	587.17	0	14373.76	38062.09
4 ProcFood	931.13	434.12	0	3306.19	2480.65
5 TextWapp	110.25	1810.12	0	1039.18	706.93
6 LightMnfc	3295.80	4785.22	0	8288.82	7532.43
7 HeavyMnfc	17263.22	44582.05	0	70617.99	35077.88
8 Util_Cons	249.51	122.58	0	123.53	536.01
9 TransComm	2018.69	2473.14	0	1508.65	6045.51
10 OthServices	3833.73	1921.93	0	1913.27	7123.65

Table 5: Value of Export from Taiwan at World Prices (VXWD[i, Taiwan, d])

VXWD	USA	China	Taiwan	RCEP	Rest of World
1 GrainsCrops	2164.68	222.12	0	660.37	1761.85
2 MeatLstk	657.20	138.43	0	635.38	375.67
3 Extraction	82.76	574.83	0	14357.37	38034.42
4 ProcFood	836.26	378.86	0	2934.07	2307.08
5 TextWapp	104.09	1662.24	0	963.54	653.22
6 LightMnfc	3214.06	4613.74	0	7794.95	7002.08
7 HeavyMnfc	17053.13	44156.29	0	69645.52	34551.72
8 Util_Con	249.51	122.58	0	123.53	536.01
9 TransComm	2018.69	2473.14	0	1508.65	6045.51
10 OthServices	3833.73	1921.93	0	1913.27	7123.65

Table 6: Value of Imports to Taiwan at World Prices (VIWS[i, s, Taiwan])

VIWS	USA	China	Taiwan	RCEP	Rest of World
1 GrainsCrops	2164.68	222.12	0	660.37	1761.85
2 MeatLstk	657.20	138.43	0	635.38	375.67
3 Extraction	82.76	574.83	0	14357.37	38034.42
4 ProcFood	836.26	378.86	0	2934.07	2307.08
5 TextWapp	104.09	1662.24	0	963.54	653.22
6 LightMnfc	3214.06	4613.74	0	7794.95	7002.08
7 HeavyMnfc	17053.13	44156.29	0	69645.52	34551.72
8 Util_Con	249.51	122.58	0	123.53	536.01
9 TransComm	2018.69	2473.14	0	1508.65	6045.51
10 OthServices	3833.73	1921.93	0	1913.27	7123.65

6 Simulation Results

In Figure 3 and Figure 4, the main simulation results are presented. The value of the EV and VGDP growth rates presented the welfare of the general equilibrium after the shock. We apply the sensitivity analysis by adjusting the shock's power as we move importing taxes between Taiwan and the RCEP country bilaterally. As an experiment, import tariffs are lowered by 10% across all sectors.

Figure 3 demonstrates the welfare change using the monetary measure of the Equivalent Variation (EV). We extract the EV after applying a different level of policy shock. Starting with a ten percent reduction in the bilateral importing tariff between Taiwan and RCEP countries, we add ten percent to the power of the policy shock. The EV unit in Figure 3 is millions in the U.S. dollar. The vertical axis represents the value of EV, and the line represents five groups of countries that we aggregate in this paper.

Several conclusions can be drawn from the graphs. Firstly, if Taiwan is invited to join the RCEP, from the standpoint of gains from trade liberalization, it should accept the offer as soon as possible. Figs 3 and 4 demonstrate that Taiwan benefits the most as the GDP growth rate and the EV increase along with the power of shock. Secondly, the impact of the participation of Taiwan in the RCEP is surprisingly small compared to the combined effect of the RCEP and China. Even though the aggregate trade values of RCEP countries are ranked second among Taiwan's trade counterparts, we are unable to see a significant impact of the tariff reductions in the RCEP countries on goods imported from Taiwan on the macroeconomic indicators we selected. Lastly, China does not appear to have many economic incentives to dissolve the current equilibrium of Taiwan's exclusion from the Regional Comprehensive Economic Partnership (RCEP), indicating that the concession could be a political tool for China to achieve economic integration with Taiwan. We will discuss its policy implications in the final paragraph.

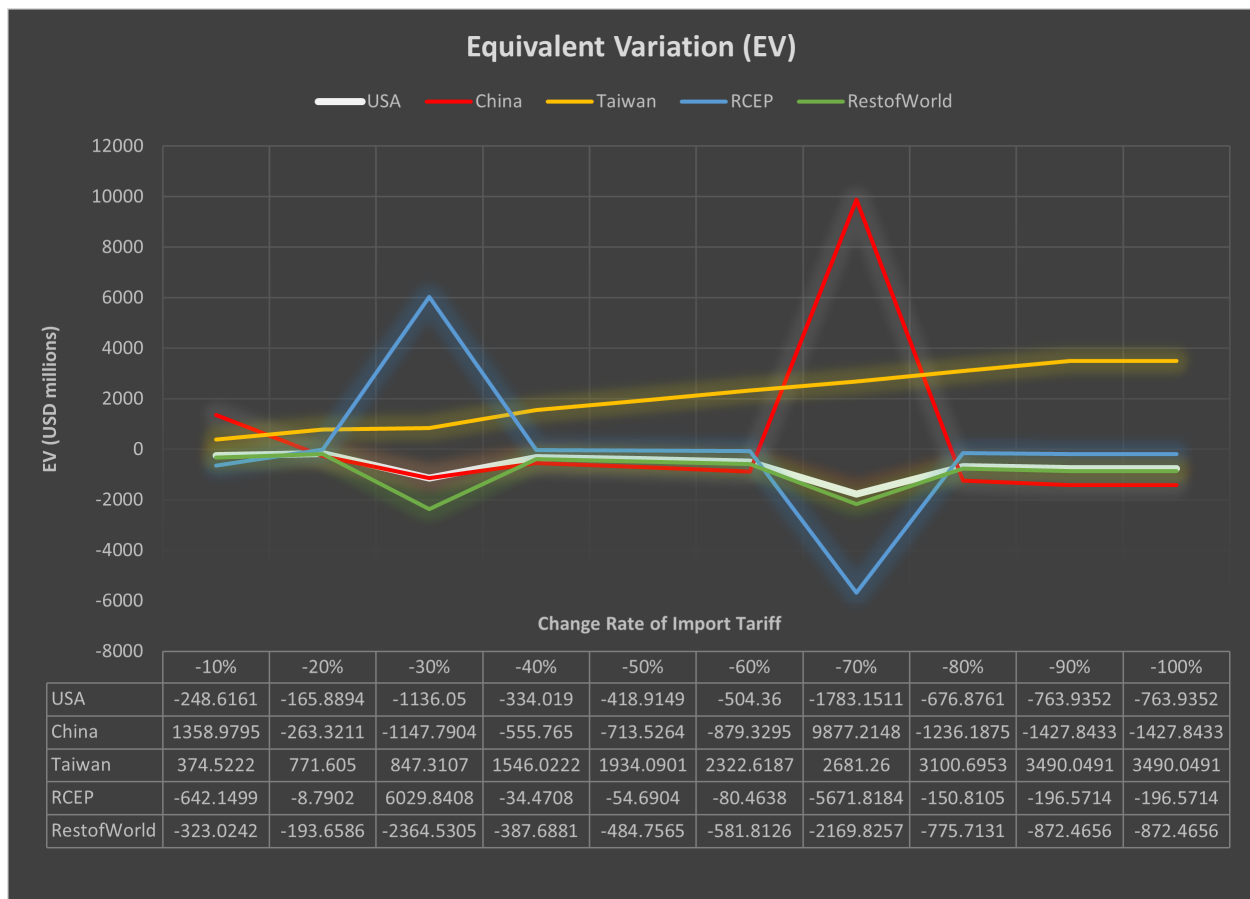


Figure 3: Welfare Change (EV, in USD Millions) as Taiwna Joins RCEP

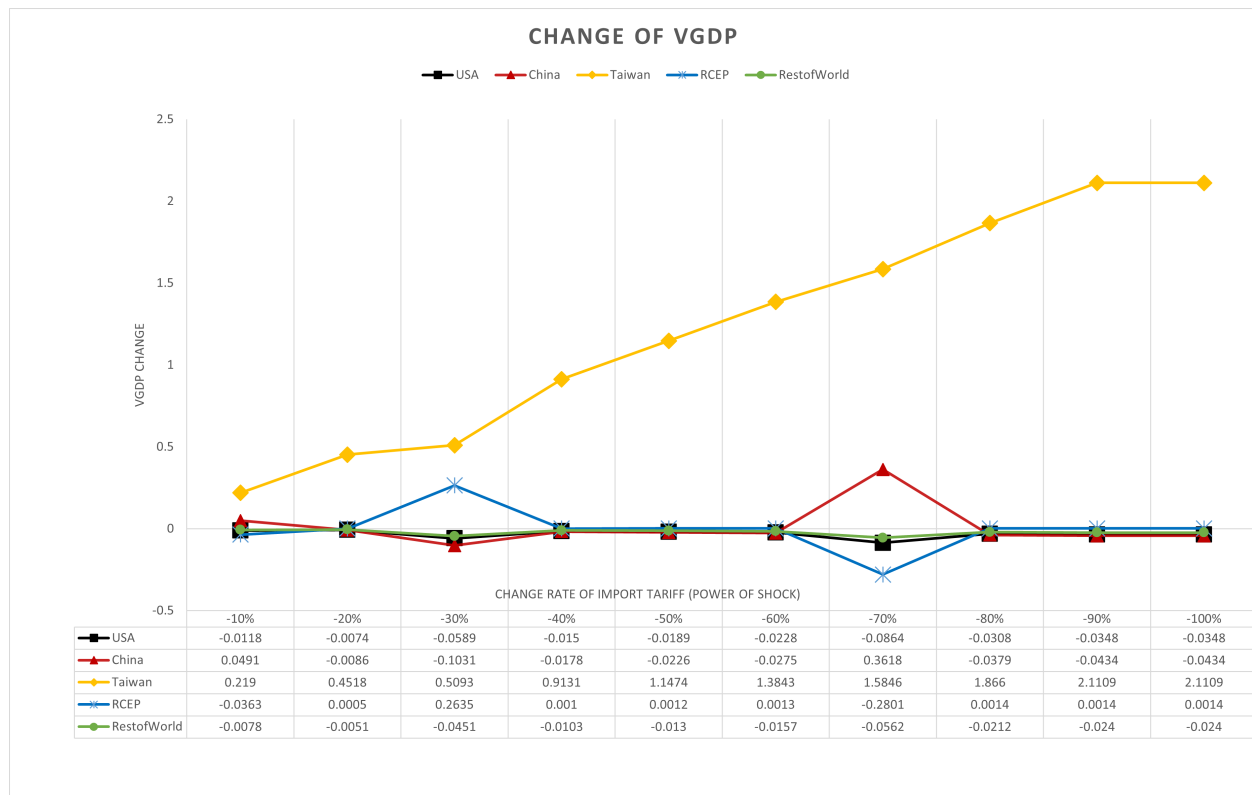


Figure 4: GDP Change Rate as Taiwan Joins RCEP

7 Conclusion

7.1 Policy Implication

There are three main takeaways from this study. First, from the results, we could see that Taiwan would be an obvious beneficiary if she were invited to become a member. As the shock power of a tariff reduction increases, the EV and VGDP will also increase. Therefore, if Taiwan receives an invitation to join the RCEP in the future, it should consider it economically. Second, if Taiwan joins the RCEP and the U.S. does not, then the U.S. would be the one that hurts the most. RCEP and China rank first and second in terms of trade volume. Also, due to the proximity of all the counterparts, lowering trade barriers and increasing the diversity of goods should improve the welfare level of a country. Lastly, since the benefit of Taiwan's joining is not reciprocal to China, we have an economic rationale behind the current equilibrium. The financial incentives for China and RCEP countries to welcome Taiwan are low. The present circumstances of Taiwan's exclusion from RCEP could be explained by economics. It implies, however, that if the invitation did appear, political incentives might be behind it. The Taiwanese government should not ignore this while advocating the New Southbound Policies, which again retracted back to the long-standing dilemma that the Taiwanese must face, striking a balance between political concession and economic gains.

Taiwan's unique role in East Asia recently had to choose between trade agreements led by the world's two most powerful countries. Taiwan played a unique position in the East Pacific geopolitics due to the competition between the U.S. and China. Taiwan shares the same ancient Chinese culture and history as China. Still, it is divided by modern political ideologies. On the other hand, the U.S. has treated Taiwan as a protector of a legion of democratic countries.

Taiwan's decision on which regional trade block it should join reaches beyond a purely economic issue, and the literature on this subject is limited. Making policies that balance national security and gains from trade toward the People's Republic of China (PRC, China) has always been a central issue in presidential elections. Throughout

the Cold War era, the Taiwan issue has been the most sensitive political issue in the middle of the U.S.-China conflict. The battle between economic incentives and the political system has always been an issue. The distance from Taiwan to mainland China is only 68 nautical miles, around 125 kilometers, and less than one hour of air travel. And since both Taiwan and China share the same cultural and ethnic heritage, the vast China market is difficult to ignore. However, China has been known to utilize its economic power to reach its ultimate goal of unifying the island. Taiwan's recent democratization has brought her closer to long-standing U.S. political values, making it more of a political issue than an economic one. As the political implications are indirectly shown, Taiwan's administration might be wise to rethink the meaning and strategies of the "New Southbound Policy" and prepare for upcoming proposals that might be raised during the RCEP negotiations.

7.2 Future Work: Interaction with Other PTAs

Except for the RCEP, Taiwan had made a deal with China to cosign a Bilateral Trade Agreement, the Economic Cooperation Framework Agreement (ECFA). Though the ECFA is still in effect, there were few studies to focus on how it would affect the economic outcome of Taiwan joining another PTA, like RCEP. In future studies, as an extension of this paper, we are interested in how the decision to join the RCEP intertwines with the existing free trade agreement. Currently, Taiwan is not a member of the RCEP and does not have an official preferential trade agreement with the current members of the RCEP. However, Taiwan did sign a preferential trade agreement, the Economic Framework Cooperation Agreement (ECFA), with China in 2008.

Due to world politics leaning toward discouraging China from becoming a superpower as the tension between the U.S. and China gets higher, the Taiwanese have begun to question its policies with China, and some pro-independent delegates even advocate the suspension of the pre-existing ECFA with China. Because Taiwan is currently dealing with the existing ECFA and has an incentive to join the RCEP. We run the policies experiments in the following experimental scenario. Considering the

Taiwanese government has to choose between terminating or honoring the ECFA, at the same time, they would have the option to bid for membership in the RCEP. That is, for Taiwan, there are four scenarios when it comes to RCEP and ECFA. (1) ECFA was not terminated and is accepted by RCEP. (2) ECFA was not discontinued and is not recognized by RCEP. (3) ECFA was discontinued and is not recognized by RCEP. (4) ECFA was terminated and accepted by RCEP.

To have a clearer view of the outcome of discontinuing the ECFA while bidding for membership in RCEP, we can adjust the policy shocks based on other role players in the precarious triangle. In addition, we changed the import tariff for goods from China simultaneously in the previous setting. For example, In scenario 1, we would reduce the import tariffs on the goods between Taiwan and China. In addition, we would reduce the import tax on goods between Taiwan and the RCEP countries. For the results, we chose 10 percent as the increment of the change rate, and we calculated the Equivalent Variation (EV) change as an indicator of the welfare change in the country.

References

- Acemoglu, D., Yared, P., 2010. Political limits to globalization. *American Economic Review* 100, 83–88. <https://doi.org/10.1257/aer.100.2.83>
- Aguiar, A., Chepeliev, M., Corong, E.L., McDougall, R., Van Der Mensbrugghe, D., 2019. The GTAP data base: Version 10. *Journal of Global Economic Analysis* 4, 1–27.
- Baldwin, R.E., Chen, T.-J., Nelson, D.R., 1995. *Political economy of US-taiwan trade*. University of Michigan Press.
- Baysan, T., Panagariya, A., Pitigala, N., 2006. [Preferential Trading in South Asia](#). World Bank Policy Research Working Paper.
- Brockmeier, M., 2001. [A graphical exposition of the GTAP model](#) (GTAP Technical Paper No. 08). Global Trade Analysis Project (GTAP), Department of Agricultural Economics, Purdue University, West Lafayette, IN.
- Brown, C., Linden, G., 2011. *Chips and change: How crisis reshapes the semiconductor industry*. MIT Press.
- Chen, M.-J., Leong, J., 2022. [Geopolitics and the global semiconductor industry](#). Darden Case No UVA-S-0373.
- Cheng, A.-T., 2022. Reinventing the industrial land use policy in democratized development states—a comparison of taiwan and south korea. *Land Use Policy* 112, 105857.
- Corong, E., Hertel, T., McDougall, R., Tsigas, M., Mensbrugghe, D. van der, 2017. The standard GTAP model, version 7. *Journal of Global Economic Analysis* 2, 1–119. <https://doi.org/10.21642/JGEA.020101AF>
- Dittmer, L., 1981. [The strategic triangle: An elementary game-theoretical analysis](#). *World Politics* 33, 485–515.
- Gereffi, G., 2019. Economic upgrading in global value chains, in: *Handbook on Global Value Chains*. Edward Elgar Publishing.
- Glaser, B.S., Kennedy, S., Mitchell, D., Funaiole, M.P., 2018. [The new southbound policy: Deepening taiwan’s regional integration](#), CSIS report. Center for Strategic; International Studies; Center for Strategic; International Studies.

