

# An Analysis of the Effect of Logistics Efficiency on the Export of Korean Agricultural Products to New Southern Countries

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## Abstract

**Purpose** – This paper analyzes the effect of the agricultural export market for Korea's new southern countries in consideration of logistics efficiency. In order to expand Korean agricultural exports, the logistics performance index, national income, per capita income, consumer price index, distance and FTA are included. Through empirical analysis, the impact of logistics efficiency on Korean agricultural exports is derived and measures are proposed to expand exports in the future.

**Design/methodology** – The analytical model of this study takes into account the import demand factors of the new southern countries for Korean agricultural exports. A research model was established based on prior research based on the gravity model, which is widely used in international trade effect analysis. In particular, logistics efficiency measures the effect on Korean agricultural exports using the logistics performance index and examines the effect by deriving factors for export expansion.

**Findings** – The main findings of this study can be summarized as follows: The higher the logistics efficiency of the new southern countries in exporting Korean agricultural products, the more directly they have an effect on expanding exports. In addition, it was analyzed that the expansion of Korean agricultural exports has a positive effect on the other countries' national income, per capita income, consumer price index, population, and FTA. Based on these results, the importance of efficient logistics management in agricultural exports has been emphasized.

**Originality/value** – There are not many studies on the export of agricultural products by logistics efficiency. However, prior studies that have adapted to manufacturing and other areas suggest that logistics efficiency has a direct effect on exports. This study suggests that Korean agricultural products are directly effective in exporting to new southern countries in terms of logistics efficiency. This can be an important time point in recognizing that logistics capabilities are important to ensure new books and the safety of agricultural products.

**Keywords:** Agricultural Product Export, Gravity Model, Logistic Performance Index (LPI), New Southern Policy

**JEL Classifications:** F10, F14, Q17

## 1. Introduction

The global economy has maintained steady growth, pushing for trade liberalization through the market opening, and Korea's trade volume has also grown rapidly. Recently, however, Korea's trade has faced new challenges due to the U.S.-China trade war and Japan's enforcement of export self-regulation. The new market is expected to have a significant impact on future changes in the environment of Korea's trade, as well as on the economy in

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the mid and long-term, as well as on social and cultural exchanges. New Southern countries are emerging as alternatives amid these economic changes.

The new southern country is an economic bloc that accounts for more than a quarter of the world's population, and its import market is expanding significantly with rapid economic growth. Exports of goods to the new southern region in 2018 amounted to \$1.7625 trillion, while imports amounted to \$1.8997 trillion, accounting for 9.03 percent of global exports and 9.70 percent of imports. The new southern country is an economic bloc that is rapidly emerging as a new "super consumer market" by expanding market size and improving income levels along with rapid economic growth.

At the Korea-Indonesia Business Forum in 2017, Korea promoted the New Southern Policy (NSP), which raised the level of cooperation with the new southern countries under the core concept of so-called "3P" such as people, peace and co-prosperity communities. The aim is to enhance relations with the new southern states like those of the four neighboring powers: The United States, China, Japan, and Russia. The seven countries in the new southern region are among the top 20 exporting countries in Korea. And five countries - Vietnam, India, Malaysia, Singapore and Thailand - whose global exports exceed \$200 billion, with Korea's top 20 export destinations.

On the other hand, research on the agricultural export market among the trade sectors with new southern countries, which are emerging as Korea's new market, is still insufficient. Reflecting the recent K-Food fever that has centered around the ASEAN region, the need for various studies to expand the Korean agricultural export market is being emphasized. Unlike other goods, agricultural products are recognized as areas directly affected by climate conditions, and logistics activities have a significant impact on the trade market. Many previous studies have shown that the nation's logistics efficiency has a significant impact on trade.

Under the circumstances in which strategic approaches to agricultural trade with the new southern countries are needed, it is thought that analyzing the impact of logistics efficiency of the new southern country on the trade of Korean agricultural products will provide meaningful implications.

In this study, we would like to analyze the determinants of Korea's overall exports to the new southern countries and the exports of agricultural products. And I would like to analyze the impact of the logistics performance index of the new southern countries on Korea's agricultural exports and suggest implications for expanding agricultural exports.

