THE EFFECT OF NON-TARIFF MEASURES ON INTERNATIONAL TRADE: Analysis on Gravity Model about Border Effects on Korean Exports

By

MIN, Jihee Grace

THESIS

Submitted to

KDI School of Public Policy and Management

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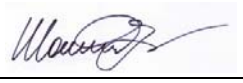
Professor Sherzod SHADIKHODJAEV 

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ABSTRACT

The Effect of Non-tariff measures on International Trade

: Analysis on Gravity Model about Border Effects on Korean Exports

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In recent years, advanced countries, especially the US, have sought to reverse the cause of income inequality problems and unstable economic condition to the trade with emerging countries, which enjoy trade surpluses. Since 1990s, trade liberalization has come into being, and international organizations such as the WTO have been launched. Meanwhile, from 2000s, trade agreements have been concluded in many countries.

In this context, developed countries have tried to make trade barriers through various kinds of non-tariff measures. In this process, Korean steel

products have also been subject to trade remedies by the US, and based on the fact that Korean export market and products are concentrated, not diversified, it is expected that non-tariff measures by the US or China will have a negative impact on Korean exports.

Therefore, in this paper, regression analysis was conducted to figure out that the implementation of such non-tariff measures could have a negative impact on exports despite the fact that tariff barriers were relaxed due to the current RTA conclusion. Prior to the empirical analysis, literature review about the implications of the border effects, more specifically, non-tariff and tariff barriers were explored and prior studies on regional trade agreements were also examined. Sample data utilized 15 developed and 15 emerging countries among the major trading partners with Korea from 2002 to 2015. In addition, in order to derive more precise empirical analysis results, export data is limited to processed foods and steel products. This empirical analysis has led to the conclusion that non-tariff measures still cause exports to decline despite trade liberalization.

Key words: **Border Effect, Non-tariff measurement, Regional Trade Agreement, Gravity Model**

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1. Introduction

1.1. Background

New Protectionism on International Trade

The recent emergence of protectionism policies has been intensified with the Brexit and the launch of the Trump administration. In the past, developed countries in 1970s had implemented various protectionism policies to protect their own industries and create jobs for domestic workers, which is closely related to protectionism in recent years.

After protectionism from developed countries in 1970s, the increase in the number of trade liberalization policies and FTAs (Free Trade Agreements) since 1990s raised the level of trade openness in each country and this phenomenon could be explained by existing international trade theories such as the comparative advantage of the Ricardian model and Heckscher-Ohlin theorem. These theories explain that if one country specialized in the specific industry and exported the good but imported the other good from another country which has comparative advantage in the other good, then it can bring trade benefits to both countries while trading each other. In this context, several international organizations such as WTO

(World Trade Organization) for the promotion of free trade have been established.

Recently, however, many developed countries have tried to resolve domestic economic problems by solving the problem of domestic income inequality by protecting their domestic industries through their own preferential policies. In developed countries, it seemed that the problem of domestic income inequality has been intensified as cheap foreign labors have been infiltrated into their own countries through international trade, resulting in the loss of unskilled workers of developed countries. In addition, with the preponderance of populist policies of recent days, protectionism policies related to national preference became popular with the people of developed countries, which changed economic policies in order to reduce trade openness and protect their own economy.

Therefore, the new protectionism that emerged under this background is attempting to regulate trade liberalization in more various ways than the existing tariff policy and one of these examples is Non-Tariff Measure (NTM) policy. NTM refers to restrictions on trade, such as import quota or refusal of clearance by SPS or TBT (technical barriers). Without tariff policy, this kind of non-tariff protectionism can also result in limitation

on import from foreign countries and in this way, one country can protect their own industry.

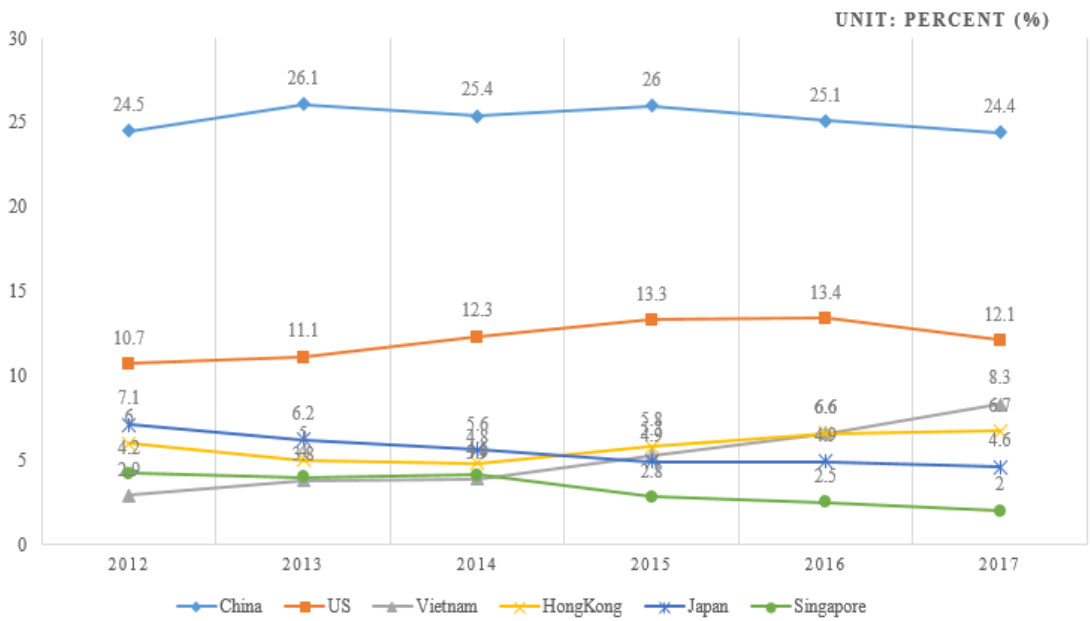
The reason why this kind of regulations is problematic is that if a non-tariff measure is increased in one country, the trading partner can also take a retaliatory position by using non-tariff measures or tariff barriers. In other words, if emerging countries as well as developed countries join in the trade protectionism policies, this could lead to a contraction of global trade markets. Also, it has been analyzed from many studies that the shrinkage of the world trade market leads to economic instability, job slump and economic recession. In the case of South Korea, which is highly dependent on foreign economies due to its lack of resources, it is necessary to analyze how the expansion of recent non-tariff barriers affects foreign exports because the recession of the world trade market will cause damage to the domestic economy.

Non-diversified export market of Korea

The Korean economy is not only highly dependent on foreign countries but also has a feature of concentrated export market, which means that export markets are not diversified and exporting products are also very

limited. China, the United States, Vietnam, Hong Kong, and Japan are top major trading partners of Korea and South Korea's export dependence on these countries exceeds 50% in 2017. In particular, Korea is showing the greatest dependence on China, which is close to 30%, and considering Korea's dependency on exports to GDP is more than 60%, Korea can be greatly affected by economic changes in major trading partners.

[Figure 1] South Korea and major trading partners (2012~2017)



Source: Korea International Trade Association (visited Dec. 2017)

Therefore, in the light of the emergence of new protectionism centered on non-tariff barriers and the problem of concentrated export markets of South Korea, this paper will explore the effect of non-tariff measures on trade volume between two countries. First, after reviewing the literature on the border effect acting as a barrier to bilateral trade and Regional Trade Agreements (RTAs) and then panel data analysis through the model will be conducted. The model to be used here is a Gravity Model and will set the border effect as a constant that can affect bilateral trade in addition to GDP and bilateral distance. In particular, the change in trade volume between Korea and major trading partners, focusing mainly on non-tariff measures will be analyzed through regression analysis using data from 30 sampling countries from 2002 to 2015. To sum up, this paper will explore changes in trade volume between Korea and trading partners, which have become the subject of intensifying non-tariff barriers.

2. Literature Review

2.1. The Border Effect

The border effect implies factors affecting bilateral trade, including tariff, import quota, some administrative rules or regulations, population, geographical factors, cultural factors, language and religion, etc. In summary, those factors still act as obstacles to the bilateral trade and have a great effect on international trade compared to intra-national trade. Thus, the border effect arises from trade between countries and countries, which in turn increases the trading costs between the two countries. In other words, as the transaction costs increase, it means that the opportunity cost of trading with other countries increases, resulting in reducing the bilateral trade volume. Therefore, this border effect has been a determinant of inter-country trade. Regarding this, David C. Parsley and Shang-Jin Wei(2001) defines that the 'border effect' as 'the frictions that hinder the international integration of markets' and highlights that "many policy makers across the globe are keen on reducing them." This implies that the border effect is an obstacle to the integration of the world trade, suggesting that reducing the border effect can further integrate the world trade market and promote international trade throughout the world.

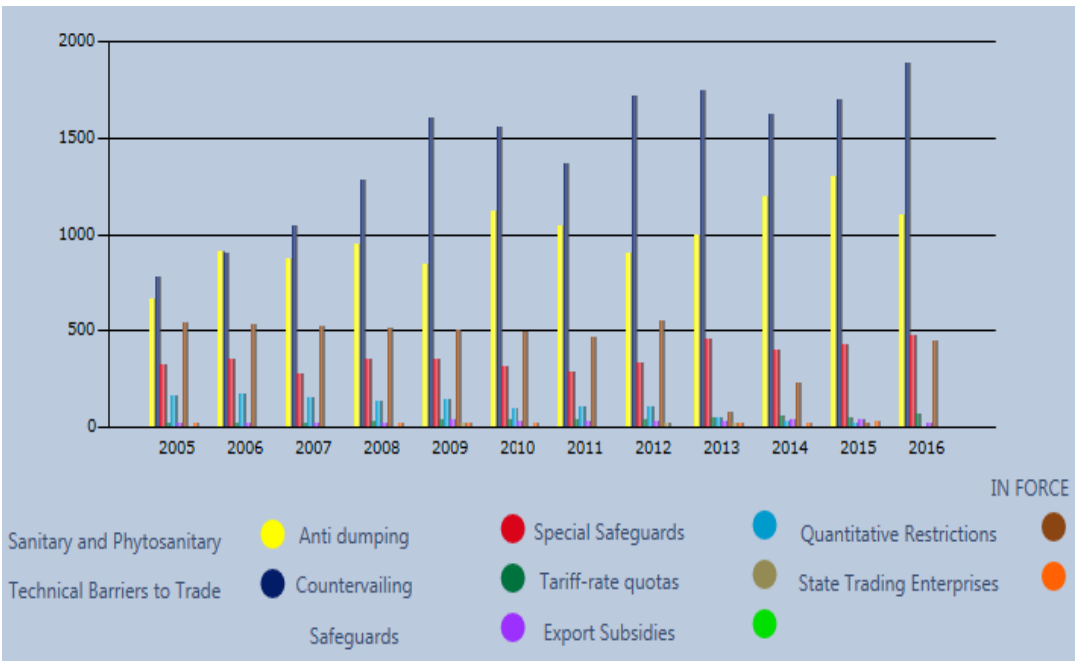
In addition, Natalie Chen(2004) refers the way to analyze the border effect as "investigating the role of various border related trade barriers in explaining border effects across manufacturing industries." This statement implies that in order to evaluate the border effects across countries, analyzing trade barriers such as import quota, tariff, and non-tariff barriers is a necessary process. However, in this paper, the analysis on the border effect will be conducted centering on non-tariff and tariff barriers which are quantifiable compared to other factors like religion, language, etc. in order to use the gravity model.

Non-tariff barriers (Non-tariff measures)

Among trade barriers, firstly, the report on non-tariff barriers by Koen and Joseph(2009) defines non-tariff barriers as "all non-price and non-quantity restrictions on trade in goods, services and investment, at federal and state level" and refers this measure as "border measures (customs procedures) as well as behind-the-border measures flowing from domestic laws, regulations and practices". Furthermore, WTO defines such non-tariff measures (NTMs) as technical barriers to trade (TBT), sanitary and phytosanitary measures (SPS), anti-dumping and countervailing measures. This kind of non-tariff measures can be considered as more complex and

concrete trade barriers compared to tariff, since this kind of regulation is diverse in terms of their scope and types. Especially, if SPS and TBT measures are expanded, exporting companies should pay attention to the possible rejection of customs clearance that may arise from these measures, and the inefficiency can also be caused to countries who want to restrict trade through trade barriers because of the high trading costs while monitoring the whole trading process.

