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Original Article

## Financial analysis effect on management performance in the Korean logistics industry

Seung Wook Jang, Woo Chul Ahn\*

Gangneung–Wonju National University, Republic of Korea

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### ABSTRACT

This study aims to contribute to the stable growth of the logistics industry by analyzing the differences in the financial structures within the Korean logistics industry and the impact of these financial structures on management performance.

This result shows that there are differences in financial factors that affect return on assets (ROA) and return on equity (ROE) by business types in the logistics industry, they require more management improvement efforts to enhance the soundness of their financial structure. Therefore, they need to recognize differences in major financial factors that affect performance according to the type of business it owns and push forward pre-emptive measures such as management efficiency and improvement of profits accordingly and the diversification of its continuous business portfolio.

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### 1. Introduction

A country's national competitiveness depends on the competitiveness of its logistics industry, which plays the role of an artery in the country's body. Korea's history of logistics is relatively short, but the logistics industry developed as a key industry supporting foreign trade and helped to vitalize the national economy. Notwithstanding the national economic importance of the logistics industry, this industry faces challenges such as infrastructure expansion, labor market rigidity, and diversification of its competitiveness. In addition, the development of the logistics industry is hindered by the perception that it is primarily engaged in activities that support corporate activities, instead of being viewed as an independent industrial sector. This is because the logistics industry has the characteristics of a service industry that supports companies' management activities (e.g., procurement, production, and sales). In addition, the demand for logistics services is driven by its customers' needs. Accordingly, the logistics industry was treated as a passive industry that affects the price competitiveness of products, along with labor costs and financial costs, among others, even

though the industry is engaged in production activities that create value by moving freight from suppliers to consumers.

While the logistics industry continues to improve efficiency, and thereby reduce costs, and enhances the competitiveness of companies and the country overall, these aspects have limitations in explaining the importance of the logistics industry. In other words, the importance of the logistics industry should be emphasized by more active aspects. For example, logistics activities themselves have various ripple effects on the national economy.

For Korea to become a logistics hub in Northeast Asia and lead the global logistics industry, it is necessary to accurately grasp the status of the logistics industry and to analyze the factors affecting the financial and management performance of its logistics industry.

To the extent that national competitiveness depends on the competitiveness of the logistics industry, stable growth of the logistics industry is important for the growth of the country. Despite the national economic importance of the logistics industry, research on its financial and management performance is lacking. Moreover, to classify the logistics industry into its component parts (i.e., businesses) and establish and implement appropriate management policies based on their characteristics, an analysis of the factors affecting the financial and management performance is much needed.

Therefore, the goal of this study is to contribute to the stable growth of the logistics industry by analyzing the differences in the financial structures within the Korean logistics industry and the impact of these financial structures on management performance. In addition, this study is expected to be of practical significance

\* Corresponding author.

E-mail addresses: [swjang@gwnu.ac.kr](mailto:swjang@gwnu.ac.kr) (S.W. Jang), [logistics.gwnu@gwnu.ac.kr](mailto:logistics.gwnu@gwnu.ac.kr) (W.C. Ahn).

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as it will provide useful information for management decision-making that contributes to the stable growth of the industry by comparing the financial strengths and weaknesses of each type of business within the industry. In addition, it is expected to provide important implications for management decision-making that will improve corporate performance based on the differences in the factors affecting the company's management performance by type of business.

The composition of this paper is as follows. Chapter 2 reviews the theoretical background and prior studies related to the financial analysis of the logistics industry. Chapter 3 presents the research design and methodology. Chapter 4 presents the results of the financial ratio analysis and panel regression analysis by type of business in the logistics industry. Chapter 5 presents the conclusion and key implications.

## 2. Theoretical background

Kim and Kang (2008) analyzed the management efficiency of domestic shipping and logistics companies that could be targeted for benchmarking by analyzing their sales efficiency, operating profit, and net profit using the data envelopment analysis (DEA) technique. The authors evaluated 29 shipping and logistics companies for CCR efficiency, BCC efficiency, and returns to scale (RTS). In addition, shipping and logistics companies that could be targeted for benchmarking were presented based on the analyzed data. Their analysis indicated that 7 companies had a CCR efficiency of 1 and 13 companies had a BCC efficiency of 1. In terms of RTS, 15 companies, 5 companies, and 9 companies were categorized for analysis as IRS (i.e., increasing RTS), DRS (i.e., decreasing RTS), and CRS (i.e., constant RTS), respectively. Jeong and Park (2010) analyzed changes in the input structure and production-inducing effects of the Korean logistics industry. The results of their empirical analysis show that: (1) the proportion of domestic intermediate inputs and physical inputs is decreasing in the logistics industry, (2) the proportion of indirect intermediate inputs is higher than that of direct intermediate inputs, (3) the production inducement in the logistics industry is largely induced by export demand, and (4) the production-induced amount is increasing. In addition, Oh and Gi (2003), Lee, Chang, and Shin (2006), Won and Park (2008), Park and Lee (2008) and others analyzed the industrial links in the logistics industry. These studies focused on the aspects of the logistics industry's contribution to improving productivity in other industries, but simply analyzed the types of ripple effects using various types of coefficients in the existing inter-industry relations table. This study, on the other hand, analyzes the economic ripple effects of the logistics industry on other industries more systematically by using a research method called the exogenous specification of the logistics industry. Chung and Lee (2011) analyzed the economic ripple effects of the logistics industry empirically, emphasizing the national importance of the logistics industry as a driving force for the creation of new wealth, as well as strengthening export competitiveness in manufacturing.

