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Factors Affecting Stock Beta Variations of Korean Listed Shipping Companies

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Abstract : *This study investigated determinants of stock betas of shipping companies in Korea. Beta is a measurement of sensitivity of an individual stock to the movement of the whole stock market. It is widely accepted that stock betas are not constant, but time-varying, which implies that they are affected by other factors. In this regard, this study examined betas of six shipping companies listed on the Korea Exchange for the period of 2000-2021 and their relationship with financial leverage, operating leverage, and cyclicality in the shipping market. Empirical analysis showed that betas of Korean shipping companies were positively associated with financial and operating leverages but negatively with cyclicality.*

Key words : *beta, shipping, financial leverage, operating leverage, cyclicality*

1. Introduction

Shipping transportation plays a key role in shaping the global economy by serving approximately 80% of international trade (UNCTAD[1], 2022). This is especially true for South Korea, an open economy with the Trade-to-GDP ratio over 60%, because 99.7% of its export and import is serviced by maritime transport.[2]

Despite the significance of the shipping industry in facilitating economic activity, it is generally perceived that investors in the financial market pay relatively little attention to the sector. Although there is no unanimous agreement on the phenomenon, majority of research in the relevant filed points out investors' perception of riskiness of the shipping industry. For example, Albertijn et al. (2011) document that the annualized volatility of Baltic Dry Index (BDI) is 53.09% while that of the stock market index is 15.73%.

However, there is a great deal of empirical evidence that shows, in contrast to the high volatility in shipping freight rate, the risk of shipping companies' stocks is lower than the market average (for example, see Kavussanos and Marcoulis, 1997a; 1997b). The risk of an individual stock is generally measured in the beta (β) derived from the Capital Asset Pricing Model (CAPM). The beta is the sensitivity of an individual stock to the movement of the whole stock market. Therefore, when the beta of a stock is greater than one (1), it is regarded as risker than the market average, and vice versa.

Research in shipping finance has also found two other stylized facts on the betas of shipping companies. First, the betas of shipping companies are not constant, but time-varying (Drobetz et al., 2016; Tezuka et al., 2012). Second, betas of shipping companies vary by the ship type that a company engages in (Kavussanos et al., 2003). In this regard, it is of great importance to investigate factors affecting changes in betas of shipping companies. This study especially focuses on Korean shipping companies highlighting the impact of firm-specific factors.

To this end, this paper investigates the changes of betas of 6 shipping companies listed on Korea Exchange and examines whether changes in those betas can be explained by the financial leverage, the operating leverage and freight market cyclicality. Given the importance of the risk-return relationship of a stock to both investors and financial managers, the findings in this study can provide practical contributions.

The rest of this research is organized as following: Section 2 reviews the theoretical aspect of changes in beta and the previous literature on betas of shipping companies. Section 3 describes the dataset employed in this research and the methodologies. Section 4 provides the empirical results. Finally, Section 5 concludes this study.

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1) United Nations Conference on Trade and Development.
2) Korea International Trade Association (http://stat.kita.net)

2. Literature Review

Modern financial research has been built on the portfolio theory, the seminal work of Markowitz (1952). Based on this, the risk-return relationship of a stock was established with CAPM (Lintner, 1965; Sharpe 1964). Since its development in 1960s, CAPM has gained popularity from both academic and industrial areas in estimating the cost of equity capital (Graham and Harvey, 2001). In this regard, investors can calculate appropriate required rate of return for risky investment.

With regard to the shipping industry, research in this area has been performed since 1990s when Greek-based shipping companies explored tapping the US capital market. Kavussanos and Marcoulis (1997a) examine the stock returns of 28 maritime transportation companies in the United States of America (USA) for the period of 1984-1995 and report that there is no statistically significant difference between shipping betas and the market average. Furthermore, Kavussanos and Marcoulis (1997b) find that betas of US shipping companies are lower than the market average and their stock returns are affected by asset-to-book value ratio. Similar results are reported in Kavussano and Marcoulis (2000).