[Figure 2] Non-tariff measures initiated and in force (2005~2016)



Source: I-TIP of WTO (visited Dec. 2017)

However, despite this ineffectiveness in trade, the number of non-tariff measures has increased recently, as shown in [Figure 2]. This is a graphical representation of the number of non-tariff measures implemented in force currently. In the last 10 years, the number of SPS and TBT measures, especially TBT has increased the most among non-tariff measures. Anti-dumping and quantitative restrictions are the next largest ones, but safeguards are showing a gradual decline. Therefore, in this paper, the impact of non-tariff barriers will be analyzed focusing on SPS and TBT.

More specifically, non-tariff measures can be classified in detail in the following [Table 1]. This is a classification of non-tariff measures organized by the United Nations Conference on Trade and Development (UNCTAD). Considering the following table, non-technical measures as well as technical measures are further subdivided. SPS refers to regulatory measures related to animal or plant pests and diseases or food constituents, and TBT contains provisions on standards related to the procedures of production and other technical regulations. Those two measures can be further subdivided according to the UNCTAD classification. UNCTAD assigns two codes A and B to SPS and TBT respectively, and classifies them according to different rules from A1 to A8 and B1 to B8. In addition, it encompasses a wide range of regulations, including labeling, marking and

conformity with product quality standards, as well as licensing related to drugs, registration of importers, and provisions of product constituents.

Furthermore, Section D contains anti-dumping, countervailing and safeguard measures. This implies that protectionism in response to "unfair" trade practices that may occur in the foreign exporting markets. Recently, developed countries are likely to consider emerging countries experiencing trade surplus as "unfair" markets, so these measures can be applied to those countries if developed countries interpret that the price of export goods from emerging countries is distorted through dumping and subsidies. Moreover, the implementation of such measures will require relevant investigation, so there is a high level of probability that non-tariff measures will be adversely affected to emerging economies at the discretion of the governments of developed countries. Meanwhile, Section F includes price control, which provides the minimum import prices associated with administrative measures. Section G increases the prices of imports by providing advance payment requirement and foreign exchange regulations for imports, causing a similar result from the tariff barrier. In addition, such as government procurement and the origin rules in Section M and O, imply that each of these measures can be widely used as part of the trade-protectionism measures.

[Table 1] Non-tariff measures classification

Imports	**Technical Measures**	**A**	Sanitary and phytosanitary measures (SPS)
		B	Technical barriers to trade (TBT)
		C	Pre-shipment inspection and other formalities
	Non-technical Measures	**D**	Contingent trade-protective measures
		E	Non-automatic licensing, quotas, prohibitions and quantity-control measures other than for SPS or TBT reasons
		F	Price control measures, including additional taxes and charges
		G	Finance measures
		H	Measures affecting competition
		I	Trade-related investment measures
		J	Distribution restrictions
		K	Restrictions on post-sales services
		L	Subsidies (excluding export subsidies)
		M	Government procurement restrictions
		N	Intellectual property
		O	Rules of Origin
Exports		**P**	Export-related measures

Tariff barriers

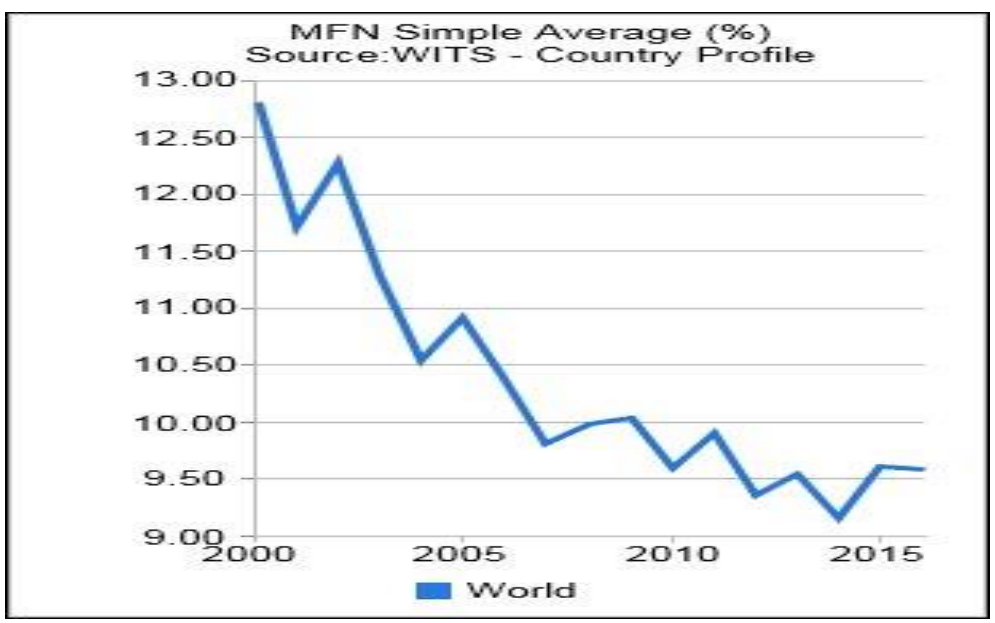
The tariff barrier is another kind of trade barriers and generally countries that have signed in free trade agreements (FTAs) trade at the lowest tariff rates but countries that have not signed in FTAs can face higher goods prices because of the effect from tariffs. Jongchan Park and Sangkhil Bak(2010) describes tariff policy as 'the mean for the purpose of government revenue and the protection of the country's industry'. This statement implies that several governments would like to earn financial revenue through tariff and protect their own industry by raising imported goods prices. WTO also defines tariff policy as 'customs duties on merchandise imports' but explains that "the result of the Uruguay Round was countries' commitments to cut tariffs and to 'bind' their customs duty rates to levels which are difficult to raise" This explanation describes that after the launch of the WTO and the conclusion of the Uruguay Round, the free trade trend has been spreading through the tariff reduction throughout the world.

Therefore, many countries recently have benefited from the low tariff rates through bilateral FTAs, many of which started from 1990s and mega FTAs represented by Trans-Pacific Partnership (TPP) and Regional Comprehensive Economic Partnership (RCEP). Regarding this, Jae-Woo

Jung and Kil-Nam Lee(2014) considers FTAs as “the advance to foreign markets” and analyzes the effect of reducing tariffs through FTAs that “the price of goods will be lowered by tariff cuts and the volume of trade will increase.” This claim supports that the tariff reduction policy is in line with the contract of FTAs.

To sum up, the tariff rate between countries has gradually been reduced based on the trend of free trade in 1990s, and changes in tariff rate are in the [Figure 3] from the World Bank.

[Figure 3] Changes in tariff rate (2000~2016)



2.2. Regional Trade Agreements (RTAs)

WTO defines “Regional Trade Agreements” as “a reciprocal trade agreement between two or more partners, not necessarily belonging to the same region”. Since the core and important principle of the WTO is the non-discrimination clause, WTO members generally cannot treat any country in a favorable position relative to other trading partners. However, discriminatory or advantageous measures can be exceptionally applied to countries that have concluded the RTAs. Until recently, the number of such RTAs has increased.

Oh Moon-Kap(2013) highlights that this increasing Regional Trade Agreements(RTAs) phenomenon arises from regionalism. In addition, he refers the regionalism as ‘a phenomenon of economic block through free trade zone and customs union’. However, the meaning of “region” here does not mean a close geographical distance between trading countries, and it can be considered that RTAs are being used as a way to promote trade liberalization among trading countries through free trade zones and customs union. Furthermore, Shim(2010) classifies the types and forms of RTAs into four groups: free trade zone, customs union, common market, full economic integration.

Meanwhile, Jun Yun-yong and Kim Jin-sup(2011) points out in the

paper on RTA, “The regional trade agreement aims to expand the trade scale, and in the short run, it will bring about international trade expansion to each of the individual industries through tariff and exchange rate policy.” However, they also explain that “The exchange rate is not a system that can be changed according to the RTA between individual countries.” This means that analyzing the effect of the RTA conclusion means analyzing the short-term changes in trade volume between the two countries when mitigating tariff barriers.

To sum up, through the agreement, a wide range of economic partnership has been established to ensure the free movement of goods and services, to broaden the choice of products for consumers, and companies should conduct R&D (Research and Development) continually while competing with foreign products through tariff reduction or elimination. Therefore, the proliferation of trade liberalization through RTAs not only increases the global trade volume, but also contributes to the development of the economy as a whole.

However, in the paper on the countermeasure strategy about anti-dumping measures and RTA, Oh Moon-Kap(2013) states that “Korea and the US FTA does not resolve trade dispute in the FTA and use the WTO dispute

settlement procedure.” Also, he highlights that “there may be limitations as to whether or not they can play an important role in reducing the friction on the measures”. That is, trade agreements do not provide adequate solution to anti-dumping measures which are part of the non-tariff barriers. On the basis of this, RTA suggests that although it is presented as an alternative to promote trade liberalization and mitigate trade barriers, it is hard to properly sanction the recent increasing non-tariff measures.

The following table summarizes the list of the countries where South Korea has concluded the current RTAs. Korea has concluded trade agreements with countries that are geographically far from such as the US and EU as well as close countries like China and Asian countries. According to the table, there is another kind of trade agreements, which is Economic Integration Agreements (EIAs). In the report on EIA and the margins of international trade, Baier, Bergstrand, and Feng(2014) refer to EIA as "preferential trade agreements, free trade agreements, customs unions, common markets, and economic unions." This implies that EIA covers a wide range of economic cooperation similar to RTA so it can be understood as South Korea's current RTA contracting partners without distinction between FTA and EIA.

[Table 2] RTAs in force of South Korea

RTA Name	Type	Date of entry into force
Korea- Colombia	FTA & EIA	15-Jul-16
Korea- China	FTA & EIA	20-Dec-15
Korea- New Zealand	FTA & EIA	20-Dec-15
Korea- Vietnam	FTA & EIA	20-Dec-15
Korea- Canada	FTA & EIA	01-Jan-15
Korea- Australia	FTA & EIA	12-Dec-14
Korea- Turkey	FTA	01-May-13
Korea- United States	FTA & EIA	15-Mar-12
Korea- Peru	FTA & EIA	01-Aug-11
Korea- EU	FTA & EIA	01-Jul-11
Korea- ASEAN	FTA & EIA	01-Jan-2010(G) 14-Oct-2010(S)
Korea- India	FTA & EIA	01-Jan-10
Korea- EFTA	FTA & EIA	01-Sep-06
Korea- Singapore	FTA & EIA	02-Mar-06
Korea- Chile	FTA & EIA	01-Apr-04

3. Empirical Study

3.1. Data Set

In order to analyze the effect of non-tariff measures on the volume of bilateral trade, this paper will utilize the gravity model. First, according to the gravity model, GDP of the two countries and the distance between the two countries will be used to the variables. Also, NTBs (Non-Tariff Barriers) index and technical measures of SPS and TBT, which have recently increased among non-tariff barriers mentioned above, will also be used as main independent variables. The number of SPS and TBT measures will be based on non-tariff measures data from WTO. Country sets to be analyzed in this paper is the major trading partners with South Korea. However, because of different economic status or trade environment, the countries will be separated into developed and emerging countries groups based on GDP per capita. Sampling countries are selected from 15 developed[1] and emerging countries[2], respectively from 2002 to 2015.

[1] Developed countries: Australia, Canada, Finland, France, Germany, Greece, Italy, Israel, Japan, Netherlands, New Zealand, Singapore, Spain, United Kingdom, US

[2] Emerging countries: Argentina, Brazil, Chile, China, India, Indonesia, Malaysia, Mexico, Philippines, Russia, South Africa, Taiwan, Thailand, Turkey, Vietnam

HS Code classification on products

In this paper, export data items to be used for regression analysis are processed food and steel. This is because the highest export items from Korea subject to customs clearance due to SPS and TBT measures are processed food, and steel exports are also experiencing difficulties due to non-tariff barriers. In the case of processed food, it corresponds to Chapter 16~24 in the HS Code classification[3], and in the case of steel, it corresponds to Chapter 72 and 73.

