Master Thesis

Determinants of bilateral trade on gravity model: An empirical analysis of some countries for G20 and WJP Rule of Law Index

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The Graduate School of Hansung University

Major in International Trade and Economics

Dept. of International Trade and Economics

Attib Ullah

Master Thesis

Advisor Professor Roh

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G20 및 WJP 규칙에 관한 연구

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December, 2021

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Abstract

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중력 모델에 따른 양자 무역의 결정 요인: G20 및 WJP 규칙에 관한 연구

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This study contributes to the balance of trade/bilateral trade in the research field by examining the bilateral trade between South Korea to Czech Republic, France, Germany, Netherlands, Singapore, UK, USA, Belgium, Hungary, India, Italy, Malaysia, Thailand, Mexico, Russia Federation, Saudi Arabia, Turkey, Vietnam, Poland, Canada, Indonesia, Philippines, Australia, Hong Kong, China, Brazil The sample period is from 2000 to 2020. and 546 observations. I follow the ETL process for

panel data analysis.

The objective of this research focuses on two major factors which play a crucial role in impacting bilateral trade between the countries. One of them is how much international relationships affect bilateral trade by G20 summits. On the other hand, if the country has a high-level rule of law and justice in side of country then it will affect the balance of trade significantly. I have done analysing by figure then apply several tests including pooled test, breusch pagan test, random effects, hausman test, fixed effects test and F-test with gravity model.

【Keywords】bilateral trade, empirical analysis, gravity model

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Chapter 1: Introduction

1. Background

Bilateral trade has become the backbone of every country since the last century, and it has been affecting the economies both significantly and insignificantly. Many of the scholar' s published papers related to this topic and their contribution to this research field are outstanding and highly appreciated; some published papers will be discussed later. However, the continued growth of the economies will significantly affect the balance of trade and trading opportunities. Nevertheless, the common problems associated with rapid growth are on the rise.

Khim-Sen, Kian-Ping, and Huzaimi in 2003 This study proved that the exchange rate has a significant and direct effect on the balance of trade. Mehmood, Rehmatullah, and Wakeel in 2010 determined Pakistan' s balance of trade with autoregressive distributed lag (ARDL) Cointegration method. Mohamed Nur and Yassin Sheikh in 2016 This study focuses on Somalia's balance of trade deficit by analyzing the effects of the inflation rate, exchange rate, and foreign direct investment. Amadou, Xiaojuan, and Badamassi in 2017 analyzed the balance of trade VAR approach. Aboobucker, Kalideen, and Abdul Jawahir in 2021 also investigated some factors which directly affect the balance of trade. Furthermore, above mentioned research already investigates and impact of the balance of trade with other factors like money supply, inflation, investment, exchange rate, Gross Domestic Product, income, and household consumption but haven' t been used.

However, in this study, I used a gravity model for empirical analysis to know how much Bilateral trade affects. After studying lots of general and research papers, I analyzed two main factors that are missing that are correlated with bilateral trade.

Firstly, I used G20 summits for international relationships with countries. The G20 is a strategic multifaceted platform that connects the world's major developed and emerging economies. The G20 plays a strategic role in securing future global economic growth and prosperity. Overall, the G20 members make up more than 80% of the world's GDP, 75% of international trade, and 60% of the world's population. The G20 member states are listed below. Czech Republic, France, Germany, Netherlands, Singapore, UK, USA, Belgium, Hungary, India, Italy, Malaysia, Thailand, Mexico, Russia Federation, Saudi Arabia, Turkey, Vietnam, Poland, Canada, Indonesia, Philippines, Australia, Hong Kong, China, Brazil.

Secondly and lastly, I used the World Justice Project (index) and it is based on four universal principles which are; 1) Accountability 2) Law 3) Open Government 4) Accessible and Impartial Justice. These Four universal principles have been further spread in the following elements of the Annual World Justice Project (WJP) Rule of Law Index.

1. Constraints on Government Powers
2. Absence of Corruption
3. Open Government
4. Fundamental Rights

5. Order and Security
6. Regulatory Enforcement
7. Civil Justice
8. Criminal Justice

These factors are very important for bilateral trade because these factors are directly correlated with the economy and its effect on bilateral trade. further details will be discussed in the methodology part.

Chapter 2. Literature review

The development of gravity models in bilateral trade continued and unabated after (Anderson, 1979) Through scientific research. Anderson mentions his research gravity model equation which will use pooled cross-section and time-series data and it' s also called panel data.

Gravity Model Equation

$$\text{Trade Flow}_{ij} = C \cdot \text{GDP}_i\text{GDP}_j / \text{Dist}_{ij}$$

Khim-Sen, Kian-Ping, and Huzaimi in 2003 This study analyzed 5 countries (Indonesia, Malaysia, Thailand, Philippines and Singapore) which were doing bilateral trade with Japan from 1986 to 1999. Malaysia, Thailand, Philippines and Singapore trade results showed a positive relationship with the exchange rate but Indonesia showed negativeness due to the currency rate.

According to (Mehmood KK, Waliullah 2010), the research aims to investigate three major alternatives of the adjustment of balance of payment. These studies are the absorption approaches and elasticities. It focuses on the relationship of the short and long run between the real exchange rate, income, money supply, and trade balance. The error correction model and testing method have developed within the autoregressive distributed lag (ARDL) and worked on the duration from

1970 to 2005. The result of above test shows that there is a strong long run relationship between the money supply, exchange rate, trade balance and income variables. The result further tells us that the domestic level of income as measured by GDP is a crucial component of balance of trade. Moreover, the increase in domestic income rises the demand for money and will alternatively push the exports and enhance the balance of trade.

According to (Ali Yassin sheikh, 2016), In their study, they identified the determinants of trade balance in the country Somalia and observed the stats duration from the period 1970 – 2010. It showed that there is only one factor that is impacting the trade balance which is foreign direct investment and negatively impacts the balance of trade in Somalia. However, the other factors include the inflation rate and the exchange rate had no impact on the balance of trade in Somalia.

This research mentioned three factors to examine the impact on balance of trade in Somalia by using regression analysis during the specified period. But one factor is very important that is Foreign direct investment because it was negatively impact on the balance of trade.

According to (Badamassi Aboubacar and Xiaojuan Hu, 2017), the analysis of main factors which have and direct effect on current account balance and trade. The study investigates that there is a statistically significant and negative impact on money supply by using the VAR module.

The research used the sample of 8 countries with subsequent degradation in the current account and balance of trade. The result shows the negative relationship between investment in a current account and money supply. On the other hand, there is a positive impact between current account balance, income, and Exchange rate. The period is limited to the duration of 34 years from 1980 to 2013.

According to (Abdul Jawahir and FATHIMA THAHARA, 2021), examine the relationship between the trade balance and exchange rate. The study investigates that, there is a negative impact on the balance of trade by using the period from 1977 to 2019. The Gross Domestic Product and the exchange rate have a detrimental effect on the balance of trade in the longer run. To find out long run and short run adjustment the researcher developed the Auto-Regressive Distributed Lag (ARDL) model. The result indicates that there is a positive impact with the balance of trade for specifically short run.

According to (Juan Huang, Chuanmin Shuai 2021), the research focuses on the factors which can influence the bilateral trade between China and Mongolia by using the trade gravity model, unit root test, principle component analysis, and the estimation of coefficient in the series of panel data from 1996 to 2019, there are overall nine variables including gross domestic product (GDP), geographical distance, trade agreements, exports, population, cultural distance, trade facilitation index of China and Mongolia-China trade cost were supposed to be for all models. The outcome shows us that the cultural difference between

China and Mongolia is at a stationary level.

Moreover, the other crucial factor which has a major impact is tariffs because it was behaving negatively significant for the export. This shows that China adopted restricted laws and policies on the good flow from Mongolia. In a nutshell, if China imposed a tax on the exports on Mongolian, then the number of exports would go down drastically. Thus, the study explains that the issue can be settled down by building up the trade agreement between Mongolia and China.