## 2. Empirical Framework and Hypothesis

### 2.1. Overview of New Southern Policy

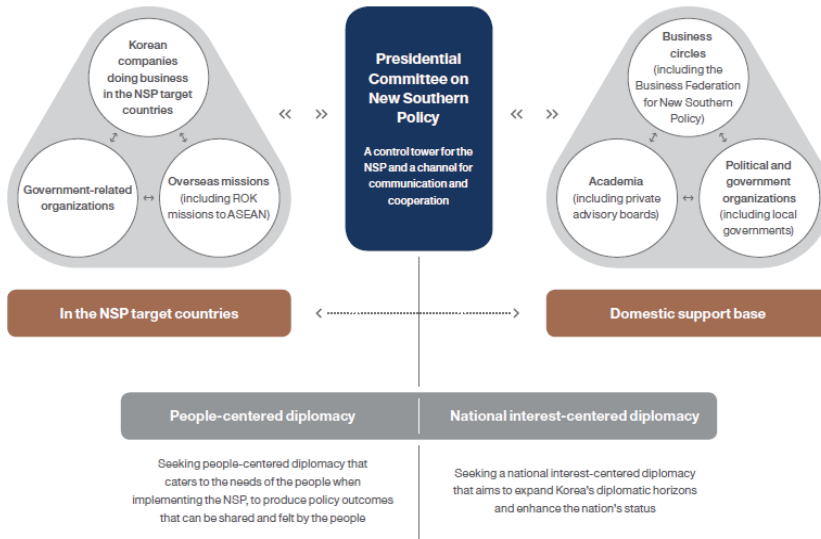
The "New Southern Policy" came from the "Korea-Indonesia Business Forum" on November 9, 2017, which aims to raise the level of cooperation to a similar level with the four powers around Korea, the United States, China, Japan and Russia, in a wide range of areas including politics, economy, society and culture. The biggest reason behind the new southern policy was the decrease in attractiveness to the Chinese market and the growing uncertainty caused by the trade dispute between the United States and China in the course of the changing global trade environment. ASEAN countries maintain diplomatic relations with South and North Korea at the same time, which has highlighted their importance as a cooperative zone as expectations have risen for their role as coordinators for maintaining peace on the Korean Peninsula in the future.

Through this policy promotion, Korea seeks to expand human exchanges, including technology, culture and art, away from commodity-oriented trade. And it is a policy that contains the determination to strengthen the necessary cooperation for ASEAN countries in such areas as transportation and energy, water resource management and smart information and communication.

The implementation of the New Southern Policy to realize the future community with Korea, ASEAN and India are expected to perform well in the long term, not only in the economic sector, but also in political and social aspects. The implementation of the New Southern Policy to achieve a win-win and prosperous community is aimed at laying the foundation for shared growth through expanding social and cultural exchanges beyond economic cooperation with ASEAN and India.

The detailed objectives of the policy are schematized in Fig. 1. The people's community aims to improve the quality of life by increasing two-way cultural exchanges, including the expansion of mutual visitors, and protecting mutual interests. The win-win prosperity community aims to establish a mutually beneficial and future-oriented foundation for win-win economic cooperation, creating an institutional basis for promoting trade and investment, and focusing on developing customized cooperative models for each country. In order to establish a peaceful and safe regional security environment, the peace community set a goal of strengthening cooperation for peace and prosperity on the Korean Peninsula and strengthening its ability to respond to emergencies in the region.

Fig. 1. Aim of the New Southern Policy



Source: Presidential Committee on New Southern Policy (2019).

## 2.2. Trade Status with New Southern Countries

The members of the new southern countries are 11 countries, including ASEAN and India. ASEAN is a union of countries of various economic sizes and is divided into four groups. In addition to high-income countries such as Singapore and Brunei, middle-income countries

such as Thailand and Malaysia, and low-income countries such as Vietnam, the Philippines and Indonesia, they are also classified as extremely poor countries such as Cambodia, Laos and Myanmar.

Looking at the status of the New Southern countries, ASEAN had a population of 667.28 million as of 2020, 8.56% of the world's population, especially India's population of 1.35 billion and 17.37% of the world's population. The new southern country is a large economic bloc, accounting for 25.93% of the world's population (see <Table. 1>).

**Table 1.** Economic Scale of the New Southern Countries

Country	Population (Million)	Square (km <sup>2</sup> )	GDP (Billion US\$)	Per Capita GDP (US\$)	Export (Million US\$)	Import (Million US\$)
India(A)	1,354.05	3,287,260	2,726.3	1,995	323,367	479,968
Brunei	0.43	5,770	13.6	33,589	6,501	4,099
Cambodia	16.71	181,040	24.6	1,410	12,368	19,560
Indonesia	273.52	1,913,580	1,042.2	3,773	180,209	188,673
A Laos	7.28	236,800	18.1	2,448	5,473	7,069
S Malaysia	32.37	330,350	354.3	10,851	247,299	217,420
E Myanmar	54.40	676,590	71.2	1,291	16,672	19,345
A Philippines	109.58	300,000	330.9	3,723	67,598	115,119
N Singapore	5.85	720	364.2	58,975	412,813	370,650
Thailand	69.80	513,120	505.0	6,947	249,757	247,528
Vietnam	97.34	331,230	244.9	2,423	240,470	230,244
Total of ASEAN(B)	667.28	4,489,200	2,969.0	12,543 (Average)	1,439,160	1,419,707
Total of New Southern States(C)	2,021.33	7,776,460	5,695.3	11,584 (Average)	1,762,527	1,899,675
Total of World(D)	7,794.80	510,072,000	86,926.6	-	19,522,259	19,587,304
Ratio(A/D)	17.37%	0.64%	3.14%	-	1.66%	2.45%
Ratio(B/D)	8.56%	0.88%	3.42%	-	7.37%	7.25%
Ratio(C/D)	25.93%	1.52%	6.55%	-	9.03%	9.70%