The current HS code uses the 2012 version, and processed foods are divided into 55 headings in total. For example, Chapter 16 corresponds to 'preparations of meat, of fish or of crustaceans', 17 includes sugars and sugar confectionery item, while Chapter 21 includes 'miscellaneous edible preparations'. Meanwhile, steel items are Chapter 72 and 73. Chapter 72 refers to 'iron and steel' but Chapter 73 corresponds to 'articles of iron or steel', and these two Chapters contain 55 subheadings currently.

[3] Customs Law Information Portal (https://unipass.customs.go.kr/clip/index.do)

3.2. Gravity Equation

This study adds NTBs index (non-tariff barriers index), the number of SPS and TBT measures related to the processed food products and steel products from 2002 to 2015 to the explanatory variables. Therefore, by adding the explanatory variables set in this study to the basic gravity model, the following regression equation can be derived.

$$\ln(\mathrm{EXPORT^{k}_{ijt}}) = \alpha + \beta_1(\mathrm{NTB_{jt}}) + \beta_2(\mathrm{SPS^{k}_{jt}}) + \beta_3(\mathrm{TBT^{k}_{jt}}) + \beta_4 \ln(\mathrm{GDP_i} \cdot \mathrm{GDP_j})_t + \beta_5 \ln(\mathrm{DIS_{ij}}) + \beta_6(\mathrm{X_{ijt}}) + \epsilon_{ijt}$$

$\mathrm{EXPORT^{k}_{ijt}}$:

Exports of item k from country i to country j in year t (i is South Korea)

$(\mathrm{NTB_{jt}})$: Non-tariff barriers protection level index of country j in year t

$(\mathrm{SPS^{k}_{jt}})$:

Number of notifications of SPS measures on item k by country j in year t

$(\mathrm{TBT^{k}_{jt}})$:

Number of notifications of TBT measures on item k by country j in year t

$(GDP_i \cdot GDP_j)_t$: GDP multiplied by two countries (i and j)' GDP in year t

DIS_{ij}: Distance between country i and j

X_{ijt}: RTA Dummy variable between country i and j in year t

YEAR and *PARTNER* Dummy variables are also considered.

ϵ_{ijt}: Error term

In the above regression equation, the dependent variable is set as the export amount, which is to analyze the relation between trade barriers and export volume of Korea when the major trading partners of Korea take non-tariff measures against Korean exports, considering GDP of both countries and distance between the two countries, together. In addition to the non-tariff measures, this study will also consider the relevance of other factors affecting bilateral trade by adding dummy variables. The tariff barriers, which are still another trade barrier that can be utilized as another main explanatory variable even if they have been reduced through the conclusion of FTAs in recent years. To make the analysis more precisely, *YEAR* and *PARTNER* dummy variables are also considered to control the specificity of specific economic circumstances in each year and consider the particular effect of each of the PARTNER countries.

3.3. General Information on Variables

3.3.1. Non-tariff Barriers (NTBs) Index

In this study, non-tariff barriers index is added to the explanatory variables, which is based on the economic freedom data released by the Fraser Institute. In this data set, figures related to non-tariff barriers and tariff rates from 2002 to 2015 as well as numerical values such as restrictions on foreign investment are presented. The data used in this paper are the non-tariff barriers index of the major trading partners of Korea from 2002 to 2015. In other words, by presenting these data, the extent how many non-tariff measures are being implemented in each country can be figured out, so that how these barriers affect to bilateral trade volume. That is, by setting this index into independent variables, it is possible to gauge the level of non-tariff barriers of the sample countries. As shown in [Table 3], the NTB index of each of the major ten countries is summarized as follows. In [Table 3], the major European countries are calculated into the average and put in the EU as a single index.

[Table 3] NTBs index of major country (2012~2015)

Country	Year			
	2012	2013	2014	2015
Australia	6.35	5.86	7.35	6.5
China	5.46	5.77	5.97	5.49
EU	5.86	5.66	6.76	6.06
India	5.63	5.19	5.68	5.98
Japan	4.92	4.94	5.38	5.3
Mexico	5.72	5.61	6.41	5.7
Israel	5.31	5.33	7.38	5.94
Taiwan	6.25	6.35	6.27	6.56
USA	5.77	5.61	6.52	6.37
Vietnam	5.02	5.43	5.15	4.89

As can be seen from the table, generally advanced countries represented by EU and USA are showing high level of NTB but several emerging countries like Taiwan and India are also showing quite high level of NTB index. In the case of US, 2014 and 2015 are showing high index compared to the previous years. Generally, the higher the NTBs index, it can be expected that more likely the trade barriers and border effects will affect negatively to bilateral trade.

3.3.2. Distinctions between SPS and TBT measures[4]

Before entering the regression analysis, it should be preceded to precisely differentiate the two measures, which is the main theme of this paper. In general, SPS measures correspond to foods and TBT can be regarded as measures corresponding to products other than food. In other words, according to the definition of non-tariff measures in the report published by UNCTAD in 2012, SPS is referred to as “regulations of organisms or toxic substances that can cause diseases in foods” and TBT is referred to as “the technical regulations excluding measurements in SPS agreements”. The cases of refusal of clearance due to SPS and TBT to be used in this study are based on the data from WTO I-TIP and KITA.

KITA classifies rejected products related to these two non-tariff measures into 29 categories. In this context, food related industries are processed foods, agricultural products, aquatic products, forest products, and livestock products. In addition to these four industries, however, SPS regulations also apply to chemical, rubber, some manufacturing and steel industries. However, the analysis in this paper mainly judged that the case of

[4] More detailed classification attached in Appendix A

denial of customs related to food is SPS. According to the TBT Agreement of the WTO, TBT measures apply to agricultural products, industrial products and all industries except for the sanitary or quarantine measures defined in the SPS Agreement.

[Table 4] is the summary with reference to UNCTAD classification criteria. The customs clearance cases to be used in the empirical analysis are analyzed according to the code of [Table 4], and each example will be given the UNCTAD code, A1~A8 and B1~B8 properly, and then sum each of the cases assigned A and B, which represents SPS and TBT measures respectively.

[Table 4] SPS and TBT measures

	SPS measures
A1	Prohibitions/restrictions of imports for SPS reasons
A2	Tolerance limits for residues and restricted use of substances
A3	Labeling, marking and packaging requirements
A4	Hygienic requirements
A5	Treatment for elimination of plant and animal pests and disease-causing organisms in the final product
A6	Other requirements on production or post-production process
A8	Conformity assessment related to SPS

TBT measures	
B1	Prohibitions/restrictions of imports for objectives set out in the TBT agreement
B2	Tolerance limits for residues and restricted use of substances
B3	Labeling, marking and packaging requirements
B4	Production or post-production requirements
B6	Product identity requirement
B7	Product-quality or -performance requirement
B8	Conformity assessment related to TBT

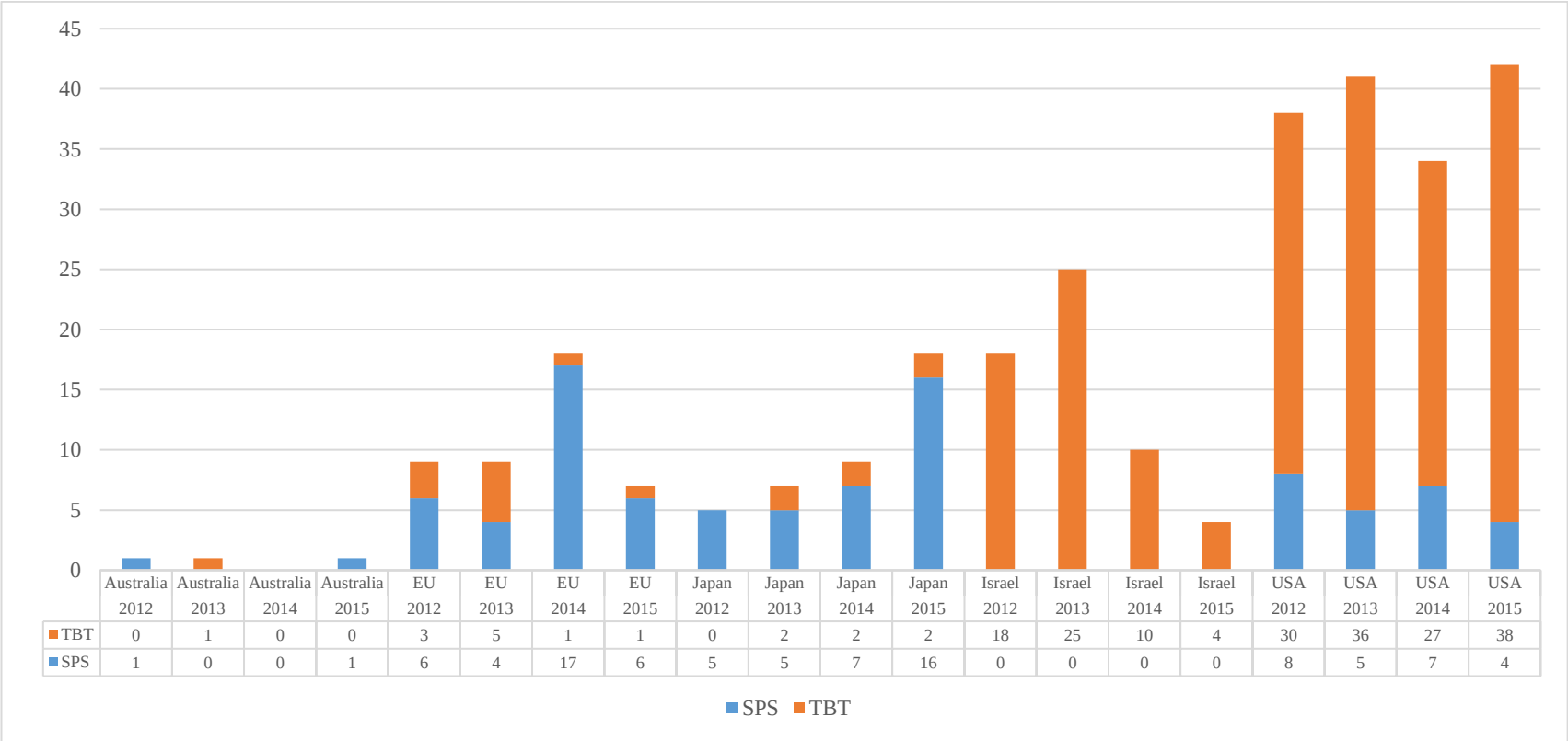
[Figure 4] and [Figure 5] are summarizing the non-tariff measures data of each country according to SPS and TBT agreements in I-TIP of WTO[5]. This is a summary of data from 2012 to 2015, and it can be seen that in most countries, generally the number of SPS actions is greater than TBT. The United States has a significantly higher number of SPS and TBTs compared to other countries except China in 2015. This indicates that laws and regulations on food, drug and technology measures in the United States are more detailed and specific compared to other countries.

[5] More data used in regression analysis attached in Appendix B.

In addition, comparing the numbers of non-tariff measures implemented in developed and emerging countries, it clearly shows that non-tariff measures are more actively implemented in developed countries. In particular, the US has been implementing high SPS and TBT measures steadily over the last four years since 2012, followed by a high level of non-tariff measures in China and the EU. In other words, given the fact that China and the US are Korea's largest trading partners, the implementation of these non-tariff measures is highly likely to affect to domestic export in the future. This is because it is likely that customs denials due to such SPS and TBT measures are likely to occur frequently in Korean exports.