According to (Mehmed, Bahtiyar, Arefin, Sazzadul2018), the main factors which are affecting Kyrgyzstan's bilateral trade flows and forecasting the trade potential by using the gravity model and panel data duration from 2000 to 2016 only from his main trading partners. The result shows that there is a positive impact on GDP but on the other hand it negatively impacts the population of the country. It is mentioned that this research is the first attempt to apply the gravity model to predict the potential of the trade.

According to (Subash Acharya 2012), This research focuses to find out the overall trade including import, export, and trade balance which are major determinants of Nepal by using the extended gravity model and it gives assistance in trade policy to promote foreign trade. This type of model, widely used in the analysis of the determinants of international trade, describes the relationship between the variables of representative of attraction forces and bilateral trade flows such as the proximity and

economic parameter of partners, but also the existence of common borders, similar legal systems, old colonial ties or even a free trade agreement between them.

The result of empirical data is consisting of panel data set. It contains 21 major companies of a trade partner for 6 years; it has been found out that the import and export of Nepal are elucidated by the real GDP countries of the trade partner. Nepal has started to unilaterally liberalize its trade and investment in 1992 and became the first of the least developed countries (LDCs) to access WTO in April 2004, at the end of the accession process. Since then, its economic results have not allowed the economic boom that Nepal needs.

The main factors holding back GDP growth are political instability (due to the transition process initiated following the internal conflict from 1996 to 2006) and the constraints on the supply side the shortage of energy, poor infrastructure, and strikes. Recognizing the effective role of trade in the establishment of sustainable economic growth beneficial to all and the establishment of conditions necessary to fight poverty and improve the standard of living of its population, Nepal is taking further steps to create a more favorable business environment and to help its exporters become more competitive. As per the knowledge of gravity model, the proximity to trade partner countries is effectively significant implying a much higher distance, lessening the trade. The fixed effect analysis of the country depicts that time-invariant factors are significant to compute the balance of trade of Nepal.

According to (Matthew G, Dimitrios 2010), The gravity model is majorly used in international trade research for the last forty years because it contains explanatory power and considerable empirical robustness. The gravity models model describes global and sectoral bilateral export flows by forces of attraction such as distance and economic size of partners. It thus makes it possible to identify the countries and sectors towards which there are potential trade gains and to simulate the impact of a tariff shock on trade flows. free trade agreement (FTA) is a special trade agreement that diminishes non-tariff and tariff barriers for free trade of goods between the member countries. It has been diversified into mainly 4 stages as per the degree of closeness.

Until now, the European Union (EU) or the North American Free Trade Agreement (NAFTA), is often referred to as a regional trade agreement because it has been centered on neighboring countries in certain regions. However, in recent times, the number of long-distance FTAs has been rapidly increasing. As of August 2010, there is the sum of 285 regional trade agreements in effect worldwide, including FTAs.

According to (Khim-Sen, Kian-Ping Lim 2002), This research mainly focuses on the answer to whether the exchange rate does have any direct impact on the trade balance or not. After analyzing the trade balances between Japan and ASEAN-5 countries between the period of 1986 and 1999, the research found out that the change in the exchange

rate and its impact on the trade balances is somehow exaggerated.

The current world trade environment is centered on the change from "multilateral to bilateral" . it's working However, the Association of Southeast Asian Nations, including Korea, Japan, and China, the East Asia region, which includes (ASEAN), accounts for a large proportion of world trade and even though there are distinct regions

except for AFTA, the ASEAN Free Trade Agreement. The reality was that economic cooperation did not exist. As FTAs have increased significantly in recent years, East Asian countries are also interested in them. Meanwhile, the promotion of FTAs in East Asia is accelerating. Japan in 2001 Following the launch of the Japan-Singapore FTA, the first free trade agreement in The Japan-Philippines FTA negotiations was concluded. China's rapidly growing economy to promote an FTA with ASEAN to secure economic leadership in East Asia are doing as such, China and Japan are promoting economic cooperation through AFTA. Therefore, the study proposes that the trade balance is majority influenced by real money than the exchange rate.

To further validate the study a mathematical framework is provided combined with theoretical history. The empirical data analysis that we have done points out that the real money effect proposition consistently explains the analyzed trade balances in Malaysia, Singapore, the Philippines, and other ASEAN countries concerning Japan. Hence, it is proven that if the government of ASEAN countries has to cope with

trade deficits, they need to be compliant with the policy measures that mainly focus on the variable of real money.

According to (Michael D. McKenzie,1997), The research investigates the effect of exchange rate volatility on US-Germany bilateral trade lows for the duration from 1973 to 1992. ARCH models have been utilized to generate a measure of exchange rate volatility and are then testified against the export of Germany to, and imports from, the United States. The study focuses on the exchange rate systems will as a disadvantage of flexible exchange rates regularly the Mentioned uncertainty that ffects businesses and Households from the fluctuations in the exchange rate results. This exchange rate risk, it is argued, complicates international trade, and reduces the welfare gains from the international exchange of goods. Various studies have examined the issue of the effects of exchange rate volatility empirically examined. They cover many countries and periods and work with a broad choice of methods. It falls a iscrepancy based on between the empirical results that do not allow clear conclusions allow, and the traditional view of what exchange rate volatility hurts exports. The relationship between exchange rate volatility and foreign trade. The analysis was carried out in the framework of a multivariate GARCH-in-mean model of the reduced form. An attractive feature of this model is that exchange rate volatility is made up of results from the model and not as an exogenous process is defined. This research is more different from many other papers earlier published as the effects of volatility that seem to be positive and significant for many times which is under review.

chapter 3. Methodology

Bilateral trade is a very important and crucial part of economic growth. It depends on several factors however; the main component is global relationships and rule of law in the country. I have used both factors in my study the global relationship presented by the G20 summit and rule of law presented by the World Justice Project (index). Moreover, these two elements are briefly explained in the introduction part.

3.1 Data Collection

This research conduct on quantitative data and its collected and data mining by secondary resources from different platform and web sites which is mention on table 1. Furthermore, after data mining, and before analyses manage all the data in R-Language with ETL process and made it as panel data to use for regression analysis.

Tabel 1. websites list.

Web sites list
www.data.worldbank.org
www.customs.go.kr
www.g20.org
www.worldjusticeproject.org

3.2 Methods of this research

My research is on a sample basis so, I selected the 30 Highest GDP countries which are doing bilateral trade with South Korea, Period from

2000 to 2020 except 4 countries that are excluded from this research due to the unavailability of data. For reference, you can see table 2 which shows excluded 4 countries, and table 3 which shows all the 26 countries.

Table 2. These Countries are Excluded

Countries Name
Taiwan
Japan
UAE
Marshall Islands

Table 3. These countries are included

Countries Name
Australia
Brazil
Canada
China
France
Germany
India
Indonesia
Italy
Mexico
Poland
Russian Federation
Saudi Arabia
Turkey
United Kingdom
United States

3.3 Variables

In the gravity model, some variables are fixed for instance GDP, distance, and balance of trade as (Anderson, 1979) explained the

scientific approach. It shows that the distance variable is necessary fixed effects because it will not change over time, but we can add more variables to make a complicated dataset which result will be more reliable (Shirly Becker - book 2001).

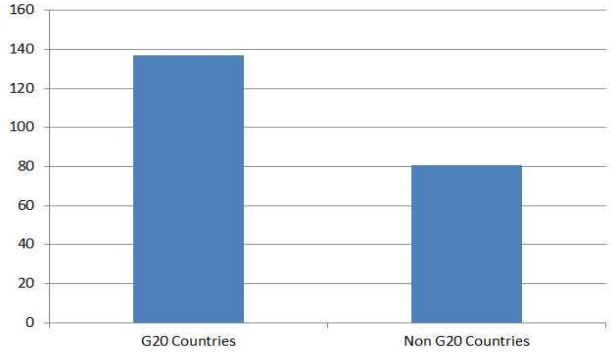
There are two more variables I have used in my study which were already in the past research papers. The first one is the exchange rate (Khim-Sen, Kian-Ping, and Huzaimi in 2003) quantity. On the other hand, the second one is the number of imports and exports in units (Gravity model example by LU Department of Econometrics 2020). These two variables are my contribution to the research of the G20 summit and rule of law. Let's have a comprehensive discussion on this.