- Gray, K., 2011. Taiwan and the geopolitics of late development. *The Pacific Review* 24, 577–599. <https://doi.org/10.1080/09512748.2011.634077>
- Hashmi, S.M., Lee, Y.T., 2008. Towards east asian economic integration. *European Journal of Economics, Finance and Administrative Sciences* 12, 116–122.
- Hertel, T., 1997. [Global trade analysis: Modeling and applications](#). Center for Global Trade Analysis, Department of Agricultural Economics, Purdue University.
- Hertel, T.W., Peterson, E.B., Surry, Y., Preckel, P.V., Tsigas, M.E., 1990. Implicit Additivity as a Strategy for Restricting The Parameter Space in CGE Models (1990 Annual meeting, August 5-8, Vancouver, Canada No. 270868). American Agricultural Economics Association (New Name 2008: Agricultural; Applied Economics Association). <https://doi.org/10.22004/ag.econ.270868>
- Hsieh, J.F., 2020. Continuity and change in the US-china-taiwan relations. *Journal of Asian and African Studies* 55, 187–200. <https://doi.org/10.1177/0021909620905051>
- Hsieh, P.L., 2011. The China-Taiwan ECFA, Geopolitical Dimensions and WTO Law. *Journal of International Economic Law* 14, 121–156. <https://doi.org/10.1093/jiel/jgr009>
- Huang, M., Soong, J.-J., 2016. The political economy of ECFA impact between china-taiwan and the ASEAN states: Opportunity and challenges. *The Chinese Economy* 49, 429–441. <https://doi.org/10.1080/10971475.2016.1207968>
- Jue, S., 2016. [Triangular relations between u.s., China and taiwan](#). *American Journal of Chinese Studies* 23, v–ix.
- Kan, S.A., Morrison, W.M., 2013. US-taiwan relationship: Overview of policy issues. Library of Congress, Congressional Research Service.
- Kaynak, E., Kuan, W.K., 1993. Environment, strategy, structure, and performance in the context of export activity: An empirical study of taiwanese manufacturing firms. *Journal of Business Research* 27, 33–49. [https://doi.org/10.1016/0148-2963\(93\)90014-G](https://doi.org/10.1016/0148-2963(93)90014-G)
- Lee, T.-C., Wu, C.-H., Lee, P.T.-W., 2011. Impacts of the ECFA on seaborne trade volume

- and policy development for shipping and port industry in taiwan. *Maritime Policy & Management* 38, 169–189. <https://doi.org/10.1080/03088839.2011.556674>
- Lin, H.-C., Hsu, S.-H., 2015. Taiwan, in: G., B.N., Aguiar, A., McDougall, R. (Eds.), *Global Trade, Assistance, and Production: The GTAP 9 Data Base*. Global Trade Analysis Project (GTAP), Department of Agricultural Economics, Purdue University, West Lafayette, IN.
- Lipsey, R.G., 1957. *The theory of customs unions: Trade diversion and welfare*. *Economica* 24, 40–46.
- Martin, P., Mayer, T., Thoenig, M., 2008. Make Trade Not War? *The Review of Economic Studies* 75, 865–900. <https://doi.org/10.1111/j.1467-937X.2008.00492.x>
- Pearson, K., Horridge, M., Corong, E., 2018. Hands-on computing with RunGTAP and WinGEM to introduce GTAP and GEMPACK.
- Petri, P.A., Plummer, M.G., Zhai, F., 2012. *The trans-pacific partnership and asia-pacific integration: A quantitative assessment*, Policy analyses in international economics series. Peterson Institute for International Economics.
- Plummer, M.G., Cheong, D., Hamanaka, S., 2011. Methodology for impact assessment of free trade agreements. Asian Development Bank.
- Reyes-Heroles, R., Traiberman, S., Leemput, E.V., 2020. Emerging markets and the new geography of trade: The effects of rising trade barriers. *International Finance Discussion Papers*.
- Shimizu, K., 2021. The ASEAN economic community and the RCEP in the world economy. *Journal of Contemporary East Asia Studies* 10, 1–23. <https://doi.org/10.1080/24761028.2021.1907881>
- Wang, Z., 1997. China and taiwan access to the world trade organization: Implications for u.s. Agriculture and trade. *Agricultural Economics* 17, 239–264. [https://doi.org/10.1016/S0169-5150\(97\)00018-2](https://doi.org/10.1016/S0169-5150(97)00018-2)
- Weidenbaum, M., 2000. United states-china-taiwan: A precarious triangle. *Challenge* 43, 92–106.
- Young, L.M., Huff, K.M., 1996. Free trade in the pacific rim: On what basis?, in:

Hertel, T.W.E. (Ed.), *Global Trade Analysis: Modeling and Applications*. Cambridge University Press, pp. 235–252. <https://doi.org/10.1017/CBO9781139174688.010>

Zagoria, D.S., 2011. U.s.–china and cross-strait relations: How stable? A conference with the PRC taiwan affairs office on u.s.–china and cross-strait relations. *American Foreign Policy Interests* 33, 168–177. <https://doi.org/10.1080/10803920.2011.605717>

Appendix

A.1 Detailed List of GTAP Sectors

Table 7: Detailed Sectoral Code of GTAP

No.	Code	Description
1	pdr	Rice: seed, paddy (not husked)
2	wht	Wheat: seed, other
3	gro	Other Grains: maize (corn), sorghum, barley, rye, oats, millets, other cereals
4	v_f	Veg & Fruit: vegetables, fruit and nuts, edible roots and tubers, pulses
5	osd	Oil Seeds: oil seeds and oleaginous fruit
6	c_b	Cane & Beet: sugar crops
7	pfb	Fibres crops
8	ocr	Other Crops: stimulant; spice and aromatic crops; forage products; plants and parts of plants used primarily in perfumery, pharmacy, or for insecticidal, fungicidal or similar purposes; beet seeds (excluding sugar beet seeds) and seeds of forage plants; natural rubber in primary forms or in plates, sheets or strip, living plants; cut flowers and flower buds; flower seeds, unmanufactured tobacco; other raw vegetable materials nec
9	ctl	Cattle: bovine animals, live, other ruminants, horses and other equines, bovine semen
10	oap	Other Animal Products: swine; poultry; other live animals; eggs of hens or other birds in shell, fresh; reproductive materials of animals; natural honey; snails, fresh, chilled, frozen, dried, salted or in brine, except sea snails; edible products of animal origin n.e.c.; hides, skins and furskins, raw; insect waxes and spermaceti, whether or not refined or coloured
11	rmk	Raw milk
12	wol	Wool: wool, silk, and other raw animal materials used in textile
13	frs	Forestry: forestry, logging and related service activities
14	fsh	Fishing: hunting, trapping and game propagation including related service activities, fishing, fish farms; service activities incidental to fishing
15	coa	Coal: mining and agglomeration of hard coal, lignite and peat

16	oil	Oil: extraction of crude petroleum, service activities incidental to oil and gas extraction excluding surveying (part)
17	gas	Gas: extraction of natural gas, service activities incidental to oil and gas extraction excluding surveying (part)
18	oxt	Other Mining Extraction (formerly omn): mining of metal ores; other mining and quarrying
19	cmt	Cattle Meat: fresh or chilled; meat of buffalo, fresh or chilled; meat of sheep, fresh or chilled; meat of goat, fresh or chilled; meat of camels and camelids, fresh or chilled; meat of horses and other equines, fresh or chilled; other meat of mammals, fresh or chilled; meat of mammals, frozen; edible offal of mammals, fresh, chilled or frozen
20	omt	Other Meat: meat of pigs, fresh or chilled; meat of rabbits and hares, fresh or chilled; meat of poultry, fresh or chilled; meat of poultry, frozen; edible offal of poultry, fresh, chilled or frozen; other meat and edible offal, fresh, chilled or frozen; preserves and preparations of meat, meat offal or blood; flours, meals and pellets of meat or meat offal, inedible; greaves
21	vol	Vegetable Oils: margarine and similar preparations; cotton linters; oil-cake and other residues resulting from the extraction of vegetable fats or oils; flours and meals of oil seeds or oleaginous fruits, except those of mustard; vegetable waxes, except triglycerides; degrass; residues resulting from the treatment of fatty substances or animal or vegetable waxes; animal fats
22	mil	Milk: dairy products
23	pcr	Processed Rice: semi- or wholly milled, or husked
24	sgr	Sugar and molasses

25	ofd	Other Food: prepared and preserved fish, crustaceans, molluscs and other aquatic invertebrates; prepared and preserved vegetables, pulses and potatoes; prepared and preserved fruits and nuts; wheat and meslin flour; other cereal flours; groats, meal and pellets of wheat and other cereals; other cereal grain products (including corn flakes); other vegetable flours and meals; mixes and doughs for the preparation of bakers' wares; starches and starch products; sugars and sugar syrups n.e.c.; preparations used in animal feeding; lucerne (alfalfa) meal and pellets; bakery products; cocoa, chocolate and sugar confectionery; macaroni, noodles, couscous and similar farinaceous products; food products n.e.c.
26	b_t	Beverages and Tobacco products
27	tex	Manufacture of textiles
28	wap	Manufacture of wearing apparel
29	lea	Manufacture of leather and related products
30	lum	Lumber: manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
31	ppp	Paper & Paper Products: includes printing and reproduction of recorded media
32	p_c	Petroleum & Coke: manufacture of coke and refined petroleum products
33	chm	Manufacture of chemicals and chemical products
34	bph	Manufacture of pharmaceuticals, medicinal chemical and botanical products
35	rpp	Manufacture of rubber and plastics products
36	nmm	Manufacture of other non-metallic mineral products
37	i_s	Iron & Steel: basic production and casting
38	nfm	Non-Ferrous Metals: production and casting of copper, aluminium, zinc, lead, gold, and silver
39	fmp	Manufacture of fabricated metal products, except machinery and equipment
40	ele	Manufacture of computer, electronic and optical products
41	eeq	Manufacture of electrical equipment
42	ome	Manufacture of machinery and equipment n.e.c.
43	mvh	Manufacture of motor vehicles, trailers and semi-trailers
44	otn	Manufacture of other transport equipment
45	omf	Other Manufacturing: includes furniture

46	ely	Electricity; steam and air conditioning supply
47	gdt	Gas manufacture, distribution
48	wtr	Water supply; sewerage, waste management and remediation activities
49	cns	Construction: building houses factories offices and roads
50	trd	Wholesale and retail trade; repair of motor vehicles and motorcycles
51	afs	Accommodation, Food and service activities
52	otp	Land transport and transport via pipelines
53	wtp	Water transport
54	atp	Air transport
55	whs	Warehousing and support activities
56	cmn	Information and communication
57	ofi	Other Financial Intermediation: includes auxiliary activities but not insurance and pension funding
58	ins	Insurance (formerly isr): includes pension funding, except compulsory social security
59	rsa	Real estate activities
60	obs	Other Business Services nec
61	ros	Recreation & Other Services: recreational, cultural and sporting activities, other service activities; private households with employed persons (servants)
62	osg	Other Services (Government): public administration and defense; compulsory social security, activities of membership organizations n.e.c., extra-territorial organizations and bodies
63	edu	Education
64	hht	Human health and social work
65	dwe	Dwellings: ownership of dwellings (imputed rents of houses occupied by owners)

A.2 Codes of GTAP Regions

Table 8: Detailed Sectoral Code of GTAP

Number	Code	Description
1	AUS	Australia
2	NZL	New Zealand
3	XOC	Rest of Oceania
4	CHN	China
5	HKG	Hong Kong, Special Administrative Region of China
6	JPN	Japan
7	KOR	Korea, Republic of
8	MNG	Mongolia
9	TWN	Taiwan
10	XEA	Rest of East Asia
11	BRN	Brunei Darussalam
12	KHM	Cambodia
13	IDN	Indonesia
14	LAO	Lao PDR
15	MYS	Malaysia
16	PHL	Philippines
17	SGP	Singapore
18	THA	Thailand
19	VNM	Viet Nam
20	XSE	Rest of Southeast Asia
21	BGD	Bangladesh
22	IND	India
23	NPL	Nepal
24	PAK	Pakistan
25	LKA	Sri Lanka
26	XSA	Rest of South Asia
27	CAN	Canada

28	USA	United States of America
29	MEX	Mexico
30	XNA	Rest of North America
31	ARG	Argentina
32	BOL	Bolivia
33	BRA	Brazil
34	CHL	Chile
35	COL	Colombia
36	ECU	Ecuador
37	PRY	Paraguay
38	PER	Peru
39	URY	Uruguay
40	VEN	Venezuela (Bolivarian Republic of)
41	XSM	Rest of South America
42	CRI	Costa Rica
43	GTM	Guatemala
44	HND	Honduras
45	NIC	Nicaragua
46	PAN	Panama
47	SLV	El Salvador
48	XCA	Rest of Central America
49	DOM	Dominican Republic
50	JAM	Jamaica
51	PRI	Puerto Rico
52	TTO	Trinidad and Tobago
53	XCB	Rest of Caribbean
54	AUT	Austria
55	BEL	Belgium
56	BGR	Bulgaria
57	HRV	Croatia
58	CYP	Cyprus
59	CZE	Czech Republic

60	DNK	Denmark
61	EST	Estonia
62	FIN	Finland
63	FRA	France
64	DEU	Germany
65	GRC	Greece
66	HUN	Hungary
67	IRL	Ireland
68	ITA	Italy
69	LVA	Latvia
70	LTU	Lithuania
71	LUX	Luxembourg
72	MLT	Malta
73	NLD	Netherlands
74	POL	Poland
75	PRT	Portugal
76	ROU	Romania
77	SVK	Slovakia
78	SVN	Slovenia
79	ESP	Spain
80	SWE	Sweden
81	GBR	United Kingdom
82	CHE	Switzerland
83	NOR	Norway
84	XEF	Rest of European Free Trade Association
85	ALB	Albania
86	BLR	Belarus
87	RUS	Russian Federation
88	UKR	Ukraine
89	XEE	Rest of Eastern Europe
90	XER	Rest of Europe

91	KAZ	Kazakhstan
92	KGZ	Kyrgyzstan
93	TJK	Tajikistan
94	XSU	Rest of Former Soviet Union
95	ARM	Armenia
96	AZE	Azerbaijan
97	GEO	Georgia
98	BHR	Bahrain
99	IRN	Iran, Islamic Republic of
100	ISR	Israel
101	JOR	Jordan
102	KWT	Kuwait
103	OMN	Oman
104	QAT	Qatar
105	SAU	Saudi Arabia
106	TUR	Turkiye
107	ARE	United Arab Emirates
108	XWS	Rest of Western Asia
109	EGY	Egypt
110	MAR	Morocco
111	TUN	Tunisia
112	XNF	Rest of North Africa
113	BEN	Benin
114	BFA	Burkina Faso
115	CMR	Cameroon
116	CIV	Côte d'Ivoire
117	GHA	Ghana
118	GIN	Guinea
119	NGA	Nigeria
120	SEN	Senegal
121	TGO	Togo
122	XWF	Rest of Western Africa

123	XCF	Rest of Central Africa
124	XAC	South Central Africa
125	ETH	Ethiopia
126	KEN	Kenya
127	MDG	Madagascar
128	MWI	Malawi
129	MUS	Mauritius
130	MOZ	Mozambique
131	RWA	Rwanda
132	TZA	Tanzania, United Republic of
133	UGA	Uganda
134	ZMB	Zambia
135	ZWE	Zimbabwe
136	XEC	Rest of Eastern Africa
137	BWA	Botswana
138	NAM	Namibia
139	ZAF	South Africa
140	XSC	Rest of South African Customs Union
141	XTW	Rest of the World

A.3 R Codes

```
knitr::opts_chunk$set(echo = TRUE)
library(knitr)
opts_chunk$set(tidy.opts=list(width.cutoff=60),tidy=TRUE)
knitr::include_graphics("gtapflow.png")
knitr::include_graphics("graph/gtapmrgraph.png")
library("kableExtra")
library("readxl")
agg<-read.csv("data/aggregation.csv")
knitr::kable(agg, caption="Mapping of Regional Aggregation", format="
  latex", longtable = T, booktabs = T) %>% kable_styling(font_size =
  10) %>%
  column_spec(4, width = "25em")
library("kableExtra")
library("readxl")
agg<-read.csv("data/secaggregation.csv")
knitr::kable(agg, caption="Mapping of Secotral Aggregation", format="
  latex", longtable = T, booktabs = T) %>% kable_styling(font_size =
  10) %>%
  column_spec(4, width = "25em")
library(kableExtra)
VXMD<-read.csv(file = 'data/VXMD.csv')
VXMD<-VXMD[-c(7)]
colnames(VXMD) = c("VXMD", "USA", "China", "Taiwan", "RCEP", "Rest of
  World")

knitr::kable(VXMD, caption='Value of Exports from Taiwan at Destination
  Prices(VXMD[i, Taiwan, d])', format = "markdown", digits = 2) %>%
kable_styling(bootstrap_options = c("striped", "hover"),
```

```

        full_width = F,
        font_size = 11,
        position = "left")

library(kableExtra)

VIMS<-read.csv(file = 'data/VIMS.csv')
VIMS<-VIMS[-c(7)]

colnames(VIMS) = c("VIMS", "USA", "China", "Taiwan", "RCEP", "Rest_of_
World")

knitr::kable(VIMS, caption='Value_of_Imports_to_Taiwan_at_Source_Prices
_(VIMS[i, , Taiwan])', format = "markdown", digits = 2) %>%
kable_styling(bootstrap_options = c("striped", "hover"),
        full_width = F,
        font_size = 11,
        position = "left")

library(kableExtra)

VXWD<-read.csv(file = 'data/VIWS.csv')
VXWD<-VXWD[-c(7)]

colnames(VXWD) = c("VXWD", "USA", "China", "Taiwan", "RCEP", "Rest_of_
World")

knitr::kable(VXWD, caption='Value_of_Export_from_Taiwan_at_World_Prices
_(VXWD[i, , Taiwan, , d])', format = "markdown", digits = 2) %>%
kable_styling(bootstrap_options = c("striped", "hover"),
        full_width = F,
        font_size = 11,
        position = "left")

library(kableExtra)

VIWS<-read.csv(file = 'data/VIWS.csv')
VIWS<-VIWS[-c(7)]

```

```

colnames(VIWS) = c("VIWS", "USA", "China", "Taiwan", "RCEP", "Rest_of_
World")

knitr::kable(VIWS, caption='Value_of_Imports_to_Taiwan_at_World_Prices_
(VIWS[i,,"Taiwan"])', format = "markdown", digits = 2) %>%
kable_styling(bootstrap_options = c("striped", "hover"),
              full_width = F,
              font_size = 11,
              position = "left")

library(kableExtra)
library("readxl")
GTAPsector <-read.csv(file = 'data/gtapsectorlist.csv')
GTAPsector2 <- head(GTAPsector, 65)
knitr::kable(GTAPsector2, caption='Detailed_Sectoral_Code_of_GTAP',
format="latex", longtable = T, booktabs = T) %>% kable_styling(font_
size = 10) %>%
column_spec(3, width = "40em")

#knitr::kable(GTAPsector2, format = "simple") %>% kable_paper(full_
width = F) %>%
#column_spec(1, width = "3em", bold = F) %>%

library(kableExtra)
library("readxl")
GTAPsector <-read.csv(file = 'data/regiongtap.csv')
GTAPsector2 <- head(GTAPsector, 142)
knitr::kable(GTAPsector2, caption='Detailed_Sectoral_Code_of_GTAP',
format="latex", longtable = T, booktabs = T) %>% kable_styling(font_
size = 10) %>%
column_spec(3, width = "40em")

```


The Silicon Shield: How Has International Trade Shaped the IT Industry?

Jeffrey Kuo*

March 27, 2023

Abstract

This paper utilizes the latest international trade methodology, international trade network analysis. We are particularly interested in learning how international trade contributes to Taiwan's production of consumer electronics and computer-related products. Taiwan's role in the global supply chain as a manufacturer of personal computers has two main reasons. As part of the US-China competition framework, it has been a geopolitical hotspot. In addition, Taiwan is known for its ability to manufacture high-tech products. Would political transformation and the dominance of the global high-tech product market conflict with one another? From 2001 to 2006, we found the order of Taiwan and China's centrality using the UN Comtrade database. In addition, we provided a graphical representation of globalization by showing that intercontinental trade has significantly increased.

Keywords: International Trade Network, Trade Liberalization

JEL Code D85 Network Formation and Analysis: Theory, F11 Neoclassical Models of Trade, F14 Empirical Studies of Trade

Latest version: <https://jeffjkuo.github.io/ITN1.pdf>

*George Washington University, email: jeffkuo@gwu.edu, webpage: <https://jeffjkuo.github.io>

Introduction

Taiwan has been a center for computer chip manufacturing for a long time. Over the past three decades, Taiwan's personal-computer industry has experienced stellar growth. In conjunction with established firms in the West, Taiwanese firms participate in the global production chain. (Yu and Shih 2014) What was the process of building the world's technology center? Does trade policy influence it? In this context, how does institutional change play a role? Is it related to the transition from authoritarian to democratic regimes? How can a technological and industrial settlement benefit from trade liberalization? In order to answer these questions, it is necessary to examine Taiwan's trade network. This paper examines how a small country can gradually become a dominant exporter of technology-related products using a trade network graph.