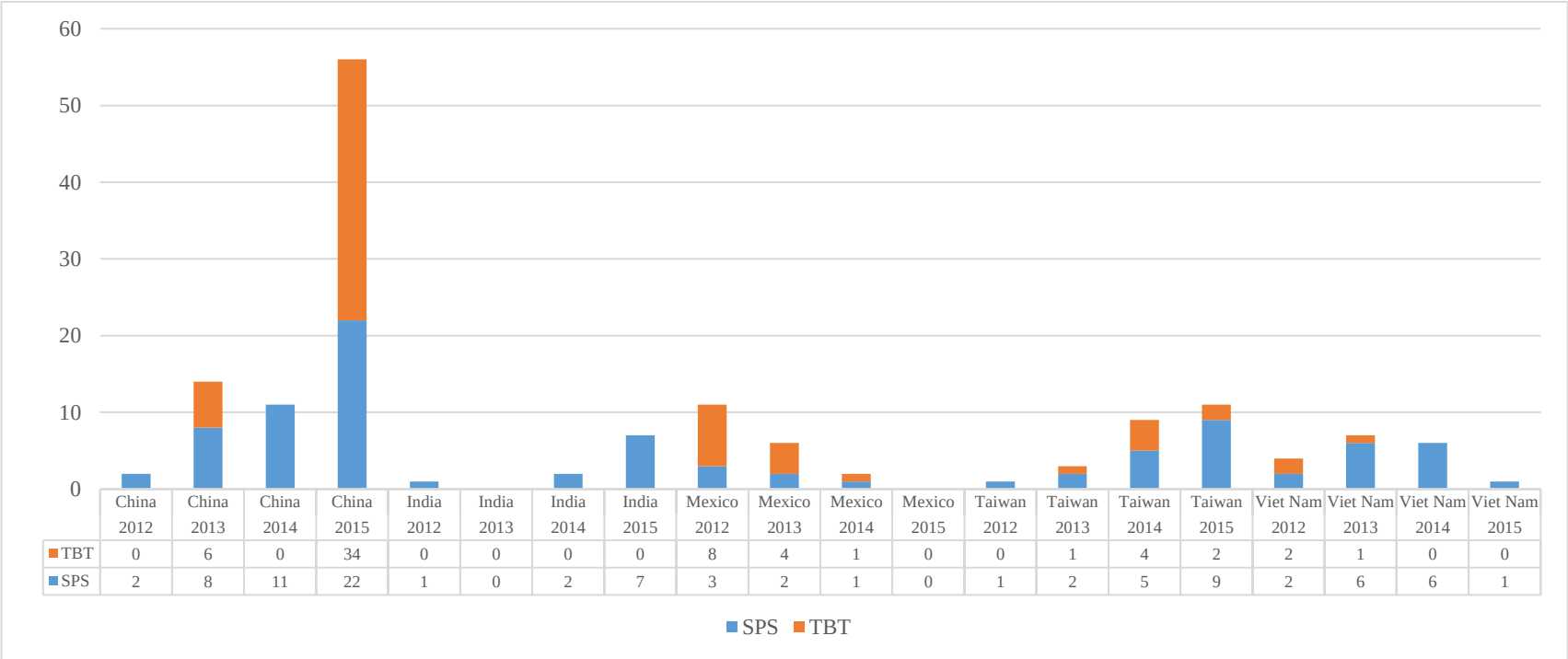
Moreover, when referring to emerging economy data, these non-tariff measures are steadily increasing in Taiwan and Vietnam. These two countries are also in the major trading partner group of Korea. This shows that these non-tariff measures will act as border effects and export barriers under the new protectionism in the future, which means that Korean export companies should be carefully monitor the implementation of non-tariff barriers to facilitate exports and reduce the case of customs denial.

[Figure 4] Rejection of customs clearance related to NTMs in ADVANCED COUNTRIES



	Australia 2012	Australia 2013	Australia 2014	Australia 2015	EU 2012	EU 2013	EU 2014	EU 2015	Japan 2012	Japan 2013	Japan 2014	Japan 2015	Israel 2012	Israel 2013	Israel 2014	Israel 2015	USA 2012	USA 2013	USA 2014	USA 2015
TBT	0	1	0	0	3	5	1	1	0	2	2	2	18	25	10	4	30	36	27	38
SPS	1	0	0	1	6	4	17	6	5	5	7	16	0	0	0	0	8	5	7	4

[Figure 5] Rejection of customs clearance related to NTMs in EMERGING COUNTRIES



	China 2012	China 2013	China 2014	China 2015	India 2012	India 2013	India 2014	India 2015	Mexico 2012	Mexico 2013	Mexico 2014	Mexico 2015	Taiwan 2012	Taiwan 2013	Taiwan 2014	Taiwan 2015	Viet Nam 2012	Viet Nam 2013	Viet Nam 2014	Viet Nam 2015
TBT	0	6	0	34	0	0	0	0	8	4	1	0	0	1	4	2	2	1	0	0
SPS	2	8	11	22	1	0	2	7	3	2	1	0	1	2	5	9	2	6	6	1

Source: I-TIP of WTO (visited Dec. 2017)

SPS measures

According to the SPS data shown in the above two graphs, it can be seen that the SPS measures against Korean products are now more than TBT. This is because SPS measures contain regulatory provisions related to the substances of food. For example, there is a case of rejection against Korean soft drink by the US in 2015. It is described as “an ‘unsafe ingredient” colorant or the product contains that colorant”. According to the SPS and TBT classification rules referenced in Appendix B, this corresponds to the “Tolerance limits for residues and restricted use of substances” of the A2 regulation, more specifically the “Restricted use of certain substances in foods” of A22.

In addition, the types of products for which Korean products are frequently rejected by SPS measures are regulatory provisions related to product labeling and packaging. Among Korean products rejected for customs clearance by China in 2015, reason for rejecting fruit juice in processed foods is “label failure”, and according to the UNCTAD rules, this is the “labeling, marking and packaging standard”. In summary, when analyzing each case of SPS measures, the most common ones were listed in

order of labeling/packaging errors, failure to comply with sanitary standards, dissatisfaction of ingredient regulation and lack of required documents.

TBT measures

On the other hand, TBT, another type of technical measure, shows lower non-tariff measures than SPS in Korean exports as a whole. This seems to be due to the inclusion of processed foods and aquatic products, which show a lot of refusal cases of customs clearance through non-tariff measures in the food items, so that correspond to SPS measures. However, TBT cases are shown in the refusal of medical devices and pharmaceuticals. Likewise, TBT cases can also be found mostly in the labeling/packaging type cases. In the case of Korean contact lenses rejected in the US in 2015, the reason for the refusal was “not adequately used”. This is interpreted as a failure to comply with the US drug and medical device labeling provisions, as it would be appropriate for labeling purposes, and in accordance with the UNCTAD classification, it is a breach of the B3 regulations and was therefore denied clearance.

In the case of TBT, cases of noncompliance with product related standards are also frequently found. According to the case of ‘a preventive protection system’ that has been rejected by the US in 2015, this case is described as “the drug is not provided as prescribed by the manufacturer’s registration law”, so this is the case of the breach of the B8 of “Conformity assessment related to TBT” in UNCTAD classification. Likewise, by analyzing the number of TBT measures by type, customs clearance cases occurred in the order of labeling, non-conformity of product standards, inadequacy of required documents, and regulation of product ingredients.

Finally, the analysis of the two measures by country shows that the highest SPS and TBT measures have occurred in the US in comparison with other countries. This shows that the most active non-tariff measures by the US are applied to Korean exports. Next to the US, non-tariff measures are being implemented in China, followed by Japan. In Hong Kong and Vietnam, there are few non-tariff measures compared to other major trading partners, indicating that the trade barriers between Hong Kong, Vietnam and Korea are lower than those of the US, China and Japan.

3.4. Regression Analysis

3.4.1. Variables

Dependent Variable

The dependent variable set in this paper is the export volume that South Korea has exported to each trading partner. This paper will utilize the data calculated by UN Comtrade, which provides data sets related to each product summarized by HS Code so this study will use this data set to calculate the export volume that Korea has exported to 30 major trading partners from 2002 to 2015.

Independent Variables

In addition to GDP and distance, which are basically used to the explanatory variables in the gravity model, NTB index, the number of SPS and TBT measures are set into the independent variables as well. GDP and distance data are from Cepii gravity data set. NTB index is calculated using Fraser Institute.

Dummy Variables

Data to use for dummy variables include tariff barriers, year and partner. In the case of tariff barriers, as mentioned earlier, rather than using numerical data, whether the two countries are in the relation of RTA will be considered. Dummy variable parts will also deal with country and year to control the specificity of each variable.

Dummy on RTAs

The two countries have concluded an RTA, set as 1, otherwise 0.

Dummy on YEAR

Each YEAR from 2002 to 2015 is separated into dummy variables to control the specific effect of economic circumstance on non-tariff barriers.

Dummy on PARTNER

Each PARTNER from Argentina to Vietnam (30 countries) is separated into dummy variables.

[Table 5] Summary of Variables

Variables	Explanation	Source
EXPORT	South Korean Export Volume	UN Comtrade[6]
NTB	Non-Tariff Barriers Index	Fraser Institute[7]
SPS	SPS measures to Korean products	WTO I-TIP[8], KITA[9]
TBT	TBT measures to Korean products	WTO I-TIP, KITA
GDP	GDP growth (%)	Cepii[10]
DIS	Distance between two countries	Cepii
DUMMY	Dummy variables on EXPORT	
RTA	RTA to measure tariff barriers	WTO I-TIP
YEAR	YEAR dummy variable	
PARTNER	PARTNER dummy variable	

[6] UNcomtrade: https://comtrade.un.org/data/

[7] Economic Freedom: https://www.fraserinstitute.org/studies/economic-freedom

[8] I-TIP: http://i-tip.wto.org/goods/default.aspx?language=en

[9] KITA: http://www.tradenavi.or.kr/CmsWeb/viewPage.req?idx=PG0000001711#none

[10] Cepii: http://cepii.fr/

3.4.2. Hypothesis Testing

Testing on multicollinearity among the independent variables

To summarize the discussion until now, this paper analyzes factors affecting bilateral trade, focusing on non-tariff measures. However, it is necessary to check whether there is multicollinearity among the independent variables by analyzing the correlation between the variables fundamentally. This is because the correlation between the independent variables and the dependent variables is less accurate under multicollinearity condition. Therefore, in the next [Table 6], VIF is used to confirm it related to the basic parameters of gravity model (GDP and distance), NTB, and RTA. In general, if the VIF is more than 10 or the mean VIF is excessively larger than 1, multicollinearity may be suspected. However, as can be seen in the following table, there is no doubt about it.

[Table 6] Multicollinearity among variables

VARIABLE	VIF	1/VIF
NTB	1.08	0.9244
DIS	1.06	0.9412
GDP	1.04	0.9599
RTA	1.04	0.9639
Mean VIF	1.06	

Hypothesis groups

The tariff barriers are much lowered due to the RTA conclusion, but international trade is still affected by the border effect under new protectionism, so assuming that the cause of this decreasing global trade phenomenon is increasing non-tariff measures, the regression analysis with six models are conducted as follows.

[Model 1] H0: Higher NTB does not result in a decrease in export, which implies that the increasing NTB is irrelevant to exports.

H1: Higher NTB leads to a decrease in exports, while NTB has a negative correlation with exports.

[Model 2] H0: For countries that have signed in RTA with Korea, which means there exists tariff barriers, higher NTB does not result in a decrease in exports.

H1: For countries that have signed in RTA with Korea, which means there exists tariff barriers, higher NTB leads to a decrease in exports.

[Model 3] H0: Considering YEAR dummy, higher NTB does not result in a decrease in exports when the partner country signed in RTA with Korea.

H1: Considering YEAR dummy, higher NTB results in a decrease in exports when the partner country signed in RTA with Korea.

[Model 4][11] H0: Considering YEAR and PARTNER dummy, higher NTB does not result in a decrease in steel exports when the partner country signed in RTA with Korea.

H1: Considering YEAR and PARTNER dummy, higher NTB results in a decrease in steel exports when the partner country signed in RTA with Korea

[11] This model was conducted under panel fixed model.