Firstly, table 4 showed non-G20 countries list because these countries are not a member of G20, and table 5 showed G20 countries list these countries are G20 summit members.

Table 4. Non G20 members list with South Korea bilateral trade

Country Name	Non G20 Countries
Belgium	7.838525068
Czech Republic	7.546188742
Hong Kong	7.567285312
Hungary	8.439346019
Malaysia	8.209449099
Netherlands	8.279735306
Philippines	7.845812722
Singapore	8.299690707
Thailand	7.974909215
Vietnam	8.711272475

Figure 1: G20 countries trade correlations with South Korea



Source: www.G20.org

Table 5. G20 members list with South Korea bilateral trade

Country Name	G20 Countries
Australia	8.665493423
Brazil	8.254749329
Canada	8.225032714
China	9.535777203
France	8.675026564
Germany	8.18988088
India	8.201813645
Indonesia	8.545364333
Italy	8.473073391
Mexico	8.308579668
Poland	8.480918342
Russian Federation	8.739302189
Saudi Arabia	8.612156715
Turkey	8.310874266
United Kingdom	8.741094643
United States	9.288558073

The G20 summit countries are positive and high correlation relationship with south Korea because bilateral trade is high with G20

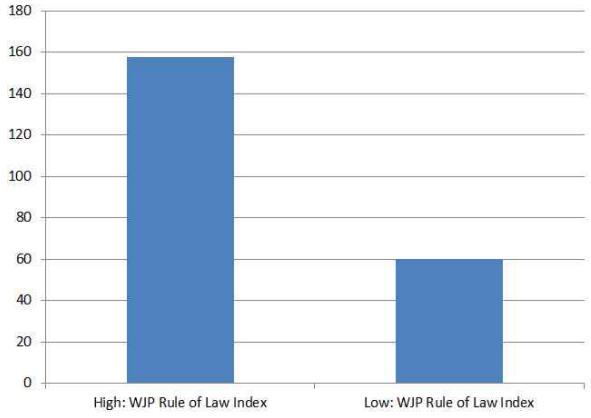
countries as compared to non-G20 countries. you can see the relationship in figure 1.

Secondly, Justice index and rule of law, these variables depend on the world Justice Project (index), briefly explained in the introduction section. Moreover, there must be criteria for selection of the countries in the variables and I have set that by ranking as per the World Justice Project (index). So, I listed two categories one is higher than 50% which is seen in table 6 and the second is below 50% in table 7. This variable showed high trade and high correlation if the country exists higher than 50% otherwise it will show low correlations as per WJP index rank, for reference, you can see figure 2.

Table 6. High: WJP Rule of Law Index above 50%(In Rank) countries

Country Name	Balance of trade in Log
Australia	8.665493423
Canada	8.225032714
Czech Republic	7.546188742
France	8.675026564
Germany	8.18988088
Hong Kong	7.567285312
Netherlands	8.279735306
Singapore	8.299690707
United Kingdom	8.741094643
United States	9.288558073
Belgium	7.838525068
Brazil	8.254749329
Hungary	8.439346019
India	8.201813645
Indonesia	8.545364333
Italy	8.473073391
Malaysia	8.209449099
Poland	8.480918342
Thailand	7.974909215

Figure 2, WJP Rule of Law Index relationship



Source:www.worldjusticproject.org

Table 7. Less: WJP Rule of Law Index below 50%(In Rank) countries

Country Name	Balance of trade in Log
China	9.535777203
Mexico	8.308579668
Philippines	7.845812722
Russian Federation	8.739302189
Saudi Arabia	8.612156715
Turkey	8.310874266
Vietnam	8.711272475

Note: China's Bilateral trade is higher with South Korea because of the near border and it's also the main factor for bilateral trade even as per the WJP Index China rank under below 50% as of 2020. Cross border is also the main part of bilateral trade but it is not a part of this research.

3.4 Gravity Model Equation

Gravity model equation as per my dataset: All my variable was in different units for reference you can see table 8 that's why I took log for normalization.

Table 8. Variables in Unit

t_{ab}	USD
gdp_a	USD
gdp_b	USD
$dist_{ab}$	Km
$imex_{ab}$	USD
nix_{ab}	Waight / Valume

log(tab)=c+log(gdpa)+log(gdpb)+log(distab)+log(exab)+log(nixab)+lawb+g20ab+eab

Dependent Variable

tab = trade flow / bilateral trade /trade balance (which mean South Korea bilateral trade with partner countries)

Independent Variable

c = Constant

gdpa = Export country GDP (which mean South Korea GDP)

gdpb = Import country GDP (which mean all partner countries GDP)

distab = Distance (which mean all partner countries distance with South Korea)

exab = Exchange Rate (USD)

imexab = Number of import and export with partner countries

lawb = Dummy Variable and control variable (Rule of law index)

If its above 50% is 0 otherwise 1

g20ab = Dummy Variable and control variable (G20 summit index)

If countries in G20 member list then 0 otherwise 1

eab = error term

Chapter 4. Result

In order to result, I used to check the first correlation in the data as per (Gauss Markov 1970) for reference you can see table 9. Furthermore, I used a gravity model with panel data analysis on OLS and I got significant result.

Table 9. Correlation relationship with variable

Variable	trade	num of im.ex	gdp im	gdp ex	dist	exchange rate
trade	1.00	0.86	0.69	0.42	0.03	-0.13
num of im.ex	0.86	1.00	0.66	0.33	-0.07	-0.02
gdp im	0.69	0.66	1.00	0.31	0.24	-0.08
gdp ex	0.42	0.33	0.31	1.00	0.00	-0.32
distance	0.03	-0.07	0.24	0.00	1.00	0.00
exchange rate	-0.13	-0.02	-0.08	-0.32	0.00	1.00

The above results shown in this data are not correlated with each other. All variables are very far from each other, except for their self-values. These are not correlated, so we can move to further analysis and tests.

4.1 All the countries individually bilateral trade with South Korea.

I've analyzed all the countries individually and I figured it out that all the countries have their bilateral trade with South Korea. If we technically conclude this, then we can say that each country has it own intercepts with South Korea bilateral trade.

Note: All figure on x axis is year from 2000 to 2020 and y axis is trade amount in USD.

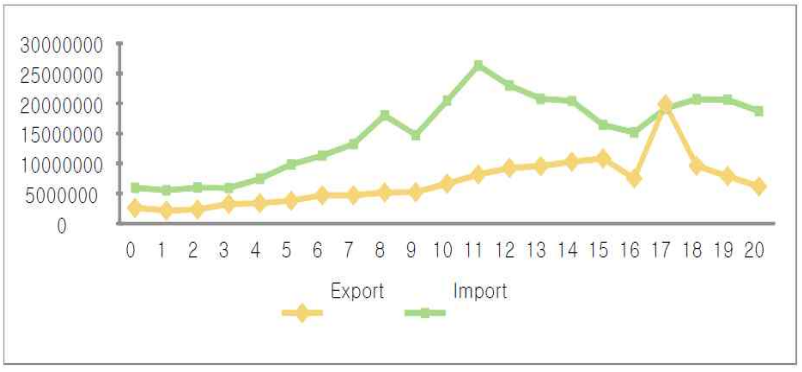
South Korea to Australia Trade

The graph clearly shows the yearly export and import of South Korea to Australia in million dollars. With a brief look, it shows that both export and import of the country have shot up significantly till 2011. But in 2011, the exports and imports respectively were 10.00 million dollars and 26.00 million dollars.