In this paper, we use a new-development methodology in international trade, international trade network analysis, to identify the formation of a technological hub in the global supply chain. Specifically, we would like to know what role international trade plays in Taiwan's production of consumer electronics and computer-associated products? There are two main reasons to focus on Taiwan's role in personal computer products production in the global supply chain.

First, Taiwan's prowess in producing semiconductor chips and computer-related products makes it a geopolitical hotpoint of potential conflicts in an era of US-China competition. (Tung 2001) By using the network analysis methodology, we could find out the degree of centrality in each network within a different time span. This was so we could see when the world depended on Taiwan's computer-related sectors of production. As far as producing computer-related products is concerned, what is the level of dependency at the moment?

Secondly, by applying World International Trade Solution (WITS) data. We could plot the network graph for different years. And hence it would be of interest to know if the creation of the technological hub correlates with Taiwan's economic or political transformation. Would trade liberalization and political transformation cause technological settlements? How

would this industrial settlement be formed? Were they correlated with Taiwan’s infrastructure development timing? Or were they started at the same time Taiwan adjusted its import substitution policy? Or is it related to the timing of trade liberalization, say Taiwan becoming a member of the World Trade Organization (WTO)?

It is no secret that Taiwan is renowned for its integrated circuit design globally. A major part of Taiwan’s Information Technology (IT) industry is comprised of the Taiwanese semiconductor industry, which includes integrated circuit manufacturing, design, and packaging. Globally, Taiwan dominates the market and differentiates itself from its competitors. Due to the fact that the chip is crucial to the production of a personal computer’s Core Process Unit (CPU). By looking at the international trade network of Taiwan’s computer related products, we hope to distangle the effects of how the high-tech industry was formed.

As a result of Taiwan’s strong capabilities in Original Equipment Manufacturer (OEM) wafer manufacturing and the complete industry supply chain, the semiconductor industry in Taiwan accounts for about 20 percent of global semiconductor sales. Taiwanese companies account for 50 percent of the global market in foundries. The largest foundry player is Taiwan Semiconductor Manufacturing Company (TSMC).

International trade data can be analysed from a network perspective, where the network is a set of countries linked by weighted and directed trade ties. This network is referred to by various names, the International Trade Network (ITN), World Trade Web (WTW) and the World Trade Network (WTN) etc. We use the World International Trade Solution database as our main trade data source. We have used a R software package, called ITNr, to plot out the trade network at the different timings. This package provides a number of functions for cleaning and processing international trade data into a network, and undertaking relevant analyses. ([Amighini and Gorgoni 2014](#))

Taking part in international trade is like making friends between countries and firms. Network analysis provides an excellent explanation of how well those countries are connected. The result we find here does not apply only to Taiwan, for those countries have become open

economies by trading with others. International trade, therefore, bridges the gaps between countries and creates a sense of connection and reliability between those countries.

In the next section, we will review the literature related to network theory, and the literature we followed. Then we will discuss the database we targeted to extract the data from. In the following sections, we will introduce the methodology and the main index, the degree of centrality. Last, we cross-examine the evolution of the degree of centrality of computer-associated industries in Taiwan with the timing of major events or policies in history to see if we can indirectly demonstrate the causality between historical events and the change of Taiwan's role in the Global Value Chain of producing computers.

Literature Review

Homophilly

We review the literature on Network Theory in this section so that we understand the economic behavior behind graphical analyses. Then we can link them to the latest methods of international trade analysis. Jackson ([2014](#)) focuses on the essential differences between the existing economic literature and network analysis. Throughout history, economists have attempted to identify the peer effects of human behavior. With network analysis, we might gain more insight and understanding of those behaviors. Take a quote from the paper as an example: "People's opinions, which products they buy, whether they invest in education, become criminals and so forth, are all influenced by friends and acquaintances."

Peer effects can be intuitively explained. When an economic agent faces a problem and has to make a choice, the decision she makes might not be pinned down by her own rationality, or her strategic interactions with her counterparts (game theory). Typically, a person will consider other people's opinions from time to time. Hence, her decisions depend on her relationship with other agents in society (network). For example, if an individual's friends attended college, she might have an increased opportunity to pursue higher education. Since

her friends could provide more valuable information.

Jackson (2014) believes that the increased accessibility of data makes it easier to conduct research on people's interactions within groups. As a result, network analysis could provide more opportunities to decipher peer effects or measure economic behavior externalities. To support the plausibility of identifying peer effects, the author cites Banerjee et al. (2013), and provides details of the methodology and experimental results in it.

Except for the descriptions of how to capture peer effects, Jackson (2014) defines two salient categories in network analysis, macro and micro perspectives in networks. Macro-perspective provides the aggregate characteristics of the network, for example, how the density of agents (nodes) in the economy (network) affects the diffusion of information, as well as how the different structures of the networks affect the process of social learning. On the other hand, the micro perspective provides individual (or local) characteristics of the network. An example might be how the nodes in the network were positioned or how often the agents should communicate. Finally, (Jackson 2014) points out another key idea in network theory microanalysis, agents' essential characteristics, homophily.

Homophily is defined as similar individuals in the group being linked to each other. As the author argues, this is a well-known characteristic of human nature. Basically, people with similar traits or interests are more likely to become friends. If the network is applied to peer effects, homophily may cause an endogenous problem. (Jackson 2014) argues that there are some intangible forces that influence people to become in a group (homophily), but at the same time, we argue that getting into a group might change their behavior (network, peer effects).

(Jackson 2014) then uses (Banerjee et al. 2013) to shed more light on peer effects and homophily. (Banerjee et al. 2013) addresses empirical methodologies to support network analysis theory. Taking it back to the trade network and the formation of Taiwan's high-technology industry, since computers relied on the assembly of many precise particles, homophily also played a crucial role in tech settlements.

Externality

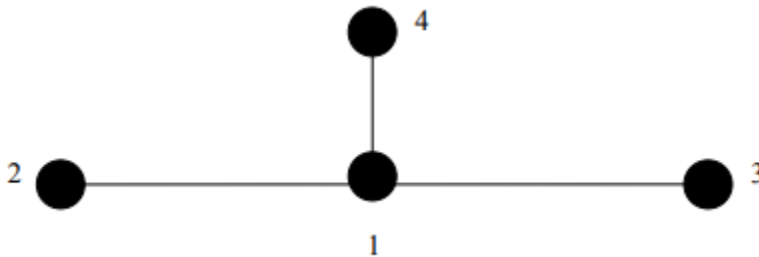


Figure 1: A star network with four agents

Jackson (2014) mentioned that, exploring the externalities involved in the economic behavior is the fundamental reason why we need to incorporate the networks. Jackson et al. (2016) discusses the applications of social network analysis to every perspective of externalities.

To capture indirect connections and externalities in a network, Jackson et al. (2016) uses a simple graphical example. Consider a “star network” in Figure 1, agent 1 serves as the center agent, who has multiple direct connections with the rest of the three agents. For agents 2, 3, and 4, each has a single connection with agent 1. However, under this structure, agent 2 might enjoy the benefits via indirect connection with agent 3. The same ideas apply to the relationships between peripheral agents. Agent 1 might not take into account those positive externalities when cultivating the friendship with agents 2, 3, and 4 individually since it is reasonable to assume maintaining the friendship is costly. Hence, the Figure 1 network implies a crucial argument in welfare economics. This is, the individual rational incentive and the overall societal welfare sometimes conflict with each other. Once again, by using a simple diagram, a network analysis demonstrates its ability to prove this essential idea of conventional economic theory. This is that the internalization of the externality might lead to an inefficient equilibrium.

Moreover, this simple diagram not only serves as a good indication of the distortion to the efficiency resulted from the positive externalities, but also shows that the position of the

node, in fact, plays a significant role in the corresponding economy (network), which then contributes to the heterogeneity of the agents (nodes). As we could see, the role for agent 1 in Figure 1 is different from the others, because of her distinct, central, and pivotal location. Hence, in terms of the network analysis, agent 1 could be considered as a pivotal player in the network. Recalling the Vickery-Clark-Grove mechanism, if we want to run a welfare analysis on public goods or design a mechanism to internalize externalities, we must identify the pivot player. According to Figure 1, removing agent 1 will reduce societal welfare the most. That is, in the economy (network), the more central a person (node) is, the more influence she will have. Centrality captures direct and indirect influences on a individual. Ballester et al. (2006) proposes an alternative measure of network centrality, inter-centrality, which can be used to identify *key players* in a network.

After pointing out the externalities and centrality of the network, Jackson et al. (2016) shows how to apply network analysis to several other fields. The theory of international trade, for instance. Jackson et al. (2016) is an excellent tool to link networks to Economics fields.

Diffusion

Banerjee et al. (2013) is cited multiple times in two previous reviewed papers. It aims to explain how economists design a social experiment to disent and the show the diffusion effect of the network.

Banerjee et al. (2013) distributed a survey before a microfinance institute entered 43 rural villages in Karnataka, a southern state in India. The financial institute is called Bharatha Swamukti Samsthe (BSS). As BSS entered the village and began offering micro loans, the authors collected responses to a detailed survey from the villagers. This was about how they interact with others and transmit information. Those villages rely heavily on word-of-mouth communication to spread information, and they are linguistically homogeneous.

Furthermore, before the introduction of BSS, there were no similar financial services

offered, and most residents had little exposure to micro loans. Villagers can only find out about the new financial service from their friends and acquaintances. At the beginning, the BSS asks some “leaders” in the villages, such as teachers and shopkeepers, to spread information about their loan offers. As a result, the whole Indian village setting provides a good context for studying peer effects on information diffusion. In a nutshell, the authors developed a regression model to estimate the magnitude of peer effects.

$$\log\left(\frac{p_i}{1-p_i}\right) = X_i'\beta + \lambda F_i$$

Following the logistic regression model, p_i is the probability that a household i participates in the loan program. Participants should be asked whether to participate in the micro loan program or not, indexed with binary variables 1 and 0\$. X_i is a vector of households’ characteristics, such as caste, wealth, profession, and others, which controls survey takers’ observable facts. And F_i is the fraction of household i ’s friends who also take part in the program. So the coefficient λ could be indicated as the magnitude of peer effects. The authors’ empirical result shows the estimation of peer effects, $\hat{\lambda}$, is statistically significant under their sample data. Using the data, Banerjee et al. (2013) also tested the effect of communication and diffusion centrality, which some people might play a more significant role in passing information along. Furthermore, since BSS approached the village leaders at the start, the authors were able to explore the effects of the information injection at different points. For example, which leaders spread information more effectively?

In terms of international trade, the issue of funds may not pose as much of a problem as the villagers in India. But since the tech industry is a highly-integrated industry, the diffusion of information of the reliable supplier is also very critical. In the Taiwanese tech industry, supplier reliability plays a crucial role in success. Whether you have a reliable supplier for the must-use particles to build your products is very critical. And this factor might also play a critical role in the tech settlement formation in Taiwan. And without the network perspective, we won’t identify this effect.

Key Player

The peer effect is a reasonable incentive to develop network analyses. However, now we need to think about peer effects in the same network homogeneous? In standard peer effects models, this is homogeneous across members and corresponds to an *average* group influence. Or would the nodes with different positions or different structural linkages with other agents cause the different peer effects? If we refer back to Figure 1, this argument links to centrality.

In Ballester et al. (2006), the proposed measurement replacing Bonacich centrality was mathematically modelled. The Bonacich-Nash linkage implies that aggregate equilibrium increases with network size and density, and only considers the systematic distinction between nodes. As an example, the more links a node has, the more important it may be. Under this construction, the previous literature pins down equilibrium. But this Bonacich-Nash equilibrium did not consider the facts that externalities within a group are heterogeneous between different nodes. So Ballester et al. (2006) constructs a novel model of a n -player game and figures out the equilibrium strategies of each node. The newly developed measurement of centrality could identify a “key player” in the network, as well as rank the importance of each node.

Ballester et al. (2006) considers a finite population of players with linear-quadratic interdependent utility functions. Assuming players $i = 1, 2, \dots, n$ select an effort $x_i \geq 0$ and obtain the payoff as follows.

$$u_i(x_1, \dots, x_n) = \alpha_i x_i + \frac{1}{2} \sigma_{ii} x_i^2 + \sum_{j \neq i} \sigma_{ij} x_i x_j$$

Here, we can treat x_i as his own benefits of being linked, and the α_i represents agent i 's preference (location). σ_{ij} is the coefficient of interdependence on the network for agent i . In which agent i could build a bunch of linkages with other $n - 1$ players. If we only consider the symmetric case, we can ignore the discussion of the bilateral coefficient restriction. σ_{ij} does not necessarily have to be equal to σ_{ji} . And their signs are indefinite also, the interde-

pendence between any i and j could be either positive or negative.} and assume $\alpha_i = \alpha > 0$ as well as $\sigma_{ii} = \sigma$ for all $i = 1, 2, \dots, n$. To illustrate the game format, the authors define $\Sigma = [\sigma_{ij}]$ as a $n \times n$ square matrix of cross-effects. Or we can simply take Σ as the payoff matrix of a n -player game with strategy space \mathbf{R}_+^n .

At this stage, Ballester et al. (2006) has already shown an elegant n -player game, with a well-defined payoff matrix and plausible strategy space. The only thing we need furthermore to analyze the network is a set of coefficients to capture the structure.

Ballester et al. (2006) then defines the n -square adjacency matrix \mathbf{G} of a network \mathbf{g} to keep track of the network connections. Let \mathbf{G}^k be the k th power of \mathbf{G} , with coefficient $g_{ij}^{[k]}$, where k is some integer. The matrix \mathbf{G}^k keeps track of indirect connections in the network. $g_{ij}^{[k]}$ measures the number of paths in network \mathbf{g} from node i to node j .

Given a scalar $\alpha > 0$ and a network \mathbf{g} , a matrix $\mathbf{M}(\mathbf{g}, a)$ could be set as an n -player network with structure \mathbf{g} and Bonacich centralities parameter a . In plain words, the Bonacich centralities parameter a , could be treated as the identity of the whole network. This is like the density or the shape, which are fixed when the network structure settles down. And then we could map each network $\mathbf{M}(\mathbf{g}, a)$ to a n vector, as a certain type of Bonacich centrality $\mathbf{b}(\mathbf{g}, a) = \mathbf{M}(\mathbf{g}, a) \cdot \mathbf{1}$.

Finally, to capture the heterogeneity of the nodes, the author defines the Bonacich centrality of node i is $b_i(\mathbf{g}, a) = \sum_{j=1}^n m_{ij}(\mathbf{g}, a)$. The term, $\sum_{j=1}^n m_{ij}(\mathbf{g}, a)$, counts the total number of paths in \mathbf{g} that start at node i . It is the sum of all loops $m_{ii}(\mathbf{g}, a)$ from i to i itself and of all the outer paths $\sum_{j \neq i} m_{ij}(\mathbf{g}, a)$ from i to every other player $j \neq i$, that is,

$$b_i(\mathbf{g}, a) = m_{ii}(\mathbf{g}, a) + \sum_{j \neq i} m_{ij}(\mathbf{g}, a).$$

In which this term captures the heterogeneity across nodes i in the same network $\mathbf{M}(\mathbf{g}, a)$.

After some derivation, if we assume the equilibrium exists, the equilibrium strategy for i could be represented as $n \times 1$ vector $\mathbf{x}^*(\Sigma)$.¹ Also, at equilibrium, the Bonacich centrality

¹The detailed derivation and equilibrium conditions, please refer to Ballester et al. (2006) pp.1408

parameter of the network is a constant, $a = \lambda^*$. The Bonachic equilibrium finally implies that each player contributes to the aggregate equilibrium outcome in proportion to her network centrality.

$$x_i^*(\Sigma) = \frac{b_i(\mathbf{g}, \lambda^*)}{b(\mathbf{g}, \lambda^*)} x^*(\Sigma)$$

As the author indicates, the dependence of individual outcomes on group behavior is called the peer effects. It means that, even though the linkages between nodes i are the same, the effect of the externalities of each node i is not the same. The position of the node does have an effect as we see in the equation above. We not only have to take the number of connections ($\sum_{j \neq i} m_{ji}(\mathbf{g}, a)$) into account, but also the centralities of each nodes ($m_{ii}(\mathbf{g}, a)$). The effects of externalities are heterogeneous across n members, with a variance related to Bonacich network centrality.

Network Formation

We discussed the definition and existence of peer effects in the network in the literature review section. We also elaborated on the heterogeneity of agents caused by centrality in the micro network. At this point, Cabrales et al. (2011) provides a different perspective on the theory of network formation.

Cabrales et al. (2011) provides an excellent example in education and how parents form a network via the children's school. Its arguments could be traced back to the problem of double causalities between peer effects and homophily. Cabrales et al. (2011) argues that network formation does not result from socialization. I interpret this as the authors want to reverse the sequential order between network construction and bilateral linkages. Previously, if we follow M.O. Jackson's assumption (Figure 1), people have the incentives to build up connections with each other because they want to enjoy the future benefits of linkages. And as more links are built, the social network grows. However, in Cabrales et al. (2011), the

authors believe that if the economy population is large enough, the social network between the agents exists. In addition, people participate in social groups before benefiting from pairing links. The linkages between the agents should be considered as a normal process, instead of behaviors driven by innate rational incentives.

Cabrales et al. (2011) uses an example from family economics to support their ideas.² Let parents of children about to start school make decisions whether or not to form a network. Each pair of parents cares about their children's future. Parents can choose from two types of costly behaviors, which might help their children's future learning.

At first, the *productive effort*. Taking their children home after school, playing sports together, or studying and doing homework together. This kind of effort does not interact with other agents in the network. Secondly, the *socialization effort*, participating in social activities that are related to children's education. For example, attending to parental evenings, birthday parties, or any activities that involve other parents. By participating in those social activities, parents might be able to share some valuable information pertaining to education. For example, study techniques, school conditions, and other significant issues related to children's education. As a result of those socialization efforts, friendships between parents and children might be created. This friendship might continue to produce synergies (externalities) in the future. The authors model his idea using a quadratic linear utility function throughout the paper. This shows the reverse socialization process also provides multiple stable equilibria mathematically.

Cabrales et al. (2011), definitely demonstrates another perspective of the endogenous problem of network theory, which is related to bilateral trade. Would the countries and firms form the network from the bilateral linkages first, or is it because there are too many firms that produce the tech products, so that the network is form natrually?

In conclusion, Jackson (2014) and Jackson et al. (2016) form the basis of this literature review session. But there is network theory literature that might be highly corrected in

²Please refer to Cabrales et al. (2011), pp. 343-345 for full mathematical derivation.

trade. For, example, Corominas-Bosch (2004) identifies the different equilibrium outcomes of the alternating public offer game. While there were the same number of buyers and sellers on the market, the different pairing structures between them might have an impact on their bargaining power. Corominas-Bosch (2004) underscores the importance of network structure, which is very important in the context of trade networks as well. Jackson et al. (2012) defines a novel term, Social Quilts, and argues the “Renegotiation-Proofness Principle” in equilibrium should also be considered. According to the Jackson et al. (2012) under certain network formats, the most detrimental result of the game, the breakdown of the economy of returning a favor, or so-called grim strategies, might not be carried out by the players involved.

