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# Analysis of Influencing Factors on Air Passenger and Cargo Transport between Korea, China and Japan

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## ABSTRACT

In this study, the main factors affecting the number of passengers and cargo volume transported by air between Korea, China and Japan over the past 20 years are to be identified. For the analysis, data from three countries' GDP and per capita as well as exchange rates and international oil prices were used, and OLS multiple regression analysis and fixed effect analysis were performed. As a result of the analysis, both the number of passengers and cargo volume transported by air showed a negative (-) direction for GDP, which represents the country's economic power, and a positive (+) direction, for per capita GDP, which represents income level. And the increase in the exchange rate between China and Japan acted in a positive (+) direction on the increase in the number of passengers, and the effect of oil prices was found to be limited.

**Key Words** : Number of Passengers(여객수), Cargo Volume(화물량), Affect Factor(영향 요인), OLS Multiple Regression Analysis(OLS 다중회귀분석), Fixed Effect Analysis(고정효과분석)

## I. INTRODUCTION

In this study, we analyze the passengers and cargoes transported by air between South Korea and China/Japan, the three countries in North-east Asia that account for a large portion of the air transportation sector of South Korea. Based on this, the major factors affecting the air transportation sector between South Korea and China/Japan are identified to provide the

information required for establishing future mid and long-term air transportation policies and strategic directions for continuous trade expansions. The target period of this study was the past 20 years from 2000 to 2019, and the number of passengers and the volume of cargoes transported between South Korea and China/Japan were analyzed. The variables used were the gross domestic product (GDP), per capita GDP, exchange rates, and oil prices of the three countries. As for the analysis methods, we performed ordinary least squares (OLS) multiple regression analysis and fixed effect analysis using panel data.

This study is conducted in the following sequence. First, the status of passengers and cargoes between South Korea and China/Japan is examined, and related studies are analyzed. Then, the variables and the analysis methods used in this study are explained. Finally, the

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results of this study are summarized, and the conclusion is provided.

## II. STATUS AND RELATED WORK

### 2.1 Status of Air Transportation between South Korea and China/Japan

First, upon examination of the passenger transportation status between South Korea and two other Northeast Asia countries, China and Japan, we have found a steadily growing trend in the last ten years, as shown in Table 1. The number of air passengers between South Korea and China showed a significant increase, at an average of about 8.1% per year, but in 2017, it decreased by about 30% from the previous year because of the deepened confrontation between the two countries triggered by the Terminal High Altitude Area Defense (THAAD) deployment issue. The number of air passengers between

South Korea and Japan increased at an average of about 6% per year, but in 2019, the deteriorated relationship with Japan led to the “Japanese product boycott movement”, and the number of air passengers decreased significantly by about 12% compared to that of the previous year.

Next, the cargo volume status between South Korea and China/Japan showed an increasing trend with China for the last ten years, but a decreasing trend with Japan, as shown in Table 2. Specifically, the air cargo volume between South Korea and China increased at an average of about 2.1% per year, but with Japan, it decreased by 0.7%. Like passenger transportation with China, the decline was significant in 2017. The cargo volume with Japan declined several times, but especially in 2019, the decline was about 17.3%, much larger than the decrease in passenger transport, which due to the relationship deterioration between South Korea and Japan.

Table 1. Number of air passengers between South Korea and China/Japan

(Unit: person, %)

Year	Korea-China	Korea-Japan
2010	9,192,973 (29.8)	11,238,163 (12.7)
2011	9,769,438 ( 6.3)	10,419,380 (-7.3)
2012	10,832,322 (10.9)	11,566,437 (11.0)
2013	12,634,743 (16.6)	11,000,917 (-4.9)
2014	16,002,621 (26.7)	10,838,824 (-1.5)
2015	16,545,172 ( 3.4)	12,252,791 (13.0)
2016	19,948,843 (20.6)	15,223,982 (24.2)
2017	14,014,192 (-29.6)	19,180,863 (26.0)
2018	16,189,570 (15.5)	21,479,566 (12.0)
2019	18,509,176 (14.3)	18,962,610 (-11.7)

Source: Korea Airports Corporation and Incheon International Airport Corporation.