[Model 5] H0: Considering YEAR and PARTNER dummy, higher SPS does not result in a decrease in exports when the partner country signed in RTA with Korea.

H1: Considering YEAR and PARTNER dummy, higher SPS results in a decrease in exports when the partner country signed in RTA with Korea.

[Model 6] H0: Considering YEAR and PARTNER dummy, higher SPS and TBT do not result in a decrease in exports when the partner country signed in RTA with Korea.

H1: Considering YEAR and PARTNER dummy, higher SPS and TBT result in a decrease in exports when the partner country signed in RTA with Korea.

3.4.3. Empirical Results

First, the empirical analysis is to be conducted using the multiplied GDP by the two countries (Korea and the partner) and the distance between them, which are the basic variables of the gravity model. As can be seen from the formula of the gravity model, GDP is expected to appear in the positive direction but the distance will act in the negative direction. Therefore, refer to the [Table 7] below, if GDP increases, the export volume will increase but the distance is inversely proportional to the export amount.

[Table 7] Regression result: basic gravity model

DEPENDENT VARIABLE: EXPORT

INDEPENDENT VARIABLES	**Coefficient (std. error)**
GDP	0.616*** (0.073)
DIS	-1.307*** (0.067)
CONSTANT	-3.079 (3.973)
R-SQUARED	0.4983
OBSERVATIONS	420
F-STATISTICS	141.88
PROB(F-STATISTICS)	0.0000

* p<0.1, ** p<0.05, *** p<0.01

Now, the results of the regression analysis of the six models are listed as follows. First, the relationship of NTB with the total exports of all countries can be seen in [Table 8] below.

According to the [Table 8], since the NTB coefficient is negative in processed food and steel exports to all countries, the non-tariff barriers index shows a negative correlation with exports at 1% significance level. This is consistent with the main assumption of this paper that various non-tariff barriers have a negative influence on global trade market. Also, GDP growth and distance coincide with assumptions of the basic gravity model because they show positive (+) and negative (-) correlation with exports respectively.

The model 2 is the regression result conducted for the effects of RTA on Korean exports by adding another variable, RTA. As expected, RTA is positively correlated with total exports from all countries. However, despite in the case of countries concluded RTA, NTB also adversely affects exports from Korea. This can be shown from the second column of the [Table 8], which presents negative coefficient of NTB. Therefore, considering the

hypothesis, it can be concluded that the impact of non-tariff barriers is still valid even after the RTA.

Next, the third column of the regression result considering YEAR dummy variables but YEAR variables are omitted in the table. Interestingly, YEAR dummies are statistically significant from 2007, when the global financial crisis has begun. Also, as YEAR passes from 2002, the coefficients of YEAR variables are getting higher. Therefore, non-tariff barriers have been intensified as time goes by and after financial crisis when developed countries including the US suffered from domestic economic recession. As can be expected, NTB is negatively correlated with steel and processed food exports. Meanwhile, RTA is still showing positive coefficient, which implies it positively affects to international trade. However, even if the two countries are signed in RTA, from the table, it can be concluded that the impact of non-tariff barriers is valid on international trade. Considering remaining variables, GDP and DIS are positively and negatively correlated with exports respectively, following the basic assumption of the gravity model as well.

Next analysis is to analyze correlation between NTB and exports considering YEAR and PARTNER dummy variable. The most important thing is that this regression was conducted under panel fixed model. During regression analysis, there are several countries which show statistically significant features and this is the case for most emerging countries.

Again, [Table 8] shows the regression result of correlation between exports and non-tariff barriers considering YEAR and PARTNER dummy variables. Still, NTB shows negative coefficient with exports but one more thing to carefully consider is which countries are in the case of this negative effect of NTB on exports. From the regression analysis, most of the emerging economies, especially ASEAN countries are in this case. Under 1% significant level, most of the Southeast Asian countries are statistically significant, which include India, Indonesia, Malaysia, Philippines and Vietnam. And most of the advanced countries are located outside of the significant level. For example, despite the high level of NTB index or the number of SPS and TBT measures by the US, the US is not included in the case of significant group.

[Table 8] Regression result: [Model 1]~[Model 4]

DEPENDENT VARIABLE: EXPORT

INDEPENDENT VARIABLES	Model 1	Model 2	Model 3	Model 4
GDP	0.592*** (0.067)	0.573*** (0.065)	0.503*** (0.061)	1.112*** (0.089)
DIS	-1.238*** (0.066)	-1.262*** (0.064)	-1.268*** (0.064)	Omitted
NTB	-0.184*** (0.067)	-0.200*** (0.067)	-0.197*** (0.072)	-0.118* (0.059)
RTA	-	0.460*** (0.147)	0.372** (0.181)	-0.177 (0.239)
YEAR	-	-	INCLUDED	INCLUDED
PARTNER	-	-	NOT INCLUDED	INCLUDED
CONSTANT	-1.221 (3.492)	0.038 (3.427)	2.961 (3.435)	-41.133*** (4.919)
R-SQUARED	0.4983	0.5082	0.5355	Within=0.3382 Between=0.2297 Overall=0.2458
OBSERVATIONS	420	420	420	420
F-STATISTICS	141.88	118.07	39.55	65.91
PROB(F-STATISTICS)	0.0000	0.0000	0.0000	0.0000

* p<0.1, ** p<0.05, *** p<0.01

Now, before the analysis of SPS and TBT, multicollinearity test is conducted again with variables of SPS and TBT. Similarly, there is no doubt about multicollinearity within explanatory variables according to the following [Table 9].

[Table 9] Multicollinearity among variables_2

VARIABLE	VIF	1/VIF
GDP	1.15	0.8673
TBT	1.15	0.8720
SPS	1.09	0.9134
RTA	1.05	0.9528
DIS	1.04	0.9655
Mean VIF	1.10	

[Table 10] shows the result of analyzing the effects of SPS measures on exports considering YEAR and PARTNER dummies. Firstly, although RTA variable is showing low statistical significance in both models, it has a negative relation with exports as can be seen in the table. However, the coefficient of SPS is negative so that SPS negatively affects to exports on Korean products. Interestingly, given PARTNER dummy, most of the countries are showing statistically significant features, and especially, except Japan, China, the US, Vietnam, which are in the top exporting markets of

Korea are all in the statistical significant group. This implies that Korean exporting markets are highly related to SPS technical barriers. Considering other variables like GDP and DIS are showing also the same correlation with exports but in this case, RTA does not show any relation to exports compared to SPS.

Finally, a regression analysis of impact of SPS and TBT measures on exports is in the following table, considering all of the variables, RTA, YEAR, PARTNER dummy for all countries. In this case, only SPS measures are showing negative coefficient, but do not consider TBT and RTA because they are not statistically significant. Here, TBT variable is also showing negative coefficient, though. Considering YEAR dummy, also after 2007, data are in the significant level and most of the countries, including top major trading partners like the US, China and Vietnam are in the significant level, too. In the [Figure 4] and [Figure 5], it can be confirmed that except the US, most of the countries have been showing SPS more than TBT so far, therefore, this result could be obtained that SPS has more negative effects than TBT on Korean exports so far.

[Table 10] Regression result: [Model 5]~[Model 6]

DEPENDENT VARIABLE: EXPORT

INDEPENDENT VARIABLES	Model 5	Model 6
GDP	0.588*** (0.175)	0.585*** (0.174)
DIS	-1.270*** (0.156)	-1.277*** (0.156)
SPS	-0.012** (0.006)	-0.011** (0.005)
TBT	-	-0.009 (0.008)
RTA	-0.137 (0.169)	-0.136 (0.169)
YEAR	INCLUDED	INCLUDED
PARTNER	INCLUDED	INCLUDED
CONSTANT	-3.666 (10.693)	-3.430 (10.632)
R-SQUARED	0.7872	0.7874
OBSERVATIONS	420	420
F-STATISTICS	210.86	196.06
PROB(F-STATISTICS)	0.0000	0.0000

* p<0.1, ** p<0.05, *** p<0.01

3.5. Implications

Based on the results of six regression models, the result consistently shows that border effects, especially non-tariff barriers, which are the main analysis subject in this paper, have a negative correlation with exports. First, regression analysis based on the basic parameters of the gravity model shows that the higher the GDP and the closer the distance is, the more the trade volume between the two countries increases. In addition, when examining the overall NTBs index of a country, it can be considered that the higher the index, the more negatively the exports are affected. As for regardless of concluding RTAs that affects tariff barriers, NTMs are still influential even in countries that have concluded an RTA, which means that the solution to resolve non-tariff measures should be prepared to overcome the border effect in the future.

Considering the YEAR dummy, meanwhile, after 2007, when the global financial crisis began to occur, more non-tariff barriers were applied and affected to the international trade, more exactly to Korean exports. That's because from the financial crisis and global economic recession, Korean exports have been adversely affected, which implies that Korean trade is quite vulnerable to global economic situation.

Moreover, given PARTNER dummy, non-tariff barriers from most

of the top Korean export markets are negatively affecting Korean exports according to the regression results. This is a meaningful interpretation that Korean export markets are highly concentrated on several certain markets and one more thing to consider is ASEAN countries. From the [Model 4], most of the ASEAN countries are in the significant group and Korean exporting companies are planning to adventure into this market more in the future. This is problematic because as can be seen in the NTB index and [Figure 5], Asian countries are increasing their NTMs gradually in the recent years. The most important thing of these regression results is how NTMs negatively affects to Korean trade considering RTA, though. To sum up, NTMs are an adverse factor on Korean trade definitely and it might be more intensified in the future under new protectionism.

Also, in the above regression models, analysis on TBT is less than SPS but this is because TBT generally affects clearance of steel products but considering the steel exports from Korea, ordinarily trade remedies like anti-dumping and countervailing measures have been more applied to steel products rather than TBT so far, given the case of the US administration.

3.6. Limitation

First of all, this paper is limited in that the analysis considers only the exports of processed food and steel products. This is an analysis that reflects trends in Korean export items and recent customs clearance, but there is a limit in that the refusal of customs clearance related to medical devices or agricultural products is also increasing. Likewise, the NTB Index is a single figure of a wide range of non-tariff barriers related to countervailing duties and anti-dumping, including technical measures such as SPS and TBT. However, this kind of discussion is lack in this paper. In addition, the border effect also contains population, religion, or cultural differences in addition to tariff and non-tariff barriers but the regression analysis doesn't include those variables.

However, this paper examines the NTMs that have been less studied than the tariff and confirms that NTMs are diverse, so that despite RTA and free trade trend, NTMs have a negative impact on Korean exports. This is significant in that it is confirmed through empirical analysis.

4. Conclusion

The main thesis of this paper is the relation between the effects of non-tariff measures and Korean processed food and steel exports. Regression analysis confirmed that when NTMs are taken from developed and emerging countries, this leads to a decline in Korean exports. In addition, SPS measures are more than TBT, so far, but in the case of the US and China, currently their TBT measures cannot be ignored as well, which implies that Korean exporting companies should be aware of the regulations written in SPS and TBT agreements.

Furthermore, from the panel data analysis, data from 2002 to 2015 of 30 sampling countries that are major trading partners of Korea were used. Considering that Korean export market is concentrated, it is a meaningful analysis given that Korea will more enter into emerging markets including Southeast Asia in the future.

In conclusion, despite the trend of trade liberalization, the recent increasing NTMs obviously have a negative impact on export. Also, it can be expected that NTMs will serve as a limit to the expansion of international trade, so the solution to resolve the limitation of RTAs and further research about the effects on each NTM is needed in the future.