Data

The main database we use in this paper is World Integrated Trade Solution (WITS). With the assistance of WITS software, we can gain access to information regarding international trade, tariffs, and non-tariff measures (NTMs). In the section entitled “Country profile,” we can find information on exports, imports, tariffs, and development statistics for each country.

In spite of this, Taiwan, or the Republic of China (R.O.C.), is not included in the Worldbank and WITS databases. As it appears on the WITS and Worldbank websites, Taiwan, China is not listed as a separate country for World Development Indicators. But if we clearly see the footnote, we could see that the following quote, “For most indicators, Taiwan, China, data is not added to China data, but Taiwan, China, is added to the world aggregate and the high-income countries aggregate.” This means that the Taiwanese data was still included, but under a different name. In this case, we found that the Taiwanese data must be extracted after selecting “Other Asian” as the region name.

According to the United Nations’ website about data accessibility, here is the official quote on the webpage.

Q: I did not find Taiwan trade flow in COMTRADE database. Would it be possible for me to obtain the Taiwan import and export to these partner Hong Kong and Mainland China data from COMTRADE?

A: For political reasons, the UN is not allowed to show trade statistics referring to Taiwan, Province of China. Yes, in the partner breakdown, Taiwan, Province of China, is included under "Other Asia, not elsewhere specified" (code 490). Data for "Other Asia, nes" is available only to international organizations. In principle, trade data for territories belonging to Asia, but not specified by country, could end up in code 490. In practice, only trade of Taiwan, Province of China is included under this code, except for several countries (such as Saudi Arabia, which report all of their exports to unknown countries). Trade data for Taiwan, Province of China are not included within China's trade.

WITS is an application that provides users with access to a number of international trade databases that are provided by the World Bank. A user is able to query statistics on international trade (exports, imports, re-exports, and re-imports) from the UN's repository of official international trade statistics as well as relevant analytical tables to retrieve relevant trade statistics. Essentially, UN COMTRADE is a database based on WITS, which is a Web-based information system. There are three sets of data in the UNCTAD trade analysis and information system: tariffs and non-tariff measures, the integrated tariffs and imports database of the WTO, and the consolidated tariff schedules database of all members' bound duties. Using WITS' global preferential trade agreement module, you can also search and browse through free trade agreements that have been entered into. As well as calculating trade indicators, it is equipped with modules for simulating tariff reductions and calculating trade indicators.

As well as summary trade statistics by country regarding total exports and imports, export and import partners, top product groups exported and imported, top exporters and importers, derived analytical databases, and a WITS application to create custom trade statistics and indicators, WITS also includes a number of sections.

Methodology

The international network analysis of computer related products is primarily based on the Amighini and Gorgoni (2014) paper. Amighini and Gorgoni (2014) aims at assessing whether and how the rise of new countries as significant suppliers to the world’s leading car producers has changed the structure of the international organisation of auto production over the last decade. It has simply caused a shift in suppliers’ geography. By using network analysis, Amighini and Gorgoni (2014) shows that emerging economies have caused a structural change in auto production international organisation.

Since we would like to distangle the process of the Taiwanese tech industry settlement, instead of looking at the global motor vehicles trade flow in Amighini and Gorgoni (2014), we focus on the personal computer trade flow. To determine the trade flow with the trade partner that imports computer-related goods from Taiwan and China. WITS dataset can help us do so.

The main programming tool we used here is R, and the R package we applied was “ITNr”, International Trade Network in R. (Smith 2023) We then performed our data cleaning and plotting according to ITNr documentation. “ITNr” offers functions for cleaning and processing international trade data downloaded directly from the UN Comtrade database through Application Programming Interfaces (APIs). The downloaded data is then used in a function provided by the R package “comtradr”. This function is done by the “comtradr” package in R. (Muir 2022)

The ITN can therefore be analyzed using the set of functions that it provides. These

functions include backbone extraction, centrality, block models, and clustering. And by adding various period data, we can examine the key players in the ITN and regional trade patterns.

For demonstration purposes, we will use 2016 as an example. And we selected the top ten countries with the most technological expertise: Japan, the United States of America, China, Taiwan, Germany, Canada, South Korea, India, Mexico, and Singapore. First, we select “data processing machines” from HS 4-digit code, “8471.” But this could be expanded to the HS 6 code products in the extension.

Our first step was to call out all the packages we need in R and start searching for product codes. We put this key word into the “comtradr” package in R to search for computer-related products.

```
# Load the data from UN Comtrade  
library(comtradr)  
  
# Find all the codes associated with "computer"  
pc_codes <- ct_commodity_lookup("data processing machines",  
                                return_code = FALSE,  
                                return_char = TRUE)
```

With the help of this function, we can get the details of the HS codes for computer-related goods from the UN Comtrade database. For a complete list of computer-related HS codes, please refer to Figure 2. With the following R programming codes, we find the trade flows and plot them into a network graph.

HS Code	Description
8471	Automatic data processing machines and units thereof; magnetic or optical readers, machines for transcribing data onto data media in coded form and machines for processing such data n.e.s.
847110	Data processing machines; analogue or hybrid automatic type
847120	Data processing machines; digital automatic, containing in the same housing at least a central processing unit and input and output unit, whether or not combined
847130	Data processing machines; portable, digital and automatic, weighing not more than 10kg, consisting of at least a central processing unit, a keyboard and a display
847141	Data processing machines; digital, automatic, (not portable, analogue or hybrid), comprising in the same housing at least a central processing unit, an input and output unit, whether or not combined
847479	Data processing machines; digital, automatic, (not portable, analogue or hybrid), presented in the form of systems, n.e.s. in item no. 8471.41
847150	Units of automatic data processing machines; processing units other than those of item no. 8471.41 or 8471.49, whether or not containing in the same housing one or two of the following types of unit: storage units, input units or output units
847460	Units of automatic data processing machines; input or output units, whether or not containing storage units in the same housing
847170	Units of automatic data processing machines; storage units
847180	Units of automatic data processing machines; n.e.c. in item no. 8471.50, 8471.60 or 8471.70

Figure 2: Computer Relating Goods, HS Code

```
# Call out ITNr package:
library(ITNr)
library(comtradr)

# Download the data for another 5 countries
pc_import_1<- ct_search(reporters = "All",
                        partners = c("Other Asia, nes",
                                    "China",
                                    "USA",
                                    "Japan",
                                    "Germany"),
                        trade_direction = "exports",
                        start_date = "2016-01-01",
                        end_date = "2016-12-31",
                        commod_codes = "8471")
```

```

# change the partner_iso = N/A to "TWN"
pc_import_1$partner_iso[is.na(pc_import_1$partner_iso)] = "TWN"

# Download the same data for another 5 countries
# This is due to the limit of ct_search function
pc_import_2<- ct_search(reporters = "All",
                        partners = c("Canada",
                                     "Rep. of Korea",
                                     "India",
                                     "Mexico",
                                     "Singapore"),
                        trade_direction = "exports",
                        start_date = "2016-01-01",
                        end_date = "2016-12-31",
                        commod_codes = "8471")

# Bind those two dataset
pc_import_all = rbind(pc_import_1, pc_import_2)

# Clean up the trade flow data
pc_import_all<- Comtradrclean(pc_import_all, 2016, TRUE, 0.01)

# Make a network plot
ITN_make_plot(pc_import_all, TRUE, TRUE)

```

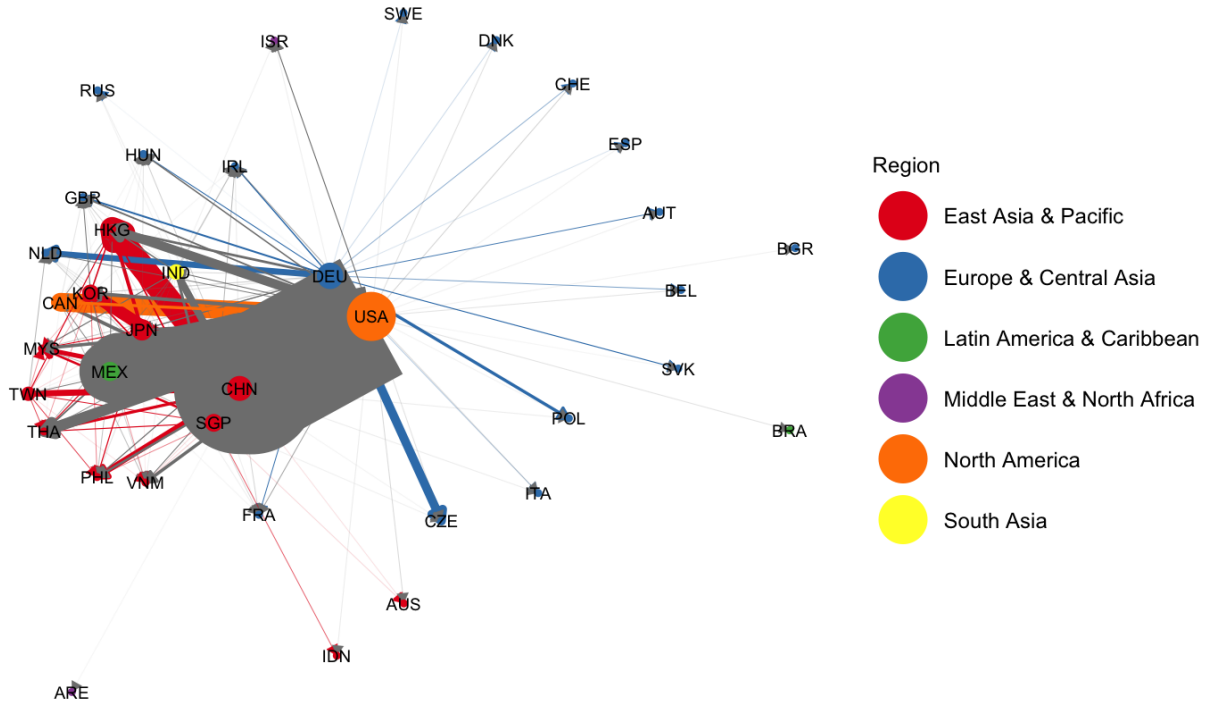


Figure 3: ITN for HS 4-Digit Good “8417” for 2016

Results

The same methodology could also be applied to determine network graphs for different years. This allowed us to identify Taiwan’s role and position in manufacturing “data processing machines” under HS 4 digit code “8417.” Since UN Comtrade API limited queries to 5 years at a time, we aim to analyze Taiwan’s role in these trade networks by examining the years 2011, 2006, 2001, and 1996 in this paper. As part, it is because Taiwan introduced direct presidential elections in 1996. Many argue that this is the starting point of democratization on the island, where 2000 is the first time the long time authoritarian regime lost its power, which was considered to be the culmination or a point to demonstrate the maturity of modern democracy. We hope that using this graph and the historical timeline, we could see when and where Taiwan’s role in the International Trade Network of producing the “data process machine” changed overlapped with democratization.

In the graph, the lines between the countries are the inflow of goods, and the colors

represent the trade was located in the same region, the countries regions was classified under UN M49. UN M49 or the Standard Country or Area Codes for Statistical Use is a standard for area codes used by the United Nations for statistical purposes. It was developed and maintained by the United Nations Statistics Division. The color line indicates trade that happened in the same regions, whereas the grey line represents the inter-regional trade. In this case, the thickness of the line represents the total value of the trade products. And the country's location in the graph indicates its centrality in the network. The higher its centrality, the more it connects to other countries, the more central the country be in the graph.