Another body of research performs international and inter-/intra-industry comparisons of shipping stock betas. Grammenos and Marcoulis (1996) investigate the stock returns of shipping companies in Norway, Sweden, the United Kingdom and the USA and find that the shipping betas are significantly lower than the market average. In addition, they document that shipping betas in the USA are lower than those in other countries. Kavussanos and Marcoulis (1998) find the betas of US shipping companies are lower than those of railway transportation firms. Kuo et al. (2016) examine the betas of freight indices in the dry bulk sector (Baltic Capesize Index, Baltic Panamax Index and Baltic Handysize Index) and report that the risk premium of the shipping industry is significantly lower than the S&P500 stock market index.

Finally, a stream of research highlights factors affecting changes in shipping betas. Kavussanos et al. (2003) and Drobetz et al. (2016) investigate the stock prices of shipping and shipping-related firms across the world. Empirical evidence in both papers is twofold: First, betas of maritime industries have changed over time. Second, betas vary by industries and sectors within the shipping industry. For example, Kavussanos et al. (2003) report the higher beta of the drilling and offshore sector than bulk, tanker and container in the maritime industry. Moreover, Tezuka et al. (2012) document a positive relationship between market competition and the betas of Japanese liner shipping companies.

Despite the abundant amount of research on shipping betas, relatively little academic attention has paid to Korean shipping companies. The only exception known to us is Kim (2017) who investigates the betas of Korean logistics firms. However, this study highlights only the time-varying property of stock betas of logistics companies and fails to distinguish heterogenous characteristics of sectors within the logistics industry. In this regard, the findings in this study can offer valuable implications for the risk-return relationship of shipping stocks by investigating the determinants of beta changes.

3. Methodologies and Data

Theoretically, the beta of a stock is the ratio of the covariance between stock returns and market returns to the market return variance. However, the use of the covariance coefficient could be biased depending on the length of the sample period. Therefore, the vast majority of empirical studies employ the linear regression model as following:

$$r_{it} = \alpha_i + \beta_i r_{mt} + \epsilon_{it} \quad (1)$$

where r_{it} is the stock return of company i at year t; r_{mt} is the market return at year t; ϵ_{it} is the error terms.

β_i in Equation (1), the coefficient of the market return, is used as the beta of company i in this study. Using the betas calculated as above, the changes in betas are estimated in the regression model as following:

$$\beta_{it} = \alpha_{1i} + \alpha_{2i} x_{it} + \alpha_{nt} X_t^{'} + \epsilon_{it} \quad (2)$$

where β_{it} is the beta of company i at year t; x_{it} is the variable of interest (independent variable); $X_t^{'}$ is the vector of the controlling variables; ϵ_{it} is the error terms.

In light of Ross et al. (2021), this paper examines whether betas of shipping companies can be explained by the financial leverage, the operating leverage and cyclicality. For example, the beta of an asset is the weighted average of those of debt and equity capital. Therefore, when the capital structure changes, the only changeable variable is the equity beta. Similar argument can be applied for the

operating leverage and cyclicality. The financial leverage are measured in two ways: debt-to-assets ratio and non-current liabilities-to-assets ratio. As the operating leverage is the sensitivity to fixed cost, it is measured by the non-current assets-to-assets ratio. Finally, cyclicality is measured by the volatility in freight rate.

The dataset for empirical analysis is collected for 6 shipping companies listed on Korea Exchange (HMM, KSS Line, Korea Line, PanOcean, Glovis and Heung-A Line). Daily stock prices are retrieved from Yahoo Finance (finance.yahoo.com) for the period between 2000 and 2021 for the calculation of betas. Financial statements are downloaded from Data Analysis, Retrieval and Transfer System (DART) of Financial Supervisory Service (dart.fss.or.kr). For controlling variables, in light of Drobetz et al. (2016), this paper consider the US Dollar-Korean Won exchange rate (FX), short-term interest rate (call rate, IR), consumer price index (CPI), GDP growth (GDP) and trade growth (Trade) all of which are collected from the Bank of Korea (ecos.bok.or.kr).