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APPENDIX A

[Detailed information about SPS and TBT classification]

Source: UNCTAD

SPS measures	
A1	Prohibitions/restrictions of imports for SPS reasons
A11	Temporary geographic prohibitions for SPS reasons
A12	Geographical restrictions on eligibility
A13	Systems approach
A14	Special authorization requirement for SPS reasons
A15	Registration requirements for importers
A2	Tolerance limits for residues and restricted use of substances
A21	Tolerance limits for residues of or contamination by certain substances
A22	Restricted use of certain substances in foods and feeds and their contact materials
A3	Labeling, marking and packaging requirements
A31	Labeling requirements
A32	Marking requirements
A33	Packaging requirements
A4	Hygienic requirements
A41	Microbiological criteria of the final product

A42	Hygienic practices during production
A5	Treatment for elimination of plant and animal pests and disease-causing organisms
A51	Cold/heat treatment
A52	Irradiation
A53	Fumigation
A6	Other requirements on production or post-production processes
A61	Plant-growth processes
A62	Animal-raising or -catching processes
A63	Food and feed processing
A64	Storage and transport conditions
A8	Conformity assessment related to SPS
A81	Product registration requirement
A82	Testing requirement
A83	Certification requirement
A84	Inspection requirement
A85	Traceability requirements
A851	Origin of materials and parts
A852	Processing history
A853	Distribution and location of products after delivery
A86	Quarantine requirement
TBT measures	
B1	Prohibitions/restrictions of imports for objectives set out in the TBT agreement
B11	Prohibition for TBT reasons
B14	Authorization requirement for TBT reasons

B15	Registration requirement for importers for TBT reasons
B2	Tolerance limits for residues and restricted use of substances
B21	Tolerance limits for residues of or contamination by certain substances
B22	Restricted use of certain substances
B3	Labeling, marking and packaging requirements
B31	Labeling requirements
B32	Marking requirements
B33	Packaging requirements
B4	Production or post-production requirements
B41	TBT regulations on production processes
B42	TBT regulations on transport and storage
B6	Product identity requirement
B7	Product-quality or -performance requirement
B8	Conformity assessment related to TBT
B81	Product registration requirement
B82	Testing requirement
B83	Certification requirement
B84	Inspection requirement
B85	Traceability requirements
B851	Origin of materials and parts
B852	Processing history
B853	Distribution and location of products after delivery

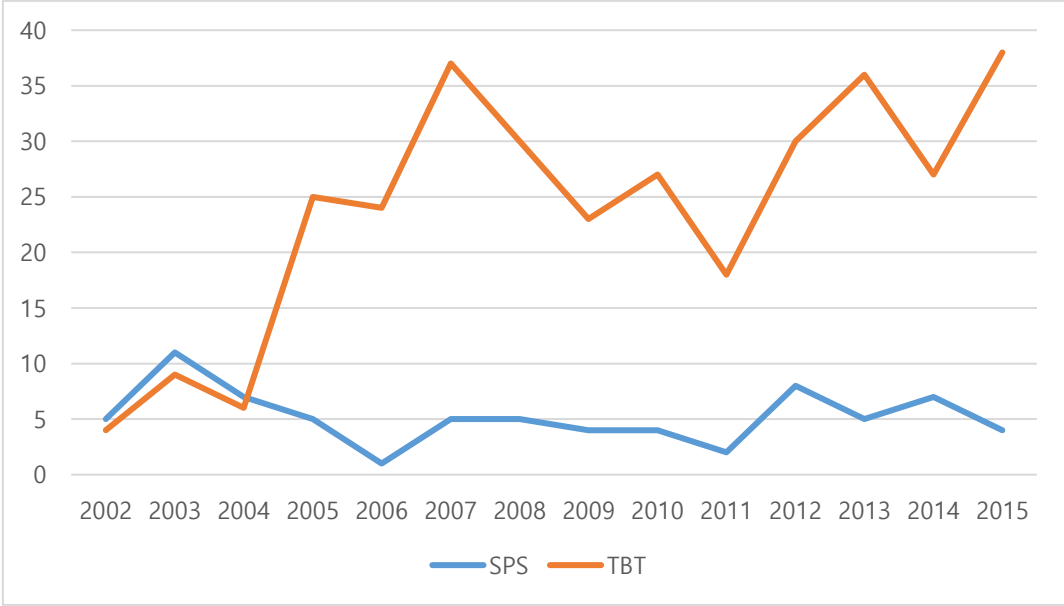
APPENDIX B

[Additional Figure: Detailed data on SPS and TBT measures]