After 2011, Within six years, that is in 2017, they rose to 20.00 million dollars both import and export respectively. However, from the graph, it is distinguishable that from 2011 to 2018 the exports and imports of the country have stable except it rose to the higher level in 2011 and 2017. A decrease happened in the year 2018. From the graph, it is also lucid that the country' s export is equilibrium to import.

If calculated individually we find out that in 2015, the amount of increased export is 11.00 million dollars and in 2017 it is 21.00 million dollars. In 2016, the export has a decrease to 9.00 million dollars. But in 2017 it has again an increase to 21.00 million dollars. Consequently, the highest increase occurs in the year 2011. Similarly, as regards import, we notice the increase to 21.00 million dollars in 2011. Thus, the highest increase happened in 2011. In that way, the graph depicts a clear image of the amount of export and import of a country over twenty years from 2000 to 2020.

Figure 3 : South Korea to Australia Trade



Source: www.customs.go.kr

South Korea to Belgium Trade

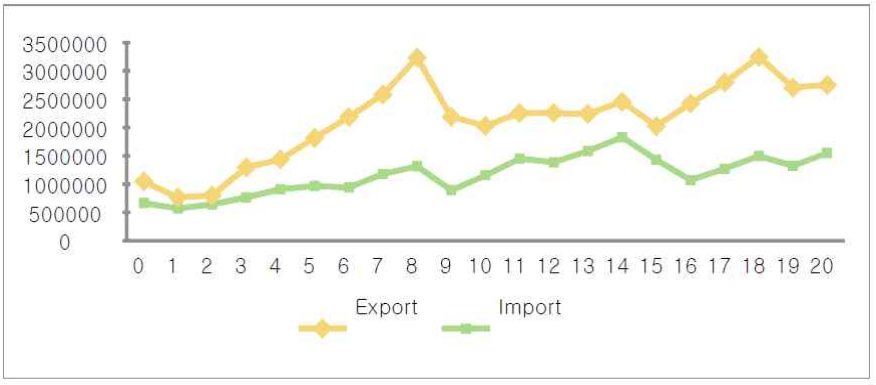
The graph clearly shows the yearly export and import of South Korea to Belgium in million dollars. With a brief look, it shows that both export and import of the country have shot up significantly throughout the period. In 2008, the exports and imports respectively were 32.00 million dollars and 13.00 million dollars.

After 2008, Within ten years, that is in 2018, they rose to again 32.00 million dollars export and import to 14.00 million dollars. However, from the graph, it is distinguishable that from 2000 to 2008 the exports and imports of the country have stable and slightly increased till 2008. A decrease happened in the year 2008 both in export and import.

If calculated individually we find out that in 2008, the amount of increased export is 32.00 million dollars and in 2018 it is 21.00 million dollars. In 2015, the export has a decrease to 10.00 million dollars. But in 2018 it has again an increase to 32.00 million dollars. Consequently, the highest increase occurs in the year 2008. Similarly, as regards import, we

notice the increase to 17.00 million dollars in 2014. Thus, the highest increase again happened in 2020. In that way, the graph depicts a clear image of the amount of export and import of a country over twenty years from 2000 to 2020.

Figure 4 : South Korea to Belgium Trade



Source: www.customs.go.kr

South Korea to Brazil Trade

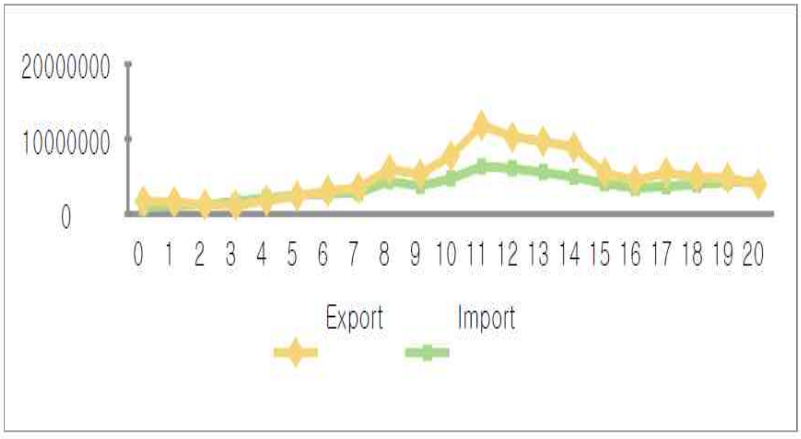
The graph clearly shows the yearly export and import of South Korea to Brazil in million dollars. With a brief look, it shows that both export and import of the country remain steady throughout the period except for a short period. In 2008, the exports and imports respectively were 11.00 million dollars and 6.00 million dollars.

After 2011, the imports and exports stepped down and they decrease to 2.00 million dollars export and import to 1.89 million dollars. However, from the graph, it is distinguishable that from 2000 to 2011 the exports

and imports of the country have stable and slightly increased till 2011. A decrease happened in the year 2015 both in export and import.

If calculated individually we find out that in 2011, the amount of increased export is 11.00 million dollars and in 2014 it is 8.00 million dollars. In 2015, the export has a decrease to 2.00 million dollars. Thus, the highest increase in 2011. In that way, the graph depicts a clear image of the amount of export and import of a country over twenty years from 2000 to 2020.

Figure 5: South Korea to Brazil Trade



Source: www.customs.go.kr

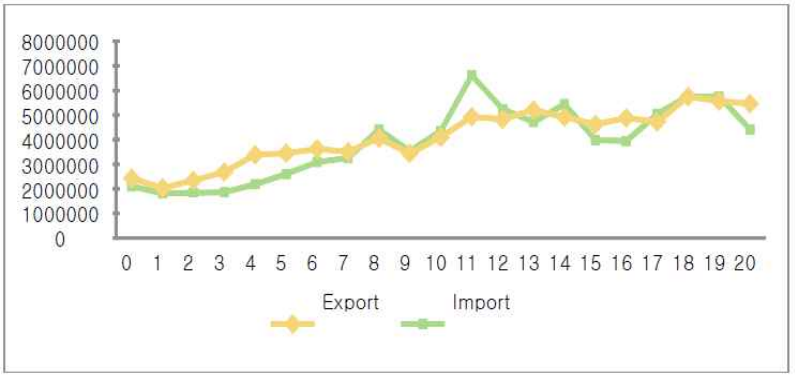
South Korea to Canada Trade

The graph clearly shows the yearly export and import of South Korea to Canada in million dollars. With a brief look, it shows that both export and import of the country have shot up significantly till 2011. In 2011, the exports and imports respectively were 5.00 million dollars and 7.00 million dollars.

After 2011, Within seven years, that is in 2018, they rose to 6.00 million dollars both import and export respectively. However, from the graph, it is distinguishable that from 2011 to 2018 the exports and imports of the country have many ups and down and it rose to the higher level in 2011 and 2018. A decrease happened in the year 2019. From the graph, it is also lucid that the country' s export is much like import at many times.

If calculated individually we find out that in 2011, the amount of increased export is 6.00 million dollars and in 2018 it is 5.00 million dollars. In 2009, the export has a decrease to 3.50 million dollars. But in 2018 it has again an increase to 5.00 million dollars. Consequently, the highest increase occurs in the year 2018. Similarly, as regards import, we notice the increase to 6.50 million dollars in 2011. Thus, the highest increase happened in 2011. In that way, the graph depicts a clear image of the amount of export and import of a country over twenty years from 2000 to 2020.

Figure 6: South Korea to China Trade



Source: www.customs.go.kr

The graph clearly shows the yearly export and import of South Korea to China in million dollars. With a brief look, it shows that both export and import of the country have shot up significantly. But in 2018, the exports and imports respectively were 16.00 million dollars and 11.50 million dollars.