**Note :** Population - 2020, Square - 2016, GDP · Per Capita GDP · Export-Import – 2018 base.

**Source :** Ministry of Foreign Affairs ([www.mofa.go.kr](http://www.mofa.go.kr)), KOSIS(<http://kosis.kr/>), KITA (<http://stat.kita.net/stat/world/trade/>), IMF([www.imf.org/](http://www.imf.org/)).

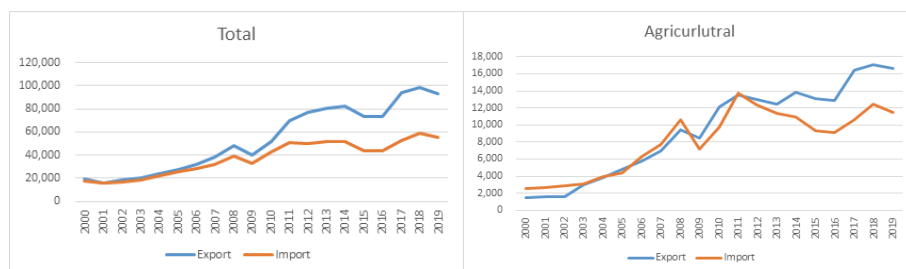
ASEAN's GDP is \$2,969 billion, accounting for 3.42% of the world's total GDP, while India's GDP is \$2,726.3 billion, accounting for 3.14% of the world's GDP. Countries belonging to the New Southern States account for 6.55% of global GDP, with an average per capita GDP of \$12,543. Compared with other emerging countries' groups, it is the most likely economic growth, and the market is expected to expand its consumer market as well as economic growth.

Total exports to the New Southern States rose 374% from \$19.7 billion in 2000 to \$93.6 billion in 2019. Agricultural exports rose 1,018% from \$1.49 billion in 2000 to \$16.6 billion in 2019. During the same period, total imports increased by 211%, but imported agricultural products increased by 354%. This means that new southern countries are attractive as new emerging markets. In particular, agricultural exports accounted for 7.5% of total exports in 2000, but increased by 10.3% to 17.8% in 2019. The share of agricultural imports in total

imports increased 6.6%p from 14.1% in 2000 to 20.7% in 2019. This is interpreted as a rapid increase in the share of agricultural trade in the total trade.

Fig. 2 shows the overall import and export trend from 2000 to 2019 and the import and export trend of agricultural products. As shown in the picture, overall exports and imports are increasing, but especially exports are increasing more than imports. In the case of agricultural exports and imports, export growth is more pronounced than imports. In particular, the gap between exports and imports has widened since the FTA took effect. In the case of agricultural exports, Korean agricultural exports are showing a greater increase than imports, except in 2007 and 2010.

**Fig. 2.** Trade Trend between Korea and the New Southern Countries



Source: KITA (<http://stat.kita.net>).

### 2.3. Literature Review

The subject of research on the economic effects of international trade is the development and presentation of quantified logistics-related indicators by applying various methods of survey. Using these indicators, studies have consistently been conducted to analyze the effects of reducing transportation costs, reducing trade costs by reducing customs clearance, and the economic effects of logistics efficiency. In particular, recent studies have focused on analyzing the impact of logistics efficiency to enhance export effects in new markets using gravity models.

With the global trade environment changing, the New Southern Policy was proposed in November 2017 to raise the level of cooperation in a wide range of areas such as politics, economy, society and culture with New Southern countries such as ASEAN and India. Emphasizing that the New Southern Policy is an important area for creating a new economic map of Korea, it also suggested the need to develop a new cooperative model by diversifying investment and trade concentrated in Vietnam to promote sustainable policies (Cho Dae-Hyun, 2019).