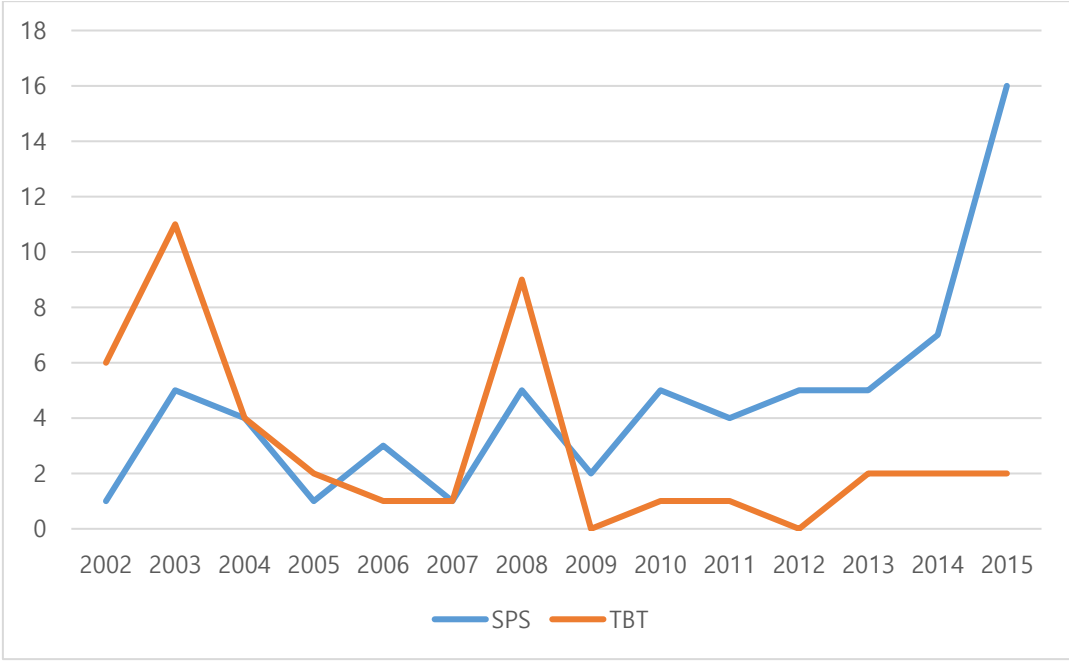
Source: I-TIP of WTO

Developed countries

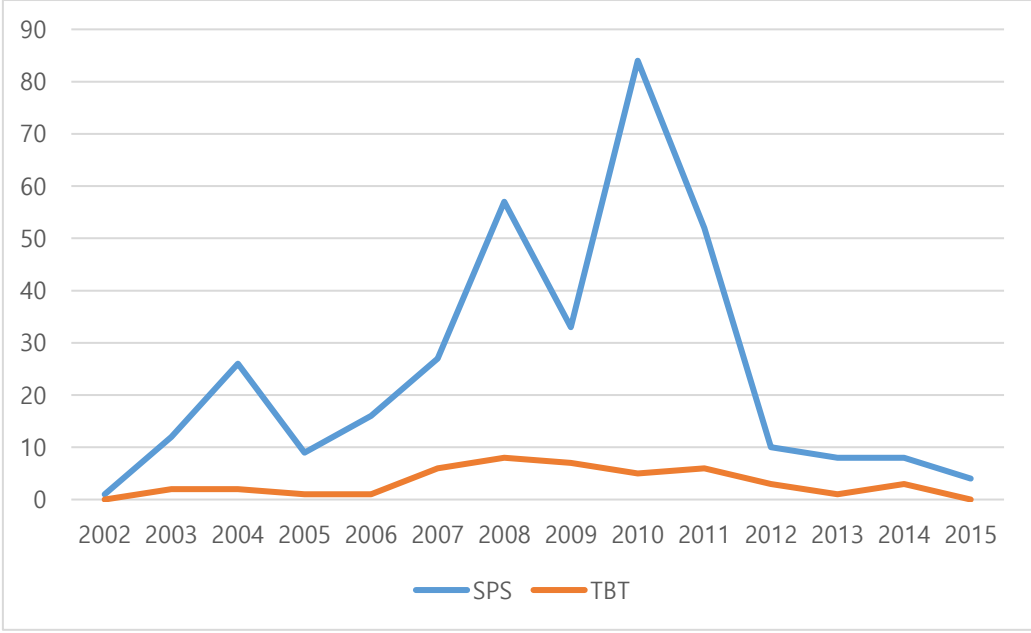
the US



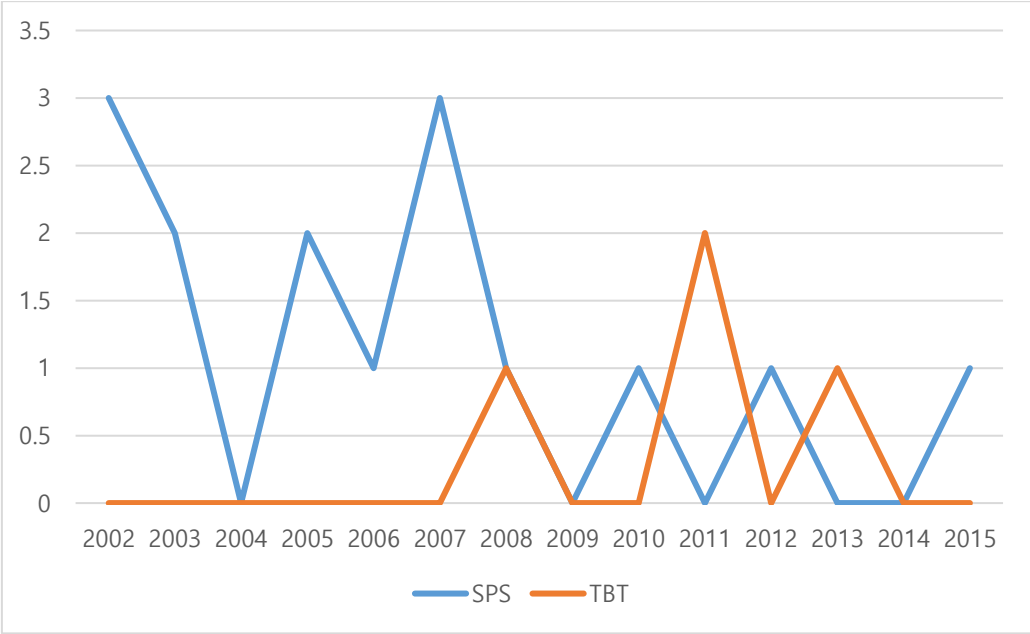
Japan



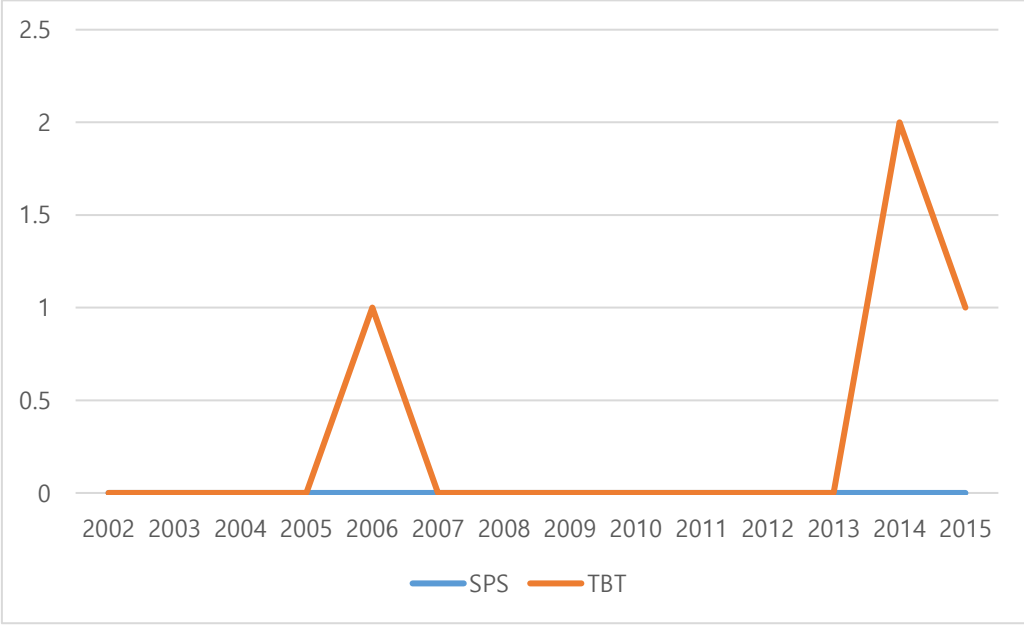
Canada



Australia

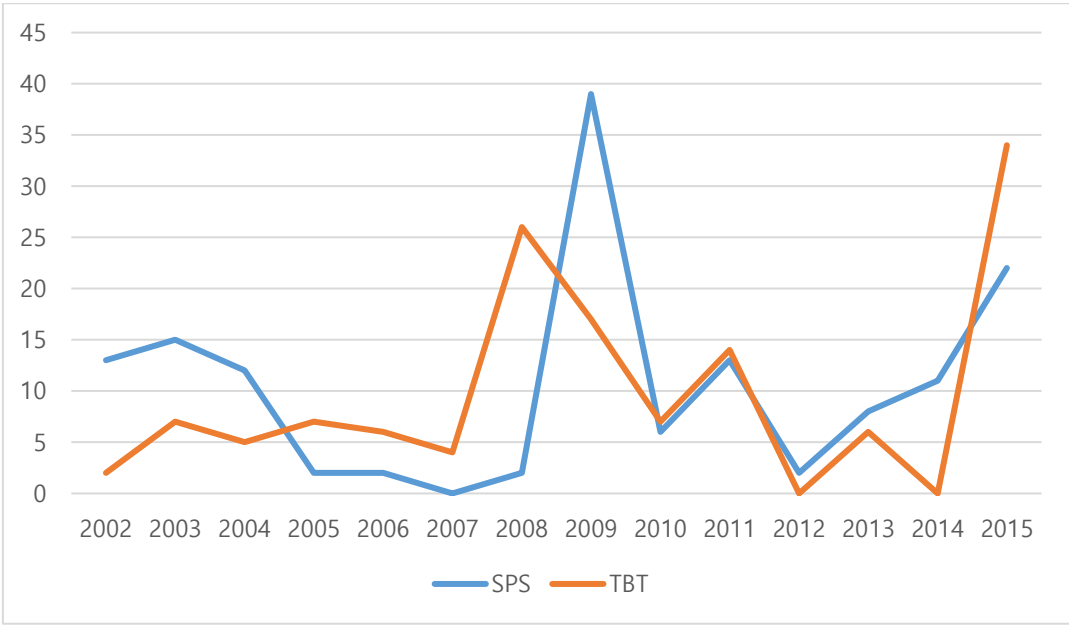


United Kingdom

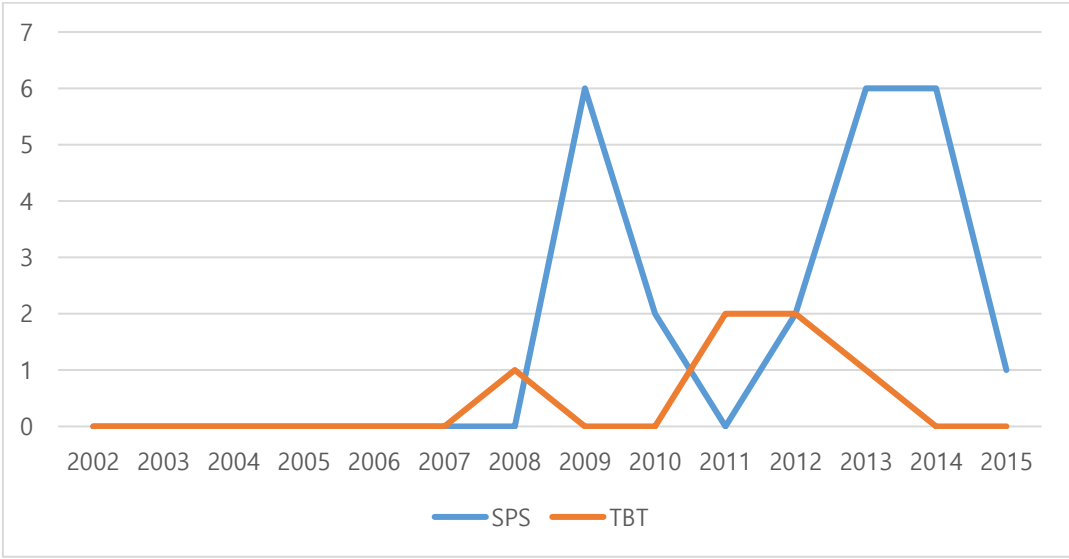


Emerging countries

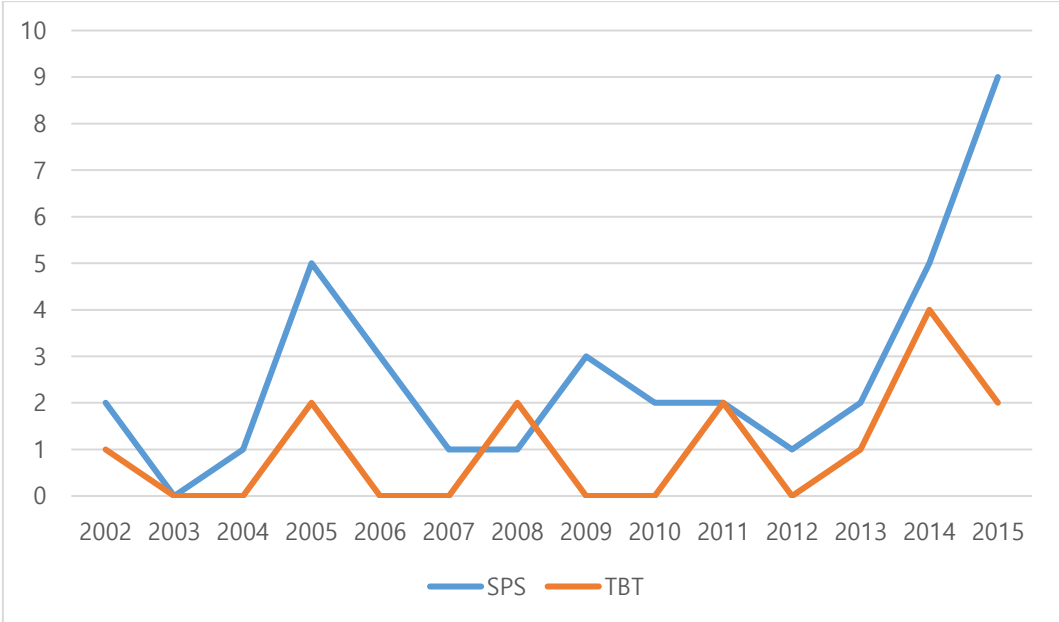
China



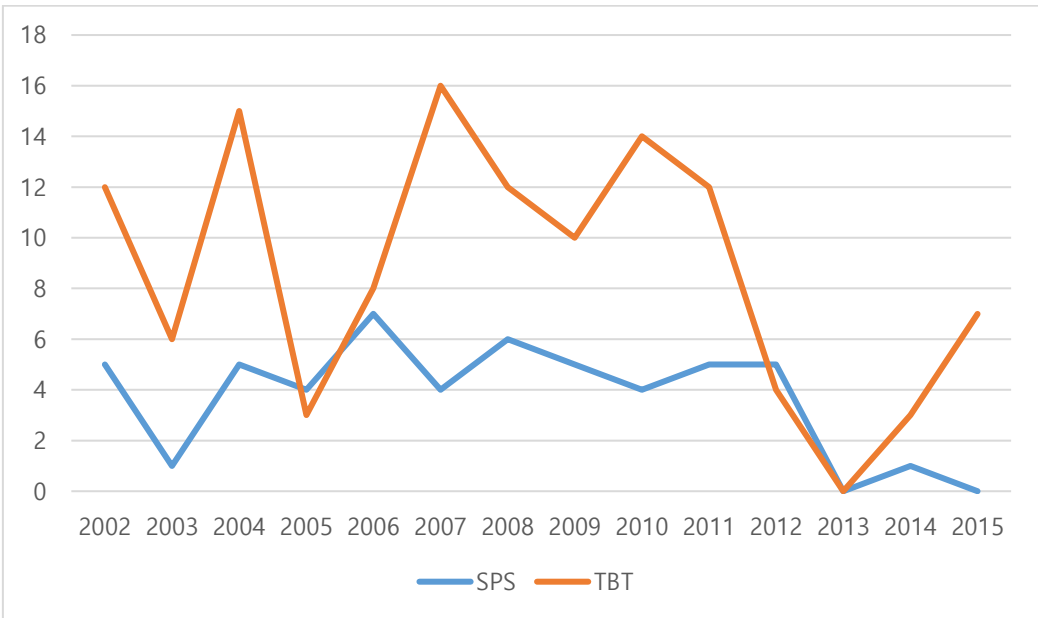
Vietnam



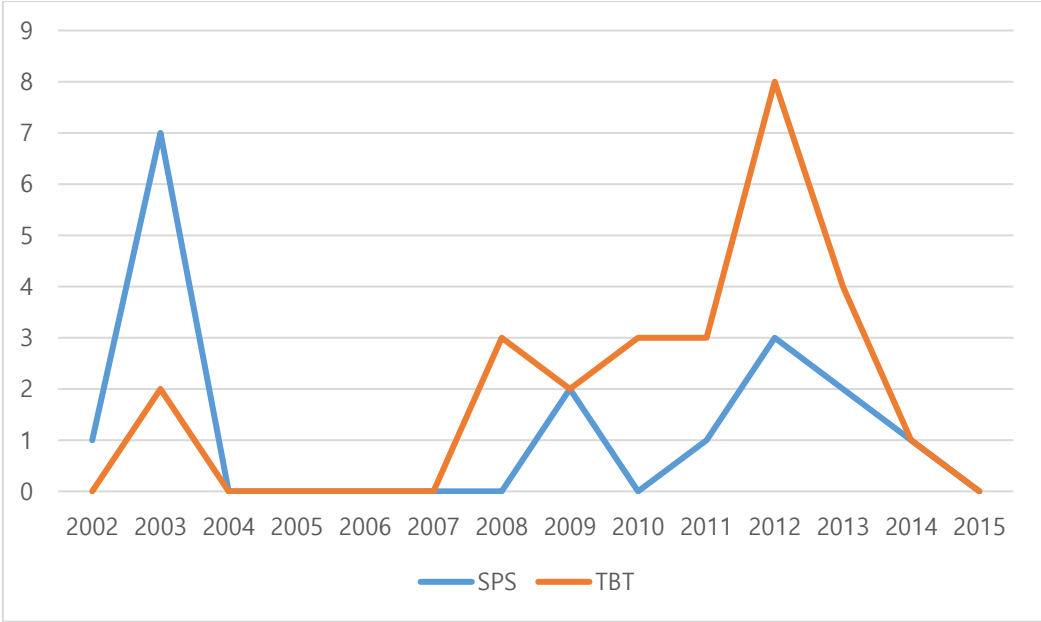
Taiwan



Thailand



Mexico

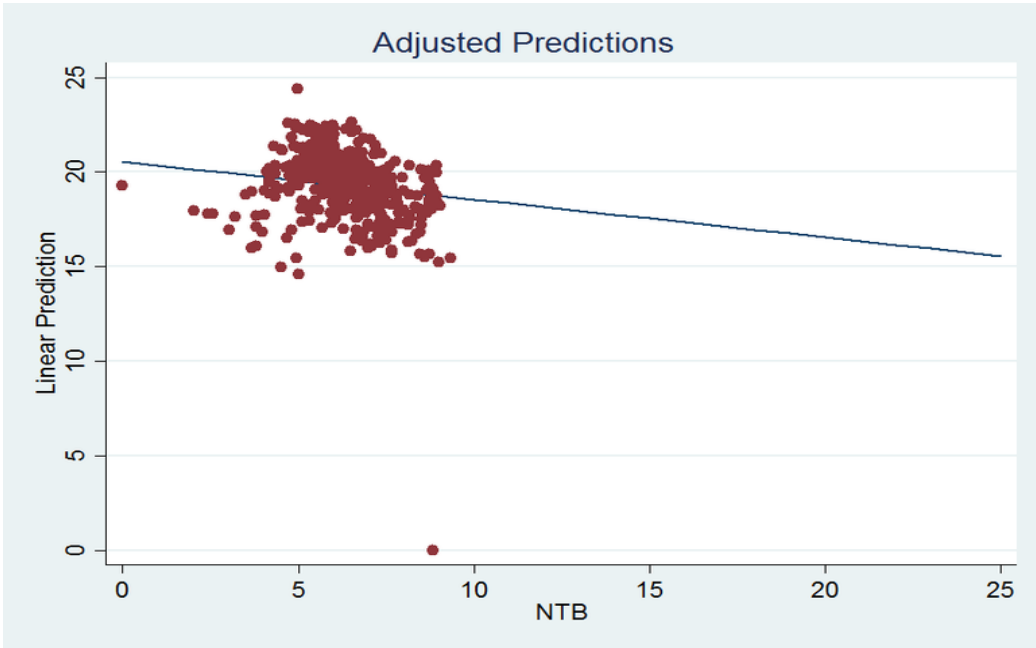

9
8
7
6
5
4
3
2
1
0
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015
SPS
TBT