After 2009, Within ten years, that is in 2018, they rose to 16.00 million dollars both import and export to 11.50. However, from the graph, it is distinguishable that from 2000 to 2009 the exports and imports of the country have been slightly increasing then it rose to the higher level in 2013 and 2018. A decrease happened in the year 2009. From the graph, it is also lucid that the country's export is higher than the import.

If calculated individually we find out that in 2018, the amount of increased export is 16.00 million dollars and in 2013 it is 14.00 million dollars. In that way, the graph depicts a clear image of the amount of export and import of a country over twenty years from 2000 to 2020.

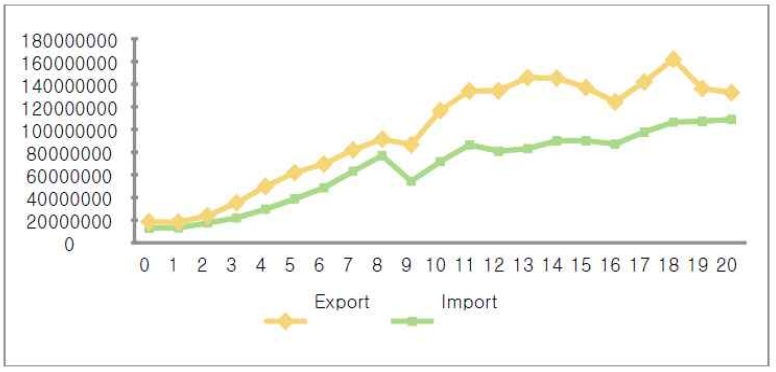
South Korea to Czech Republic Trade

The graph clearly shows the yearly export and import of South Korea to Czech Republic in million dollars. With a brief look, it shows that both export and import of the country have shot up significantly. In 2020, the exports and imports respectively were 26.39 million dollars and 5.70 million dollars.

After 2007, Within couple of years, that is in 2020, they rose to 5.70 million dollars both import and export 26.39 million dollars. However,

from the graph, it is distinguishable that from 2011 to 2019 the exports and imports of the country have stable except it rose to the higher level in 2018 and 2020. A decrease happened in the year 2008.

Figure 7: South Korea to Czech Republic Trade



Source: www.customs.go.kr

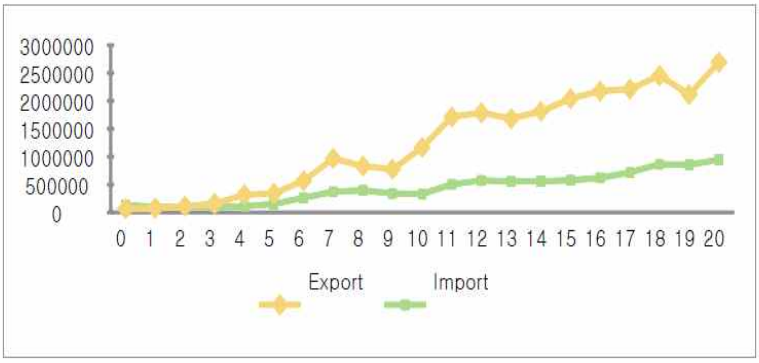
From the graph, it is also lucid that the country's import is much steeper than the export.

Thus, the highest increase happened in 2020. In that way, the graph depicts a clear image of the amount of export and import of a country over twenty years from 2000 to 2020.

South Korea to France Trade

The graph clearly shows the yearly export and import of South Korea to France in million dollars. With a brief look, it shows that both export and import of the country have ups and down significantly. In 2011, the exports and imports respectively were 7.00 million dollars and 7.00 million dollars.

Figure 8: South Korea to France Trade



Source: www.customs.go.kr

After 2011, there has been sudden decrease in both import and export, that is in 2012, they go down to 2.90 million dollars import and export to 5.00 million dollars respectively. However, from the graph, it is distinguishable that from 2000 to 2010. The exports and imports of the country have stable except it rose to the higher level in 2011 and 2014. A decrease happened in the year 2012. From the graph, it is also lucid that the country's export is equivalent to import.

If calculated individually we find out that in 2014, the amount of increased export is 7.00 million dollars and in 2011 it is 6.00 million dollars. In 2012, the export has a decrease to 3.00 million dollars. But in 2014 it has again an increase to 7.00 million dollars. Consequently, the highest increase occurs in the year 2014. In that way, the graph depicts a clear image of the amount of export and import of a country over twenty years from 2000 to 2020.

South Korea to Germany Trade

The graph clearly shows the yearly export and import of South Korea to Germany in million dollars. With a brief look, it shows that both export and import of the country have shot up significantly throughout these years. In 2011, the exports and imports respectively were 20.00 million dollars and 11.00 million dollars.

From the graph, it is distinguishable that from 2010 to 2016 the exports and imports of the country have moving in the opposite direction until it gets stable in the year of 2017 it rose to the higher level in 2007 and 2020. A decrease happened in the year 2009. From the graph, it is also lucid that the country' s export is equivalent to import in the beginning of the years.

Thus, the highest increase happened in 2011. In that way, the graph depicts a clear image of the amount of export and import of a country over twenty years from 2000 to 2020.

South Korea to Hong Kong Trade

The graph clearly shows the yearly export and import of South Korea to Hong Kong in million dollars. With a brief look, it shows that export of this country is higher than the import of the country till the end. In 2018, the exports and imports respectively were 48.00 million dollars and 2.00 million dollars.

After 2002, Within couple of years, that is in 2018, they rose to 48.00 million dollars export. However, from the graph, it is distinguishable that from 2002 to 2018 the exports of the country have rose to the highest

level. A decrease happened in the year 2019 onwards. From the graph, it is also lucid that the country' s import is very low as compare to the export.

Thus, the highest increase happened in 2018. In that way, the graph depicts a clear image of the amount of export and import of a country over twenty years from 2000 to 2020.

South Korea to Hungary Trade

The graph clearly shows the yearly export and import of South Korea to Australia in million dollars. With a brief look, it shows that export of the country has many ups and down. In 2020, the exports and imports respectively were 30.00 million dollars and 5.00 million dollars.

After 2012, Within couple of years, that is in 2020, they rose to 30.00 million dollars export and import to 5.00 million respectively. However, from the graph, it is distinguishable that from 2011 to 2018 the exports and imports of the country have stable except it rose to the higher level in 2011 and 2017. A decrease happened in the year 2015. However, the export slightly touched the equilibrium point in 2016.

Thus, the highest increase happened in 2020. In that way, the graph depicts a clear image of the amount of export and import of a country over twenty years from 2000 to 2020.

South Korea to India Trade

The graph clearly shows the yearly export and import of South Korea to India in million dollars. With a brief look, it shows bilateral trade and

graduality increasing and decreasing export and import and highest exports from South Korea to Indonesia in 2012 and the lowest exports was 2001 to 2002.

After 2010, Within right years, that is in 2018, the export rose to 16.00 million dollars and import decrease to 5.10 million dollars respectively. However, from the graph, it is distinguishable that from 2000 to 2008 the exports and imports of the country have stable except it gets down in the year 2009 and then it goes to higher level in 2011 and 2018. A decrease happened in the year 2016. From the graph, it is also lucid that the country's export is higher than the import throughout the years.

In that way, the graph depicts a clear image of the amount of export and import of a country over twenty years from 2000 to 2020.

South Korea to Indonesia Trade

The graph clearly shows the yearly export and import of South Korea to Indonesia in million dollars. With a brief look, it shows that both export and import of the country have shot up significantly. In 2011, the exports and imports respectively were 17.00 million dollars and 15.00 million dollars.

After 2009, Within two years, that is in 2011, the export rose to 15.00 million dollars and import rose to 15 million dollars respectively. However, from the graph, it is distinguishable that from 2000 to 2008 the exports and imports of the country have stable until it rose to the higher level in 2011 and 2018. A decrease happened in the year 2019.