In a similar study, Han (2013) analyzed financial and non-financial factors that affect the management performance of the construction and manufacturing industries. The result of Kim (2014) investigated the financial performance of Korean outbound shipping companies before and after the financial crisis of 2008 through financial ratio analysis. He found that these companies improved their stability, profitability, productivity, growth, and activity indicators before the financial crisis, compared to the entire industry and transport companies, but that these indicators deteriorated relatively after the financial crisis. In addition, the importance of debt management in these outbound shipping companies was emphasized since they had a lower proportion of capital and a higher proportion of debt than the entire industry

and transport companies. Lastly, the author suggested that a stable financing structure should be diversified, such as through the disclosure of companies, since their profitability was relatively low due to their high-cost structures. Hong (2017) divided companies not included in KRX Eco Leaders 100 of KOSPI 200 Index into a group of general companies and conduct a comparative analysis of their financial ratio and business performance. Kim (2017) compared the age-specific enterprise-wide financial performance based on the financial data of the domestic manufacturing enterprise of the last four years. The result of comparing to firm age after dividing each firm size, Large companies analyzed that the average difference between the age groups no larger than SMEs. Stability ratio, utilization ratio of the asset, capital, and ROA is a significant difference by age. The highest activity was mature group companies (less than 21 years–40 years), ROE is start-ups and growing companies, and corporate 1 corporate group in liquidation can have the greatest share in the net assets were now elderly companies. On the other hand, showed SMEs numerical value is lower than the average of all of the large enterprise. Performance differences between age groups were also analyzed that a significant difference. Jang and Ahn (2018) analyzed the financial characteristics and corporate performance of Korean outbound cargo transport companies according to vessel type by using financial data from 2008 to 2017. Their results suggested the necessity for outbound cargo transport companies to identify the differences in financial factors according to the type of vessel owned and to diversify their portfolios of vessels.

Lee (2020) was mainly based on financial panel data over ten years from 2009 to 2018 from 29 mid-sized shipping companies, and independent variables were deduced from strategy related financial data. Regarding the growth strategy, the analysis showed that total asset growth and sales growth had positive effect on performance. Regarding the stability strategy, debt increase had negative effect, and equity had positive effect on performance. In addition, the interaction of total asset growth and equity had positive effect on performance, the interaction of total asset growth and debt increase, and interaction of sales growth and equity had negative effect on performance. However, the globalization related G/T and interaction of sales growth and debt increase had no effect on performance.

Most of the research was conducted on the relationship between financial factors and management performance in the manufacturing, finance, construction, and shipping sectors, and limited logistics, a representative asset-type industry. Therefore, this study analyzes the relationship between financial structure and management performance by dividing the logistics industry into 12 businesses, which is different from existing research.

## 3. Methodology and framework

This study selected 724 logistics companies with the necessary data available to meet the purposes of this study. The factors affecting financial and management performance were analyzed for the 2008–2018 period. The sample includes companies audited externally and based on the Industrial Classification (KSIC-9) large category. In addition, the impact on corporate characteristics and performance were analyzed according to the type of business by creating portfolios according to industrial classification and type of business. The types of businesses comprising the logistics industry are as follows.

- 1 Other maritime transport business
- 2 Coastal port freight transportation business
- 3 Refrigerated and frozen warehouse business
- 4 Ocean-going shipping cargo transport business

- 5 General warehouse business
- 6 Special warehouse business
- 7 Forwarder business
- 8 Air transport business, air handling business
- 9 Port transport business, port unloading business
- 10 Trucking Transport Business
- 11 Trucking Transport terminal operation business
- 12 Other (including rail transport business)

The data necessary for this study were obtained through Kis-Value. The variables used in this study were winsorized at the 0.5% level to minimize the distortion of the results due to extreme values.