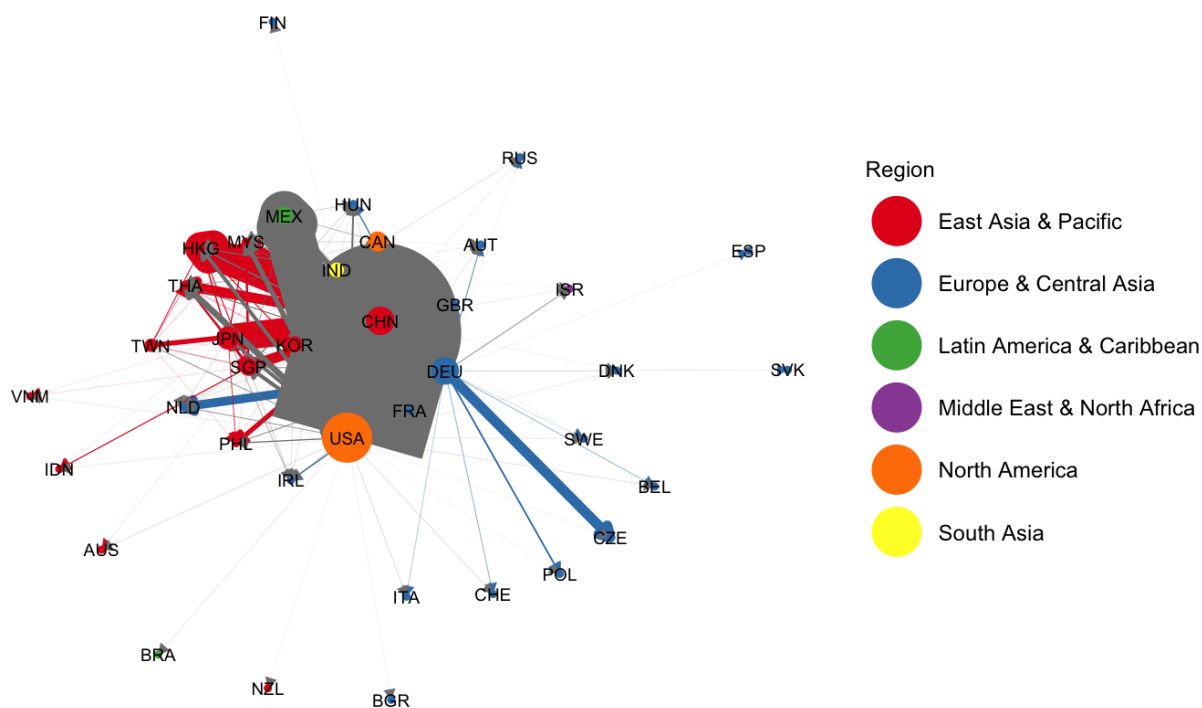


Figure 4: ITN for HS 4-Digit Good “8417” for 2011

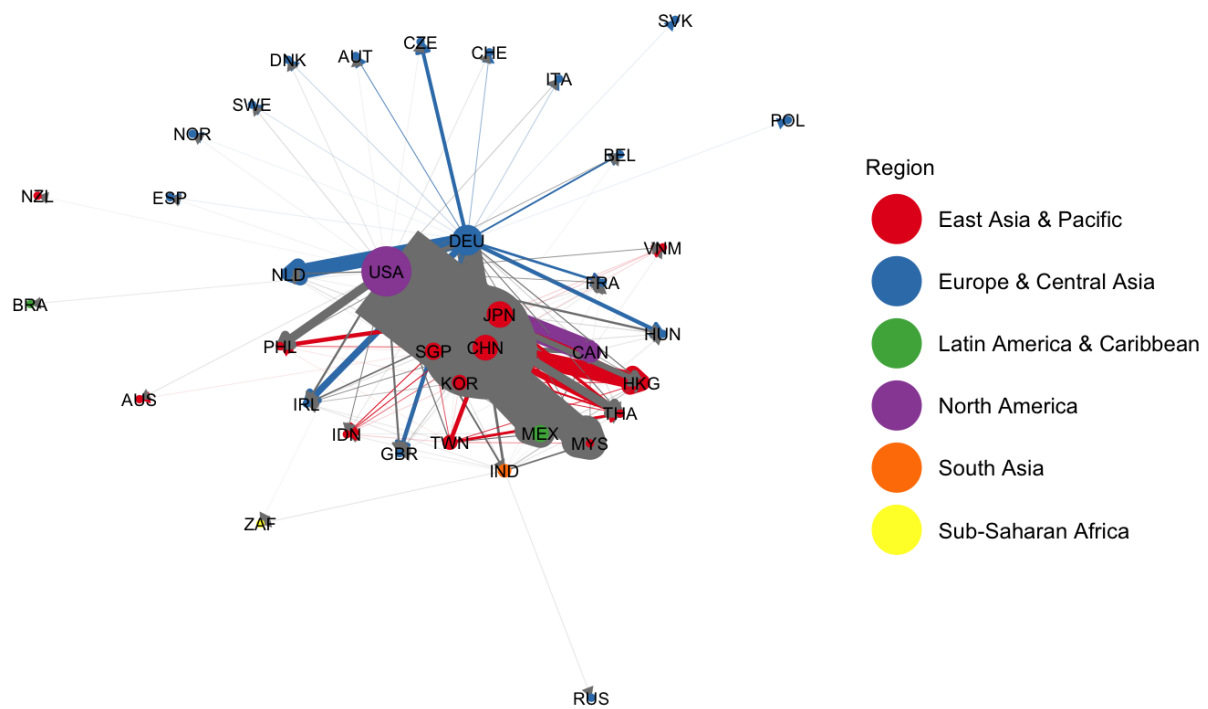


Figure 5: ITN for HS 4-Digit Good “8417” for 2006

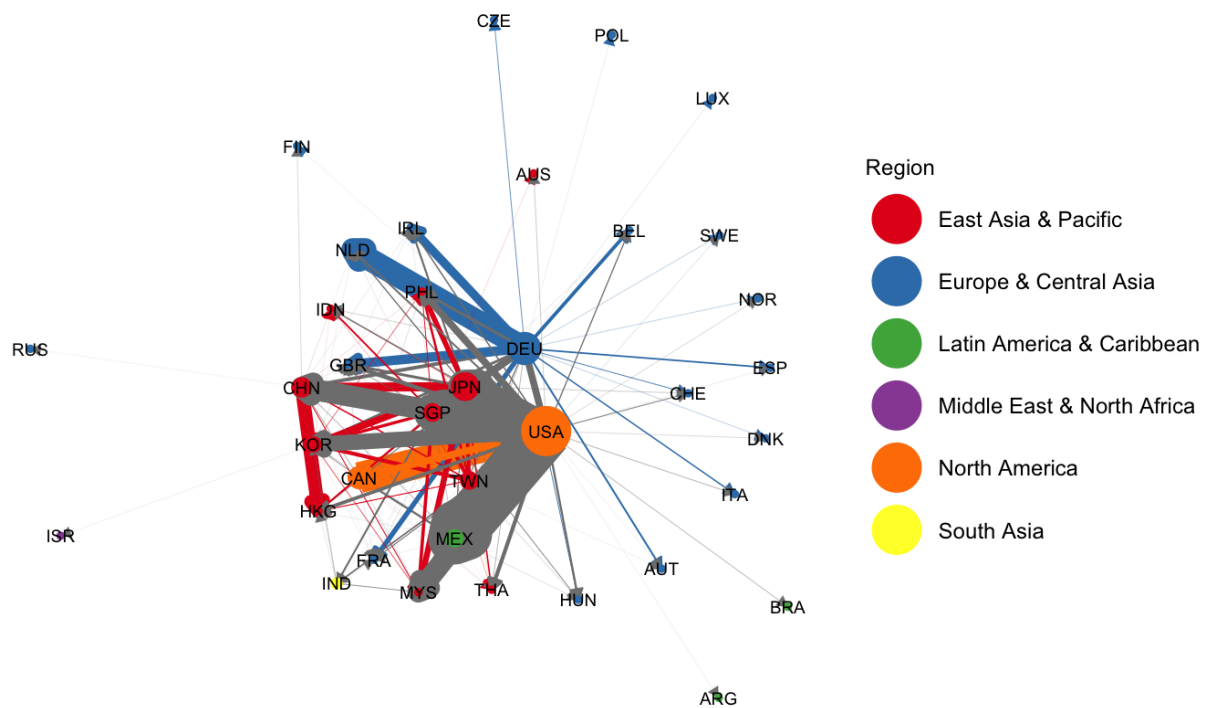


Figure 6: ITN for HS 4-Digit Good “8417” for 2001

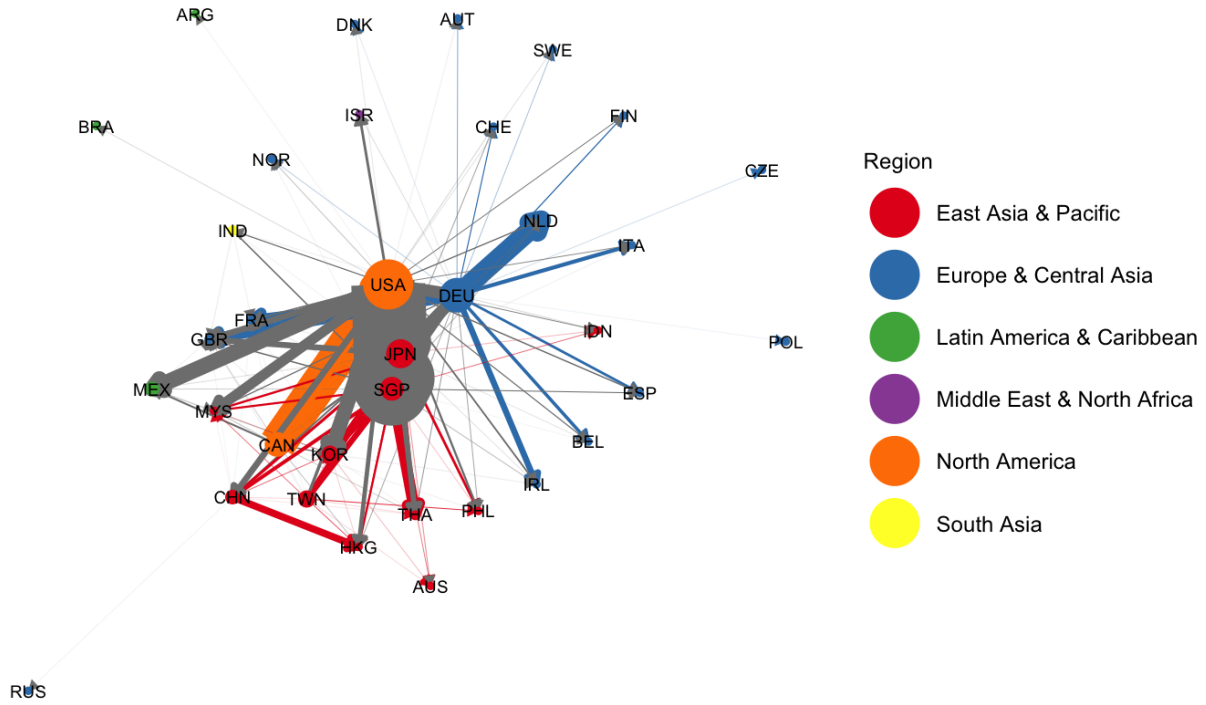


Figure 7: ITN for HS 4-Digit Good “8417” for 1996

Conclusion

Two things are apparent from the sequential graphs: 1996, 2001, 2006, 2011, and 2016. First, in the past few decades, trade between regions has become increasingly significant in the world. If you compare the graph between 1996 and 2016, you could see that the grey line has grown wider and more dense in the network. On the other hand, the color line becomes thinner as time passes. And this could be another evidence of globalization, in terms of trading the product under the category of “data processing machine.”

Secondly, from the graph, we could see that China’s position, in terms of producing computer related products, changed the most between 2001 and 2006. That the distance between Taiwan and China reversed during that period. The United States of America has always been at the center of the network across this timespan. However, the distance to centrality for Taiwan is shorter than for the Chinese distance to network central. However, in 2006, we could see that the wave of trade liberalization showed up in terms of China’s

central role. China became more linked to other countries than Taiwan at that time.

Although this does not sufficiently demonstrate that Taiwan's centrality was lost due to democratization. However, this paper offers an alternative perspective to demonstrate that the timelines overlapped. A traditional econometric or other empirical model may be difficult to replace the results of this analytical method. It has been suggested that network analysis can be used to solve many intangible economic behaviors, as mentioned by Jackson (2019). And this paper is an excellent example and a starting point. We use a small amount of sequential graphs to illustrate the dynamics of competition developed between a pair of rivalry countries in selling technological goods, specifically computer-related goods, to the world.

Bibliography

- Amighini, A., Gorgoni, S.: [The international reorganisation of auto production](#). *The World Economy*. 37, 923–952 (2014)
- Ballester, C., Calvó-Armengol, A., Zenou, Y.: [Who’s who in networks. Wanted: The key player](#). *Econometrica*. 74, 1403–1417 (2006)
- Banerjee, A., Chandrasekhar, A.G., Duflo, E., Jackson, M.O.: The diffusion of microfinance. *Science*. 341, (2013)
- Cabrales, A., Calvó-Armengol, A., Zenou, Y.: Social interactions and spillovers. *Games and Economic Behavior*. 72, 339–360 (2011). <https://doi.org/https://doi.org/10.1016/j.geb.2010.10.010>
- Corominas-Bosch, M.: [Bargaining in a network of buyers and sellers](#). *Journal of Economic Theory*. 115, 35–77 (2004)
- Jackson, M.O.: Networks in the understanding of economic behaviors. *Journal of Economic Perspectives*. 28, 3–22 (2014). <https://doi.org/10.1257/jep.28.4.3>
- Jackson, M.O.: *The human network : How your social position determines your power, beliefs, and behaviors*. Pantheon Books, New York (2019)
- Jackson, M.O., Rodriguez-Barraquer, T., Tan, X.: Social capital and social quilts: Network patterns of favor exchange. *American Economic Review*. 102, 1857–97 (2012). <https://doi.org/10.1257/aer.102.5.1857>
- Jackson, M.O., Rogers, B., Zenou, Y.: *Networks: An economic perspective*. Oxford Handbook of Social Network Analysis, Oxford, Oxford University Press (2016)
- Muir, C.: [Comtradr: Interface with the united nations comtrade API](#). (2022)
- Smith, M.: ITNr: Analysis of the international trade network. (2023)
- Tung, A.-C.: Taiwan’s semiconductor industry: What the state did and did not. *Review of Development Economics*. 5, 266–288 (2001). <https://doi.org/10.1111/1467-9361.00123>
- Yu, H.H., Shih, W.C.: [Taiwan’s PC industry, 1976-2010: The evolution of organizational capabilities](#). *The Business History Review*. 88, 329–357 (2014)

The Impact of Lifting Travel Bans on Political Ideology^{*}

Jeffrey Kuo[†]

March 02, 2023

Abstract

“How would the lift of long-standing travel bans and different levels of exposure to un-acquainted visitors affect party identification and political ideology? This paper uses the district-level presidential electoral results and Annual Survey Report on Visitor Expenditure and Trends (ASRVET) in Taiwan between 1996 and 2020 to test how the shock of open policy to mainland Chinese visitors changed the political ideology among the Taiwanese constituents living across the municipalities. Firstly, I build a new dataset by merging geographical information into the Taiwanese electoral database. Then, I utilize the regression discontinuity (RD) design model according to the running variables of driving times and distances to the top-rank tourist attractions in Taiwan and categorize the treatment and control group as high and low tourist-exposure areas. Finally, I estimate and compare the treatment effects between the high and low visitors-exposure regions across the presidential election outcomes and run the robustness check by testing various local polynomial functions in the RD model. I show that, after ECFA went into effect, the local treatment effect became more significant. In other words, electoral districts exposed to more Chinese tourists encountered a larger scale of political-ideological realignment. The result hence demonstrates ECFA as a counter-example of the progressive economic integration theorem.”

^{*}This is a primary draft of an ongoing research project, please do not circulate without permission. The author thanks my dissertation advisor, [Joseph Pelzman](#) his valuable feedback and support. Also, the author thanks Rémi Jedwab, Ariel Weinberger, Ding Xiang, Marta Bengoa, Davin Chor, Maggie X. Chen, Ebad Ebadi, Jialu Ma, Thomas Prayer, Alexandre Skiba, Thomas Zylkin, and all participants in the previous workshops and conferences, i.e., GW-IIEP Development Tea Webinars, 2020 Annual Meeting of South Economics Association, and 2021 Annual Conference of International Trade and Finance Association, for solid feedback and suggestions. This paper is rendered by R Markdown, all the results are reproducible, programming codes are upon request. All errors belong to the author.

[†]George Washington University, Email:jeffkuo@gwu.edu, Webpage:<http://jeffkuo.github.io>

1 Introduction

How would the lift of long-standing travel bans and different levels of exposure to unacquainted visitors affect party identification and political ideology? This paper uses the district-level presidential electoral results and Annual Survey Report on Visitor Expenditure and Trends (ASRVET) in Taiwan between 1996 and 2020 to test how the shock of open policy to mainland Chinese visitors changed the political ideology among the Taiwanese constituents living across the municipalities. Firstly, I build a new dataset by merging geographical information into the Taiwanese electoral database. Then, I utilize the regression discontinuity (RD) design model according to the running variables of driving times and distances to the top-rank tourist attractions in Taiwan and categorize the treatment and control group as high and low tourist-exposure areas. Finally, I estimate and compare the treatment effects between the high and low visitors-exposure regions across the presidential election outcomes and run the robustness check by testing various local polynomial functions in the RD model. I show that, after ECFA went into effect, the local treatment effect became more significant. In other words, electoral districts exposed to more Chinese tourists encountered a larger scale of political-ideological realignment. The result hence demonstrates ECFA as a counter-example of the progressive economic integration theorem.

2 Institutional Background

2.1 Bipartisanship: DPP v.s. KMT

Like most of the democratic nations in the world, the modern politics in Taiwan is built upon bipartisanship. Democratic Progressive Party (DPP) and Kuomintang (KMT, also known as the Chinese Nationalist Party) are considered two major political parties in Taiwan in the modern democratization era.¹ Two parties have nominated the presidential candidates since the first

¹Here, we denote the democratization era began around the 1990s after the Martial Law ended. Since the modern democratization in Taiwan in the 1990s, DPP and KMT have been the only two parties that nominated the can-

direct presidential election held in 1996. Moreover, both also endorsed the candidates, held campaign activities, and participated in the most local elections for public officials.

Given the historical path that the two parties have taken, KMT and DPP hold very different views on the Cross-strait relationship and national identification. The KMT is more policies-friendly to China, whereas DPP seeks more independencies. The dispute of the national identification is uncommon to see in other countries, but in Taiwan, any topics relating to China will become controversial. The debate of the national identification boils down to the official name of the nations. While KMT insists on being called the “Republic of China (R.O.C.),” DPP prefers to use “Taiwan” as the promotion name in the international community. And this bipartisanship gradually forms the political ideology in current Taiwan.

There have been two generations of Chiang’s family ruling since Chiang Kai-shek retreated to Taiwan. The Chiangs, both represented KMT, held power from 1949 to 1988. However, the political goal of the then KMT-led government adjusted with time as well. From 1949 to the 1970s, the Chiang Kai-shek and KMT-led government made the island a military base to reconquer mainland China. However, after the 1970s, due to the change of international politics, the KMT realized it was unlikely to reclaim the mainland and switched its focuses to building up the infrastructure in Taiwan. Chiang Ching-kuo, the eldest son of Chiang Kai-shek took over the president seat in 1978 shifted his attention to build up the infrastructure on the island. And since then, the political ideology of the KMT leans to inherit the “real China” legacy even without the support of other countries, and seek the opportunity in the future to unify the mainland.²

In contrast, DPP started as a group of anti-authoritarian activists extradited by the KMT government and was the only voice to demand democratization and political reform during the authorization regime. Hence, there is a substantial ideological cleavage between the two parties. The KMT inherited their Chinese roots to deem the current Taiwanese government legal representative of “real China.” Also, KMT holds a more conservative stance on claiming Taiwan’s

didate across seven general presidential elections during 1996-2020.

²Since retreating to Taiwan, the Republic of China government *de facto* only controls several areas, including Penghu, Kinmen, and Mastu, in addition to Taiwan.

independence and focuses more on economic cooperation with China. For example, KMT under the Ma administration (2008-2016) proposed maintaining the status quo on the cross-strait, building a peaceful relationship, and targeting the enormous Chinese market.

On the contrary, DPP was considered an illegal party during the KMT-Chiang family ruling period. The DPP chartered members were against the Chiang-KMT administration and wanted to disconnect with China. Members and politicians affiliated with DPP advocate the self-identification of Taiwan and claim to normalize Taiwan as an independent sovereignty country. DPP's stands to China are more progressive, resistant, and not lean toward solely relying on the market of China, whose ultimate goal was to transform Taiwan into a normal country.

Also, the two parties have been fighting for their political beliefs since the democratization era. And the Cross-strait and national identity topics have played important roles in every presidential election. Although domestic politics in Taiwan look reasonably stable nowadays as the elections of public officials are held regularly, and the transition of power is relatively peaceful, bipartisanship is still relatively young compared with other democratic countries worldwide.³

2.2 Political Ideology

Kuomintang (KMT) is considered the right-wing, meritocratic, and conservative political party in modern Taiwan, whose political stands on national identification generally following the ideology recognizing "The Republic of China on Taiwan."⁴ The Chiang Kai-shek and the KMT retreated to Taiwan in 1949, which opened the Chiang-family ruled era under the most extended martial law in the history of the world. The KMT remained the sole legal ruling party in Taiwan under

³Taiwan's period of martial law in Taiwan (1949-1989) had been the most prolonged period of martial law in the world. The long-existing martial law was not lifted until 1990, and the president's first general direct elections occurred in 1996.

⁴KMT was the organization that Dr. Sun Yat-sen initially founded in 1911 to overthrow the Qing Dynasty during imperial China, whose main goal was to build a modern republic based on the new democratic system. Since KMT's early establishment in 1919, it became the dominant ruling party of the Republic of China on the mainland. From 1928 to 1949, the Kuomintang-run China, led by Chiang Kai-shek, represented the "China" to engage in the political activities of the international community, such as World War I and II. However, after losing the Chinese Civil War to the Chinese Communist Party (CCP).

the “Dang Guo” system until democratization were enacted in the 1990s.⁵

Unlike the KMT representing the traditional and conservative power, as they still consider themselves the legal delegate of the Republic of China, Democratic Progressive Party (DPP) was the hub of non-Kuomintang supporters under the Chiang-family-Kuomintang authoritarian regime. Under grounded for about decades, DPP was officially formed in 1986, under the proclamation of pursuing the nationality of Taiwan and cutting ties with the old relationship with PRC under the control of the Chinese Communist Party. After the democratization starting in 1989, DPP then became the major opposition party. Traditionally, DPP represented the mainstream “non-Kuomintang” voice in the Chiang-family-Kuomintang period and was deemed to be lining to the left on the political spectrum. One of the charted goals of DDP was to ultimately declare the independence of Taiwan and make the island officially becomes an actual sovereign state.

To sum up, the DPP is the leading party with the anti-China ideology. In contrast, KMT deems pro-China, given it embraces the image of the true inheritance of the Chinese legacy and would like to use the “Republic of China” or “ROC” as the nation’s official name. This paper defines the pro-China margin as the winning votes and shares of the KMT candidates in each election, as specified in Equation 1. The t will represent the year of the elections, and the pro-China margin will be the primary dependent variable capturing the political ideology in the following analysis in this paper.

$$\text{Pro-China Margin}_t = \text{Vote to KMT}_t - \text{Vote to DPP}_t \quad (1)$$

2.3 Presidential Elections in Taiwan

The election of the president and vice president of Taiwan is a universal direct election through secret votes by the Taiwanese citizens. After the democratization starting from the 1990s, the

⁵“Dang Guo” in Chinese means to use a single-party to run the country, which is the system that KMT used during Chiang’s administration in Taiwan.

single-district two-vote system was introduced to Taiwanese society. The legal constituent has two ballots when it comes to the general elections for the presidents. One ballot is for the presidential candidate, and another is for the political party.⁶

There is no early vote nor absentee vote in Taiwanese elections. The president and vice president are nominated on a joint ticket. Political parties that have gained at least 5% of the last presidential or legislative election votes may directly appoint a set of candidates. For example, during the 2012 elections, only the KMT and DPP were qualified to nominate candidates through this rule. Alternatively, candidates may be nominated by a petition signed by eligible voters numbering no less than 1.5% of the electors in the last legislative election.⁷

2.4 Cross-strait Relationship

Cross-strait relationship between Taiwan and China has been complicated, thanks to long-term historical and political disputes. Despite being largely ethnic Chinese societies, Taiwan and China are very different due to their differentiated histories, which have been influenced by multiple factors including foreign colonial rule, their separate independent governments, and experiences with democratization (Kwan, 2016). As China started to bring in foreign investment in the 1980s and soon became the world's factory, the economic power of Chinese firms and consumers, in addition, plays another important role regarding cross-strait politics. Meanwhile, while the China was embracing the world market, Taiwan encountered the process of democratization and tried to find a path to cut tie with the name of China (Rigger, 2003).

The tension across the Taiwanese strait has also been fluctuating due to globalization and modern democratization in Taiwan after the Chiang family's authorization stepped down. The political uncertainty in China is also highly correlated with the political cycle in Taiwan. In general, since the KMTs and their supporters are leaning to consider themselves as the Chinese's

⁶The most recent election occurred on January 11, 2020. The Presidential and Vice Presidential Election and Recall Act of R.O.C. states that a candidate for President or Vice President must be a citizen of the Republic of China, at least 40 years old, and a resident of Taiwan for no less than 15 years with a physical presence of no less than six consecutive months.

⁷This equals 252,848 signatures for the 2012 election.

inherent, at the period of the KMT being the incumbent (1996-2000, Lee; 2008-2016 Ma), the cross-strait relationship was usually more peaceful, and the communication between Taipei and Beijing are smoother. On the other hand, since DPP was chartered with the consensus of normalizing Taiwan as a real country, the relationship with China was usually colder when the DPP's presidents were in office. There have been four different presidents who the people in Taiwan elected. They are Lee Tang-Hui (KMT) in 1996-2000, Chen Shui-bian (DPP) in 2000-2008, Ma Ying-jeou (KMT) in 2008-2016, and Tsai Ing-wen from 2016 to the present.