An analysis of trade status in the agricultural sector, along with the implementation of the New Southern Policy, suggested market diversification for agricultural exports to the ASEAN region in conjunction with the New Southern Policy (Hur Jang, 2018). And there is a study that revealed through analysis of export determinants with New Southern countries that the FTA is actually affecting the agricultural trade sector (Park Hyun-Hee and Cho Sung-Je, 2020). It is also suggested that a strategy to expand exports of high-end consumer goods is needed to grow into a core market for Korean companies through analysis of import structures in major countries in the New Southern region (Cho Eui-Yoon, 2020).

With the importance of logistics efficiency being emphasized to boost exports, Hoekman and Nicita (2008) used the Logistics Performance Index published by the World Bank to

analyze the impact of logistics on trade among countries around the world and suggested that logistics is the most influential variable in trade and that it can expand trade by improving logistics performance. Shepherd and Wilson (2009) presented an analysis of the impacts of logistics on trade in ASEAN countries. In particular, he suggested that the Trade Facilitation in international trade has greater meaning than the change in the tariff field, and suggested that the Trade Facilitation is more necessary to revitalize international trade

Duval and Utoktham (2010) suggested that improvements in logistics activities, such as improved customs clearance systems, improved transportation infrastructure, and reduced port costs, had the effect of improving the trade environment in international trade, and that improved logistics and improved logistics were important. Shepherd (2011) emphasized that the most important thing in Trade Facilitation is supply chain connectivity and that improving logistics performance has a significant impact on international production and trade. It also argued that improvement in logistics activities in developing countries is essential. Burmaoglu and Sesen (2011) emphasized that the role of international logistics is an important factor in determining trade competitiveness and suggested that it has a significant impact on the industrial competitiveness and efficiency of a country. It was also mentioned that logistics activities need to derive new competitiveness through infrastructure enhancement.

Gani (2017) suggested that the continuous growth in world trade depends on the efficiency of trade support structures such as logistics services. This paper explores the effect of logistics performance in international trade. The findings show that the overall logistics performance is positively and statistically significantly correlated with exports and imports. The analysis is also extended by investigating if logistics specificities mattered for international trade. Hausman, Lee and Subramanian (2013) presented the results of an analysis of the effect of measured indicators of logistics activities, such as time and cost used in supply chain management, on trade. Metrics of logistics activities were found to have a significant impact on mutual trade in 80 countries subject to analysis and the results of the study suggested that the volume of trade could increase through improved logistics activities. In addition, studies have shown that the development of various indicators to measure logistics activities reduces transportation costs and trade costs due to reduced customs clearance procedures (Liamo and Venable, 2001; Nordas and Piermartini, 2004).

An empirical analysis using the gravity model in international trade was presented by Tinbergen (1962) and is known to explain the actual trade patterns between countries. It is known that the actual trade form between countries is best suited to explain trade in industry. Empirical analyses of international trade using gravity models have been presented since Tinbergen (1962) by Helpman (1987), McCallum (1995), Anderson and Wincoop (2003). In agricultural trade, Grant and Lambert (2005) presented an empirical analysis of regionalism in world agricultural trade through the estimation of gravity models. In particular, the analysis of how regionalism agreements affect trade using the gravitational model suggests that they have a positive effect on agricultural trade through regional trade agreements. Analysis of agricultural trade using gravity models included Sevela (2002) with respect to the Czech Republic and Malhotra and Stoyanov (2008) with respect to Canada and Chile. Jagdambe and Kannan (2020) presented an analysis of the impact of the Free Trade Agreement between ASEAN and India on agricultural trade, suggesting that free trade agreements have a significant impact on the liberalization of agricultural trade.

In the case of Korea, the results of the study on the expansion of exports of wood and horticulture by item among agricultural products were presented, especially in the case of wood products, and the need to support export logistics costs was mentioned (Lim Jung-Bin,

An Dong-Whan and Sung Jae-Hoon, 2011). In addition, according to Park Hyun-Hee (2017), the signing of an FTA to enter the ASEAN market was confirmed to have a positive effect on agricultural exports, and Park Hyun-Hee and Cho Sung-Je (2020) suggested that the FTA, including the consumer price index, had a positive effect on agricultural exports to the new southern countries.

This study is an empirical analysis of the effect of logistics efficiency on agricultural trade in trade with new southern countries using gravity model. The contribution of this study is to derive that logistics efficiency is a positive factor for expanding agricultural trade and to suggest ways to improve the logistics structure in the future.

### 3. Empirical Methodology

#### 3.1. Gravity Equation and Empirical Model

The gravity model is a model applied to international trade theory, derived from Newton's physics theory that in physics, the forces that attract two objects to each other are proportional to the product of mass and inversely proportional to the square of the distance between two objects. The basic premise of the gravity model is that the volume of bilateral trade is proportional to the product of both countries' GDP and inversely proportional to the distance between the two countries, based on the assumption that the trade pattern between countries is determined by economic size and distance (Deardorff, 1998).