From the graph, it is also lucid that the country' s export is equilibrium to import in the year of 2014-15. Thus, the highest increase happened in 2011. In that way, the graph depicts a clear image of the amount of export and import of a country over twenty years from 2000 to 2020.

South Korea to Italy Trade

The graph clearly shows the yearly export and import of South Korea to Italy in million dollars. With a brief look, it shows that both export and import of the country have shot up significantly throughout these years. In 2011, the exports and imports respectively were 70.00 million dollars and 40.50 million dollars.

After 2003, Within two years, that is in 2005, the export rose 10 million dollars and there is no major difference in the export respectively. However, from the graph, it is distinguishable that from 2011 to 2018 the exports and imports of the country is not stable and the import and export to the higher level in 2020 and 2018. A decrease happened in the year 2009. From the graph, it is also lucid that the country' s export is equilibrium to import in two different years 2007 and 2011.

Thus, the highest increase happened in 2020. In that way, the graph depicts a clear image of the amount of export and import of a country over twenty years from 2000 to 2020.

South Korea to Malaysia Trade

The graph clearly shows the yearly export and import of South Korea to Malaysia in million dollars. With a brief look, it shows that both export and import of the country have shot up significantly throughout these years. In 2013, the exports and imports respectively were 11.00 million dollars and 9.50 million dollars.

After 2009, Within four years, that is in 2013, the export rose 11 million dollars and import rose to 9 million dollars respectively. However, from the graph, it is distinguishable that from 2000 to 2008 the exports and imports of the country is stable and it gets higher level in 2008 and 2014. A decrease happened in the year 2009. From the graph, it is also lucid that the country's export is equilibrium to import in three different years 2003, 2017, and 2020.

Thus, the highest increase happened in 2013. In that way, the graph depicts a clear image of the amount of export and import of a country over twenty years from 2000 to 2020.

South Korea to Mexico Export

The graph clearly shows the yearly export and import of South Korea to Mexico in million dollars. With a brief look, it shows that both export and import of the country have shot up significantly throughout these years. In 2008, the exports and imports respectively were 6.50 million dollars and 3.50 million dollars.

From the starting the graph seems to be linear but gradually the export rose higher point to 6.50 million dollars in 2008 and on the other

hand the import goes up to 7.00 million dollars in 2018. However, from the graph, it is distinguishable that from 2000 to 2007 the exports and imports of the country is stable and it gets higher level in 2008 and 2018. A decrease happened in the year 2009. From the graph, it is also lucid that the country' s export is equilibrium to import in two different years 2015 and 2019.

Thus, the highest increase happened in 2008 and 2018. In that way, the graph depicts a clear image of the amount of export and import of a country over twenty years from 2000 to 2020.

South Korea to Netherland Trade

The graph clearly shows the yearly export and import of South Korea to Netherland in million dollars. With a brief look, it shows that both export and import of the country is steady till 2010. In 2018, the exports and imports respectively were 12.00 million dollars and 2.50 million dollars.

From the starting the graph seems to be linear but gradually the export rose higher point to 12.00 million dollars in 2008 and on the other hand the import looks remain unchanged throughout the years.

However, from the graph, it is distinguishable that from 2000 to 2009 the exports and imports of the country is stable and it gets higher level in 2014 and 2015. A decrease happened in the year 2016. From the graph, it is also lucid that the country' s export slightly touched the equilibrium point in the initial years.

Thus, the highest increase happened in 2014 and 2018. In that way, the graph depicts a clear image of the amount of export and import of a country over twenty years from 2000 to 2020

South Korea to Philippines Trade

The graph clearly shows the yearly export and import of South Korea to Philippines in million dollars. With a brief look, it shows that both export and import of the country is steady till 2008. In 2013, the exports and imports respectively were 11.00 million dollars and 8.10 million dollars.

From the starting the graph seems to be little steep but gradually the export rose higher point to 11.00 million dollars in 2008 and on the other hand the import rose the higher level to 9.00 million dollars in the year 2020.

However, from the graph, it is distinguishable that from 2000 to 2008 and the exports and imports of the country is stable and it gets higher level in 2014 and 2018. A decrease happened in the year 2009. From the graph, it is also lucid that the country' s export touched the equilibrium point in the year 2016.

Thus, the highest increase happened in 2011 and 2013. In that way, the graph depicts a clear image of the amount of export and import of a country over twenty years from 2000 to 2020.

South Korea to Poland Trade

The graph clearly shows the yearly export and import of South Korea to Poland in million dollars. With a brief look, it shows that both export and import of the country is steady till 2007. In 2014, the exports and imports respectively were 25.00 million dollars and 11.00 million dollars.

From the starting the graph seems to be linear but gradually the export rose higher point to 25.00 million dollars in 2014 and on the other hand the import rose to the higher level to 11.00 million dollars in the year 2014.

However, from the graph, it is distinguishable that from 2000 to 2008 and the exports and imports of the country is stable and it gets higher level in 2008 and 2014. A decrease happened in the year 2020. From the graph, it is also lucid that the country' s export touched the equilibrium point in the initial years.

Thus, the highest increase happened in 2008 and 2014. In that way, the graph depicts a clear image of the amount of export and import of a country over twenty years from 2000 to 2020.

South Korea to Russia Trade

The graph clearly shows the yearly export and import of South Korea to Russia in million dollars. With a brief look, it shows that both export and import of the country is steady till 2008. In 2018, the exports and imports respectively were 9.00 million dollars and 6.00 million dollars.

From the starting the graph seems to be linear but gradually the export rose higher point to 9.00 million dollars in 2018 and on the other hand the import rose to the higher level to 6.00 million dollars in the year 2018.

However, from the graph, it is distinguishable that from 2000 to 2008 and the exports and imports of the country is stable and it gets higher level in 2011 and 2018. A decrease happened in the year 2009. From the graph, it is also lucid that the country' s export touched the equilibrium point in the initial years.

Thus, the highest increase happened in 2011 and 2018. In that way, the graph depicts a clear image of the amount of export and import of a country over twenty years from 2000 to 2020.

South Korea to Saudi Arabia Trade

The graph clearly shows the yearly export and import of South Korea to Saudi Arabia in million dollars. With a brief look, it shows that the export of the country has ups and down and import looks straight throughout the years. In 2014, the exports and imports respectively were 7.00 million dollars and 2.00 million dollars.

From the starting the graph seems to slope and gradually the export rose higher point to 7.00 million dollars in 2014 and on the other hand the import rose to the slightly higher level to 2.00 million dollars in the year 2020.

However, from the graph, it is distinguishable that from 2000 to 2008 and the exports of the country is not stable throughout the time period

and the import on the other hand remain stable throughout and it gets higher level in 2014 and 2020. A decrease happened in the year 2009. From the graph, it is also lucid that the country' s export is higher than the import.

Thus, the highest increase happened in 2014 and 2020. In that way, the graph depicts a clear image of the amount of export and import of a country over twenty years from 2000 to 2020.

South Korea to Singapore Trade

The graph clearly shows the yearly export and import of South Korea to Singapore in million dollars. With a brief look, it shows that the export of the country has ups and down and import looks straight throughout the years. In 2012, the exports and imports respectively were 40.00 million dollars and 8.00 million dollars.

From the starting the graph seems to be incline and gradually the export rose higher point to 40.00 million dollars in 2012 and on the other hand the import rose to the slightly higher level to 10.00 million dollars in the year 2015.

However, from the graph, it is distinguishable that from 2000 to 2007 and the exports of the country is stable and the import on the other hand remain stable throughout and it gets higher level in 2012 and 2015. A decrease happened in the year 2016. From the graph, it is also lucid that the country' s export is higher than the import.

Thus, the highest increase happened in 2008 and 2012. In that way, the graph depicts a clear image of the amount of export and import of a country over twenty years from 2000 to 2020.