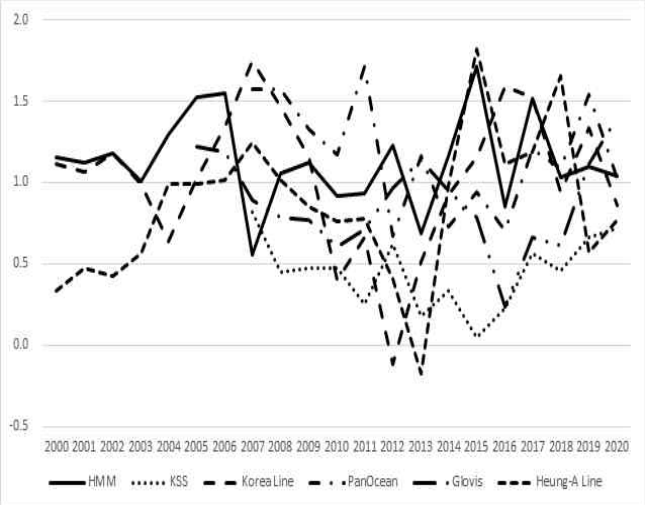

Fig. 1 Changes in Betas of Shipping Companies (2000-2021)

Fig. 1 depicts the changes in betas of 6 shipping companies for the period of 2000-2021. Consistent with the findings in previous literature, betas of Korean shipping companies are also time-varying. In contrast, however, while the extant literature points out the shipping beta that is significantly lower than the market average, those of Korean shipping companies are highly volatile with frequent observations of betas greater than one (1).

Table 1 provides the descriptive statistics for the betas of shipping companies, debt-to-assets (DA), non-current liabilities-to-assets ratio (NCLA), non-current assets-to-assets ratio (NCAA) and freight rate volatility (Vol). For the period of 2000-2021, the average of shipping betas is 0.93 that is consistent with empirical evidence that it is lower than the market average. Regarding the debt-to-assets and the non-current liabilities-to-assets ratios, some observations have negative values (see Min column). This is because some shipping companies underwent financial distress and capital impairment after the market collapse in 2008. Therefore, in order to relieve the impact of those outliers, the two variables are winsorized by 10% at top and bottom, respectively.

Table 1 Descriptive Statistics for Variables

	Mean	Max	Min	Std. Dev.	Obs.
Beta	0.9300	1.8165	-0.1736	0.4099	110
DA	4.4444	60.4397	-11.9107	7.9543	110
NCLA	2.8237	48.2833	-7.3596	5.7491	110
NCAA	0.7467	0.7817	0.9602	0.3119	110
Vol	0.0758	0.2529	0.0191	0.0403	110

1) Std. Dev. and Obs. indicate the standard deviations and the number of observations, respectively.
2) The reason the number of observations is 110 (not 132 for 6 companies during 22 years) is that some companies listed on stock exchange after 2000. Specifically, while Glovis went public in 2005, KSS Line and PanOcean listed in 2006.

4. Empirical Results

Table 2 reports the regression results for the impact of debt-to-assets ratio. Although, consistent with the theoretical expectation, the direction of the coefficient is positive, there is no statistical significance (see Model 1). However, when the effect of certain period is fixed (Year-Fixed), the positive relationship between the debt-to-assets ratio and the shipping beta is statistically significant (see Model 3). This is possibly explained by the abnormal financial conditions of Korean shipping companies after the collapse of the shipping market following the financial crisis in 2008. Similar phenomenon is observed in the relationship between non-current liabilities-to-assets and shipping betas (see Table 3).