Gravity Model can be expressed as in expression (1) and the gravity ( $GF_{ij}$ ) between two objects ( $i$  and  $j$ ) is proportional to the mass ( $M_i$  and  $M_j$ ) of an object and inversely proportional to the distance ( $D_{ij}$ ).

$$GF_{ij} = \frac{M_i M_j}{D_{ij}}, \quad i \neq j \quad (1)$$

If logarithm is taken in equation (1), it becomes equation (2) and becomes a linear equation.

$$\ln GF_{ij} = \ln M_i + \ln M_j - \ln D_{ij}, \quad i \neq j \quad (2)$$

In international trade, the Gravity Model can be implemented by formula (2) and export ( $E_{ij}$ ) from Country  $i$  to Country  $j$  can be used on behalf of gravity ( $GF_{ij}$ ). Equation (3) can be obtained by modifying expression (2) using an alternative variable as a variable in place of mass ( $M$ ).

$$\ln E_{ij} = \alpha + \beta_1 \ln GDP_i + \beta_2 \ln GDP_j + \beta_3 \ln D_{ij} \quad (3)$$

$$\beta_1 > 0, \beta_2 > 0, \beta_3 < 0$$

Equation (3) is the application of GDP to formula (2) and the application of income that can theoretically be the most solid foundation as a variable that has a positive effect on trade. Distances ( $D$ ) from the other country are typical trade obstacles.

Since its introduction by Tinbergen (1962), the gravity model has begun to be applied to international trade theory, and Anderson (1979) has applied product differentiation to explain the existence of income variables in the Gravity Model, explaining the relationship between trade volume and the multiplication of income. Since then, gravity equations have

been applied in various ways to explain the phenomena of international trade by Helpman and Krugman (1985), Bergstrand (1985, 1989), Deardorff (1998).

Generally, the gravity model is an efficient model for explaining trade patterns between the two countries and predicting trade volume, but in this study, instead of two-way trade, we would like to set up and analyze export function formulas to see the impact of the logistics efficiency of importing countries on exports in Korea's agricultural exports to new southern countries.

In this study, we would like to analyze the impact of logistics efficiency of the new southern countries on our exports by using the logistics performance index. Korea's exports to the New Southern States have set up a model, believing that it depends on the other country's gross domestic product, per capita gross domestic product, consumer price index, distance from the other country, the population, FTA effectuation, and logistics performance index.

Among the 11 countries belonging to the new southern states, seven countries were subject to analysis except for four countries (Cambodia, Myanmar, Laos and Brunei), and the entire exports and agricultural exports to these countries were set as the period to be analyzed from 2007 to 2018. Each of the independent variables affecting Korea's exports was analyzed by taking a logarithm, and as a result, the coefficient value of each variable means elasticity.

In predicting export functions, the use of the elasticity approach is to derive changes in exports resulting from changes in prices or income, and the demand for goods depends on the price of the goods and is analyzed. The export function is to measure the direction and extent of changes in exports as these variables change by selecting variables that can affect exports in addition to prices or income.

In this study, equation (3) was applied to establish equation (4). Korea's overall exports ( $EXQ$ ) and agricultural exports ( $AGRIEXQ$ ) to the new southern states are affected by GDP of trading partners, GDP per capita ( $PGDP$ ), consumer price index ( $CPI$ ), distance from the other countries' capitals ( $DIST$ ), the population of other countries ( $POP$ ), FTA effectuation ( $FTA$ ), and logistics performance index ( $LPI$ ).

$$EXQ_i = \alpha_0 + \alpha_1 GDP + \alpha_2 PGDP + \alpha_3 CPI + \alpha_4 DIST + \alpha_5 POP + \alpha_6 FTA + \alpha_7 LPI + \varepsilon$$

$i = \text{total export volume, agriexport volume}$  (4)

Taking the logarithm of equation (4) means equation (5) and the coefficient value of each variable in the equation (5) means elasticity and the degree to which the change in that variable affects the change in exports.

$$\ln EXQ_i = \alpha_0 + \alpha_1 \ln GDP + \alpha_2 \ln PGDP + \alpha_3 \ln CPI + \alpha_4 \ln DIST + \alpha_5 \ln POP + \alpha_6 \ln FTA + \alpha_7 \ln LPI + \varepsilon$$

$\alpha_1 > 0, \alpha_2 > 0, \alpha_3 > 0, \alpha_4 < 0, \alpha_5 > 0, \alpha_6 > 0, \alpha_7 > 0$  (5)