The financial ratios used for the analysis consist of the liquidity ratio, efficiency ratio, profitability ratio, and so on. The current ratio [current,=(current assets/current liabilities) × 100] and the quick ratio [quick, =(liquid current assets/current liabilities) × 100] were used as measures of the liquidity ratio. The debt ratio [LEV, =(debt/total assets) × 100] and the interest coverage ratio [=operating profit/interest expense] were used to measure the capital structure. In addition, the receivables turnover ratio [= (sales/accounts receivable) × 100], the tangible assets turnover ratio [= (sales/tangible assets) × 100], and the total asset turnover ratio [= (sales/total assets) × 100] were used as measures of efficiency. The net income to total assets ratio [= (net income/total assets) × 100] and the net profit margin [= (net profit/sales) × 100] were used as measures of profitability. Lastly, the total asset growth rate [= (total assets for the current period – total assets for the prior period)/total assets for the prior period × 100] and the sales growth rate [= (sales for the current period – sales for the prior period)/sales for the prior period] were used as measures of growth and for a comparative analysis of the businesses in the industry.

In addition, a panel regression analysis was conducted to verify whether there were differences in financial factors affecting corporate performance for each business type as well as an analysis using the Fama-MacBeth (1973) model. Given endogeneity concerns, this study used lagged variables for the analysis.

As in the literature review, the econometric and time series methods using lagged variables can be used to reduce endogeneity concerns. In other words, one of the best ways to deal with endogeneity concerns is through the instrument variables (IVs) technique, where the most common IV estimator is the two-stage least squares (2SLS) method. Alternatively, the fixed-effect model can be used for panel data (Dowell, Hart, & Yeung, 2000; Kim, 2009). The time series method, on the other hand, involves using the variable for the next period rather than the explanatory variable as the dependent variable (Nelling & Webb, 2009; Makni, Francoeur, & Bellavance, 2008, etc.). The most difficult aspect of the IV technique lies in the selection of the appropriate IVs. Therefore, this study used the panel regression model with one-period lagged variables, as in most prior studies using the same method (Kim & Wee, 2011; Kim, Choi, & Bae, 2009).

The model for this study is set up by referring to existing studies to reduce the omitted variables problem, which could arise as a result of missing variables in the selection of explanatory variables. Morck, Shleifer, and Vishny (1988) and McConnell and Servaes (1990) argued that company size has a significant effect on corporate performance. Kwon (2012) used company size, sales increase/assets, and debt ratio, among others, as explanatory variables, while Lee and Kim (2012) used company size, growth rate, and financial soundness (i.e., the debt ratio) as explanatory variables. Kwon, Kim, and Kim (2013) used company size, debt ratio, R&D expenses, advertising expenses, and age in business as explanatory variables. Park and Lee (2003) argued that corporate insolvency may be a result of arbitrary or malicious expenditures by managers, or maybe a means of concealing profits. Lee (2008) argued that companies use entertainment expenses as compensa-

**Table 1**  
Basic statistics.

Variable	Mean	Std. Dev.	Min	Max
current	2.379	6.928	0.006	74.824
quick	2.340	6.916	0.006	74.824
LEV	0.640	0.301	0.006	2.075
IntC	70.519	566.923	-178.744	6907.571
RecT	31.121	150.443	0.845	1830.604
AssT	1.095	1.268	0.000	7.127
ROA	0.029	0.101	-0.572	0.435
ROE	0.110	0.814	-5.100	5.932
AssGr	0.290	1.460	-0.938	16.520
SalGr	0.292	1.432	-0.991	14.298
Size	10.415	0.627	8.259	12.770
Fixed	0.536	0.330	0.000	0.993
AdEx	0.001	0.004	0.000	0.042
enter	0.004	0.006	0.000	0.043
RD	0.000	0.002	0.000	0.021
Age	1.117	0.336	0.301	1.820

tion for past performance. A study by Park and Park (2007) found a positive relationship in the profits for the current and future periods and whether the company spent in excess of its entertainment expenses and the amount spent in excess of the limit. In addition, a study by Kim and Kim (2011) found that donations and entertainment expenses had a positive effect on corporate performance.

The explanatory variables included company size (Size, log (total assets)), growth rate (Growth, total asset growth rate), debt ratio (LEV, debt/asset × 100), tangible assets ratio (Fixed, tangible assets/total assets × 100), advertising ratio (AdEx, (sales promotion cost + overseas market development cost + advertising cost)/total assets × 100), entertainment ratio (Enter, entertainment expenses/total assets × 100), R&D expenses (RD), and the number of years in business (Age, corresponding year – year of establishment), among others. In addition,  $\gamma$  is a dummy variable representing the individual corporate effect,  $\delta$  is a dummy variable representing the time effect, and  $\epsilon_{i,t}$  is the error term.

Min and Kim (2012) analyzed the effect of the growth rate of assets and the growth rate of equity on the ROA.

In particular, Jang and Ahn (2018) decided to use the ROA as subordinate variables as they analyze the impact of the debt ratio, enterprise size, and growth rate of foreign shipping companies on ROA. For mid-sized foreign shipping companies to grow into large foreign shipping companies in the long term, the size expansion is related to total assets, and the dependent variable, which is management performance, is set as the ROA. Therefore, in this study, the net Return on total assets (ROA) and Return on equity (ROE) are used as a variable for corporate performance. This study analyzed the factors that affect the return on assets (ROA), which is an indicator of a company's performance.