South Korea to Thailand Trade

The graph clearly shows the yearly export and import of South Korea to Thailand in million dollars. With a brief look, it shows that both the export and import of the country has ups and down throughout the years. In 2020, the exports and imports respectively were 75.00 million dollars and 60.00 million dollars.

From the starting the graph seems to be incline and gradually the export rose higher point to 75.00 million dollars in 2020 and on the other hand the import rose to the higher level to 60.00 million dollars in the year 2020.

However, from the graph, it is distinguishable that from 2000 to 2008 and the exports of the country is stable and the import on the other is lower throughout and it gets higher level in 2019 and 2020. A decrease happened in the year 2009. From the graph, it is also lucid that the country's export is higher than the import.

Thus, the highest increase happened in 2019 and 2020. In that way, the graph depicts a clear image of the amount of export and import of a country over twenty years from 2000 to 2020.

South Korea to Turkey Trade

The graph clearly shows the yearly export and import of South Korea to Turkey in million dollars. With a brief look, it shows that both the export

and import of the country has ups and down throughout the years. In 2017, the exports and imports respectively were 82.00 million dollars and 61.00 million dollars.

From the starting the graph seems to be incline and gradually the export rose higher point to 82.00 million dollars in 2017 and on the other hand the import rose to the higher level to 78.00 million dollars in the year 2014. However, from the graph, it is distinguishable that from 2000 to 2006 and the exports of the country is stable and the import on the other is lower throughout and it gets higher level in 2014 and 2018. A decrease happened in the year 2009. From the graph, it is also lucid that the country' s export has multiple equilibrium point in 2009, 2011, 2014, and 2018.

Thus, the highest increase happened in 2007 and 2017. In that way, the graph depicts a clear image of the amount of export and import of a country over twenty years from 2000 to 2020.

South Korea to United Kingdom Export

The graph clearly shows the yearly export and import of South Korea to United Kingdom in million dollars. With a brief look, it shows that both the export and import of the country has ups and down throughout the years. In 2018, the exports and imports respectively were 12.50 million dollars and 6.50 million dollars.

From the starting the graph seems to be incline and gradually the export rose higher point to 12.50 million dollars in 2018 and on the other

hand the import rose to the higher level to 6.50 million dollars in the year 2020.

However, from the graph, it is distinguishable that from 2000 to 2005 and the exports of the country gets up and down and the import on the other is slightly gets higher throughout and it gets higher level in 2019 and 2020. A decrease happened in the initial year and in 2013. From the graph, it is also lucid that the country's export is higher than the import. Thus, the highest increase happened in 2015 and 20218. In that way, the graph depicts a clear image of the amount of export and import of a country over twenty years from 2000 to 2020.

South Korea to U.S.A Trade

The graph clearly shows the yearly export and import of South Korea to United States of America in million dollars. With a brief look, it shows that both the export and import of the country are getting higher gradually throughout the years. In 2017, the exports and imports respectively were 50.00 million dollars and 12.00 million dollars.

From the starting the graph seems to be incline and gradually the export rose higher point to 50.00 million dollars in 2017 and on the other hand the import rose to the slighter higher level to 21.50 million dollars in the year 2020.

However, from the graph, it is distinguishable that from 2000 to 2006 and the exports of the country gets higher and the import on the other is slightly gets higher throughout and it gets higher level in 2019 and

2020. From the graph, it is also lucid that the country's export is higher have equilibrium point in the initial years of trade.

Thus, the highest increase happened in 2019 and 20220. In that way, the graph depicts a clear image of the amount of export and import of a country over twenty years from 2000 to 2020.

South Korea to Vietnam Trade

The graph clearly shows the yearly export and import of South Korea to Vietnam in million dollars. With a brief look, it shows that both the export and import of the country has many ups and down throughout the years. In 2020, the exports and imports respectively were 70.00 million dollars and 40.00 million dollars.

From the starting the graph seems to be incline and gradually the export rose higher point to 70.00 million dollars in 2020 and on the other hand the import rose to the slighter higher level to 45.50 million dollars in the year 2018.

However, from the graph, it is distinguishable that from 2000 to 2003 and the exports of the country gets higher and the import on the other is slightly gets higher throughout and it gets higher level in 2006, 2011, and 2018. From the graph, it is also lucid that the country's export is higher have equilibrium point in two years 2007 and 2011.

Thus, the highest increase happened in 2014 and 2020. In that way, the graph depicts a clear image of the amount of export and import of a country over twenty years from 2000 to 2020.

4..2 Panel Data

Analysis with Gravity Model after analysed the countries individually now I am going to determine with gravity model panel data analysis on OLS-R-Studio. the below test are pooled test, bruesh pagan test, random effect test, husman test, fixed effect test, f-test and at the and I compared tests with my added variable or with out added my variable.

4.2.1 Pooled Model

Table 10 shows GDP in importing countries, GDP in exporting countries Num. of import-export, distance, g20 and WJP rule of law are significant except for the exchange rate. Table 10 shows that the exchange rate is insignificant because I took the exchange rate only in USD currency, so it changes by year but not by country to country. That's why it shows negative value.

Table 10. Pooled model test Result

	Estimate	Std. Error	t-value	Pr(>|t|)	
GDP import countries	0.07295	0.032299	2.2586	0.02431	*
GDP export country	0.51	0.07	6.78	0.00	***
exchange rate	−0.97	0.30	−3.27	0.00	**
num. of import export	0.61	0.02	25.72	0.00	***
distance	0.07	0.03	2.42	0.02	*
g20	0.36	0.07	4.94	0.00	***
rule of law	0.34	0.06	6.13	0.00	***

Table 11. Pooled model result

R-Squared	0.81416
Adj. R-Squared	0.81175
F-statistic:	336.72
DF	538
Variable	7
P-value:	2.22E-16

Table 11 shows the pooled test result and it doesn't exclude any variable, but it reduces the degree of freedom and now after the pooled test, only 538 observation remain before was 546 observation. Its mean pooled test excluded 10 observations. The Pooled test r-square is 0.81416, the adjusted r-square is 0.81175, the F-statistic is 336.72 and the p-value is 2022E-16 which is less than 0.05.

Now we have to go through the Breusch-Pagan test for pooled model conformation. If it is less than 0.05, the null hypothesis (Ho) will reject or if it is more than 0.05 then the null hypothesis (Ho) will not reject.

4.2.2 Breusch-Pagan Test

Table 12 shows Breusch-Pagan's results. In this result, the p-value is 2.20E-16, which is less than 0.05. That means this model has Heterogeneity and error have variance, which is a violation of (gauss-Markov) the assumption, in another word we can say Homoscedasticity does in a pooled model, so, now we have to Moving random effect model.

Table 12. Breusch-Pagan test

P−value	2.20E−16
df	7
BP	137.84
Alternative hypothesis	significant effect

4.2.3 Random Effects model

The Random effect model analyzes and picks up the data from the dataset randomly. That's why we call them random effects. Table 13 shows GDP in importing countries, GDP in exporting countries, Num. Import-export, distance, g20, rule of law are significant, except for the exchange rate. And about the exchange rates, I already mentioned in the pooled test. The random-effects method ignores heterogeneity that behaves in a random fashion and the coefficient is not correlated with the regressor. Therefore, we call panel data random effects.

Table 13. Random effects model

	Estimate	Std. Error	z−value	Pr(>|z|)	
GDP import countries	0.455271	0.045577	9.989	2.20E−16	***
GDP export countries	0.170135	0.074421	2.2861	0.02225	*
exchange rate	−1.002505	0.158225	−6.336	2.36E−10	***
num. of import export	0.536755	0.038819	13.8271	2.20E−16	***
distance	0.056243	0.122627	0.4586	0.64649	
g20	0.275917	0.236957	1.1644	0.24425	
rule of law	0.526183	0.238072	2.2102	0.02709	*

Table 14 shows R-Squared 0.81911, Adj. R-Squared 0.81675 and p-value is 2.22E-16 which means p-value is less than 0.05. Now we will do confirmation from husman test to know if the random effect will reject or not reject.