In equation (5)  $\alpha_1$  and  $\alpha_2$ ,  $\alpha_5$  are variables that represent the size of the other country's market, and the larger the market size of the other country, the more Korea's exports can be expected to increase. Therefore, it is expected that the increase in the income ( $GDP$ ) and population ( $POP$ ) of trading partners will increase the demand for Korean exports, which will lead to an increase in exports, so we expect a positive sign. And  $\alpha_3$  expects positive signs as higher consumer price index ( $CPI$ ) in other countries is expected to have a relatively lower price effect on Korea's exports, which will increase exports.  $\alpha_4$  expects a negative effect on the assumption that the distance between Korea and each capital in the analyzed country may



increase trade costs and have a negative effect on trade. Since the FTA with its trading partners has eliminated trade barriers,  $\alpha_6$  expects positive signs for exports. And the logistics performance index (*LPI*)<sup>1</sup> can expect the higher the logistics efficiency of trading partners, the higher the nation's exports, so  $\alpha_7$  expects positive effects.

### 3.2. Data Structure

Among the variables used in the analysis of export determinants with New Southern countries, the total export (*EXQ*) and agricultural export (*AGRIEXQ*) were used by the Korea International Trade Association. The GDP and per capita GDP, which are used as income variables, are data obtained from the economic statistics system of the Bank of Korea and the National Statistical Portal System of the National Statistical Office.

The base year of the Consumer Price Index (*CPI*) is 2010, and the consumer price index of the other countries was used for analysis due to difficulties in obtaining the agricultural product consumer price index of the trading partner countries. The data were obtained using the National Statistical System of Korea. The FTA variables were analyzed by dividing them into the time when the FTA with Korea was signed and entered into effect. A value of '0' prior to the entry into force of the Agreement and '1' after entry into force were used as dummy variables.

The Logistics Performance Index (*LPI*), which means logistics efficiency, used data published every other year by the World Bank from 2007. It combines various factors, including logistics processes, infrastructure, and costs. These indicators do not only mean logistics performance, but also those are which can comprehensively measure logistics efficiency by country.

The descriptions and sources of the variables used in this study are summarized in Table 2.

**Table 2.** Variables used for Analysis

Variable	Description of the variable	Source of variable
EXQ (AGRIEXQ)	Total Export (Agricultural Product Export) Volume of Exporting Countries	KITA(www.kita.net)
GDP	GDP of Exporting Countries	National Statistical Office ( <a href="http://kosis.kr">http://kosis.kr</a> )
PGDP	Per capita GDP of exporting countries	
DIST	The Distance between the Capital of Korea and the Capital of the Exporting Countries	Distance Calculator ( <a href="https://distancecalculator.globefeed.com/Country_Distance_Calculator.asp">https://distancecalculator.globefeed.com/Country_Distance_Calculator.asp</a> )
POP	Population of Export Countries	National Statistical Office ( <a href="http://kosis.kr">http://kosis.kr</a> )
FTA	Free Trade Agreement with Korea (dummy variable)	FTA Homepage ( <a href="http://www.fta.go.kr">www.fta.go.kr</a> )
LPI	Logistics Performance Index	World Bank ( <a href="http://www.worldbank.com">www.worldbank.com</a> )

<sup>1</sup> The Logistics Performance Index is an interactive benchmarking tool created to help countries identify the challenges and opportunities they face in their performance on trade logistics and what they can do to improve their performance. The LPI consists therefore of both qualitative and quantitative measures and helps build profiles of logistics friendliness for these countries (<https://lpi.worldbank.org/about>)

## 4. Result of Empirical Analysis

### 4.1. Method of Analysis

The export function was established using gravity models to derive determinants affecting the export of agricultural products and to analyze the effects of logistics efficiency on exports in the trade of agricultural products between Korea and the New Southern States. For this purpose, we would like to analyze time series by country and cross-section data of seven countries in the New Southern Region. Panel analysis is a method that reflects both the characteristics of cross-section data and time-series data.

This method of analysis implies a lot of information and variability in variables, which results in an efficient estimate. In addition, the analysis results are evaluated as a useful method for analyzing the variation between cross-section observations over time, as the heterogeneity between cross-section observations can be taken into account.

Panel data provide both time series variation and variability between panel objects. This is estimated by Generalized Least Squares (GLS) as a way to efficiently control autocorrelation or hetero-scedasticity in a linear regression model because it can generate autocorrelation and hetero-scedasticity in the error term. In addition, when analyzing panel data, the basic model ( $Y = \alpha + \beta X + \mu_i + \varepsilon$ ) can be used as a model ( $Y = (\alpha + \mu_i) + \beta X + \xi$ ) in which the constant term varies depending on whether the error term ( $\mu_i$ ) is viewed as a fixed effect or a probability effect. The fixed effect model then interprets the constant term ( $\alpha + \mu_i$ ) as a fixed parameter for each panel object, and the probability effect model is a random sample from the population and becomes a probability variable that follows the probability distribution.