Table 2 Results for Debt-to-Assets

Model	1	2	3	4	5
DA	0.0031	-0.0116	0.0354*	0.0269	0.0097
	[0.2332]	[-0.8703]	[1.8739]	[1.4435]	[0.5742]
FX					-0.0008
IR					-0.0307
CPI					5.6894
GDP					0.1719
Trade					-0.3547
C	0.9193***	0.9702***	0.8076***	0.8371***	1.7316*
Firm-Fixed	No	Yes	No	Yes	No
Year-Fixed	No	No	Yes	Yes	No
Adjusted R^2	0.0005	0.2956	0.2134	0.4845	-0.0468
Observations	110	110	110	110	110

1) ***, ** and * denote the statistical significance at 1%, 5%, and 10%, respectively.
2) Values in [.] are t-statistics and only those for the variables of interest are reported.

Table 3 Results for Non-Current Liabilites-to-Assets

Model	1	2	3	4	5
NCLA	0.0122	-0.0126	0.0673**	0.0579*	0.0270
	[0.5146]	[-0.5082]	[2.1148]	[1.7787]	[0.9191]
FX					-0.0009
IR					-0.0385
CPI					6.4770
GDP					0.2202
Trade					-0.4006
C	0.9055***	0.9552***	0.7950***	0.8139***	1.8705*
Firm-Fixed	No	Yes	No	Yes	No
Year-Fixed	No	No	Yes	Yes	No
Adjusted R2	0.0024	0.2922	0.2217	0.4911	-0.0416
Observations	110	110	110	110	110

1) ***, ** and * denote the statistical significance at 1%, 5%, and 10%, respectively.
2) Values in [.] are t-statistics and only those for the variables of interest are reported.

As seen in Table 4, it is also found that the shipping betas are positively associated with the operating leverage, which is consistent with previous empirical evidence. In Model 3 of Year-Fixed, the coefficient of non-current assets-to-assets is positive and significant at 10% level (Still, there is no statistical significance in Model 1, similar to the result regarding the financial leverage in Table 1).

Table 4 Results for Non-Current Assets-to-Assets

Model	1	2	3	4	5
NCAA	-0.4611	-0.0126	0.0673**	0.0579*	0.0270
	-1.8697	-0.5082	2.1148	1.7787	0.9191
FX					-0.0009
IR					-0.0385
CPI					6.4770
GDP					0.2202
Trade					-0.4006
C	1.2743***	0.9552***	0.7950***	0.8139***	1.8705*
Firm-Fixed	No	Yes	No	Yes	No
Year-Fixed	No	No	Yes	Yes	No
Adjusted R^2	0.0314	0.3154	0.1963	0.4764	-0.0221
Observations	110	110	110	110	110

1) ***, ** and * denote the statistical significance at 1%, 5%, and 10%, respectively.
2) Values in [.] are t-statistics and only those for the variables of interest are reported.

Finally, Table 5 documents the empirical results regarding the impact of freight rate volatility on betas of Korean shipping companies. In stark contrast to the conventional wisdom of the negative impact of cyclicality on a stock beta, freight market volatility is negatively related with stock betas of Korea shipping companies.

Table 5 Results for Freight Rate Volatility

Model	1	2	3	4	5
Vol	-1.1671	1.7762	-4.6135***	1.6185	-1.8648
	-1.1997	1.6271	-2.9084	0.6526	-1.4200
FX					-0.0004
IR					-0.0296
CPI					5.3762
GDP					-1.6665
Trade					-0.2334
C	1.0184***	0.7953***	1.2797***	0.8073***	1.5495*
Firm-Fixed	No	Yes	No	Yes	No
Year-Fixed	No	No	Yes	Yes	No
Adjusted R^2	0.0132	0.3082	0.2542	0.4742	-0.0300
Observations	110	110	110	110	110

1) ***, ** and * denote the statistical significance at 1%, 5%, and 10%, respectively.
2) Values in [.] are t-statistics and only those for the variables of interest are reported.

5. Conclusion

This study investigates the factors affecting changes in stock betas of Korean shipping companies. It is found that the shipping betas are positively associated with the financial leverage and the operating leverage, while negatively associated with cyclicality.

The implication of the findings in this paper is twofold. First, by investigating the factors affecting changes in beta of Korean shipping companies, this paper supports previous research on the cost of capital and risk-return relationship in the shipping industry. Second, financial managers of Korean shipping companies can take advantage of the impact of the financial and the operating leverages in establishing capital structure and calculating the cost of capital.