APPENDIX C

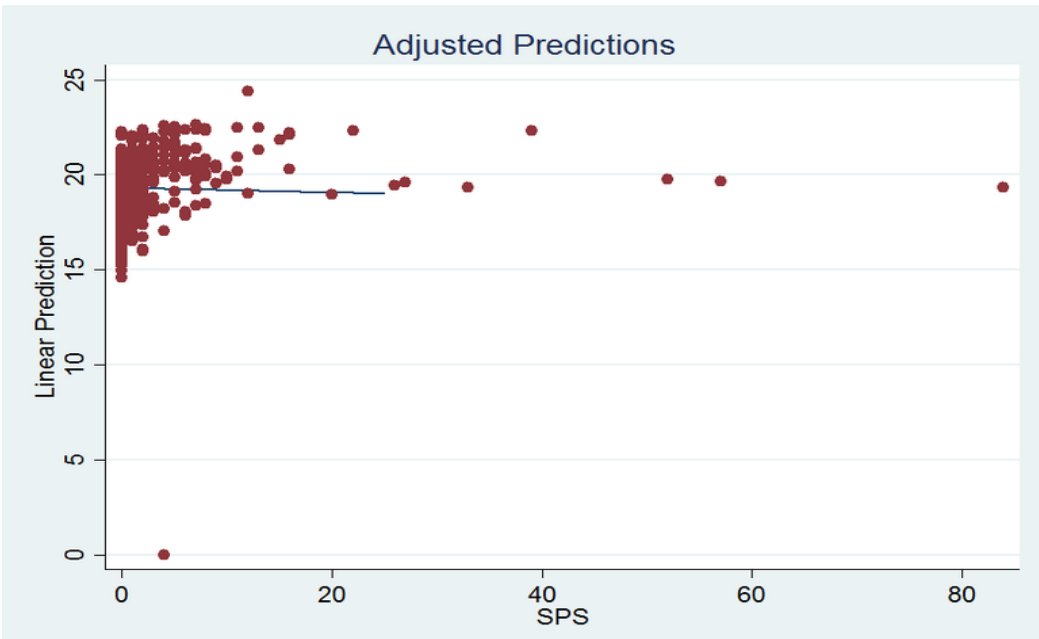
[Testing on the assumptions of multiple regression analysis]

Here, OLS graphs of main panel data analysis conducted at the Section 3 are attached in order to clearly show the correlation between exports and non-tariff barriers. These are scatter plots using STATA program. Since this regression analysis was a multiple regression analysis, other variables were fixed to the sample mean to show the relationship between the NTB (Non-tariff barriers) index, the SPS and TBT measures and the dependent variable, export volume. In other words, the purpose of this study was to investigate the patterns of export volume by NTB, SPS and TBT measures. The following OLS graphs show that the NTB index, which includes various NTMs in general, obviously has a negative correlation with exports.

[Model 2]



[Model 5]



Chow Testing

In order to determine whether year variable has influence on changes in effect of non-tariff barriers on exports, chow testing has been conducted. In this test, the base year is 2007, when the global financial crisis has started. Therefore, the whole sample period can be divided into two periods based on 2007 as follows, and regression analysis can be conducted like two equations below. Here, equation of [Model 2] is used for testing and by using the Chow formula below the equations, chow testing was conducted.

$$\ln(\mathrm{EXPORT^k_{ijt}}) = \alpha + \beta_1(\mathrm{NTB_{jt}}) + \beta_2 \ln(\mathrm{GDP_i} \cdot \mathrm{GDP_j})_t + \beta_3 \ln(\mathrm{DIS_{ij}}) + \beta_4(\mathrm{X_{ijt}}) + \epsilon_{ijt}$$

t=2002, 2003 ,..., 2006

$$\ln(\mathrm{EXPORT^k_{ijt}}) = \alpha + \beta_1(\mathrm{NTB_{jt}}) + \beta_2 \ln(\mathrm{GDP_i} \cdot \mathrm{GDP_j})_t + \beta_3 \ln(\mathrm{DIS_{ij}}) + \beta_4(\mathrm{X_{ijt}}) + \epsilon_{ijt}$$

t=2007, 2008, ..., 2015

$$\mathrm{Chow} = \frac{(\mathrm{S_c} - (\mathrm{S_1} + \mathrm{S_2}))/\mathrm{k}}{(\mathrm{S_1} + \mathrm{S_2})/(\mathrm{T_1} + \mathrm{T_2} - 2\mathrm{k})} \sim \mathrm{F}(k, T_1 + T_2 - 2k)$$

Hypothesis Set for Chow Testing

H0: Compared to before global financial crisis and after, there is no change in the effect of NTB on exports.

H1: Compared to before global financial crisis and after, there is change in the effect of NTB on exports.

The result is as follows through STATA program.

(1) dum_2007 = 0

(2) dum_NTB = 0

(3) dum_RTA = 0

F(3, 412) = 6.27

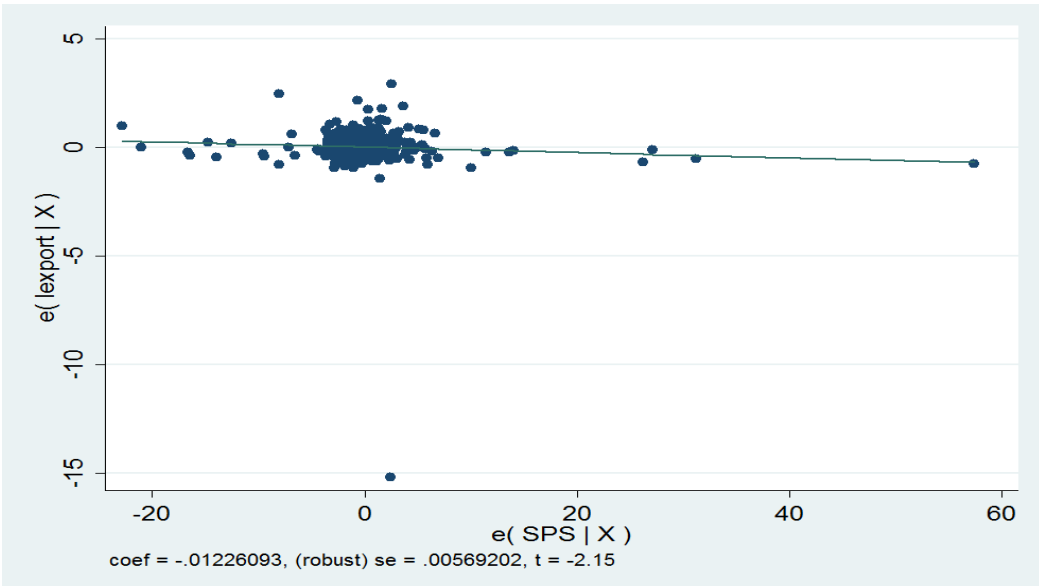
Prob > F = 0.0004

According to the result, H0 is rejected in 1% significance level. Therefore, it can be concluded that based on the global financial crisis year, this worldwide economic recession has influence on Korean exports and also the NTB effect had been intensified compared to before crisis.

Residual Analysis and heteroskedasticity

Now, for Model 5, through residual analysis, the compatibility of testing is conducted as follows. Below is the equation for Model 5.

$$\ln(\mathrm{EXPORT}^{k}_{ijt}) = \alpha + \beta_1(\mathrm{SPS}_{jt}) + \beta_2 \ln(\mathrm{GDP}_i \cdot \mathrm{GDP}_j)_t + \beta_3 \ln(\mathrm{DIS}_{ij}) + \beta_4(\mathrm{X}_{ijt}) + \epsilon_{ijt}$$



If assume the residual of EXPORT is $e(lexport \mid X)$ and that of SPS is $e(SPS \mid X)$, the coefficient is -0.012, which is exactly the same as the coefficient of the [Model 5] in Section 3.

Additionally, all the hypothesis testings conducted in this paper are using Robust testing, in order to avoid heteroskedasticity. There are several assumptions to test the multiple regression analysis more precisely and in the section 3, to avoid the multicollinearity, vif test was conducted among explanatory variables. It is obvious that the variance between residuals has to be equal among all the observations to make the regression more correctly. If there exists heteroskedasticity, this will affect the standard error of the coefficient of regression model, so adjusted standard error should be needed as alternatives. This adjusted standard error is called as robust standard error and all the testings conducted here in this paper are using robust standard error, which implies that these testings can be more credible results.

국문 초록

최근, 미국을 중심으로 한 선진국 국가들은 자국 소득 불평등 문제 및 불안정한 경제 상황에 대해 무역 흑자를 누리고 있는 신흥국과의 무역에 그 원인을 돌리려고 하였다. 1990년대 이후 무역 자유화가 도래함에 따라 WTO와 같은 국제기구가 출범하였으며, 2000년대에 이르러서는 여러 국가에서 FTA를 비롯한 다자 협정을 체결하게 되어 이로써 전세계 각국은 고관세 장벽을 통한 무역 규제를 더 이상 활용할 수 없게 되었다.

이러한 상황에서 선진국들은 그 범위가 넓고 종류가 다양한 비관세조치를 통한 무역 장벽을 이용하려고 하였다. 이 과정에서 한국산 철강 제품 역시 미국에 의한 무역 구제 조치의 대상이 되었으며, 한국의 수출 시장 및 수출 품목이 집중되어 있다는 점을 토대로 할 때, 수출 상위 2개국인 중국 및 미국에서 비관세조치를 시행한다면 수출에 부정적인 영향이 있을 것으로 예측된다.

따라서 본 논문에서는 현재 RTA 체결로 인해 관세 장벽이

완화되었음에도 불구하고 이러한 비관세조치 시행이 수출에 부정적인 영향을 미칠 수 있다는 점을 회귀 분석을 통해 밝혀내고자 하였다. 패널 데이터 분석에 앞서 국경 효과의 의미를 살펴보고, 비관세 및 관세 장벽, 그리고 지역무역협정에 관한 선행 연구를 검토하였다. 샘플 데이터는 2002년부터 2015년까지 한국과의 주요 교역 대상국 중 선진국 15개국, 신흥국 15개국을 선정하였다. 또한 수출 품목은 가공식품과 철강으로 한정해 보다 정밀한 실증분석 결과를 도출하고자 하였다. 6개의 모델로 진행한 실증 분석으로 RTA를 통한 무역자유화 기조에도 불구, 신 보호무역주의 하에서 비관세조치가 한국 수출 감소를 초래한다는 결론을 도출하였다.

주요어 : 국경효과, 비관세조치, 지역무역협정, 중력모형

학번 : 201731005