In particular, if the assumption of  $\text{cov}(X, \mu_i) = 0$  is established, the estimates of both the fixed-effect model and the probability-effect model are the consistent estimator. However, if  $\text{cov}(X, \mu_i) \neq 0$ , the estimate of the probability effect model is not a consistent estimator, so there is a systematic difference in the estimation results. In general, the hypothesis test for selecting an estimation model is the Hausman Test. In other words, it is suggested that if the assumption is made that the null covariance is zero ( $\text{cov}(X, \mu_i) = 0$ ), the probability effect model is more efficient, and if it is wrong, the fixed effect model is more efficient (Wooldridge, 2008).

The Hausman test is a test to estimate which model is appropriate between a fixed and random effect model, and is used to analyze whether there is a correlation between the explanatory variable and the individual effect disturbance term. Which model is more plausible depends, among other things, on the correlation between the individual effects and the independent variables; if there is a correlation between the individual effects and the independent variables, the fixed effect model is chosen and if there is no correlation, the random effect model is used (Kennedy, 2003, 302-312).

In this study, the export function was set and analyzed using Gravity Model to analyze the determinants of Korea's exports and agricultural exports to the new southern states. The logistics performance index was used to analyze the impact of logistics efficiency on exports, and the index is an objective indicator of logistics efficiency that the World Bank has measured logistics performance in 155 countries since 2007. The analysis is conducted in two directions. In the analysis of Model I, the dependent variable was analyzed as the total export of Korea to the new southern countries, and in the analysis of Model II, the dependent variable was set as the export of agricultural products to analyze the factors of the export decision.

## 4.2. Result

The logistics efficiency of Korea's agricultural exports was analyzed for new southern countries (Vietnam, Singapore, Malaysia, Indonesia, Thailand, the Philippines and India). The analysis period is from 2007 to 2018, and Table 3 summarizes the analysis results by dividing them into total exports and agricultural exports. The analysis was conducted in 2007 because the logistics performance index used as a proxy variable for logistics efficiency was published in 2007.

To summarize the results of the analysis of the overall export (*EXQ*), the analysis of the fixed effect model shows statistically significant results at 5% and 10% significance levels *PGDP* and *FTA*, respectively. On the other hand, the probability effect model shows that per capita GDP (*PGDP*), population (*POP*), and logistics efficiency (*LPI*) have significant effects at a significant level of 10%. And the Consumer Price Index (*CPI*) is significant at a 5% significant level, and the *FTA* is significant at a 1% significant level (see Model I).

The analysis results of variables affecting agricultural exports (*AGRIEXQ*) are as follows. For the fixed effect model, the consumer price index (*CPI*) shows a significant impact at a 1% significant level. On the other hand, the random effect model shows that the *GDP*, the *GDP* per capita (*PDGDP*) and the population (*POP*) have a statistically significant impact on agricultural exports at a significant level of 5%. The Consumer Price Index (*CPI*) shows significant results at a 1% significant level. And the logistics performance index (*LPI*), which is being used as a proxy variable for logistics efficiency, shows significant results at the 1% significant level, indicating that logistics efficiency plays a positive role in Korea's exports (see Model II).

To summarize the results of the export of agricultural products, the export of agricultural products shows statistically significant results only in the consumer price level of the trading partner country in the fixed effect model. In addition, the results of the probability effect model show that gross national product, per capita income, consumer price index and population have a positive impact on exports.

In particular, the analysis of the logistics performance index, which measures the logistics efficiency of trading partners, shows that the logistics efficiency of the exporting countries has a positive impact on exports. In particular, it was analyzed that strengthening logistics efficiency in agricultural exports, like the results presented in the preceding study, has positive effects such as reducing logistics costs and improving service speed. As a result, farmers and agricultural exporters related to agricultural exports can reduce distribution and logistics costs, and it can be interpreted as a significant influence on export market competitiveness by utilizing agricultural food price competitiveness to promote sales and increase sales.

The following is a summary of the estimated export decision model for Korea's exports to the New Southern States. The variables estimated in the model of probability effects show results similar to those expected. In particular, the analysis result that the higher the logistics efficiency of the trading partner country has a positive effect on the export of the exporting country shows similar results to the research by Lee Hong-Sik and Bang Ho Kyung (2009). However, the distance (*DIST*) variable, which is the basic variable of the traditional gravitational model, shows the expected signs in the estimated model for overall exports and agricultural exports, but is not statistically within the range of significant levels. Since agricultural products are highly affected by climate conditions, they are not particularly affected by distance from trading partners.