Note: The figure in ( ) denotes the increase/decrease rate compared to the previous year.

Table 2. Air cargo volume between South Korea and China/Japan

(Unit: ton, %)

Year	Korea-China	Korea-Japan
2010	627,817 (15.0)	474,180 (18.4)
2011	598,681 (-4.6)	439,415 (-7.3)
2012	577,721 (-3.5)	431,318 (-1.8)
2013	611,088 ( 5.8)	420,070 (-2.6)
2014	676,723 (10.7)	408,826 (-2.7)
2015	707,768 ( 4.6)	428,510 ( 4.8)
2016	782,467 (10.6)	474,879 (10.8)
2017	726,262 (-7.2)	519,294 ( 9.4)
2018	761,133 ( 4.8)	539,826 ( 4.0)
2019	753,699 (-1.0)	446,595 (-17.3)

Source: Korea Airports Corporation and Incheon International Airport Corporation.

Note: The figure in ( ) denotes the increase/decrease rate compared to the previous year.

## 2.2 Related Work

In general, related studies conducted in the past for air transport between South Korea, China, and Japan focused on cargo transportation measures rather than passenger transportation measures and suggested that plans should be established to secure competitiveness through cooperation between the countries. First, Lee, Y. H. (2007) studied the growth trends of the air cargo market between the three countries of South Korea, China, and Japan, and examined the measures for securing the competitiveness between the countries in terms of future growth prospects. Particularly, an open policy and inter-country cooperation improvement measures were suggested for the inter-country air cargo sector rather than the passenger transport sector. Baek et al. (2007) analyzed the operation performance and the policy direction for the major airports in the Northeast Asia region and investigated operation strategies and competitiveness securing measures for the airports in South Korea. The study showed that the acceleration of the economic cooperation system of the three countries, South Korea, China, and Japan would serve as a positive factor in the overall international cooperation system, thus enhancing the competitiveness of the aviation industry. Furthermore, Kim et al. (2003) investigated the air cargo competition between South Korea, China, and Japan, and argued that cooperation between the countries is required, such as building an airport network within the region of the three countries. Studies were also conducted for the low-cost airline industry and business, and Seo, C. B. (2014) conducted a study to vitalize the regional exchange and cooperation between South Korea, China, and Japan in line with the growth trend of the low-cost carriers (LCC) around the world. Based on the study results, it was expected that the cooperation between the three countries would play a positive role in

South Korean industries, such as vitalization of local tourism and creation of jobs. Moreover, Kim, K. H. (2013) conducted a study for the business aviation industry between South Korea, China, and Japan and proposed an analysis method for measuring competitiveness. According to the analysis results in the study, China had higher competitiveness than South Korea and Japan, but he argued that continuous efforts are needed to secure competitiveness in the future since the industrial scope is not limited to within South Korea.

## III. VARIABLES AND ANALYTICAL METHODS

As shown in Table 3, the analysis data for the number of air passengers and cargo volume were obtained from the public disclosure data of the Korea Airports Corporation and the Incheon International Airport Corporation. The GDP and per capita GDP data, which were independent variables, were extracted from the data provided by the World Bank. The exchange

Table 3. Variables and sources

Category	Variable	Description	Source
Dependent variable	Number of passengers	Between South Korea and China,	Korea Airports Corporation,
	Cargo volume	Between South Korea and Japan	Incheon International Airport Corporation
Explanatory variable	GDP	Gross domestic product	World bank
	PERGDP	Per capita GDP	World bank
	Exchange rate	Currency exchange rate of the country	OECD
	Oil price	International oil price	OECD, Statista

rate data were obtained from the data for each OECD (Organisation for Economic Co-operation and Development) country, and the oil price data were obtained from the data provided by the OECD and Statista.