Table 14. Random effects result

Residual	36.09
R-Squared	0.81911
Adj. R-Squared	0.81675
P-value	2.22E-16

4.2.4 Hausman Test

Table 15 Hausman test compares the pooled model and the random effect model. One model is inconsistent. That means the random effect model is inconsistent because the p-value is less than 0.05 that is why the null hypothesis rejects and fixed failed to reject.

Table 15. Hausman test

df	7
P-value	2.2e-16
Alternative hypothesis	one model is inconsistent

4.2.5 Fixed effects model

It allows heterogeneity or individually among all the cross-sectional units by allowing them to have their own intercept value. Table 16 shows only GDP of import countries, GDP of export country, exchange rate and num. of import export all variable are significant except of exchange rate with reason I mention above already.

However, the fixed effects model excluded two variables. The first G20 and the second rules of law because the fixed effect never includes variables if there is multicollinearity. I checked with one by one with both variable G20 and rule of law but its gave same results.

Table 16. Fixed effects test

	Estimate	Std. Error	t-value	Pr(>|t|)	
GDP import countries	0.503938	0.04779	10.5448	2.20E-16	***
GDP export country	0.102037	0.080308	1.2706	0.2045	
exchange rate	-1.03591	0.159416	-6.4981	1.92E-10	***
num. of import export	0.545562	0.041759	13.0646	2.20E-16	***

Table 17 shows Residual is 34.102, R-Squared is 0.82247, Adj. R-Squared is 0.81249, and the p-value is 2.22E-16. the p-value is significant because it is less than 0.05 but we will go through the f-test and compare it with the pooled model and fixed-effect model. If the f-test p-value is less than 0.05, then the fixed-effect model should not be rejected.

Table 17 Fixed effects result

Residual	34.102
R-Squared	0.82247
Adj. R-Squared	0.81249
F-statistic	597.637
Observation	516
p-value	2.22E-16

4.2.6 Pooled vs Fixed effects model (F-test)

we will move for fixed effect models because p-value is less then 0.05 thats why null hypothesis rejected and we can say in this dataset fixed effect model is consistent as compare to pooled model. For reference of pooled and fixed effects model result you can see table 18.

Table 18. Pooled vs Fixed effects model result(F-test)

P-value	2.2e-16
Alternative hypothesis	significant effects

4.2.7 Analysing with G20 summit and WJP Index variables and without G20 and WJP Index variable.

After analysing gravity model panel data with added variables/factors G20 summit and WJP Index I can say these variable and factor are very important for analyse the bilateral trade because its effecting significantly. we can see the tabel 19 where I mention comparison with r-square and adjusted r-square is written there with variables and with out variables.

Table 19. R-square and adjusted R-square comparison with added variable and without my added variable in this gravity model.

		R-Squared	Adj. R-Squared
Pooled model	with variables	0.81416	0.81175
	without variable	0.7826	0.78059
Random model	with variables	0.81911	0.81675
	without variable	0.81785	0.81616

First, I compared with pooled model where I added G20 summit and WJP Index variable. so the r-square was 0.81416 and the adj. r-square was 0.81175 but when I compare without added G20 summit and WJP Index variable the r-square was 0.7826 and the adj. r-square was 0.78059.

Second, I compared with random model where I added G20 summit and WJP Index variable. so the r-square was 0.81911 and the adj. r-square was 0.81675 but when I compare without added G20 summit and WJP Index variable the r-square was 0.81785 and the adj. r-square was 0.81616.

I done comparison only pooled and random model because fixed effect model was not accepting (as I mentioned above) these G20 summit and WJP Index variable because of multicollinearity. In all comparison test p-value was less than.

Chapter 5. Conclusion

The research has studied and examined the crucial factors which are affecting the bilateral trade between South Korea to Czech Republic, France, Germany, Netherlands, Singapore, UK, USA, Belgium, Hungary, India, Italy, Malaysia, Thailand, Mexico, Russia Federation, Saudi Arabia, Turkey, Vietnam, Poland, Canada, Indonesia, Philippines, Australia, Hong Kong, China, Brazil. The duration of the data is from 2000 to 2020. All data work done in R-Language with ETL process and made it as panel data to use for regression analysis. I used gravity model with panel data I applied bellow tests for model selection.

1)Pooled test
2)breusch pagan test
3)random effects
4)housman test
5)fixed effects test
6)F-test

Pooled test p-value was less than 0.05 and adj. r-square was 0.81 but breusch pagan test null hypothesis was rejected its mean pooled model variables intercept was not same. that's why we moved to randoms effect model but random effect model p-value less then 0.05 that why it was also rejected after that I did more test like housman test and F-test was also rejected that's why I move to select fixed effects model.

Final conclusion, G20 and rule of law dummy variable was showed significant effects but due to multicollinearity problem fixed effect model excluded from model,

furthermore, other model like pooled and random effect model accept G20 and rule of law dummy variable and it was showed significant results. But, we have to make our dataset more complicated to add more variable than reults will be more reliable or accurate.

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Appendix

SOUTH KOREA BILATERAL TRADE IN USD COUNTRY WISE

COUNTRY NAME	BILATERAL TRADE IN USD
Australia	462906653
Belgium	68948539
Brazil	179783292
Canada	167893048
China	3433817445
Czech Republic	35171326
France	473180201
Germany	154839186
Hong Kong SAR, China	36922008
Hungary	275008438
India	159152566
Indonesia	351046246
Italy	297216825
Malaysia	161975414
Mexico	203507148
Netherlands	190429973
Philippines	70115288
Poland	302634435
Russian Federation	548658598
Saudi Arabia	409408368
Singapore	199384185
Thailand	94386355
Turkey	204585225
United Kingdom	550927744
United States	1943381538
Vietnam	514366262

SOUTH KOREA BILATERAL TRADE IN USD YEAR WISE

YEARS	BILATERAL TRADE IN USD
2000	215151773
2001	187414670
2002	207288381
2003	246538185
2004	315449565
2005	360663766
2006	416063764
2007	484240847
2008	564229446
2009	453109080
2010	599247824
2011	720235088
2012	716673931
2013	732852672
2014	763582966
2015	696144747
2016	654059910
2017	774786322
2018	847052656
2019	783981184
2020	750879529

국 문 초 록

중력 모델에 따른 양자 무역의 결정 요인:
G20 및 WJP 규칙에 관한 연구

한 성 대 학 교 대 학 원
국 제 무 역 경 제 학 과
국 제 무 역 경 제 전 공
아 티 브 율 라

본 연구는 체코, 프랑스, 독일, 네덜란드, 싱가포르, 영국, 미국, 벨기에, 헝가리, 인도, 이탈리아, 말레이시아, 태국, 멕시코, 러시아 연방, 사우디아라비아, 터키, 폴란드, 인도네시아와의 양자 무역을 조사함으로써 연구 분야의 무역/양자 무역 균형에 기여합니다. 파인즈, 호주, 홍콩, 중국, 브라질 표본 기간은 2000년부터 2020년까지이며 관측치는 546개입니다.

이 연구의 목적은 두 나라 사이의 상호 무역에 중요한 역할을 하는 두 가지 주요 요소에 초점을 맞추고 있습니다. 그 중 하나는 G20 정상회의에 의해 국제 관계가 양국 무역에 얼마나 영향을 미치는지 입니다. 반면에, 만약 그 나라가 높은 수준의 법과 정의를 가지고 있다면, 그것은 무역 수지에 큰 영향을 미칠 것입니다. 저는 그림으로 분석을 한 후 풀링 테스트, 브루쉬 이교도 테스트, 랜덤 효과, 하우스만 테스트, 고정 효과 테스트, 중력 모델을 사용한 F 테스트 등 여러 테스트를 적용했 습니다.

키워드 쌍방향 무역, 경험적 분석, 중력 모델