The model used in this study is as follows, with the explanatory variables selected to account for potential multicollinearity.

$$ROA_{i,t} = \beta_0 + \beta_1 Size_{i,t} + \beta_2 Growth_{i,t} + \beta_3 LEV_{i,t} + \beta_4 Fixed_{i,t} + \beta_5 AdEx_{i,t} + \beta_6 Enter_{i,t} + \beta_7 RD_{i,t} + \beta_8 Age_{i,t} + \gamma_i + \gamma_t + \epsilon_{i,t} \quad (1)$$

$$ROE_{i,t} = \beta_0 + \beta_1 Size_{i,t} + \beta_2 Growth_{i,t} + \beta_3 LEV_{i,t} + \beta_4 Fixed_{i,t} + \beta_5 AdEx_{i,t} + \beta_6 Enter_{i,t} + \beta_7 RD_{i,t} + \beta_8 Age_{i,t} + \gamma_i + \gamma_t + \epsilon_{i,t} \quad (2)$$

**Table 2**  
Average financial ratios by type of business.

Type of business	current	quick	LEV	IntC	RecT	AssT	ROA
Other maritime transport	5.120	5.078	0.609	140.31	12.331	0.630	0.056
Coastal port freight transportation business	1.426	1.380	0.686	42.631	25.625	0.796	0.030
Refrigerated and frozen warehouse	2.855	2.808	0.669	41.902	10.663	0.273	0.020
Ocean-going shipping cargo transport business	1.406	1.340	0.732	23.030	47.127	0.957	0.012
General warehouse	3.039	3.016	0.652	32.262	21.506	0.437	0.026
Special warehouse	3.174	3.157	0.534	34.635	27.336	0.559	0.035
Forwarder	2.188	2.170	0.623	164.68	33.770	2.043	0.056
Air transport & air handling	2.138	2.065	0.766	144.10	37.653	1.617	0.027
Port transport & port unloading	3.949	3.878	0.748	77.951	16.852	0.667	0.034
Trucking Transport Business	1.352	1.339	0.632	57.299	27.242	1.605	0.036
Trucking Transport terminal operation business	2.086	1.934	0.558	45.623	82.870	0.835	0.028
Other	1.638	1.629	0.742	18.395	45.802	0.552	0.036

  

Types of business	ROE	AssGr	SalGr	Size	Fixed	AdEx	Enter	Age
Other maritime transport	0.100	0.100	0.146	10.336	0.490	0.000	0.004	1.119
Coastal port freight transportation business	0.151	0.130	0.197	10.332	0.590	0.001	0.003	1.239
Refrigerated and frozen warehouse	0.072	0.114	0.326	10.368	0.744	0.000	0.002	1.214
Ocean-going shipping cargo transport business	0.115	0.224	0.272	10.857	0.689	0.000	0.003	1.141
General warehouse	0.082	0.130	0.468	10.251	0.749	0.000	0.002	1.039
Special warehouse	-0.024	0.420	0.497	10.589	0.727	0.001	0.002	1.029
Forwarder	0.138	0.179	0.174	10.313	0.243	0.002	0.009	1.192
Air transport & air handling	0.101	0.155	0.520	10.870	0.435	0.006	0.002	1.231
Port transport & port unloading	0.153	0.065	0.289	10.651	0.341	0.001	0.003	1.129
Trucking Transport Business	0.117	0.230	0.167	10.384	0.472	0.001	0.005	1.083
Trucking Transport terminal operation business	0.025	0.060	0.110	10.609	0.700	0.002	0.001	1.211
Other	0.051	0.240	0.340	10.704	0.637	0.000	0.001	1.168

## 4. Empirical analysis results

### 4.1. Basic statistics and correlation analysis

Table 1 presents the basic statistics of the variables used in this study. The results for the financial ratios are as follows. The current ratio [current, = (current assets/current liabilities) × 100] and the quick ratio [quick, = (liquid current assets/current liabilities) × 100] are measures of liquidity. The debt ratio [LEV, = (debt/total assets) × 100] and the interest coverage ratio [IntC, = operating profit/interest expense] are measures of the capital structure ratio. The receivable turnover ratio [RecT, = (sales/accounts receivable) × 100] and the total assets turnover ratio [AssT, = (sales/total assets) × 100] are measures of efficiency. The net income to Return on Assets [ROA, × (net income/total assets)], Return on Equity [ROE, × (net income/stockholders' equity)], and Return on Sales [ROS, × (net income/sales) × 100] are measures of profitability. Lastly, the total asset growth rate [AssGr, = (total assets for the current period – total assets for the prior period)/total assets for the prior period] and the sales growth rate [SalGr, = (sales for the current period – sales for the prior period)/sales for the prior period] were used.

