Finans Ekonomi ve Sosyal Araştırmalar Dergisi, Cilt.8 Sayı.3, Eylül 2023
Research of Financial Economic and Social Studies, Vol.8 No.3, September 2023
ISSN : 2602 – 2486

KONTEYNER TAŞIMACILIK PAZARINDA FİNANSAL ETKİNLİĞİN BELİRLEYİCİLERİ[1]

DETERMINANTS OF FINANCIAL EFFICIENCY IN THE CONTAINER SHIPPING MARKET

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Araştırma Makalesi / *Geliş Tarihi: 13.08.2023*
Kabul Tarihi: 30.09.2023

Öz

Bu çalışmanın amacı, büyüyen küresel ticaretin bir paydaşı olan 11 lider konteyner taşımacılık şirketinin satış karlılık oranlarına etki eden sektöre özgü faktörleri belirlemektir. Çalışmada, halka açık olmayan konteyner taşımacılık şirketlerinin 2010-2021 yıllarına ilişkin finansal verileri panel veri yöntemi kullanılarak analiz edilmiştir. Analiz sürecinde kullanılan veriler her bir şirketin kurumsal web sitelerinde yayınladıkları yıllık mali raporlardan faydalanarak elde edilmiştir. Elde edilen sonuçlar, kaldıraç ve işletme büyüklüğü faktörlerinin aksine, sabit varlık oranı, kârlılık (FVÖK) ve alacak devir hızı oranlarının konteyner taşımacılık şirketlerinin satış karlılık oranları üzerinde pozitif yönlü bir etkiye sahip olduklarını göstermiştir.

Anahtar Kelimeler: Konteyner Taşımacılık Endüstrisi, Satışların Karlılığı, Finansal Etkinlik, Performans Ölçümü, Panel Veri.

JEL Sınıflaması: G15, G32, C33

Abstract

The purpose of this study is to identify the industry-specific factors affecting the return on sales ratios of 11 leading container shipping companies that are partners in the growing global trade. The study analyzes the financial data of non-publicly traded container shipping companies for the years 2010–2021 using panel data methodology. The data used in the analysis were obtained from the annual financial reports published by each company on its corporate website. The results show that, in contrast to the leverage and operating size factors, the fixed asset ratio, EBIT, and receivables turnover ratios have a positive effect on the return on sales ratios of container shipping companies.

Keywords: Container Shipping Industry, Return on Sales, Financial Efficiency, Performance Measurement, Panel Data.

JEL Classification: G15, G32, C33.

[1] **Bibliyografik Bilgi (APA):** FESA Dergisi, 2023; 8(3) ,793 - 801 / DOI: 10.29106/fesa.1342784

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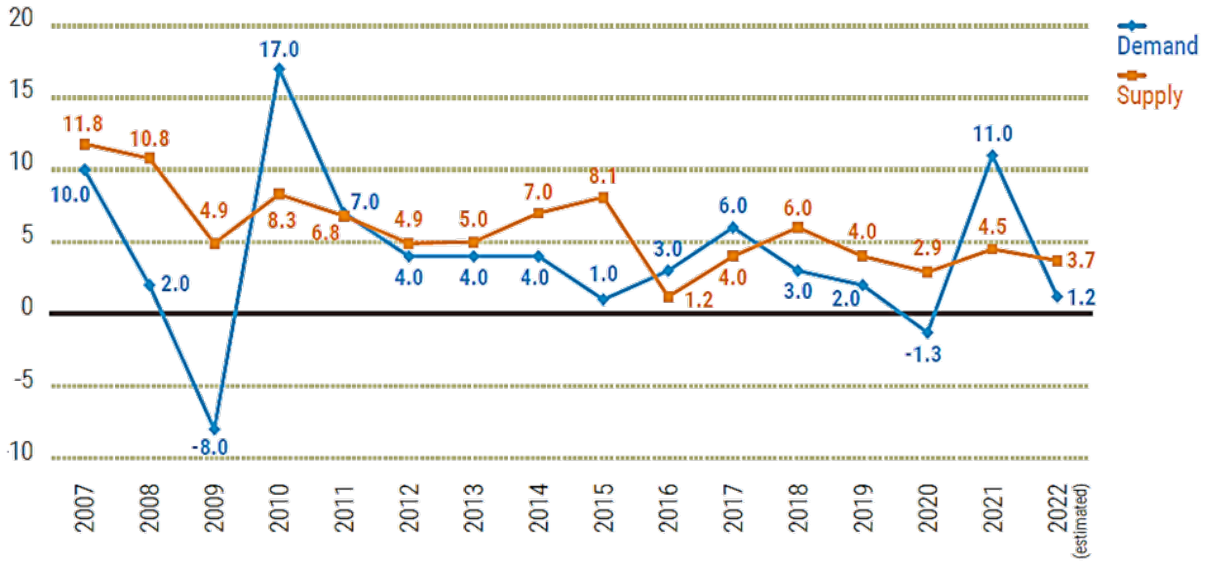
1. Introduction

By the first quarter of 2022, global trade would have reached an all-time high of around $7.7 trillion. Moreover, since the level of sophistication of container ships has increased, 90% of these non-bulk cargoes are carried by these ships. This is because the cargo-carrying capacity of modern container ships has increased to 24,000 TEU. This has contributed to the growth of international trade by reducing both transportation costs and transportation times.

In addition, ships are technically sophisticated, high-value assets that can cost more than $200 million to build (ICS, 2022). As a result, the shipping industry requires significant revenues to finance its operations and acquire assets. However, revenues and cash flows are highly volatile due to their close relationship with sales and the global economic cycle. In addition, the container shipping freight industry experienced anomalous supply and demand conditions throughout 2021. Thus, despite an 11% increase in global containerized trade volumes, global container and logistics capacity declined due to poor fleet supply growth and supply chain disruptions (UNCTAD, 2022). However, since the initial stages of the global epidemic, container carriers have faced a variety of logistical constraints and high fuel costs. On the other hand, they have been able to increase their revenues thanks to huge increases in freight rates.

Moreover, the success or failure of any organization depends on an accurate and reliable financial performance evaluation, and monitoring is also vital for concerned parties such as creditors, bondholders, investors, employees, and executives. Each group has its own motivations, but an effective financial performance score is not only a sign of the ability to generate revenue but also a major indicator of a healthy capital structure. Hence, monitoring performance is critical, but there is still a significant gap. In this context, the purpose of this paper is to specify the factors influencing the financial performance of leading container shipping companies (Hapag-Lloyd AG, A.P. Moller-Maersk, Evergreen Marine Co. Ltd., Cosco Shipping International Co. Ltd., Yang Ming Co., CMA CMG, Mitsui O.S.K. Lines, NYK Group, Orient Overseas Ltd., Wan Hai Lines Ltd., and RCL Public Company) using return on sales (ROS) to evaluate the operational effectiveness. This ratio was chosen because it is a key indicator of both efficiency and profit, and it will show how much profit each sale generates compared to its top-line revenue. However, the remaining sections of this paper are organized as follows: The review of previous research comes next, and then in Section 3, the research method, sample, data, and variables are explained. In addition, the statistical analysis and empirical findings are reported in the fourth section, and the conclusion and recommendations are discussed.

Figure 1. