Korea Trade Review (Korea Trade Rev. ; 무역학회지)
Vol. 47, No. 6, December 2022 (pp. 377-393)
https://data.doi.or.kr/10.22659/KTRA.2022.47.6.377

貿易學會誌
ISSN 1226-2765 (Print)

육상운송산업 성장의 광역권 경제성장에 대한 효과 분석*

최봉호
동의대학교 무역학과 교수

Effect of Land Transport Industry Growth on Economic Growth in Korean Metropolitan Regions

Bong-Ho, Choi[a]
[a]Department of International Trade, Dongeui University, South Korea

Received 12 October 2022, Revised 25 November 2022, Accepted 28 December 2022

Abstract

This study aims to identify the effect of growth of the land transportation industry on economic growth and to provide implications for Korea's metropolitan region policy. The effect of each metropolitan region on the integrated region where each metropolitan region is integrated is as follows. First, The integrated region where each metropolitan region was integrated with the Southeast region and the Daegyeong region had the greatest economic growth effect due to the growth of the land transportation industry in terms of value added, but the effect of the integrated region with the Chungcheong region was the least. In the case of capital such as roads, the integrated metropolitan regions with the Chungcheong region showed the greatest economic effect. However, the impact of the integrated regions with Jeolla region and the Seoul metropolitan region is insignificant. These results suggest that the synergy effect of metropolitan regional integration by spillover effect such as networks should be considered in the land transportation industry policy.

Keywords: Land Transportation Industry, Metropolitan regions, Economic Growth, Panel model Analysis, Value added and Capital
JEL Classifications: F10, F13

* This paper was studied by Dongui University Research Year support in 2021
[a] First Author, E-mail: cbh@deu.ac.kr

Ⅰ. Introduction

In order for the regional economy to grow continuously, the growth of the logistics industry is essential. The logistics industry is evaluated to have potential as one of the new growth engines that will grow like the regional main industry. The logistics industry comprises of a variety of economic activities such as transportation, unloading, packaging, and storage that occur in the process of goods being shipped and supplied to final consumers. In this study, we examine the land transportation industry of the Korea Standard Industry Classification (KSIC) among the logistics industries. The land transportation industry has the largest number of companies and workers among sub-industries of the logistics industry and its sales are larger than those of the water transportation industry and air transportation industry. However, the number of company in the land transportation industry has not increased as much as the increase in its sales, and, moreover, the size of most companies in the industry is small, with sales of less than 500 million won, so that their impacts have been very limited on the growth of land transportation industry, but also on the growth of regional economy and national economy. There are few previous studies directly analyzing the effects of land transportation industry growth on economic growth. Some of related previous studies are as follows. There are studies that have investigated the efficiency and productivity of freight or land transport, such as Kim Woong-Yi (2009), Lee Tae-Woo, Chang Young-Tae and Shin Sung-Ho (2016), and Park Hong-Gyun (2012). Also, some studies have analyzed the economic effects of cargo and land transportation through Input-Output analysis, which include Lim Eung-soon (2010) and Yoon Jae-Ho (2010). However, among these previous studies, there are few studies that investigated the economic effect at the land transport industry level or regional level. And since Input-Output analysis techniques were used in most of the studies, there is a limit to identify the direct causal relationship between the growth of the land transportation industry and economic growth. Moreover, one of key industrial characteristics of land transportation industry is that its growth can have spillover effects through its network such as roads and railways on the growth of other regional economies, but there are few previous studies reflecting these effects.

Therefore, this study investigates the effect of land transportation industry growth on economic growth in integrated regions between metropolitan regions to consider the spillover effect due to externality such as networks, using panel model framwork. Thus, we aim to derive the most efficient regions for economic growth in the land transport industry and to provide implications. The sections of this study are organized as follows. In Chapter II, we review the previous studies regarding to the effect on economic growth of land transport industry. Chapter III presents the status of the relationship between the land transport industry and economic growth. In Chapter IV, we introduce the analytical model, methodology, and data for empirical analysis. In Chapter V, we empirically investigate the effect of land transportation industry growth on economic growth of integrated metropolitan regions. In the last Chapter, the empirical results are summarized and concluding remarks are presented.

Ⅱ. Literature Review

There have been various studies on the impact of the logistics industry, including the land transportation industry, on economic growth. These studies mostly targeted the whole logistics industry and focused on the analysis of the effect on infrastructure investment. And the estimation method was largely based on Input-Output analysis technique.

As a representative study, Lee Min-Kyu et al. (2016) reviewed the regional economic effect of the port logistics industry in Busan, Incheon, and Ulsan by applying the Input-Output table. Also, Lee Min-Kyu (2013) investigated the effect of road transport, rail transport, sea transport, air transport on other industries using Input-Output analysis. Jung Hyun-Jae et al. (2011) estimated the economic impact of transportation and logistics-related industries on Incheon. As a result of the analysis, it can be seen that the economic effect of air transportation is greater than that of other transportation and logistics-related industries. Choi Young-Yoon et al. (2010) analyzed the economic effect of the logistics industry for six regions using the Multi-Regional Input-Output Analysis table (MRIO table). Park Chu-Hwan (2012) et al. analyzed the economic effects of infrastructure investment for the land logistics industries using the Input-Output table. As a result of the analysis, it was confirmed that the land logistics industry has a large effect on the industry overall, and that investment in logistics infrastructure greatly contributes to the growth of the national industry. Lim Lim Eung-Soon (2010) analyzed the effect on the national economy by subdividing the transportation industry using Input-Output analysis. Among the transportation industries, the road transportation industry and the rail transportation industry were analyzed to have the greatest effect. Park Hong-Gyun (2012) studied the efficiency and productivity of inland transportation systems in the region using CCR and BCC analysis. Lee Min-Kyu et al. (2020) examined the economic effect of the regional rail transport industry by applying the regional Input-Output table as of 2013. Yoon Jae-Ho (2016) reviewed the effect of the rail transport service industry on the national economy by using the '2013 Input-Output table'. Its effect was compared with that of 2003 analysis to examine the change in the effect over the past 10 years. Nannan Yu et al. (2011) analyzed whether causal relationship exist between transport infrastructure investment and economic growth in China at national and regional levels using panel cointegration and a Granger causality framework. Kayode1(2013) investigated the impact of transport infrastructure investment on economic growth in Nigeria using Ordinary Least Squares (OLS) estimation technique. The findings showed that transportation played an insignificant role in the determination of economic growth in Nigeria. Démurger(2001) investigated the links between infrastructure investment and economic growth in China. Using panel data from a sample of 24 Chinese provinces. The results indicate that transport facilities are a key differentiating factor in explaining the growth gap. Kai Hu et al. (2010) founded that Logistics Infrastructure Investment and Regional Economic Growth in Central China exist in co-integration relation Tianshu Fang(2016) examined Relationship between Logistics and Economic Growth on the Silk Road Economic Belt using the Unit root test, the VAR model and the Granger causality test. The research results show that the economic growth has caused the development of the logistics industry. Pınar Hayaloğlu (2015) investigated

the impact of developments in the logistic sector on economic growth for 32 OECD countries. emprical results reveals that the relationship between developments in the logistic sector and economic growth differs depending on the indicator used.

Most previous studies covered the whole logistics industry, so the analysis of the land transportation industry is rare. Since most of the studies have been conducted on the national level, but few studies have been conducted on the regional level. It also focuses on the analysis of infrastructure such as roads and railroads. As an analytical method, the Input-Output analysis or causality test framework was largely used. In particular, there are few studies that reflect the spillover effect, which is a major characteristic of the logistics industry. Therefore, this study overcomes these limitations and investigates the effect of the growth of the local land transportation industry on the economic growth of the integrated metropolitan regions to reflect the spillover effect. And, through the use of the panel model as analytical model, the causal relationship between the land transportation industry and economic growth will be derived more accurately.

Ⅲ. Status of Land Transportation Industry and Economic Growth in Korea Metropolitan Regions

Korea's land transportation industry recorded an annual growth rate of 5.49% from 2000 to 2017. It is lower than 8.22% of the logistics industry. During the analysis period, the annual growth rate of employment in the land transportation industry was 1.79% and that of the whole logistics industry was 2.19%. The annual growth rate of per capita wages in the land transportation industry was 6.32%, which is higher than the 6.10% in the whole logistics industry. The proportion of the land transport industry to GDP(based on value added) decreased from 2.34% in 2000 to 2.00% in 2017. That of the whole logistics industry decreased from 3.98% in 2000 to 3.64% in 2017. It can be seen that the land transportation industry has a lower growth rate as well as lower share in value added, employment, and wages compared to the logistics industry and manufacturing industry[1].

〈Fig. 1〉 shows the relationship between the growth of the land transportation industry and economic growth of national economy[2]. It can be seen that the economic growth of national economy and growth of the industry show almost similar trends. This trend was also observed in most metropolitan regions. 〈Fig. 2〉 shows the relationship between the growth of the land transportation industry and economic growth using capital as a proxy for the growth of the industry. The relationship between the industry growth and economic growth showed a similar trend, although less than when value added was used as a proxy variable.

The relationship between the growth of land transportation industry and economic growth in Seoul metropolitan region is shown in 〈Figure 3〉. The capital(ie, as a proxy for the growth of land transportation industry) showed a slight decreasing trend, but economic growth in Seoul metropolitan

1) During the period, the manufacturing industry's value-added growth rate was 9.15%, the employment growth rate was 1.55% per annual, and the per capita wage increased by 7.7% per year from 18.24 million won in 2000 to 43.52 million won in 2017.

2) Value added is used as a proxy variable for the growth of the land transportation industry

Fig. 1. Land Transport Industry and Economic and Economic Growth(Whole country)

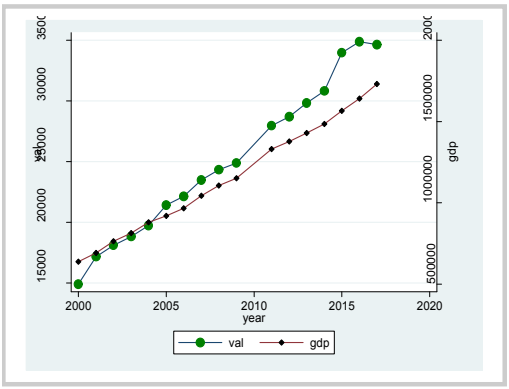


Fig. 2. Land Transport Industry and Economic and Economic Growth(Whole country)

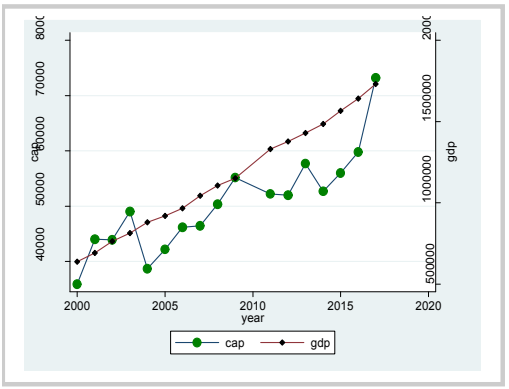


Fig. 3. Land Transport Industry and Economic and Economic Growth(Seoul Metropolitan regions)

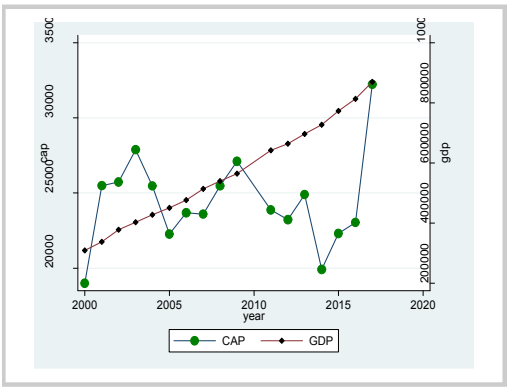
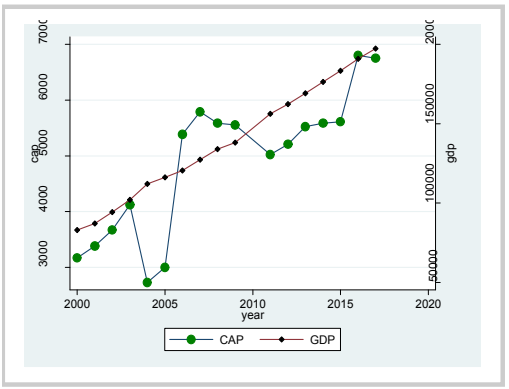


Fig. 4. Land Transport Industry and Economic and Economic Growth (Daekyung regions)



region showed an increasing trend until 2016. For the Southeastern region[3], its economic growth shows an increasing trend, similar to that of the Seoul metropolitan region.

In 〈Fig. 4〉, the relationship between capital and economic growth in the Daegyeong region showed a trend of increasing economic growth similar to that of capital. For Jeolla region, the growth of the land transportation industry showed an increasing trend until 2009, showing a similar trend to the increase in economic growth. However, two variables is moving in the opposite direction since 2009.

3) The graph of the Southeast region is omitted because it is similar to that of the Seoul metropolitan region.

Fig. 5. Land Transport Industry and Economic and Economic Growth(Jeolla regions)

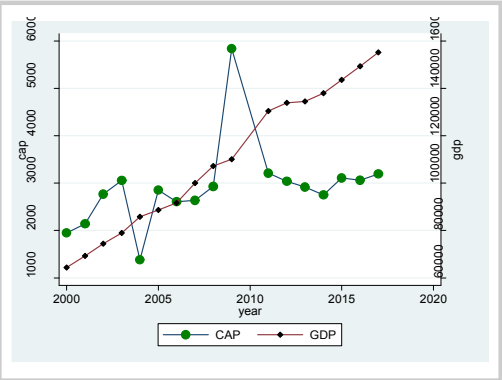
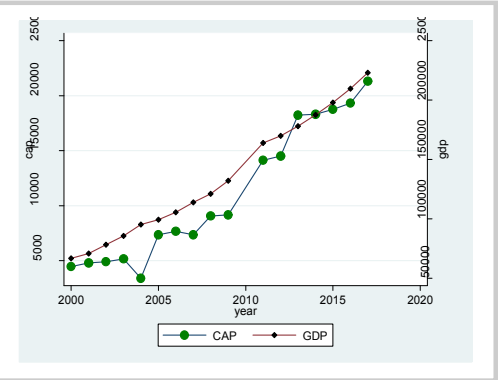


Fig. 6. Land Transport Industry and Economic and Economic Growth (Chungcheong regions)



In the case of the Chungcheong region, as shown in 〈Fig. 6〉, the growth of the land transportation industry showed a relatively steep increasing trend, and the economic growth also showed a continuous increasing trend. Among the metropolitan regions, the relationship between the two variables represented the most similar trend.

Ⅳ. Model Specification and Methodology, Data

1. Model Specification

The theoretical model for the relationship between the growth of land transportation industry and economic growth is based on Cobb-Douglas production function. The economic growth model uses traditional capital and labor as control variables and includes the growth of the land transportation industry[4]. And, the model is extended by considering factors such as externalities. Then, the general form of the Cobb-Douglas production function is expressed as Equation

$$Y_t = A_t \cdot F(L_t, K_t) = A_t L_t^{\beta 1} K_t^{\beta 2} \quad (1)$$

Y_t is GDP, L_t is Labor, K_t is Capital. A_t refers to total factor productivity such as technological level and management capability. When the growth of the land transport industry and the growth of other regional logistics industries are added to the production function, A_t is replaced by these variables and a new residual term is generated. The basic model of economic growth that reflects these factors is shown in Equation (2) below.

$$\begin{aligned} Y_t &= A_t \cdot F(L_t, K_t, GL_t, T_t) \\ &= A_t L_t^{\beta 1} K_t^{\beta 2} GL_t^{\beta 3} \; T_t^{\beta 5} \end{aligned} \quad (2)$$

However, A_t is the total factor productivity, GL_t is the growth of the land

4) The growth of the land transportation industry is modeled with added value and capital, which is hardware, as proxy variables.

transportation industry, and T_t is the degree of trade openness. Based on the above theoretical model for economic growth, the analytical model is constructed as follows using proxy variables. In the empirical analysis, each variable is constructed by taking the logarithm.

Model 1: $gdp_t = \beta_0 + \beta_1 labt_t + \beta_2 capt_t + \beta_{3_t} open_t + \beta_4 val_t + \epsilon_t$

Model 2: $\sum_{i=1}^{n} gdp_{i,t} = \beta_0 + \beta_1 \sum_{i=1}^{n} labt_{i,t} + \beta_2 \sum_{i=1}^{n} capt_{i,t} + \beta_{3_t} \sum_{i=1}^{n} open_{i,t} + \beta_4 \sum_{i=1}^{n} val_{i,t} + \epsilon_t$

Model 3: $gdp_t = \beta_0 + \beta_1 lab_t + \beta_2 capt_t + \beta_{3_t} open_t + \beta_4 cap_t + \epsilon_t$

Model 4: $\sum_{i=1}^{n} gdp_{i,t} = \beta_0 + \beta_1 \sum_{i=1}^{n} labt_{i,t} + \beta_2 \sum_{i=1}^{n} capt_{i,t} + \beta_{3_t} \sum_{i=1}^{n} open_{i,t} + \beta_4 \sum_{i=1}^{n} cap_{i,t} + \epsilon_t$

gdp: gross regional product (economic growth), $labt$: total industrial labor, $capt$: total industrial capital, $open$: trade openness, val: value-added of land transportation industry, cap: capital of land transport industry

Model 1 is a basic model using the value added of the land transportation industry in each metropolitan region as a proxy for growth of the industry. Model 2 analyzes the integration effect between metropolitan regions due to spillover effects related to externalities such as networks with neighboring regions. Model 3 is a basic model using capital such as roads as proxy variables for the growth of the land transportation industry. Model 4 analyzes the effect of the capital variable of the land transportation industry on the economic growth of the integrated region as in Model 2.

2. Methodology

We use panel data that integrates cross-sectional data and time series data for empirical analysis. In the panel model, there can be various estimation models and estimation methods depending on whether the constant terms and coefficients are the same for each cross section and for each time period and the assumptions about the structure of the error term (Choi, Bong-Ho, 2019). According to Woodridge (2008), if there is a correlation between the explanatory variable and the error term, it is appropriate to apply the fixed effect model, and if there is no correlation, it is appropriate to apply the random effect model. To examine this, we conduct the Hausman test, which tests whether the explanatory variable has a correlation with the error term. On the other hand, The panel-specific error term is recognized as a random variable in the random effect model, unlike in the fixed effect model. Since the panel-specific error term constantly affects the error term of the model, there is autocorrelation. Therefore, in order to solve the problems of autocorrelation and heteroscedasticity that may occur in the random effect model, it is estimated using the Generalized Least Squares (GLS) method. Unlike previous studies, the scope of analysis analyzes the impact of the growth of the land transportation industry on economic growth and further analyzes the impact of capital as infrastructure on economic growth. Spatially,

Table 1. The Define of Variable and Data

Variable	Contents	Data Source
lngdp	Gross Domestic Product(GDP)	Statistics Korea Financial Statement Analysis, Bank of Korea
lnval	Value Added of Land Transport Industry	Transportation survey, Statistics Korea
lnlab	Number ofworkers of All Industries	Transportation survey, Statistics Korea
lncap	Tangible Fixed Assets of Land Transport Industry	Transportation survey, Statistics Korea
lncapt	Tangible FixedAssets of All Industries	Statistics Korea, Bank of Korea
lnopen	Trade openness:(Export+Import)/GDP	Korea International Trade Association, Statistics Korea, Bank of Korea

it targets not only the current single metropolitan region but also the integrated metropolitan regions.

It makes it possible to derive the network effect or the spillover effect[5] of the land transportation industry. Using these results, it will be possible to derive a spatial and regional scope that maximizes the effect on the economic growth of the land transport industry growth.

3. Data

For the data, time series from 2000 to 2016 and cross-section data for the five metropolitan regions such as Seoul Metropolitan, SouthEast, Daegyeong, Jeolla, Chungcheng are used in consideration of consistency and availability of data.

Gross domestic product (GDP) is used as a proxy for economic growth in metropolitan regions. The proxy variables for the growth of the land transportation industry are value added and capital. Data are classified according to the Korean Standard Industrial Classification Criteria. The sources of data are the 'Mining Industry Survey' and 'Transportation Industry Survey' of Statistics Korea Statistical Information System (KOSIS), and the Input-Output Table of the Bank of Korea. The number of workers is used as the proxy variable for labor, and tangible and fixed assets and fixed capital are used as the proxy variable for capital. The data for these variables are also from Statistics Korea and the Bank of Korea data, respectively. The degree of openness is defined as the ratio of trade to GDP, and data from the Korea International Trade Association and the United Nations' Comtrade are used.

The correlation between the growth of the land transportation industry and economic growth is as 〈Table 2〉. The correlation between the value-added variable of the land transportation industry and the economic growth of the Seoul metropolitan region is quite high at 0.93. The correlation between the capital such as road of the land transportation industry and economic growth was 0.68, indicating that the correlation between the two variables was also relatively high. In the Southeast region, the correlation between the growth of the added value of

5) Externality can be generated beyond the scope of the metropolitan region to which the land transport industry currently belongs

Table 2. Correlation Analysis

Areas	*Variable*	*LGDP*	*LVAL*	*LCAP*
Metropolitan	*LGDP*	1.00		
	LVAL	0.93	1.00	
	LCAP	0.68	0.87	1.00
	LOPEN	−0.36	−0.42	−0.47
SouthEast	*LGDP*	1.00		
	LVAL	0.28	1.00	
	LCAP	0.13	0.96	1.00
	LOPEN	0.03	−0.85	−0.83
DaeKyung	*LGDP*	1.00		
	LVAL	0.61	1.00	
	LCAP	0.24	0.83	1.00
	LOPEN	0.87	0.63	0.37
Jeolla	*LGDP*	1.00		
	LVAL	0.59	1.00	
	LCAP	0.15	0.27	1.00
	LOPEN	0.51	0.44	0.39
ChungCheong	*LGDP*	1.00		
	LVAL	0.09	1.00	
	LCAP	−0.39	0.69	1.00
	LOPEN	0.80	−0.27	−0.73

the land transportation industry and economic growth was 0.28, showing a low correlation. The correlation between the value added of the land transportation industry, and the economic growth is highest in the Seoul metropolitan region, followed by Daekgyeong region, Jeolla region, Southeast region, and Chungcheong region. And the correlation between the capital and the growth of added value, the land transportation industry, was the highest in the Southeast region at 0.96, followed by the Seoul metropolitan region, Daegyeong region, Chungcheong region, and Jeolla region. In general, there is a correlation between the growth of the land transport industry and the economic growth in terms of value-added. However, the correlation is rather insufficient on a capital basis.

The basic statistics of variables related to the land transportation industry and economic growth are as follows. The average of GDP is 18.79 in the Seoul metropolitan region, which is the highest, followed by the Southeast region, Daegyeong region, Chungcheong region, and Jeolla region. The average value added of the land transportation industry is the highest in the Seoul metropolitan region at 15.01, followed by the Southeast region, Chungcheong region, Daegyeong region, and Jeolla region. The average of capital of the industry was the highest in the Seoul metropolitan region at 15.44, followed by the Chungcheong region, the Daegyeong region,

Table 3. Hausman test

Category	Metropolitan		SouthEast		DaeKyung		Jeolla		ChungCheong	
	Model2	Model4	Model2	Model4	Model2	Model4	Model2	Model4	Model2	Model4
Model1* Model3**	41.72* (0.00)	42.99** (0.00)	28.15* (0.00)	71.68** (0.00)	155.89* (0.00)	72.71** (0.00)	22.26* (0.00)	21.35** (0.00)	0.74* (0.94)	39.41** (0.00)
SouthEast	1.01 (0.98)	10.99 (0.03)								
DaeKyung	0.71 (0.94)	18.93 (0.00)	134.75 (0.00)	149.11 (0.00)						
Jeolla	2.56 (0.63)	25.98 (0.00)	64.58 (0.00)	30.65 (0.00)	3.25 (0.52)	23.18 (0.00)				
ChungCheong	17.82 (0.00)	15.55 (0.00)	3.07 (0,54)	53.25 (0.00)	17.46 (0.00)	21.65 (0.00)	0.94 (0.92)	1.56 (0.82)		

Note: 1) ( ) represent $prob > \chi^2$, and if the null hypothesis is rejected at the significance level of 1% and 5%, then the fixed effect model is appropriate. But, if adopted, then the random effect model is appropriate
2) *,** indicate each corresponding item

the Southeast region, and the Jeolla region a. The standard deviation is 0.32 to 0.88 for all variables excluding the capital variable, indicating that the distribution of the data is generally appropriate. Skewness is appropriate to be less than 1 for all variables. The kurtosis was 3 or less in all regional variables, showing a stable distribution with no significant surge or drop. When examining the basic statistics, it is judged that the data used for the analysis are generally stable and do not deviate from the normal distribution and are appropriate.

Ⅴ. Empirical analysis of the effect on the economic growth of the land transportation industry

1. Model Selection: Hausmann Test

The panel model is classified into a fixed effect model and a random effect model according to the interpretation of the 'constant term' including the error term representing the individual characteristics. If the covariance between the individual characteristic error term and the explanatory variable is not zero, the consistent estimator cannot be obtained. Therefore, it is necessary to estimate using the fixed effect model rather than fitting the random effect model.

Therefore, whether to accept the null hypothesis that the covariance is zero is tested through the Hausman test[6]. If the null hypothesis is accepted, it is appropriate to use a random effect model, and if rejected, it is appropriate to use a fixed effect model. The results of the Hausman test of the analysis on models 1 to 4 are shown in 〈Table 3〉. As a result of the test on the model integrating between Seoul metropolitan region and each metropolitan region by

6) Panel analysis can consider cross-sectional characteristics and time characteristics. In this study, only the characteristics of each region were reflected for the purpose of analysis rather than time-specific factors such as technological development or policy effects.

applying Model 2, the random effect model is selected because the null hypothesis of the Hausman test is accepted. For the integrated model integrating between the Seoul metropolitan region and the Chungcheong region, and Seoul metropolitan region model that rejects the null hypothesis, the fixed effect model is selected. Table 2 shows the results of the Hausman test in the Southeast, Daegyeong, Jeolla, and Chungcheong regions estimated by applying Model 2 as in the Seoul metropolitan region.

2. Empirical Results

The results of empirical analysis on the effect of the land transportation industry growth on economic growth are shown in 〈Table 4〉 to 〈Table 7〉 for each of Models 1 to 4. In Model 1 to Model 2, which uses value added as a proxy variable for the growth of the land transportation industry, the effect of the growth of the land transportation industry on the economic growth of the integrated region between the Seoul metropolitan region and the Southeast region was 0.80. For the Seoul metropolitan region, the effect was improved from 0.78 before the integration, but for the Southeast region it is decreased from 0.91 before the integration. The effect on the integrated region between the Seoul metropolitan region and the Daegyeong region on economic growth was 0.81, which was larger than the effect on each of the Seoul metropolitan region and Daegyeong region before the integration, indicating that there were the integration effect on these regions. For the integrated region between the Seoul metropolitan region and Jeolla region, the effect was 0.76, which was decreased for the Seoul metropolitan region compared to before the integration, but the effect was increased for the Jeolla region. The effect on the integrated region between the Seoul metropolitan region and the Chungcheong region was 0.29. This shows that the effect on Seoul metropolitan region after the integration was greatly deteriorated, but the effect on the Chungcheong region was same as before the integration, indicating that there is no effect from the integration in that region. The effect on in the integrated region between the Southeast and Daegyeong region is 0.92. Compared with the pre-integration, the effect on Southeast region was slightly increased and the effect on the Daegyeong region was greatly increased. The effect on the integrated region between the Southeast region and the Jeolla region is 0.79. this shows that the effect on economic growth of the Southeast region was decreased compared to the pre-integration, but the effect on the Jeolla region was slightly increased from 0.74 before the integration. The effect after the integration between the Southeast and Chungcheong regions was 0.37. So, the effect on the Southeast region was decreased significantly compared to before the integration, but the effect on the Jeolla region was increased compared to 0.29 before the integration. Next, the effect on the growth of in the integrated region between the Daegyeong and Jeolla regions was 0.78, which was larger than the effect before the integration in both the Daegyeong and Jeolla regions. The effect on the integrated region between Daegyeong and Chungcheong was 0.43. On the other hand, the effect on in the integrated region between the Chungcheong region of Jeolla Province was 0.37, which was decreased significantly compared to 0.74 before the integration in the Jeolla region, but was increased in the Chungcheong region. The effect on in the integrated region

Table 4. Land Transport and Economic Growth (Value Added): Each region

Regions	Coefficent	S.E.	t-value	P>t	R^2
Metropolitan	0.78	0.08	9.39	0.00	0.93
Southeast	0.91	0.11	8.42	0.00	0.78
DaeKyung	0.68	0.13	5.07	0.00	0.80
Jeolla	0.74	0.11	6.56	0.00	0.74
ChungCheong	0.29	0.10	2.87	0.00	0.36

Table 5. Land Transport and Economic Growth (Value Added): Integration of the region

Regions	Coefficent	S.E.	t-value	P>t	R^2
Metropolitan +Southeast	0.80	0.05	16.12	0.00	0.82
Metropolitan +DaeKyung	0.81	0.07	11.98	0.00	0.81
Metropolitan +Jeolla	0.76	0.06	12.97	0.00	0.81
Metropolitan +ChungCheong	0.29	0.06	5.04	0.00	0.57
Southeast +DaeKyung	0.92	0.08	11.46	0.00	0.75
Southeast +Jeolla	0.79	0.08	10.24	0.00	0.74
Southeast +ChungCheong	0.37	0.06	6.54	0.00	0.46
DaeKyung +Jeolla	0.78	0.09	8.33	0.00	0.71
DaeKyung +ChungCheong	0.43	0.07	6.02	0.00	0.46
Jeolla + ChungCheong	0.37	0.07	5.35	0.00	0.47

between each metropolitan region was found to be statistically significant at the 1% significance level.

Next, the effect of capital as a proxy for the growth of the land transportation industry on the economic growth of the integrated region in Model 4 is as follows. The effect on the economic growth of the integrated region between the Seoul metropolitan region and the Southeast region is 0.31. So, the effect was greater in both the Seoul metropolitan region and the Southeast region than before the integration. The effects of on the integrated regions between the Seoul metropolitan region and Daegyeong region, and between the Seoul metropolitan region and Jeolla region were 0.17 and 0.12, which were decreased from 0.21 and 0.16 before the integration, respectively. It means that the integration between these metropolitan regions has rather negative effects. Similar results were also found in the integrated region between the Seoul metropolitan region and the Chungcheong region. The effect on the integrated region between the Southeast and Daegyeong region was 0.20, indicating that the effect on both regions was decreased compared to before the integration. The effect on the integrated region between the Southeast and Jeolla

Table 6. Land Transport and Economic Growth (Capital): Each region

Regions	Coefficent	S.E.	t-value	P>t	R^2
Metropolitan	0.16	0.06	2.68	0.01	0.82
Southeast	0.23	0.07	3.18	0.00	0.53
DaeKyung	0.21	0.07	2.77	0.01	0.73
Jeolla	0.16	0.05	3.05	0.00	0.58
ChungCheong	0.66	0.10	6.45	0.00	0.61

Table 7. Land Transport and Economic Growth (Capital): Integration of the region

Regions	Coefficent	S.E.	t-value	P>t	R^2
Metropolitan +Southeast	0.31	0.05	6.23	0.00	0.58
Metropolitan +DaeKyung	0.17	0.06	2.78	0.01	0.61
Metropolitan +Jeolla	0.12	0.04	3.33	0.00	0.68
Metropolitan +ChungCheong	0.40	0.06	6.81	0.00	0.64
Southeast +DaeKyung	0.20	0.06	3.40	0.00	0.46
Southeast +Jeolla	0.16	0.04	3.98	0.00	0.53
Southeast +ChungCheong	0.41	0.06	7.13	0.00	0.52
DaeKyung +Jeolla	0.17	0.05	3.87	0.00	0.52
DaeKyung +ChungCheong	0.50	0.08	6.59	0.00	0.49
Jeolla + ChungCheong	0.24	0.05	4.53	0.00	0.45

region was 0.16, which was worse in the Southeast region than before the integration, and there was no change in the Jeolla region compared to before the integration. The effect on the integrated region between the Southeast and Chungnam region was 0.41. The The effect on the integrated region between Daegyeong and Jeolla was 0.17, but the effect was decreased compared to before the integration in the Daegyeong region and was slightly increased in the Jeolla region. The effect on the integrated region between Daegyeong and Chungcheong was 0.50. Compared to 0.21 before the integration, the effect of on Daegyeong region was increased significantly, but the effect on the Chungcheong region was decreased. The effect on the integrated region between Jeolla and Chungcheong regions was 0.24, indicating that the effect was increased after the integration in the Jeolla region, but was decreased in the Chungcheong region. The estimated coefficients of all regions are statistically significant at the level of 1%.

The empirical results of the effect of the growth of the land transportation industry on

Table 8. Summary of region Integration Effect: Value-Added(Income) Criteria

Regions	Integration partner, Increase (+)	Integration partner, reduction (-)
Metropolitan	Southeast 〉DaeKyung	ChungCheong 〉Jeolla
Southeast	DaeKyung	ChungCheong 〉Jeolla 〉 Metropolitan
DaeKyung	Southeast 〉 Metropolitan 〉Jeolla	ChungCheong
Jeolla	Southeast 〉DaeKyung 〉 Metropolitan	ChungCheong
ChungCheong	DaeKyung 〉Jeolla s=Southeast	Metropolitan

the economic growth of the integrated region are summarized in 〈Table 8〉 to 〈Table 9〉. First, as shown in 〈Table 8〉, the effect of integration between the Seoul metropolitan region and each metropolitan region was increased in the Southeast and Daegyeong regions, and the effect on the Southeast region was greater. However, the integration effect of on the integrated regions between the Seoul metropolitan region and the Chungcheong region, and Jeolla region were decreased, respectively, comparing to before the integration, and the decrease was greater in the Chungcheong region. Regarding the integration with the Southeast region, the effect on the Daegyeong region was increased, but the effect on the Chungcheong region, Jeolla region, and Seoul metropolitan region was decreased respectively. But the effect of integration with the Chungcheong region was decreased in most of regions. Regarding the integration with the Daegyeong region, the integration effect was increased in the order of the Southeast region, the Seoul metropolitan region, and the Jeolla region, but the integration effect on the Chungcheong region was decreased. Regarding the integration with the Jeolla region, the integration effect was increased in the order of the Southeast region, the Daegyeong region, and the Seoul metropolitan region, while the effect on the Chungcheong region was decreased. Regarding the integration with the Chungcheong region, the effect was increased in the order of Daegyeong region and Jeolla region Southeast region, and the effect on the Seoul metropolitan region was decreased. In terms of value added, the integrated region between the southeast region and the Daegyeong region was the greatest at 0.92, and the effect of the integrated region between the Seoul metropolitan region and the Chungcheong region was the least at 0.29. In particular, the integration effect between each metropolitan region and Chungcheong region was found to be the least.

Next, as shown in 〈Table 9〉, in terms of capital, the integration effect between the Seoul metropolitan region and each metropolitan region increases when it is integrated with the Chungcheong region, the Southeast region, and the Daegyeong region. Especially, the integration effect with the Chungcheong region is the greatest. However, the effect of integration with Jeolla region was decreased. For the Southeast region, the effect of integration with the Chungcheong region and Seoul metropolitan region was increased, while the effect of integration with Jeolla region and Daegyeong region was decreased. The economic effect of integration with each metropolitan region and the Chungcheng region was the greatest, and that of integration with the Jeolla region

Table 9. Summary of Region Integration Effect: Capital (Infrastructure) Criteria

Regions	Integration partner, Increase (+)	Integration partner, reduction (-)
Metropolitan	ChungCheong 〉Southeast〉DaeKyung	Jeolla
Southeast	ChungCheong 〉 Metropolitan	Jeolla 〉DaeKyung
DaeKyung	ChungCheong	Metropolitan=Jeolla 〉Southeast
Jeolla	ChungCheong 〉DaeKyung〉Southeast	Metropolitan
ChungCheong	-	Jeolla 〉 Metropolitan〉Southeast〉DaeKyung

was the least.

Regarding the integration effect on the Daegyeong region, only the integration with the Chungcheong region increased the growth effect on the region, but the integration with other regions decreased its growth effect. The integration of Daegyeong region with Seoul metropolitan regions and Jeolla region has a significant negative effect. In the Jeolla region, the economic growth effect of integration with the Chungcheong region, Daegyeong region, and the Southeast region was increased, in the order of the Chungcheong region, the Daegyeong region, and the Southeastern region. But the effect of integration with the Seoul metropolitan region was decreased. Regarding the Chungcheong region, the effect of integration with all other metropolitan regions was decreased and, especially, the negative effect was the largest with integration with Jeolla region. The effect of the capital of the land transportation industry on the economic growth of the integrated region was found to be the greatest at 0.50 for the integration between Daegyeong and Chungcheong, and the least at 0.12 for the integration between the Seoul metropolitan region and Jeolla region. In particular, the integration with the Chungcheong region yielded a large growth effect in most of the metropolitan regions.

Ⅵ. Conclusion

This study investigates the effect of the growth of the land transportation industry on economic growth in the integrated regions of the metropolitan region considering the effect of inter-regional network externality attempts to derive the region where the effect of the land transportation industry growth on regional economic growth is the most effective and provide implications. The empirical results are as follows. The effect of land transport industry growth in terms of value added on economic growth is the greatest in the Southeast region, followed by the Seoul metropolitan region and the least in the Chungcheong region. Also, the effect of land transportation industry growth in terms of capital such as roads, is the greatest in the Chungcheong region, followed by the Southeast region, and the Seoul metropolitan region and Jeolla region are less affected. The integration effect on the economic growth of the integrated region, which reflects the spillover effect of integration with other regions, is as follows. First, the effect of the land transportation industry growth in terms of value added on economic growth is increasing in all regions integrated with the Southeast regions and the Daegyeong regions. On the other hand, in the regions

integrated with the Chungcheong region, the effect of land transportation industry growth on economic growth was minimal and rather decreased. In particular, the economic growth effect on the integrated region between Southeast region and the Daegyeong region is the greatest, and the economic growth effect on the integrated between the Seoul metropolitan region and the Chungcheong region is the least. The land transportation industry growth in terms of capital has a large impact on economic growth of all regions integrated with the Chungcheong region. On the other hand, it was found that the effect on economic growth in the regions integrated with the Jeolla and Seoul metropolitan regions was minimal and rather decreased. Among them, the economic growth effect is the greatest in the region where Daegyeong and Chungcheong are integrated, and the economic growth effect is the least in the integrated region between the Seoul metropolitan region and Jeolla region.

These results provide the following policy implications. It can be seen that in the future, the policies related to the growth of the land transportation industry and the expansion of hardware capital should comprehensively consider the spillover effect between the metropolitan regions. In addition, the data from the empirical results can be used as data for policy making in the land transport industry. However, in some way, I should also admit data limitations does not allow me to conduct the analysis as much as I expect to do, with the analysis period constraints.

References

Arellano, Manuel and Stephen Bond (1991), “Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Evidence and an Application to Employment Equations”, Review of Economic Studies. 58, 277-297.

Barro, Robert J. (1997), Determinants of Economic Growth: A Cross-Country Empirical Study, Cambridge: The MIT Press.

Choi Bong-Ho and Kim Sang-Choon (2017), “An Estimation on the Determinants of Growth of Korean Port-Logistic Industry”, Journal of International Trade & Commerce, 13(1), 757-773.

Choi, Bong-Ho (2019), "Asymmetric Impacts of Human Capital Accumulation through Trade on Economic Growth in the Manufacturing Sector of Korea", Korea trade review, 44(1), 1-15

Ha, Hun-Koo and Y-Young Choi (2003), “Analysis of the Efficiency of Korea's Logistics Industry: Application of Data Envelopment Analysis-Analytic Network Process (DEA-ANP)”, Journal of Korean Society of Transportation, 25(3), 55-63.

Jeong, Dong-Won and Jong-Ho Han (2012), “An Analysis on the Economic Impacts of the Logistics Industry”, Korea Logistics Review, 22(2), 203-226.

Kang, Sang-Mok and Ju-Byung Lee (2008), “Total Factor Productivity Growth and the Decomposition Components of Korean Port-logistics Industry”, Journal of Korea Port Economic Association, 24(4), 47-70.

Kang, Sang-Mok and Myung-Sun Park (2007), “Growth Accounting Analysis of Korean Port-logistics Industry”, Journal of Korea Port Economic Association, 23(4), 49-69.

Kim Young-Ho (2009), “A Study on the Measurement Model of Logistics Industry on Economic Growth in Korea”, Korea Research Academy of Distribution and Management Review, 12(3), 169-182.

Kim, Jong-Ho (2009), “Determinants of Productivity in Korean Logistics Industry: Focusing on Market Power and Firm Structure”, Journal of International region Studies, 13(1), 123-143.

Kim, Woong-Yi (2009), A study on the Effficiency of Trucking Industry in Korea (Doctoral Dissertation), Seoul: Hanyang University, 24-31.

Lee, Min-Kyu and Ki-Youl Lee (2016), “The Regional Economic Impacts of the Port Logistics Industry: Focused on Busan, Incheon, and Ulsan”, Journal of Shipping and Logistics, 32(2), 299-320.

Lee, Tae-Woo, Young-Tae Chang and Sung-Ho Shin (2016), "A Comparative Study on Economic Effects of Transport Modes on the Korean Economy Using Input-Output Analysis", Journal of Shipping and Logistics, 51, 47-67.

Lim, Eung-Soon (2016), "A Comparative Study on Economic Effects of Transport Industry-Focused on Road, Rail, Water, Air Transport Sector", Journal of Transport Research 17(2), 61-71.

Lu, S.C., and Ching-Chiao, Y. (2006), “Comparison of investment preferences for international logistics zones in Kaohsiung, Hong Kong and Shanghai ports from a Taiwanese manufacturer’s perspective”, Transportation Journal, 45(1), 30-51.

Min, In-sik and Pil-Sun Choi (2009), STATA Panel Data Analysis, Seoul: The Korean Association of STATA, 193.

Park, Hong-Gyun (2012), "The Changes of Technical Efficiency and Malmquist Productivity of Land Transportation by Region", Journal of Korea Port Economic Association, 28(4), 59-77.

Park, Hong-Gyun and Bong-Sung Chu (2013), “The Productivity Analysis of Logistics Provider Service of Middle Standing on Korea”, Journal of Shipping and Logistics, 78, 589-608.

Park, Myung-Sub and Young-Hyo Ahn (2003), "Using DEA-AR to Measure the Efficiency of Motor Carriers in Korea", Journal of the Korean Society of Supply Chain Management, 3(2), 61-68.

Shirley, C. and Winston, C (2004), “Firm inventory behavior and the returns from highway infrastructure investments”, J. Urban Econ. 55, 398−-415.

Shuang, L. (2009), “A research on the relationship of logistics industry development and economic growth of China. International Business Research”, 2(3), 197-200.

Solow, Robert M. (1957), “Technical Change and the Aggregate Production Function”, Quarterly Journal of Economics and Statistics, 39, 312- 320.

Wang, Y. and Wang, L. (2010), “The economic growth effect of logistics industry FDI analysis”, Scientific Research Business, 2(4), 377-381.

Yoon, Jae-Ho (2016), "An Inter-industry Analysis of the Korean Railway with Input-Output Statistics : A Decade Comparison", Journal of the Korean Society for Railway 19(6), 815-825.