The Return on Assets (ROA, = net income/total asset × 100) was the dependent variable of the regression model. The explanatory variables included company size (Size, = log (total assets)), growth rate (Growth, = total asset growth rate), debt ratio (LEV, = debt/asset × 100), tangible assets ratio (Fixed, = tangible assets/total assets × 100), advertising ratio (AdEx, = (Sales promotion cost + overseas market development cost + advertising cost)/total assets × 100), entertainment ratio (Enter, = entertainment expenses/total assets × 100), R&D Expenses (RD), and number of years in business (age, = corresponding year – year of establishment).

Table 2 presents the mean of the variables by type of business. The other maritime transport business and the port transport & port unloading business showed relatively high current ratios, while the Ocean-going shipping cargo transport business and the Trucking Transport Business showed relatively low current ratios. The quick ratios showed a similar pattern to the current ratios. Therefore, the

results indicate differences in the liquidity ratios for each business within the logistics industry.

Next, the debt ratio and interest coverage ratio, which measure a company's ability to repay long-term liabilities, were examined. First, the debt ratios for the air transport & air handling business and the port transport & port unloading business were relatively high, whereas the debt ratios for the special warehouse business and the Trucking Transport terminal operation business were relatively low. Looking at the interest coverage ratio, all business types had good interest payment capabilities. In particular, the forwarder business and the air transport & air handling business had high-interest coverage ratios, while the Ocean-going shipping cargo transport business and the other business had relatively low-interest coverage ratios. Therefore, the air transport & air handling business showed a relatively high debt ratio, although the results also indicated that it has sufficient ability to pay interest on the debt. Looking at the trade receivables turnover ratio as a measure of efficiency, the Ocean-going shipping cargo transport business and the Trucking Transport terminal operation business had high trade receivables turnover ratios. For the total asset turnover ratio, the forwarder business, the air transport & air handling business, and Trucking Transport Business showed relatively high asset turnover ratios. Looking at the net income to total assets ratio as a measure of profitability, the other maritime transport business and the forwarder business showed relatively high net income to total assets ratios. The net income to shareholders' equity ratios are high for Coastal port freight transportation business, the forwarder business, and the port transport & port unloading business. The total assets growth rate, as a measure of growth, is high for the special warehouse business. The general warehouse business, special warehouse business, and the air transport & air handling business had high sales growth rates.

Lastly, looking at the size variable by business, Ocean-going shipping cargo transport business and the air transport & air handling business were relatively large in size. The tangible assets ratio was high for the refrigerated and frozen warehouse business and the general warehouse business. The air transport & air handling business had a relatively high advertising ratio, while the entertainment ratio showed high values for the forwarder business



**Table 3**  
Correlation coefficients.

	Size	AssGr	LEV	Fixed	AdEx	Enter	RD	Age
Size	1.00							
AssGr	-0.07	1.00						
LEV	-0.01	0.06	1.00					
Fixed	0.09	0.06	0.20	1.00				
AdEx	0.01	0.01	-0.01	-0.15	1.00			
Enter	-0.36	-0.03	-0.08	-0.39	0.11	1.00		
RD	-0.02	0.01	-0.04	-0.05	0.36	0.03	1.00	
Age	0.12	-0.12	-0.08	-0.14	0.00	0.00	-0.04	1.00

**Table 4**  
Regression analysis results: Financial factors affecting corporate performance (ROA) (entire logistics industry).

	OLS	Random-effects	Fixed-effects	Fama-MacBeth
Size	-0.007***	0.000	0.034***	-0.007***
Growth	0.000	0.000	0.001	0.012
LEV	-0.134***	-0.159***	-0.207***	-0.131***
Fixed	0.001***	0.000	0.000	0.000
AdEx	0.183	-0.748*	-1.760***	-0.026
Enter	1.399***	1.329***	1.174***	1.619***
RD	-0.462	-0.523	-1.305	-0.769
Age	0.004	0.006	0.018***	0.007
Constant term	0.175***	0.120***	-0.215***	0.174***

Note: \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% levels, respectively.

**Table 5**  
Regression analysis results: Financial factors affecting corporate performance (ROE) (entire logistics industry).

	OLS	Random-effects	Fixed-effects	Fama-MacBeth
Size	-0.057***	-0.060***	-0.187***	-0.070***
Growth	-0.021***	-0.021***	-0.028***	0.001
LEV	0.095***	0.097**	0.097	0.123**
Fixed	0.000	0.000	0.000	0.000
AdEx	-2.779	-3.478	-10.821	-3.456
Enter	6.525***	6.778***	8.088*	4.535*
RD	8.920	9.874	16.762*	8.475*
Age	0.020	0.023	0.116*	0.012
Constant term	0.595***	0.622***	1.850***	0.745***

Note: \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% levels, respectively.

and Trucking Transport Business. Lastly, looking at company age, Coastal port freight transportation business had a high value, while the special warehouse business had a low value. Therefore, there are differences in the financial structure of each business type within the logistics industry.

Table 3 presents the correlation coefficients between the explanatory variables in the model. Most of the correlation coefficients were relatively low, and the variance inflation factor (VIF) confirms that there was no multicollinearity problem.

#### 4.2. Panel regression analysis

Table 4 presents the regression analysis results of the financial factors affecting corporate performance (ROA) for all companies in the logistics industry. Although the results were somewhat different between the models, the debt ratio (LEV) had a negative (-) effect on corporate performance (ROA). Advertising ratio (AdEx) also had a negative (-) effect on corporate performance in general. On the other hand, looking at the entertainment ratio (Enter), the coefficients have a significantly positive (+) value in all models, indicating that the entertainment ratio had a positive effect on corporate performance.

Table 5 presents the regression analysis results for factors affecting corporate performance (ROE) for all companies in the logistics industry. The results are similar to those in Table 4 for ROA. The coefficients of the debt ratio (LEV) were negative (-) in all models,

implying that the more debt the company used, the lower its corporate performance (ROE). In addition, the coefficients of the growth rate were generally negative (-). On the other hand, the Debt to Equity Ratio (LEV) had a significant positive (+) value, indicating that the higher the debt ratio, the higher the ROE. In addition, the coefficient of the entertainment ratio (Enter) also had a positive value (+), indicating that the entertainment ratio had a positive (+) effect on ROE. Furthermore, research and development (RD) generally had a positive effect on ROE.

The results of the Hausman test using the panel model showed that the fixed effects model was more appropriate. Therefore, in the detailed business analysis of the logistics industry, the fixed effects model was used for analysis. Table 6 presents the results for the factors affecting ROA by business type using the fixed effects model. In most businesses, the coefficient of the debt ratio (LEV) had a significant negative (-) value, indicating that ROA decreases as the debt ratio increases, regardless of the type of business. The coefficients of the variables besides the debt ratio differed depending on the specific business.

First, in the case of other maritime transport business, the forwarder business, and Trucking Transport Business, the coefficient of company size had a significantly negative (-) value, indicating that ROA decreased as the company size increased. In the case of Coastal port freight transportation business, the higher the growth rate (Growth), tangible assets ratio (Fixed), R&D expense (RD), and the number of years in business (Age), the higher the ROA. In the refrigerated and frozen warehouse business, greater company size (Size), growth rate (Growth), and R&D expenses (RD) had a higher effect on ROA. In ocean-going shipping cargo transport business, the greater the company size (Size) and tangible assets ratio (Fixed), the higher was the effect on ROA. In the general warehouse business, company size (Size), tangible assets ratio (Fixed), advertising ratio (AdEx), entertainment ratio (Enter), R&D expenses (RD), and the number of years in business (Age) had a significant effect on ROA. In the special warehouse business, company size (Size), advertising ratio (AdEx), entertainment ratio (Enter), and R&D expenses (RD) affected ROA. In the forwarder business, company size (Size), growth rate (Growth), and advertising ratio (AdEx) had a significant effect on ROA. Next, in the air transport & air handling business, company size (Size), growth rate (Growth), entertainment ratio (Enter), and R&D expenses (RD) had a significant effect on ROA. In the port transport & port unloading business, the tangible assets ratio (Fixed) affected ROA. In the Trucking Transport Business, company size (Size), debt ratio (LEV), and entertainment ratio (Enter) had a significant effect on ROA. In the Trucking Transport terminal operation business, the growth rate (Growth), advertising ratio (AdEx), and the number of years in business (Age) affected ROA. In the other industries, including the rail transportation industry, no financial factors under consideration affected ROA.

Table 7 presents the analysis results of factors affecting ROE by type of business using the fixed effect model.

The coefficients of the variables differed according to the detailed businesses. First, in the other maritime transport business, the coefficient of the company size (Size) appeared to have a significantly negative (-) value, implying that ROE decreased as the company size increased. The results indicate that no factor affects ROE in Coastal port freight transportation business. The higher the growth rate (Growth) in the refrigerated and frozen warehouse business, and the higher the entertainment ratio (Enter) in the Ocean-going shipping cargo transport business, the higher the ROE was in the respective businesses. In the general warehouse business, the coefficient of company size (Size) was significantly negative (-), implying that ROE decreased as the company size increased. Additionally, ROE increased as the number of years in business (Age) increased in the general warehouse business. In the special warehouse business, the coefficients of company size (Size)

**Table 6**  
Logistics industry analysis results by business type (ROA-fixed effect).

	Other maritime transport	Coastal port freight transportation	Refrigerated and frozen warehouse	Ocean-going shipping cargo transport	General warehouse	Special warehouse
Size	-0.073*	0.032	0.096***	0.060***	0.062***	0.135***
Growth	-0.002	0.021**	0.006***	0.001	-0.001	-0.003
LEV	-0.230***	-0.354***	-0.262***	-0.327***	-0.176***	-0.097***
Fixed	0.000	0.001*	0.001	-0.001***	-0.001**	0.000
AdEx	-3.123	-4.897	0.097	8.471	-3.774***	-4.904**
Enter	-0.388	-1.950	-1.273	1.282	-5.576***	-4.704***
RD	-3.905	7.980**	5.269***	80.483	-2.768***	-843.477**
Age	0.009	0.078***	-0.004	-0.019	0.024**	-0.002
Constant	0.919***	-0.151	-0.812	-0.380*	-0.514***	-1.318***
F						
	Forwarder	Air transport & air handling	Port transport & port unloading	Trucking Transport	Trucking Transport terminal operation	Other
Size	-0.047***	0.110***	0.032	-0.043***	-0.116	-0.064
Growth	0.006**	0.023***	-0.006	-0.003	0.098**	0.002
LEV	-0.161***	-0.264***	-0.166***	-0.160***	-0.143**	0.060
Fixed	0.000	0.000	0.001**	0.000	-0.004	0.000
AdEx	-1.423*	-0.642	-0.539	0.603	-3.414**	26.876
Enter	-0.373	21.244***	-0.768	3.184***	17.145	-5.696
RD	-0.653	-797.592***	-3.220	1.058	-2.422	9.755
Age	-0.006	-0.049	0.002	0.006	0.209***	0.127
Constant	0.641***	-0.965***	-0.187	0.565***	1.074	0.530
F						

Note: \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% levels, respectively.

**Table 7**  
Logistics industry analysis results by business type (ROE-fixed effect).

	Other maritime transport	Coastal port freight transportation	Refrigerated and frozen warehouse	Ocean-going shipping cargo transport	General warehouse	Special warehouse
Size	-0.751*	0.275	-0.286	-0.154	-0.274*	-0.623**
Growth	-0.137	-0.125	0.049*	-0.040	0.010	-0.158***
LEV	0.358	-0.541	0.448	0.182	0.375	0.063
Fixed	0.000	0.000	0.002	0.000	0.000	-0.002
AdEx	-49.444	-37.189	-148.815	44.718	22.284	-14.918
Enter	26.245	-31.707	30.061	36.157*	9.038	42.943**
RD	8.844	52.963	0.401	-73.699	31.328	-898.711
Age	0.030	-0.123	-0.172	0.060	0.401***	0.426
Constant	7.564*	-2.014	2.918	1.493	2.194	6.220**
F						
	Forwarder	Air transport & air handling	Port transport & port unloading	Trucking Transport	Trucking Transport terminal operation	Other
Size	-0.099	0.070	0.181	-0.148	-1.789**	-0.207
Growth	0.009	-0.125***	-0.109**	-0.008	0.341	-0.028
LEV	-0.285**	0.160	-0.387	0.069	-0.678	1.712***
Fixed	0.000	0.000	0.000	0.000	0.079	0.000
AdEx	-3.332	-12.548	-7.075	1.583	-18.769	97.076
Enter	2.599	-21.836	-11.480	12.711	-217.97*	-36.707
RD	7.754	-6136.56***	10.718	73.383***	1.134	84.450
Age	-0.064	-0.196	0.163	0.222*	1.398***	-0.623
Constant	1.383	-0.397	-1.669	1.281	17.739	1.760
F						

Note: \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% levels, respectively.

and growth rate (Growth) were significantly negative (-), implying that ROE decreases as the company size (Size) increases, while ROE increases as the entertainment ratio (Enter) increases. In the forwarder business, the coefficient of the debt ratio (LEV) had a significantly negative (-) value, implying that ROE decreases as the debt ratio increases. In the air transport business, the coefficients of the growth rate (Growth) and R&D expenses (RD) had significantly negative (-) values, implying that ROE decreases as the growth rate and the R&D expenses increase, with the effect of the R&D expenses being very large. In the port transport & port unloading, the coefficient of the growth rate (Growth) had a significantly negative value

(-), implying that ROE decreases as the growth rate increases. In the Trucking Transport Business, the coefficients of R&D expenses (RD) and the number of years in business (Age) showed significant values, implying that ROE increases as the R&D expenses and the number of years in business increase, with the effect of the R&D expenses being very large. In the Trucking Transport terminal operation business, the coefficients of company size (Size) and entertainment ratio (Enter) were significantly negative (-), implying that ROE decreases as the company size and entertainment ratio increase. In contrast, ROE increased as the number of years in business (Age) increased in the Trucking Transport terminal operation

business. In the other business, including rail transportation, the coefficient of the debt ratio (LEV) had a significantly positive (+) value, implying that ROE increased as the debt ratio increased.

## 5. Conclusion

This study selected 724 logistics companies with the necessary data available to meet the purposes of this study. The factors affecting financial and management performance were analyzed for the 2008–2018 period. The goal of this study was to analyze the differences in the financial structures within the Korean logistics industry and the impact of these financial structures on management performance.