From a historical perspective, although without the recognition of most countries in the international community, Taiwan has been *de facto* self-ruled as a sovereign state since 1949.⁸ In Taiwan, it is well believed that the growing economic power of China has cultivated her political ambitions to carry out the ultimate plan to reclaim the autonomy of the island and officially annex it as an part of territory. The pending hostile relationship and ambiguous definition of national identification hence created physical and psychological trade barriers among the citizens living on the different sides of the straits. The international community's representative rights' prolonged diplomatic war consolidated as the world split on the political ideology. The consequence of this impact lasts until recently, halting the trade across the Taiwanese straits for nearly forty years.

The recent hostility to China culminated at the point of Sunflower Student Movement broke out in March 2014, which was originally coming from the distrust of the government on dealing with the service trade agreement with China. The rise of civic nationalism in Taiwan indicates the prominence of an ethnonational Chinese identity imposed by Beijing (Kwan, 2016). The surge of nationalism and the higher volume of seeking the official declaration of independence

⁸This dispute of sovereignty is the so-called "*Undetermined Status of Taiwan*." The origin could date to the undecided Chinese Civil war since 1949, when the Chinese Communist Party led by Mao Zedong took over mainland China's control, while the Kuomintang lost to the civil war and fled to Taiwan under the leadership of Chiang Kai-shek. Although there was never an official fire-ceasing agreement between the two political identities, the main battlefield transformed into a diplomatic format as the Cold War Era began. Both sides started to fight for the legitimacy to represent the real "China" and seek official recognition and allegiance from the rest of the world. For example, the Republic of China (ROC) government in Taiwan led by Chiang Kai-Shek of Kuomintang (KMT) was the representative of China and a chartered member of the United Nations until People's Republic of China (PRC) replaced her seat in 1979.

in Taiwan had puzzled many in the Chinese administration, who once believed that cultural interactions and economic benefit sharing on the island might bring in higher public support of the idea of reunification, which happens to be consistent with what the conventional economic integration theory advocated.

2.5 Open Border to Chinese Visitors

As Ma claimed the victory of the general election in 2008, and ended Chen Shui-bian's eight-year tenure,⁹ he did not take too much time after taking the office to explore the various opportunities to cooperate with Beijing and adjust the previous policies to take advantage of the vast markets of the Chinese consumers. At that time, it was well believed that Ma and KMT's victory in the 2008 election was resulted from the sluggish economic performance in Taiwan, and the Taiwanese constituents are eager to seek a more friendly environment with doing business with mainland China.

The episodes of the policy shocks began in 2008, led by the newly elected President, Ma Ying-jeou of Koumintong (KMT), who proposed to sign a preferential trade agreement with China to take advantage of the lower trade barriers in both goods and service sectors. Besides, as part of the economic cooperation agreements, the long-time separated citizens are allowed to travel. Ma advocated the policy change toward tourists coming from mainland China. Unlike his predecessor, the Chen administration of the DDP, Ma took a more China-friendly stance and gradually imposed a series of policies that make commerce across the straits more available. The tourism industry is the one that got the most media exposure. Ma opened up the Taiwanese borders to welcome long-time banned Chinese tourists. Even though the process only started in a few cities with higher development, the impact has gradually prolonged. Table 1 documents the timeline of open-border policies, as permission to travel to Taiwan became applicable. Within less than

⁹Chen Shui-bian, 2000-2008 the President of Taiwan in office, was once considered the "Son of Taiwan" and praised by the majority of the constituents. He is the one ending the KMT fifty-five years authoritarian regime, who held salient position to keep China in the distance and paving a path for the Taiwanese nationalism identification. For example, Chen had tried to push the movement to rejoin the United Nations by using the name of Taiwan and justify the state-own companies' brand names from the Republic of China or R.O.C. to Taiwan.

four years, the Chinese cities on the list are eligible to travel to Taiwan, which has grown from three to forty-seven. Moreover, Ma also amended the education bill to loosen Chinese students' restrictions to apply for university or graduate schools in Taiwan.

The swerve of the political attitude from the previous administration to the long-time foe made Taiwanese concerned, and the public opinion has highly diverged. Some believe that this is an excellent opportunity for mid-level exporting firms, tourism, and educational sectors in Taiwan to grab the fruits of China's enormous market. In contrast, many believed Beijing sugar-coated the trade agreement policies and tried to use their economic influence to achieve their ultimate political goal: to reunify the island.

I translate and organize the whole series of the policies relating to the trade and economic integration between Taiwan and China in Table 1, from the website of the Tourism Bureau. Table 1 documents the policies relating to the Chinese tourists from the mainland, which also shows a political climate at that time. Ma administration cashed in their commitment to exploring the China market after the KMT victory in the 2008 presidential election. And table 2 documented the cities that are open to tourism to Taiwan chronologically. As indicated in the 2, the open-border policies to allow the mainland Chinese to visit Taiwan started from three metropolises in China in 2011, which were Beijing, Shanghai, and Xiamen. However, it only took two years for these policies to extend to the other twenty-six cities in mainland China.

On the other hand, Figure 1 and Figure 2 show the series of incoming visitors to Taiwan categorized by their residences. As we can tell from the two graphs, both the absolute number and the proportion of Chinese visitors increased rapidly after the EFCA went into effect in 2008.

Date	Regulations Governing the Permission for Mainland Personnel to Come to Taiwan for Tourism Activities
2006.8.27	The Taiwan Strait Tourism Association was established.
2008.6.13	Signed the "Agreement on Mainland Residents Traveling to Taiwan on Both Sides of the Taiwan Straits."
2008.7.4	The first cross-strait voyage, the first tour group of mainland tourists arrived in Taiwan.
2008.7.18	Mainland visitors to Taiwan are officially opened for sightseeing, with a daily quota of 3,000 visitors to Taiwan.
2009.7.18	The Taiwan Travel Association and the Association For Tourism Exchange Across The Taiwan Straits (hereinafter referred to as the Two Little Associations) jointly established a regular cross-strait tourism consultation. The two sides jointly held the first cross-strait tourism exchange roundtable in Beijing.
2010.8.14	For the second anniversary of the opening of cross-strait tourism, a cross-strait tourism round table was held at the Ambassador Hotel Hsinchu.
2011.1.1	The daily quota for the tourists to Taiwan was increased to 4,000.
2011.6.28	The first batch of mainland tourists who travelled freely came to Taiwan, with a daily quota of 500 people.
2012.4.28	The quota limit for free traveling to Taiwan of the mainlanders was adjusted to 1,000 per day.
2013.4.1	The daily quota for Mainland Chinese Tourism Group was adjusted to 5,000, and the quota for free travel was adjusted to 2,000.
2013.5.1	The Tourism Bureau of the Ministry of Communications implements high-quality tour groups for land passengers and is subject to a daily quota of group guests.
2013.10.1	China implemented a new travel law, strictly regulated shopping itineraries and banned commissions.
2013.12.1	The daily quota for free travel by Mainland travelers to Taiwan was adjusted to 3,000.
2014.4.16	The daily quota for free travel by Mainland travelers to Taiwan was adjusted to 4,000.
2014.11.28	The "In-depth Tour of Indigenous Tribes" was opened without daily quota restrictions.
2015.5.1	Opened the "Mainland Chinese Tourists High-end Quality Tour" without daily quota restrictions.
2015.9.21	The daily quota for free travel by land travelers to Taiwan was adjusted to 5,000.

Table 1: Timetable of Policy Relating to Mainland Chinese Tourists. Resource: Webpage of Tourism Bureau, Ministry of Transportation and Communication. <https://admin.taiwan.net.tw/timetable>

Date	Phase	Cities Residents Allowed Travel to Taiwan	Count	Total
2011 / 6 / 28	Phase 1	Beijing, Shanghai, Xiamen	3	3
2011 / 7 / 29	Mini-Three Links ¹⁰	Xiamen, Fuzhou (Fujian), Putian, Quanzhou, Zhangzhou, Longyan, Sanming, Nanping, Ninde	(9)	(9)
2012 / 4 / 28	Phase 2 - Stage 1	Tianjin, Chongqing, Nanjing, Hangzhou, Guangzhou, Chengdu	6	9
2012 / 8 / 28	Phase 2 - Stage 2	Jinan, Xian, Fuzhou (Jiangxi), Shenzhen	4	13
2012 / 8 / 28	Mini-Three Links ¹⁰	Wenzhou, Quzhou, Lishui, Ganzhou, Fuzhou, Shangrao, Yingtan, Meizhou, Chaozhou, Shantou, Jieyang	(11)	(20)
2013 / 6 / 28	Phase 3 - Stage 1	Shenyang, Zhengzhou, Wuhan, Suzhou, Ningbo, Qingdao	6	19
2013 / 6 / 28	Phase 3 - Stage 2	Shijiazhuang, Changchun, Hefei, Changsha, Nanning, Kunming, Quanzhou	7	26
2014 / 7 / 18	Phase 4	Harbin, Taiyuan, Nanchang, Guiyang, Dalian, Wuxi, Wenzhou, Zhongshan, Yantai, Zhangzhou	10	36
2015 / 3 / 18	Phase 5	Haikou, Hohhot, Lanzhou, Yinchuan, Changzhou, Zhoushan, Huizhou, Weihai, Longyan, Guilin, Xuzhou	11	47
2019 / 7 / 31	Tourism to Taiwan was Suspended		-	0
2019 / 9 / 20	The policy of “Mini-Three Links” reinstated		(20)	(20)

Table 2: Timetable of Open Up Tourism to Taiwan for the Residences in Mainland Cities
Source: Mianland Affairs Council, Republic of China (Taiwan). Table is oragnized by the au-
ther.

¹⁰Mini-Three Link: The citizens residing in these cities in then were allowed to do tourism only in Jingmen, Mazhu, and Penghu, the remote island of Taiwan.

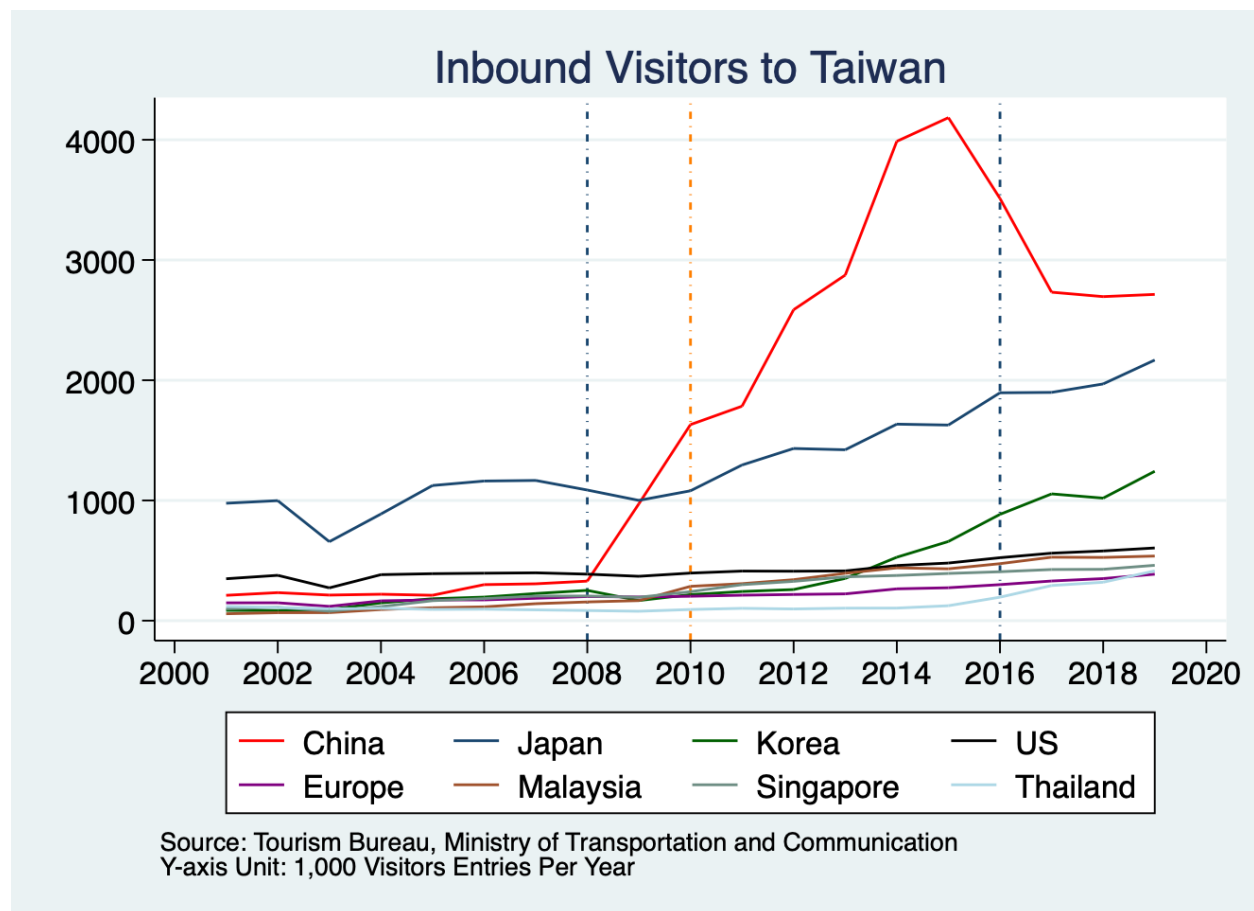


Figure 1: Inbound Visitors to Taiwan, 2001-2020

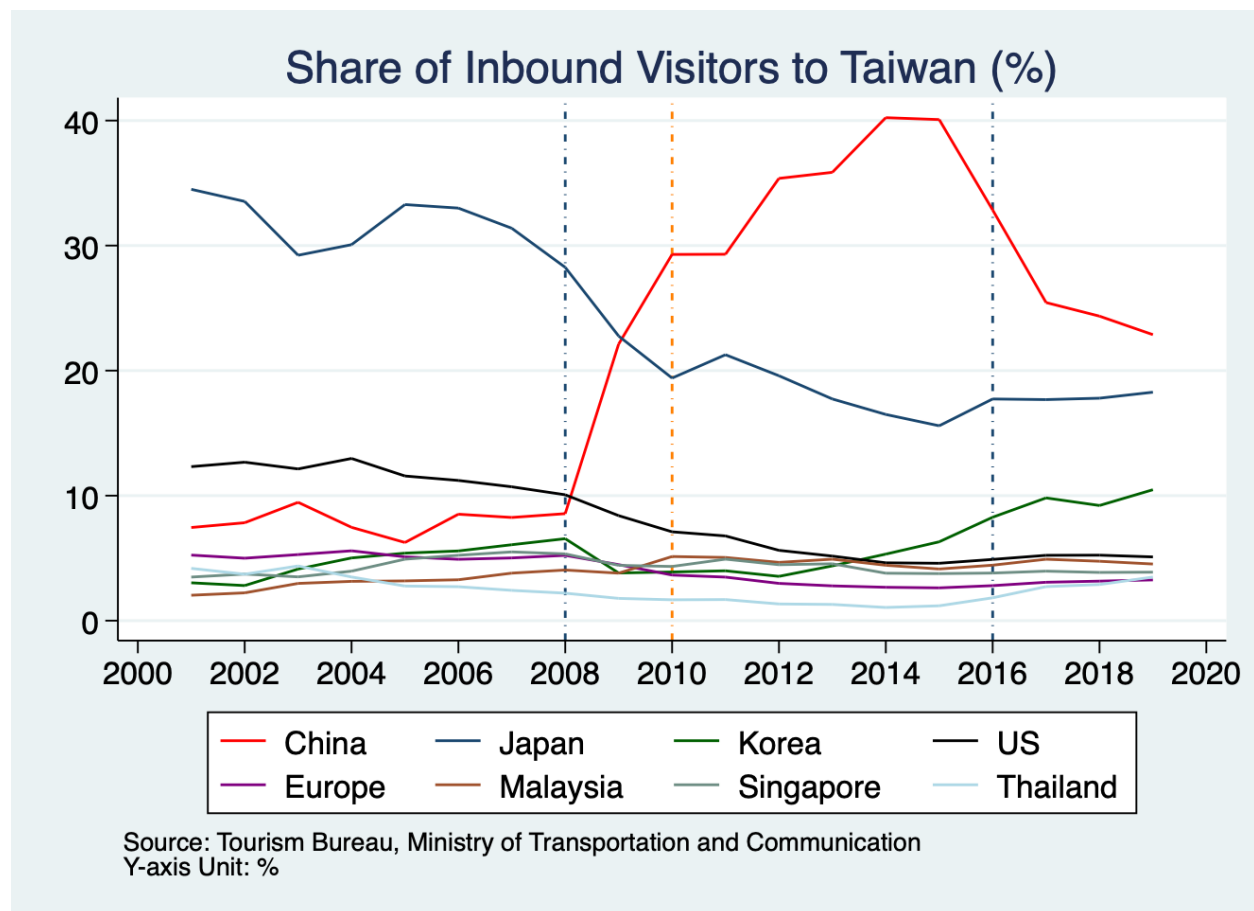


Figure 2: Share of Inbound Visitors to Taiwan, 2001-2020

3 Literature Review

3.1 Trade and China Shock

Discussions about the dynamics of the trade policies and the politics in a country are not new in the trade and political economy literature. [Irwin \(1994\)](#) examines voting patterns in the 1906 general election in the United Kingdom to explore the support for and opposition to free trade with the British electorate. [Irwin \(1994\)](#) also tests the hypothesis that support and opposition in each parliamentary district are closely related to the economic interests of the district's constituents, which in turn hinges on the international trade performance of the sectors in which the constituents are employed. Although the British voting and political system are unique globally and different from the Taiwanese political system, the result of [Irwin \(1994\)](#) still provides a broad picture of how trade policies affect the decision of the vote and its consequent political outcomes.

[Young and Magee \(1986\)](#) utilizes a simultaneous game model to delineate the strategic behavior by two contending coalitions of factor owners and also political competition between two rival parties contending to the political office. A Heckscher-Ohlin style of the trade model is assumed in this paper. Each political party pre-associates itself with the interests of one of the production factors and proposes policy intervention which benefits the factor owners support. In short, [Young and Magee \(1986\)](#) considers a Heckscher-Ohlin-Samuelson trade model with two lobbies, representing the interests of factor owners, and two political parties. The lobbies contribute resources to politics, equating their returns to political and economic activity at the margin, while the parties maximize their probability of election, trading off general voter dissatisfaction with protection against the electioneering resources that favorable policies attract from the lobbies.

On the other hand, since we focus on the Chinese tourists coming to Taiwan in this paper, we should not ignore the string of the literature that capture the growing power of the China in global trade. Since China became a member of the World Trade Organization, the large market

power has fundamentally change the global economy. There have already been many papers trying to evaluate China's impact on the U.S. labor market, mainly regarding the penetration of Chinese importing goods. For example, [Autor et al. \(2013a\)](#) exploiting the rising import competition of Chinese goods on US labor markets and concluded that the increasing import competition from the Chinese importing goods explains one-quarter of the aggregate decline in the employment of the US labor market ([Autor et al., 2020](#)). And most of the empirical literature regarding the China syndrome on the local market focus on the manufacturing sectors and the trade in goods. ([Autor et al., 2013a,b, 2014, 2019](#)). This string of literature regarding the China shock mostly focuses on the manufacturing sectors and seldom touch on the impact of trade shock on the service sector. This paper aims to identify that the municipalities in Taiwan have encountered a larger swerve of the political ideology, which fills in the current literature gap.