Despite the interesting findings in this research, this paper has some limitations. First, the analysis is performed based on the observations of only 6 firms. Second, other dimensions of the cyclicality in the shipping industry can offer interesting observations. Although the freight market volatility is employed in this study as a proxy for cyclicality, the latter is a kind of long-term cycle which is not able to be captured the short-term variations. Finally, it is of interest to examine whether the findings in this study are specific to Korean shipping companies through international comparison.

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References

[1] Albertijn, S., Bessler, W. and Drobetz, W.(2011), “Financing Shipping Companies and Shipping Operations: A Risk-Management Perspective”, Journal of Applied Corporate Finance, Vol. 23, No. 4, pp. 70-82.

[2] Drobetz, W., Menzel, C. and Schroder, H.(2016), “Systematic Risk Behavior in Cyclical Industries: The Case of Shipping”, Transportation Research Part E: Logistics and Transportation Review, Vol. 88, pp. 129-145.

[3] Graham, J. R. and Harvey, C. R.(2001), “The Theory and Practice of Corporate Finance: Evidence from the Field”, Journal of Financial Economics, Vol. 60, No. 2, pp. 187-243.

[4] Grammenos, C. T. and Marcoulis, S. N.(1996), “ A Cross-section Analysis of Stock Returns: The Case of Shipping Firms”, Maritime Policy & Management, Vol. 23, No. 1, pp. 67-80.

[5] Kavussanos, M. G., Juell-Skielse, A. and Forrest, M.(2003), “International Comparison of Market Risks Across Shipping-related Industries”, Maritime Policy & Management, Vol. 30, No. 2, pp. 107-122.

[6] Kavussanos, M. G. and Marcoulis, S. N.(1997a), “Risk and Return of US Water Transportation Stocks Over Time and Over Bull and Bear Market Conditions”, Maritime Policy & Management, Vol. 24, No. 2, pp. 145-158.

[7] Kavussanos, M. G. and Marcoulis, S. N.(1997b), “The Stock Market Perception of Industry Risk and Microeconomic Factors: The Case of the US Water Transportation Industry Versus Other Transport Industries”, Transportation Research Part E: Logistics and Transportation Review, Vol. 33, No. 2, pp. 147-158.

[8] Kavussanos, M. G. and Marcoulis, S. N.(1998), “Beta Comparisons across Industries - A Water Transportation Industry Perspective”, Maritime Policy & Management, Vol. 25, No. 2, pp. 175-184.

[9] Kavussanos, M. G. and Marcoulis, S. N.(2000), “The Stock Market Perception of Industry Risk and Macroeconomic Factors: The Case of the US Water and Other Transportation Stocks”, International Journal of Maritime Economics (Maritime Economics and Logistics), Vol. 2, No. 3, pp. 235-256.

[10] Kim, C. Y.(2017), “Time-varying Systematic Risk of the Stocks of Korean Logistics Firms”, Journal of Navigation and Port Research, Vol. 41, No. 2, pp. 71-78.

[11] Lintner, J.(1965), “The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets”, Review of Economics and Statistics, Vol. 47, No. 1, pp. 13-37.

[12] Markowitz, H. (1952). “Portfolio Selection”, Journal of Finance, Vol. 7, No. 1, pp. 77-91.

[13] Ross, S. A., Westerfield, R. W., Jaffe, J. F. and Jordan, B. D.(2021), Corporate Finance: Core Principles and Applications, 6th Edition, McGraw-Hill Korea, Seoul.

[14] Sharpe, W. F.(1964), “Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk”, Journal of Finance, Vol. 19, No. 3, pp. 425-442.
[15] Tezuka, K., Ishii, M. and Ishizaka, M.(2012), “Relationship between CAPM-B and Market Changes in the Japanese Liner Shipping Industry”, Maritime Policy & Management, Vol. 39, No. 3, pp. 297-319.
[16] UNCTAD,(2022), Review of Maritime Transport 2022.

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