The results for the factors affecting ROA by business type using the fixed effects model, in most businesses, the coefficient of the debt ratio (LEV) had a significant negative (–) value, indicating that ROA decreases as the debt ratio increases, regardless of the type of business.

By financial ratio, first, the increase in Size had a positive impact on the ROA of the Refrigerated and frozen warehouse, Ocean-going shipping cargo transport, General warehouse, Special warehouse, and Air transport & air handling. On the other hand, it had negative effects on Other maritime transport and forwarder. Second, the increase in Growth had a positive impact on the ROA of the Coastal port freight transportation, Refrigerated and frozen warehouse, forwarder, Air transport & air handling, Trucking Transport terminal operation. Thirdly, the increase in Fixed had only a positive impact on the ROA of the Port transport & port unloading. On the other hand, it had negative effects on Ocean-going shipping cargo transport and General warehouse. Fourth, the increase in AdEx had a negative impact on the ROA of the General warehouse, Special warehouse, forwarder, and Trucking Transport terminal operation. Fifth, the increase in Enter had a positive impact on the ROA of the Air transport & air handling, Trucking Transport terminal operation. On the other hand, it had negative effects on General warehouse and Special warehouse. Sixth, the increase in RD had a positive impact on the ROA of Coastal port freight transportation and Refrigerated and frozen warehouse. On the other hand, it had negative effects on General warehouse, Special warehouse and Air transport & air handling. Seventh, the increase in Age had a positive impact on the ROA of the Coastal port freight transportation, General warehouse, and Trucking Transport terminal operation.

The results for the factors affecting ROE by business type using the fixed effects model. Fixed and AdEx had no significant effect on the ROE of logistics industries. By financial ratio, first, in the case of other maritime transport business, General Warehouse, Special Warehouse, Trucking Transport terminal operation Business, the coefficient of Size had a significantly negative value, indicating that ROE decreased as Size increased. Second, the increase in Growth had a positive impact on the ROE of the Refrigerated and frozen warehouse. On the other hand, it had negative effects on Special warehouse, Air transport & air handling, and Port transport & port unloading. Third, the increase in LEV had a positive impact on the ROE of the Other. On the other hand, it had negative effects on Forwarder. Fourth, the increase in Enter had a positive impact on the ROE of the Ocean-going shipping cargo transport and Special warehouse. On the other hand, it had negative effects on Trucking Transport terminal operation Business. Fifth, the increase in RD had a positive impact on the ROE of the Trucking Transport. On the other hand, it had negative effects on Air transport & air handling. Sixth, the increase in Age had a positive impact on the ROE of the General warehouse, Trucking Transport, and Trucking Transport terminal operation.

This result shows that there are differences in financial factors that affect management performances as ROA and ROE by business

types in the logistics industry. Logistics is a representative asset-type industry that requires networks, transportation, loading and unloading, and storage facilities to improve operational efficiency and productivity.

Suggesting policy implications is as follows. First, asset-type logistics companies such as Warehouse, Ocean-going shipping cargo transport, and Air transport & air handling can contribute to improved management performance through investment in assets, on the other hand, non-asset logistics companies such as Other maritime transport, Forwarders, and Trucking transport require streamlining asset management.

Particularly, since debt ratio growth is negatively affecting management performance and asset-type logistics companies such as warehouses, shipping & air transport companies, Port transport, etc. must raise appropriate funds from outside financial institutions, logistics companies should find ways to ensure that debt-financed funds have a positive impact on management performance. Consequently, logistics companies have a positive effect on debt growth, such as credit through proper management of liquidity and debt ratios. Funding for cost reduction shall be raised by enhancing the salary, and policy-financing institutions shall provide long-term low-interest policy financing to logistics companies so that logistics companies can reduce costs in terms of revenue and increase the utilization of funds raised by debt. In addition, asset-type logistics companies should focus on specialized areas to enhance the efficiency of assets and thereby ensure that the interaction between increasing total assets and increasing liabilities has a positive impact on management performance. They require more management improvement efforts to enhance the soundness of their financial structure. Therefore, they need to recognize differences in major financial factors that affect performance according to the type of business it owns and push forward pre-emptive measures such as management efficiency and improvement of profits accordingly and the diversification of its continuous business portfolio.

Finally, Fixed has not significantly affected the management performance in logistics industry, indicating that property, plant, and equipment do not affect the profitability and value of the logistics company. On the other hand, intangible assets such as R&D contributed to management performance in Coastal port freight transportation, Refrigerated and frozen warehouse, and Trucking transport. Therefore, the evidence suggests that intangible assets affect the profitability and the value of logistics firms. The expenditures for intangible assets, especially R&D expenditures, are the most critical factor of a firm's value.

This study presented the characteristics of the financial structure of each sector of the Korean logistics industry and the major financial factors on the management performance, which can be found to be different from the existing research. Nevertheless, this study has limitations that did not reflect the various business portfolios and macroeconomic changes of each specific industry for ease of analysis.

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