[Guo and Jiang \(2021\)](#) focuses on the political effects on the open border policies, in which they defined it as cross-border tourism of Chinese tourists to Taiwan. However, instead of using the data of historical presidential elections in Taiwan, they run the regression discontinuity by using the time series survey data of the Taiwanese national identification and the tourists' numbers. [Guo and Jiang \(2021\)](#) has also shown that cross-border tourism did not help achieve Beijing's original political goal. The empirical results in [Guo and Jiang \(2021\)](#) are different from this study. They show that the independence-unification views that the arrival of Chinese tourists has not influenced the majority of Taiwanese hold. The increase in the number of Chinese tourists does not significantly affect the proportion of Taiwanese who support independence and support maintaining the status quo. By contrast, the number of Taiwanese who support unification reduces. It implies that cross-border tourism may not be an effective means to achieve political goals.

3.2 Trade in Tourism

Recently, the literature analyzing the relationship between international trade and tourism has been growing. But little does these papers touch on the political effects and barely look at the

particular shock of the open-broader policy for the Chinese tourists. For example, [Kulendran and Wilson \(2000\)](#) tests a connection between international trade and international travel flows using time series econometric techniques by using data for Australia and four important travel and trading partners, the U.S.A., the U.K., New Zealand, and Japan.

Also, there is no consensus in the literature on how to estimate the exposure of the tourist. However, in the literature, we could find that travel distance and time play important roles in the spread of tourists. There have been many papers discussing the measurement of tourist exposure. One area's exposure to the incoming tourists was highly dependent on tourist dispersion. [Becken et al. \(2008\)](#) identifies the itinerary prototypes based on the characteristics of the tourists and examines the tourist behavior across space and time. They found that the spatial distribution of the tourist itinerary is shaped by a wide range of factors, including country of origin, port of arrival, travel style, repeat visitation, the purpose of travel, and the presence of children under fifteen years old.

[Allen et al. \(2021\)](#) is the latest paper that touches on tourism in trade and its effects on the labor markets. The authors develop a new strategy to capture the region's tourism effect and ask, "Is tourism good for locals?" This paper also focuses on the political tensions regions- the Catalonia region in Spain, even though they did not test the political outcomes of the Catalonia region. [Allen et al. \(2021\)](#) uses detailed spatial data on expenditure and income patterns of residents in Barcelona. The result shows that plausibly exogenous shifts in tourist expenditure due to compositional differences in their country of origin across time and over space in the city crowd out local expenditure by increasing prices but partially compensating through increases in wages. However, the incidence of the tourism shock is highly heterogeneous across the city, with inner-city residents bearing the most significant welfare losses and peripheral residents enjoying the most lavish welfare gains.

4 Data and Variables

Since this study focuses on exploring the open-border tourism policies and their political effects on the presidential elections in Taiwan, there is no database. We have to merge different data resources published by four governmental agencies in Taiwan. I extract the data published by three Taiwanese government agencies: first, the Central Election Committee for the historical electoral data, the boundaries and the geographical shape data from the Ministry of Interior, and finally the Annual Survey Report on Visitors Expenditure and Transportation (ASRVET) from the Tourism Bureau of Ministry of Transportation and Communication. I detail them in the following subsection, starting from the historical electoral data.

4.1 Presidential Election Data

First, I pulled the historical presidential elections' voting data from Taiwan's Central Election Commission (CEC) database.¹¹ All historical electoral data are recorded and downloadable from the online database of CEC, the highest government agency in charge of government officials' elections, and conducted and supervised elections that occurred in twenty-two second-level municipalities in Taiwan.¹² CEC also governs the local election commissions who administrate the logistics of the all-level elections. All elections in Taiwan's democratized period are operated according to "Public Officers Election and Recall Law" and "Presidential and Vice Presidential Election and Recall Law." In addition, CEC has been granted its political independence and ensures the fairness of elections and campaigns. The commissioners of local and central election commissions serve a four-year term, who are not subject to party affiliation and given independent discretion.

In this paper, I focused on the presidential election results of the third-level governmental

¹¹The English version of the official website of the Central Election Commission in Taiwan, <https://web.cec.gov.tw/english/>

¹²The second-level refers to the special-municipality, city, and county. In 2021, there are twenty-two second-level administrations. There are six special-municipalities, Taipei, New Taipei, Taoyuan, Taichung, Tainan, Kaohsiung; three cities, Keelung, Hsinchu, and Chiayi; and thirteen other counties.

administration, where there are three hundred and sixty-eight municipalities, including those governed by the cities located in the outer islands of Taiwan. The names of these third-level municipalities are different depending on which their upper-level government is. It is called “district” in Chinese if the area is under “special municipality,” whereas “town,” “village,” or “county-administered city” are the names of the municipality is under the county. There are one hundred and sixty-four districts, six aboriginal mountain districts, fourteen county-administrated cities, thirty-eight towns, one hundred and twenty-two villages, and twelve aboriginal mountain villages.¹³

The third-level municipality provides sufficient variation on the vote results to explore the causal effects in the empirical model, which has also been the traditional administrative division since the Kuomintang retreated to Taiwan. In addition, the third level is the finest level that avoids the problem of gerrymandering. Even with that CEC database providing further detailed fourth-level electoral results, I am afraid that the consistent realignment in history will hinder the results we would like to explore.

4.2 Chinese Visitor Statistics

Secondly, I extract the annual statistics of the incoming visitors worldwide from the Annual Report Survey of Visitors Expenditure and Transportation (ARSVER). This survey was constructed by the Tourism Bureau under the Ministry of Transportation and Communication (MOTC) in Taiwan at the tourist attractions or the airports in Taiwan.¹⁴ This yearly published report includes the ranking of the relative visits of the tourist’s interests, as well as the numbers of tourists coming to Taiwan and what are their purposes of the stay. While this report provides the data of how many tourists stay in the different counties or cities annually, there are no more exemplary statistics on the county or city level of the tourism, let alone the district levels that I explore.

¹³There are 368 third level municipalities, include 164 districts, 6 mountain districts, 14 county administrated cities, 38 towns, 122 villiages, 24 mountain villages. $368 = 164 + 6 + 14 + 38 + 122 + 24$

¹⁴The official homepage of the Tourism Bureau, Ministry of Transportation and Communication in Taiwan. <https://admin.taiwan.net.tw/English/index.aspx>

Hence, to estimate the potential tourists' exposure, we used the driving distance and time from the districts to a particular tourist attraction as a proxy of tourist exposure, a convention documented in the tourism literature. In other words, I assume the possibility distribution of exposure to the tourists follows the uniform distribution. If the district is closer to the particular tourist attraction or the major airport, the residents living in the neighborhoods are supposed to have a better chance to interact with the tourists. The assumption hidden from our RD model is that the tourist exposure is proportional to the inverse of the travel distance or time. To represent them mathematically in the following Equation 2 and 3. For every district i to tourist attraction j ,

$$\text{Tourist Exposure of District}_i \text{ from Attraction}_j \propto \frac{1}{\text{Driving Distance}_{ij}} \quad (2)$$

$$\text{Tourist Exposure of District}_i \text{ from Attraction}_j \propto \frac{1}{\text{Driving Time}_{ij}} \quad (3)$$

4.3 Geographical Data: Travel Distance and Time

As mentioned in the subsection, we proxy the distance to estimate the exposure of Chinese tourists across the towns in Taiwan. However, by using the geographic data, we can create an index that approximates the degree of exposure of tourists in every district.

Hence, we started by extracting the geographic data maintained and published by the National Land Surveying and Mapping Center (NLSC), governed by the Ministry of Interior of Taiwan. First, according to the database that NLSC published, we locate the coordination of every town, airport, and yearly ranked tourist attractions based on the Annual Survey Report on Visitor Expenditure and Trends (ASRVET). We then use the Stata package `geodist` (Picard, 2010) and the mapping services provided by the HERE company¹⁵ to calculate the driving time from each Taiwanese town to the tourist attractions as a proxy of tourist exposure. We use the driving distance and time as the proxy of the tourist exposure is because driving or taking the touring bus is the main transportation for the tourists coming to Taiwan for the first time. There might be a slight difference between the driving distance and the driving times, considering the infrastructure of the West Coast of Taiwan is better than the East Coast of Taiwan.

¹⁵The homepage of HERE Technology, <https://www.here.com/>

5 Methodology and Identification

5.1 Regression Discontinuity Design

Since there is a data limitation in the for us to know the tourists stay and the traveling, we proximate the exposure of the tourist by using the driving distance and time to the tourist attractions in Taiwan. The Regression Discontinuity (RD) design is a quasi-experimental impact-evaluation method used to evaluate programs with a cutoff point determining who is eligible to participate. RD models allow researchers to compare the sample approximately the differences between the control and the treatment groups ([Cattaneo et al., 2020](#)). In other words, the discontinuity around the cutoff point ([Angrist and Pischke, 2008](#)), which we set by the sample mean in each model. We expect that the treatment effect will not be statistically significant before the shock of trade policies. There are minor differences in the high- and low-Chinese tourists exposure regions. In contrast, after the trade shock, the treatment effects will become more significant.

There are considerable merits for us to run the RD model to tease out the swerve of the political ideology before and after the trade shock ([Lee and Lemieux, 2010](#)). First, even though we could create an index of the exposure to the Chinese tourists, there is still much cause that might potentially confound the electoral results. For example, the demographic variables of the constituents, such as the average income, educational level, gender composition, and age composition of the citizens who resided in the regions, could potentially be factors to affect the electoral outcomes. Although we could add more controls in our traditional parametric regression models, there is always room to argue another potential variable that might endogenize the electoral outcome.

The appropriate regression discontinuity design could eliminate missing observed variables since, by definition, we focus on the areas around the imaginary cutoff of either driving distance or time. And the distance to particular tourist attractions is not supposed to have direct causality to the political ideologies. The only difference in the close and away regions from a tourist site is the traveling time. The rest of the missing variables should be very similar for those mu-

nicipalities.

There are more reasons regarding the external validity of using the RD design. First, the unobserved factors that impact the results of the elections tend to be continuous—for example, the level of education, the income, or the demographic of the constituents. Secondly, the district can not directly manipulate its treatment, whether getting tourists' exposure or not. Third, we need not additionally assume the distributions of the unknown factors.

5.2 Identification

To capture the realignment of the political ideology, I use the winning margin of the KMT as the primary outcome variable. As mentioned in Section 2.2, since many variables potentially will affect the outcomes of the elections, the Regression Discontinuity design on the proper cutoff of the driving distance and time could solve it. Using the Regression Discontinuity (RD) method, we only focus on the boundaries of the treatment and control group in the sample. Our goal in this paper is to tease out whether the various degree of tourist exposure impacts the votes before or after the shock coming from China. In other words, I compare the treatment effect of tourists' exposure across the different years of the electoral results. In the model, the confounder X_i is the real tourist exposure in the town i that we can not observe and accurately estimate. However, according to the tourism literature, we know that tourist dispersion is highly correlated with the distance and travel time to the main tourist attractions. By understanding this mechanism, we can use the driving distances as a proxy of tourist exposure.

Those towns that are distanced from tourist attractions or the airport as the low-exposed towns are the control group in our model. On the other hand, the high-exposed districts are in proximity of the tourist attractions or airports. We then calculate the sample average as the cutoff between the high and low exposure regions and estimate the treatment effects in each election. Finally, we run a regression of these treatment effects on the previous years' incoming Chinese tourists to see if the increment of the Chinese tourists impacts the treatment effects in the RD models.

The following is the RD model in each election year, which is a sharp RD design. (Lee, 2008, Lee and Lemieux (2010)) where the variables: Y_i represent the Pro-China Margin, as our primary outcome variables capturing the ideology realignment. D_i is the treatment, deciding the district is high-exposed to tourists or not. X_i is the assigning variable, the driving time or driving distance to airport or tourist attractions. W_i is the unobserved endogenous variable, which could be thought of as the real tourist numbers, which is assumed to affect the result of election Y_i . c is the cutoff of driving distance or driving time, which we use as the sample mean.¹⁶

$$Y_i = D_i\tau + W_i\delta_1 + U_i \quad (4)$$

$$D_i = 1[X_i \geq c]$$

$$X_i = W_i\delta_2 + V_i$$

Since districts can not precisely control W_i via X_i , the external validity of the RD holds. On the other hand, it is not always the case that the longer travel time from the airport brings fewer tourists; the districts have no complete control to be tourism hot spots or not. Then, to robust our analysis, we calculate the treatment effect based on the different local polynomial functions in the RD model. Here, we consider the first four degrees of the power in the RD model. The RD model with the linear local polynomial function is as following, the τ_1 is the estimated variable that we are interested in.

$$Y_i = \tau_1[X_i > c] + \delta_1(X_i - c) + U_i \quad (\text{RD1})$$

The quadratic one,

$$Y_i = \tau_1[X_i > c] + \delta_1(X_i - c) + \delta_2(X_i - c)^2 + U_i \quad (\text{RD2})$$

¹⁶In the first model we run, we pin $c = 290$ minutes as this is the average time that people spend on the highway traveling from the capital to the south. One day trip from Taipei (north region) to Kaohsiung (south area) is 4 hours and 50 minutes.

The cubic one,

$$Y_i = \tau_1[X_i > c] + \delta_1(X_i - c) + \delta_2(X_i - c)^2 + \delta_3(X_i - c)^3 + U_i \quad (\text{RD3})$$

And with the power of fourth local polynomial function, the RD model becomes

$$Y_i = \tau_1[X_i > c] + \delta_1(X_i - c) + \delta_2(X_i - c)^2 + \delta_3(X_i - c)^3 + \delta_4(X_i - c)^4 + U_i \quad (\text{RD4})$$

And finally, after calculating the treatment effects from the different elections year, we then test the stationarity of the series of treatment effects and run a time-series regression of those treatment effects on the numbers of the incoming Chinese visitors. Such as,

$$\text{Treatment Effects}_t = \beta_0 + \beta_1 \text{Chinese Tourist}_t + \varepsilon_t \quad (5)$$

5.3 Algorithm

To wrap up this section, I conclude this section by listing the algorithm we use in this study.

1. Calculate the distance between the municipalities and the tourists attractions.
2. Calculate the mean of distances, set the municipalities into control and treatment group.
3. Set the mean of the distance as the cutoff to the close and away regions.
4. Run the regression discontinuity using the 2004, 2008, 2012, 2016, 2020 presidential electoral data.
5. Compare the treatment effects across the different elections.
6. Regression those treatment effects on the importing number of the Chinese tourists.

6 Results: RD Figures

The following figures are the series of RD results based on the 2016 presidential elections and use the largest airport in Taiwan, Taipei International Airports, as the tourist concentration point. As indicated in the series of graphs, either kind of the local polynomial functions of the RD model shows a significant difference at the cutoff point between the high and low tourist exposed areas.

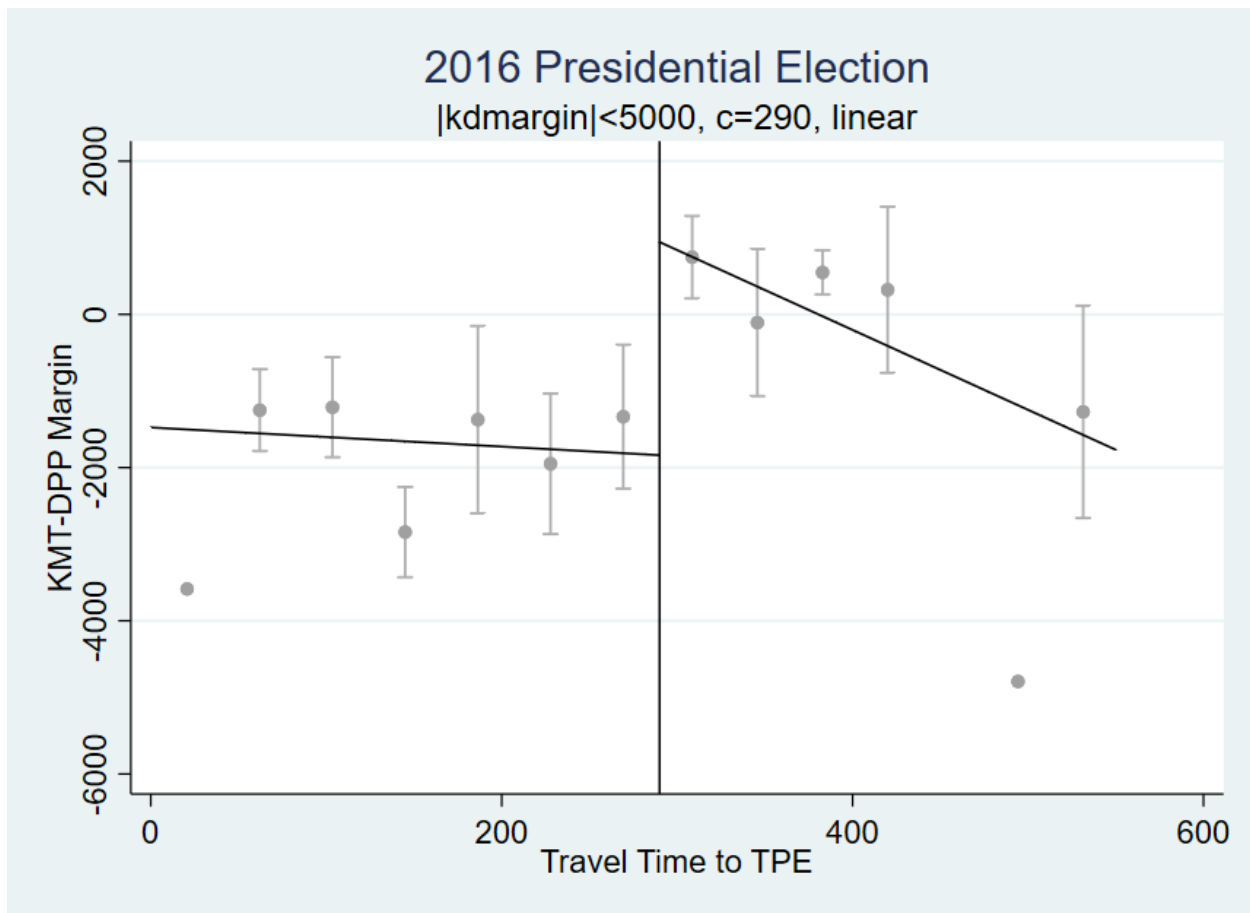


Figure 3: 2016 Election, Linear Model, Taipei Airport ($t=2016$, $d=1$, $j=TPE$, $c=290$)