**Table 3.** Result of Analysis

	<u>Total EXQ</u>		<u>Agricultural EXQ</u>	
	<u>Model I</u>		<u>Model II</u>	
	FE	RE	FE	RE
lnGDP	-1.95 (-1.02)	-6.284 (-1.90)	0.268 (0.16)	9.537** (1.97)
lnPGDP	3.743** (1.95)	5.979* (1.82)	0.919 (0.56)	9.483** (1.98)
lnCPI	0.447 (1.30)	2.439** (8.42)	1.207*** (4.06)	3.032*** (7.16)
lnDIST	-	-0.276 (-1.49)	-	-0.300 (-1.10)
lnPOP	-1.565 (-0.79)	6.015* (1.84)	1.418 (0.83)	9.960** (2.08)
FTA	0.265* (1.65)	0.767*** (2.83)	-0.100 (-0.72)	0.262 (0.66)
lnLPI	0.039 (0.06)	1.489* (1.80)	0.516 (0.88)	5.334*** (4.41)
Constant	25.561 (1.73)	-36.503 (-1.61)	-20.723 (-1.62)	76.113** (2.30)
F(7,141)	33.01		117.86	
Wald Chi <sup>2</sup> (8)		85.56		153.62

Notes: 1. Legend \*\*\*:  $p < 0.01$ , \*\*:  $p < 0.05$ , \*:  $p < 0.1$ .

2. ( ) is t-value.

## 5. Conclusion

The global economy has consistently pursued the realization of borderless trade liberalization. To this end, the world economy has actively promoted globalization and localization, and is striving to lay the foundation for the economic growth of each country while actively utilizing free trade. Korea is also making various efforts to expand its export market under the global trade environment. But at a time when the recent US-China trade war and Japan's export regulations require a new breakthrough in expanding trade with Korea, the implementation of the New Southern Policy and New Northern Policy has emerged as strategies for a new trade environment.

These regions are economic blocs that can play important roles in various fields such as Korea's politics, economy and society in the future, and Korea will be able to lead growth in various areas other than economic growth by expanding exchanges and cooperation with these regions. Therefore, entry into the New Southern Region is recognized as a major trade strategy of Korea. In particular, the need for research on agricultural trade between Korea and the new southern states is increasing as the agricultural trade environment improves.

However agricultural products, unlike the characteristics of other goods, are areas where freshness and stability are perceived as the most important factors. The empirical analysis study on the impact of logistics efficiency on agricultural trade is expected to provide important implications. In this study, we analyzed the export function model using the

gravity model to see the determinants of Korea's total exports and agricultural exports to seven major southern countries from 2007 to 2018. Through this analysis, among the determinants for export expansion, the effect of logistics efficiency on trade was estimated.

In general, the Gravity Model is a research model that is widely used to analyze the trade patterns of international trade and is useful for analyzing the form of trade between countries within the same industry. In this study, to obtain determinants for export expansion in trade with new southern countries, variables that have statistically significant effects were derived by dividing them into the overall export sector and the agricultural export sector. Analysis results were derived through the panel analysis technique using a gravity model. The analysis results can be summarized as follows by separating the overall export and agricultural export sectors.

Based on the random effect model, the analysis of the entire export sector showed that the GDP per capita, the consumer price index (CPI), the population (POP), the FTA and the logistics performance index (LPI) had a significant impact on the export decision. In particular, logistics efficiency has a positive impact on exports, and the elasticity of logistics efficiency is 1.489. As a new emerging market, it is analyzed that logistics efficiency has a direct effect on exports as new southern countries have improved logistics infrastructure due to economic growth as well as increased national income based on the current rapid economic growth.

Based on the probability effect model, the analysis of agricultural exports shows that the GDP, the GDP per capita, the consumer price index (CPI), the population (POP) and the logistics performance index (LPI) have a significant impact on export decisions. In particular, logistics efficiency has a positive effect on exports, and the elasticity of logistics efficiency is 5.334. The results show that the elasticity of the logistics efficiency of agricultural products is greater than that of the overall export. The results show that agricultural exports are more dependent on logistics efficiency in other countries.

In particular, since logistics efficiency is a very important factor in securing freshness and safety of agricultural products due to the nature of agricultural products, it is meaningful to derive research results that prove that logistics efficiency has a direct effect on exports. In order to expand Korea's agricultural exports in the future, logistics efficiency of trading partners is an important factor, so it will be an important factor to identify the level of logistics efficiency of the other countries, select, develop, and advance into the market. And it is necessary to recognize the need for intensive investment development in building logistics infrastructure to improve logistics efficiency related to Korea's agricultural exports.

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