We used the GDP as a variable in this study because in general, those are typical data indicating the total economic size of the pertinent country. It is thought that as the GDP increases, the cargo transportation volume increases between countries, as well as the human exchanges between countries. We used per capita GDP as a variable to determine whether the movement of passengers and cargoes was affected by the income level because we assumed that exchanges using air transport could increase in countries with high per capita GDP. The exchange rate refers to the currency exchange rate of each country, and it can affect the country's whole economy, including prices, imports, and exports. Oil price was included in the variables because it was an important factor in the increase of transportation fare and transportation costs, and could affect the increase/decrease in the number of passengers or cargo volume.

In this study, we performed an OLS multiple regression analysis and a fixed effect using panel data. The multiple regression analysis was used because it can improve the analysis results by simultaneously analyzing several independent variables affecting the dependent variables, and it can reduce the value of the error term. The fixed analysis method was used as an analytical method in this study because the time-series-based change trends of the characteristics, which are difficult to determine in cross-sectional analysis, can be analyzed through panel data.

#### IV. ANALYSIS RESULTS

As shown in Table 4, the number of air passengers between South Korea and China/ Japan

Table 4. Analysis results for number of passengers between South Korea and China/Japan

Variable	Number of air passengers	
	OLS	FE
ln_gdp	(+)	(-)*
ln_perpdp	(-)	(+)*
ln_kgdp	(-)	(-)**
ln_kperpdp	(+)	(+)**
ln_exchanges	(+)**	(+)
ln_oil	(+)	(+)*

Note: \*, \*\*, and \*\*\* are significant results at 10%, 5%, and 1% significance level, respectively.

was inversely proportional to the GDP of each country and proportional to the per capita GDP. Particularly, a higher level of confidence was shown with South Korea's GDP and per capita GDP. In the OLS analysis, the exchange rate variable showed a significantly positive (+) result, and in the fixed-effect analysis, the oil price variable showed a significantly positive (+) result.

As shown in Table 5, the air cargo volume between South Korea and China/Japan was inversely proportional to the GDP of each country and proportional to the per capita GDP in general, similar to the results of the number

Table 5. Analysis results of cargo volume between South Korea and China/Japan

Variable	Air cargo volume	
	OLS	FE
ln_gdp	(+)**	(-)*
ln_perpdp	(-)**	(+)*
ln_kgdp	(-)**	(-)**
ln_kperpdp	(+)**	(+)**
ln_exchanges	(+)**	(+)
ln_oil	(+)*	(+)

Note: \*, \*\*, and \*\*\* are significant results at 10%, 5%, and 1% significance level, respectively.

of passengers. Particularly, the analysis results of South Korea's GDP and per capita GDP showed a higher confidence level compared to the analysis results of the number of air passengers. On the other hand, the OLS analysis showed that the result was proportional of the GDP of China and Japan and inversely proportional to the per capita GDP. The exchange rate variable and the oil price variable showed significantly positive (+) results in the OLS analysis but did not show significant results in the fixed-effect analysis.

## V. CONCLUSION

In this study, we conducted an OLS multiple regression analysis and a fixed effect analysis for the number of passengers and cargo volume transported by air between South Korea and China/Japan over 20 years from 2000 to 2019. For the analyses, the exchange rate and international oil price data, as well as GDP and per capita GDP, were used. The analysis results generally showed that both the number of air passengers and air cargo volume were negatively (-) correlated with the GDP, which indicated the country's competitiveness, and were positively (+) correlated with the per capita GDP, which indicated the income level. Hence, it was determined that the increase in the consumption power of individual persons based on the income increase acted as a positive factor in the air transport sector. Furthermore, the rise in the exchange rate of China and Japan led to an increase in overseas passengers, affecting the number of passengers in the positive (+) direction. Furthermore, the relative decline in overseas prices led to the increase in imports, showing a positive (+) result in the cargo volume increase. However, the effect of oil price was limited, which means that a detailed

study should be conducted in the future.

Since the limited analyses considered in this study cannot clearly explain the factors affecting the number of passengers and the volume of cargoes transported by air between South Korea and China/Japan, continuous research is needed. Particularly, in addition to the economic variables, the cultural factors or preference bias factors between countries, such as national sentiment shown at the time of major changes in the status data, can affect air transportation. Therefore, a more detailed analysis should be conducted using these factors in the future.

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