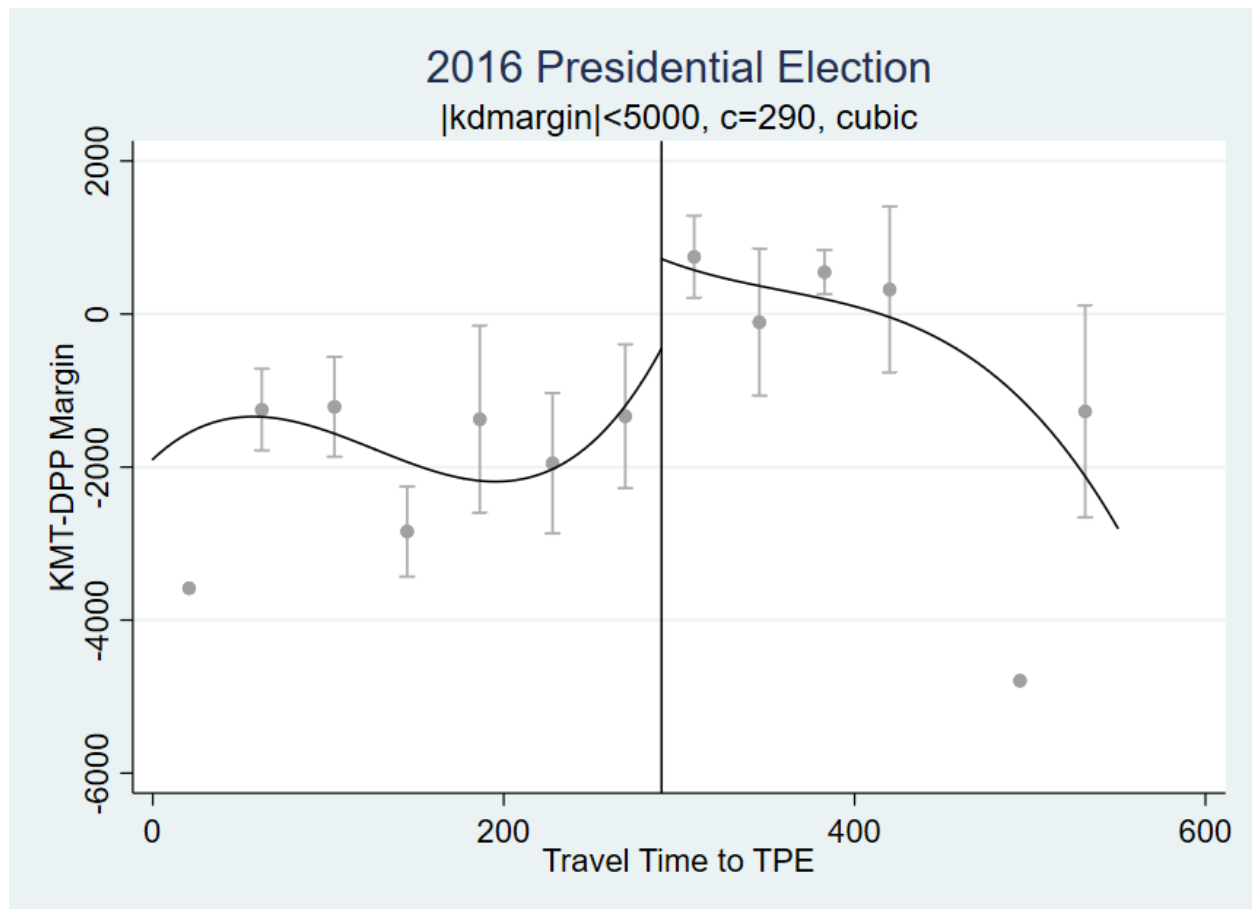


Figure 4: 2016 Election, Quadratic Model, Taipei Airport ($t=2016$, $d=2$, $j=TPE$)

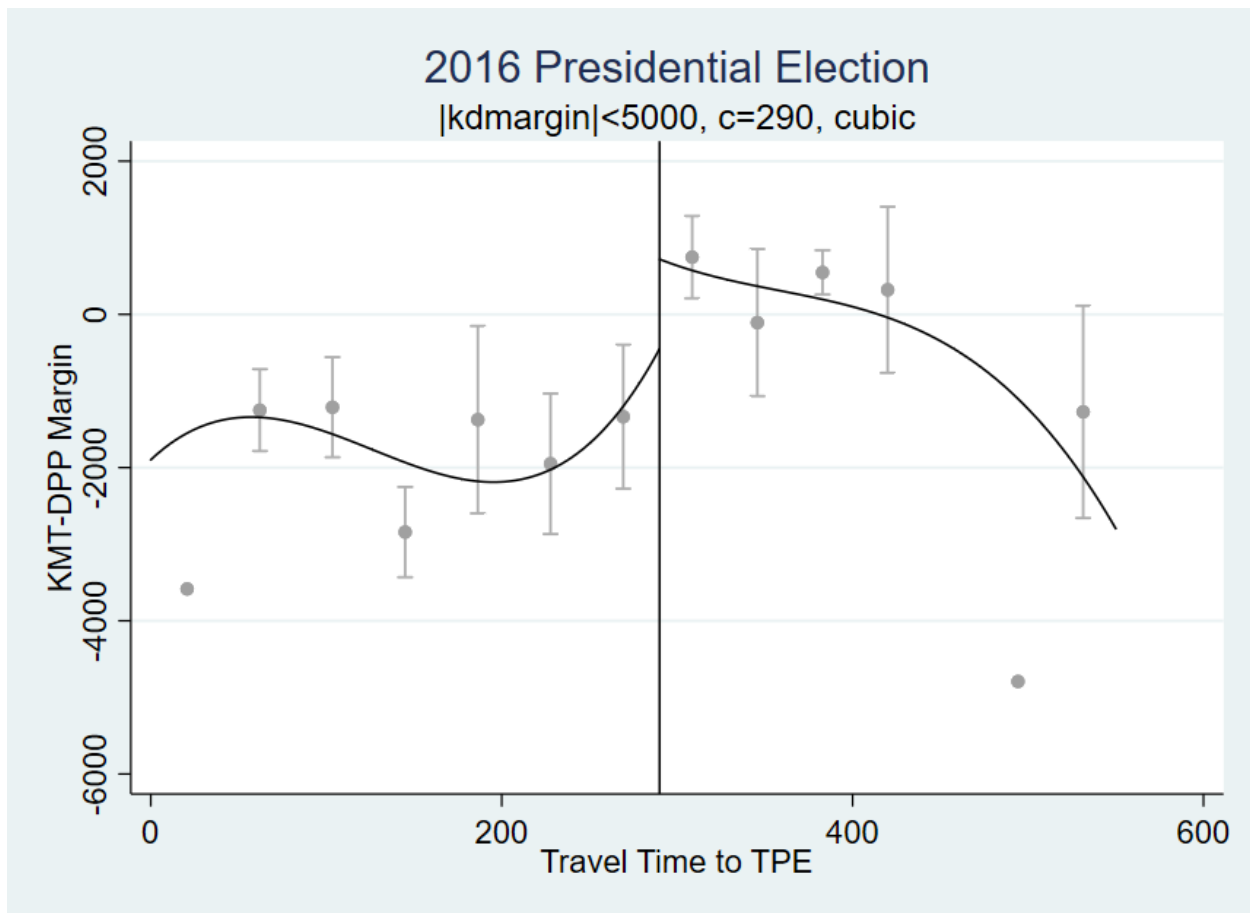


Figure 5: 2016 Election, Cubic Model, Taipei Airport ($t=2016$, $d=3$, $j=TPE$)

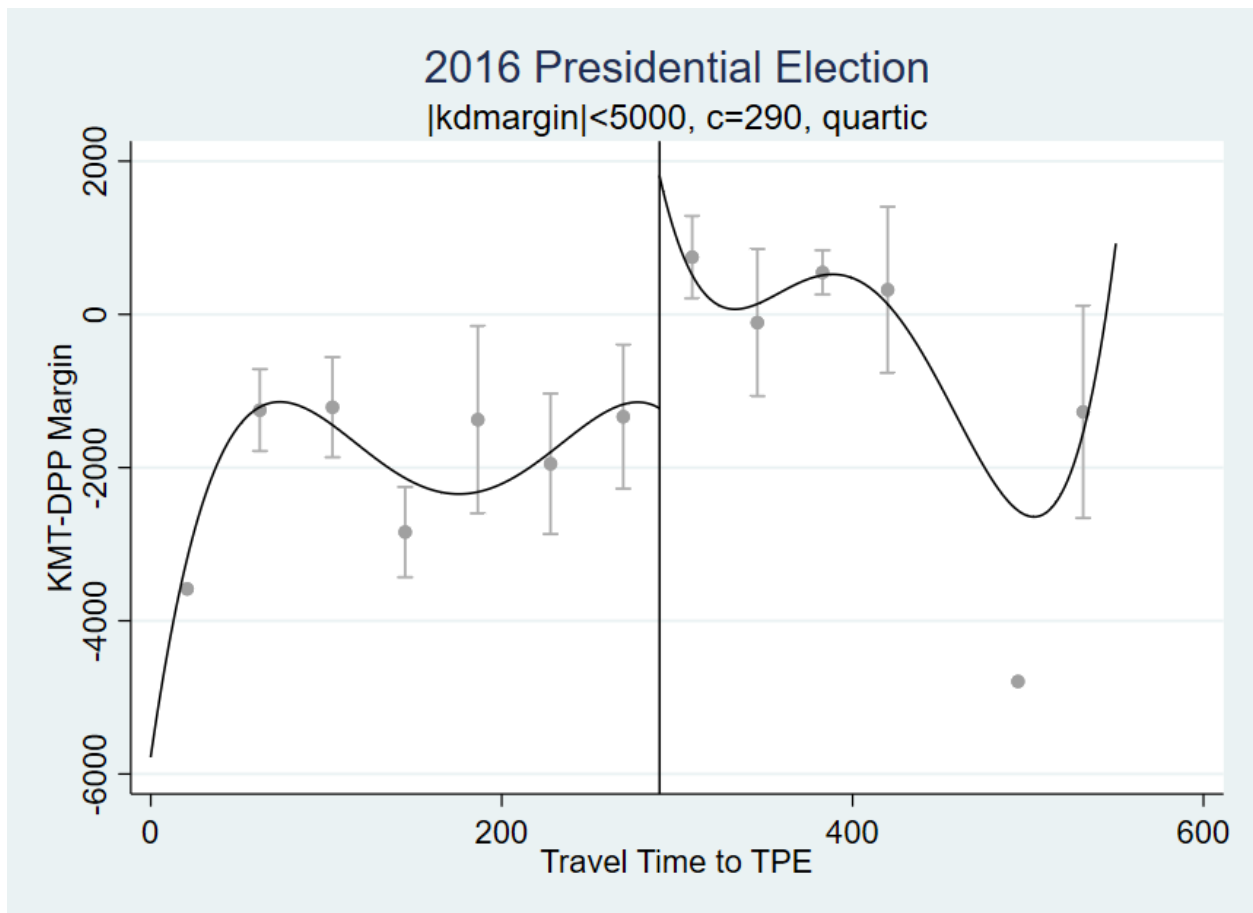


Figure 6: 2016 Election, Quartic Model, Taipei Airport ($t=2016$, $d=4$, $j=TPE$)

7 Conclusion

“Distance is the Soul of Beauty” was quoted by Simone Weil. The French scholar, philosopher, and political activist uses her words to describe humans’ social interactions and behaviors. This witty quote appreciates the merits of the distance between individuals; that is, one might be easier to get along with others should they be unfamiliar, whereas familiarity often leads to more friction. It is not feeling out of place if we put this quote into the context of global politics and economics in modern history. Countries are prone to have tensions and conflicts with their neighbors. Asian countries are no exception. Besides the prolonged cross-straits tensions between China and Taiwan, the 2020–2021 China–India skirmishes with borders resulted from long-time Sino-Indian disputes on the proclaimed territories. The consistent political tensions on the Korean Peninsula are due to the ideological distinctions between the two political identities.¹⁷ Not to mention another well-known case in the Middle East, Israel continues to have military clashes with her neighbor Arabic states, which causes the image of instability in its neighboring regions for decades. As noted above, although there are various reasons to cause countries to engage in conflicts and tensions, a shouting distance between counterparts seems to be a common trait shared.¹⁸

The tangled relationship between China and Taiwan is another case in point. Either physically or psychologically, China and Taiwan are not far from each other. The island of Taiwan is geographically separated from China’s southeast coast by the short stretch of Taiwan Strait, which ranges from 220 km at its widest point to 130 km at its narrowest. Meanwhile, ethnically, both China and Taiwan shared the primary composition of Han ethnicity and the inheritance of the Chinese culture. Follow the previous argument, the political tensions sustained since the day that two China were built.¹⁹

¹⁷Of course, the potential risks of North Korea using nuclear weapons contribute to the current tension, but it is probably hard to argue that other nations did not play a role in this context.

¹⁸Visit the website of [Peace Insight](#) for more detailed statistics and graphs of the conflicted regions around the world. Peace Insight is powered by Peace Direct, an Non-government Organization (NGO) supporting local people in the most challenging conflict environments worldwide.

¹⁹i.e., the People’s Republic of China (P.R.C.) controlled and established in mainland China, and the Republic of China (R.O.C.) relocated and settled to Taiwan.

The political gridlock resulting from the unended Chinese Civil War and the spillover of Cold War had shut down the communications and commercial cooperation at both ends during the post-war era. Although there has been no physical military engagement across the straits since the end of the Second Taiwan Strait Crisis in 1979, neither side could solve this political gridlock unilaterally. Until now, each side, either side still claims their legitimacy of China's representation in the international community and denies another.

However, although there was never an official tie built by the authorities, the underground capital investments, technological transfer, and stratigical cooperation across the straight were increasing as the wave of globalization began. Since China's post-1978 reform period, Taiwanese entrepreneurs and capital, along with outsourcing by Taiwanese firms, have played an important role in seeding coastal China with manufacturing capabilities. Those early investments in China created global production chains stretching from Taiwan's Hsinchu Techonology Park to Chinese factories in southeastern provinces to the retail electronics stores of North America and Europe ([Rosen and Wang, 2011](#)). Being aware of the investment and joint venture across the straits, both governments started to take a new route by appreciating the value of business co-operation and specialization of the trade. The logic behind this follows the belief that trade gains would ease the political tension and ultimately solve the political problems ([Pelzman, 2016](#)). The more the economies dependent upon each other, the more inseparable their citizens' lives become, hence plummeting the possibility of getting into military conflict. In short, a gradual economic integration could serve as a stepping stone for more advanced political coalitions in the future.

I interpret my results from two main perspectives. First, from the behavioral and microeconomic perspective, my results challenge the contact hypothesis advocated by sociologists ([Allport, 1954](#); [Katz, 1991](#)) and experimental economists ([Bertrand and Duflo, 2017](#)). According to my results, more intensive interactions between members of the conflict groups neither alleviate the stereotype nor form a new sense of belongingness. Instead, they reinforce the bias, perhaps due to the visitors' self-selection or existing cultural distinctions. Secondly, from the

lens of macroeconomics, my results demonstrate a higher degree of economic integration, such as the policy of opening to never-met visitors, does not necessarily lead to a higher degree of political convergence. On the contrary, I find the districts with higher exposure to Chinese visitors encountered a more significant ideological realignment after the policy shock. Residents living in the towns in the northern part of Taiwan, surrounded by the main tourist attractions, gradually swung their votes to favor the party distancing themselves from China.

References

- Allen, T., Fuchs, S., Ganapati, S., Graziano, A., Madera, R., and Montoriol-Garriga, J. (2021). Urban Welfare: Tourism in Barcelona.
- Allport, G. W. (1954). *The nature of prejudice*. Addison-Wesley Pub. Company, Cambridge, Mass.
- Angrist, J. D. and Pischke, J.-S. (2008). *Mostly Harmless Econometrics: An Empiricist's Companion*. Princeton University Press.
- Autor, D., Dorn, D., and Hanson, G. (2019). When work disappears: Manufacturing decline and the falling marriage market value of young men. *American Economic Review: Insights*, 1(2):161–78.
- Autor, D., Dorn, D., Hanson, G., and Majlesi, K. (2020). Importing political polarization? the electoral consequences of rising trade exposure. *American Economic Review*, 110(10):3139–83.
- Autor, D. H., Dorn, D., and Hanson, G. H. (2013a). The china syndrome: Local labor market effects of import competition in the united states. *American Economic Review*, 103(6):2121–68.
- Autor, D. H., Dorn, D., and Hanson, G. H. (2013b). The geography of trade and technology shocks in the united states. *American Economic Review*, 103(3):220–225.
- Autor, D. H., Dorn, D., Hanson, G. H., and Song, J. (2014). Trade adjustment: Work-level evidence. *Quarterly Journal of Economics*, 129(4):1799–1860.
- Becken, S., Wilson, J., Forer, P., and Simmons, D. (2008). Tourist itineraries and yield: technical background report. *Land Environment & People Research Report series*.
- Bertrand, M. and Duflo, E. (2017). Chapter 8 - field experiments on discrimination. In Banerjee, A. V. and Duflo, E., editors, *Handbook of Field Experiments*, volume 1 of *Handbook of Economic Field Experiments*, pages 309 – 393. North-Holland.

- Cattaneo, M. D., Idrobo, N., and Titiunik, R. (2020). *A Practical Introduction to Regression Discontinuity Designs: Foundations*. Elements in Quantitative and Computational Methods for the Social Sciences. Cambridge University Press.
- Guo, L. and Jiang, F. (2021). Is cross border tourism an effective means to achieve political goals? evidence from mainland china and taiwan. *Applied Economics Letters*, 0(0):1–7.
- Irwin, D. A. (1994). The political economy of free trade: Voting in the british general election of 1906. *The Journal of Law and Economics*, 37(1):75–108.
- Katz, I. (1991). Gordon allport's "the nature of prejudice". *Political Psychology*, 12(1):125–157.
- Kulendran, N. and Wilson, K. (2000). Is there a relationship between international trade and international travel? *Applied Economics*, 32(8):1001–1009. cited By 159.
- Kwan, J. P. (2016). The rise of civic nationalism: Shifting identities in hong kong and taiwan. *Contemporary Chinese political economy and strategic relations*, 2(2):941–973.
- Lee, D. S. (2008). Randomized experiments from non-random selection in u.s. house elections. *Journal of Econometrics*, 142(2):675–697.
- Lee, D. S. and Lemieux, T. (2010). Regression discontinuity designs in economics. *Journal of Economic Literature*, 48(2):281–355.
- Nunn, N. and Trefler, D. (2014). Chapter 5 - domestic institutions as a source of comparative advantage. In Gopinath, G., Helpman, E., and Rogoff, K., editors, *Handbook of International Economics*, volume 4 of *Handbook of International Economics*, pages 263 – 315. Elsevier.
- Pelzman, J. (2016). *Spillover Effects of China Going Global*. World Scientific.
- Picard, R. (2010). GEODIST: Stata module to compute geographical distances. Statistical Software Components, Boston College Department of Economics.

- Rigger, S. (2003). Taiwan in 2002: Another year of political droughts and typhoons. *Asian Survey*, 43(1):41–48.
- Rosen, D. H. and Wang, Z. (2011). *The Implications of China-Taiwan Economic Liberalization*. Number pa93 in Peterson Institute Press: All Books. Peterson Institute for International Economics.
- Xie, Y., Allaire, J., and Grolemond, G. (2018). *R Markdown: The Definitive Guide*. Chapman and Hall/CRC, Boca Raton, Florida. ISBN 9781138359338.
- Xie, Y., Dervieux, C., and Riederer, E. (2020). *R Markdown Cookbook*. Chapman and Hall/CRC, Boca Raton, Florida. ISBN 9780367563837.
- Young, L. and Magee, S. P. (1986). Endogeneous Protection, Factor Returns and Resource Allocation. *The Review of Economic Studies*, 53(3):407–419.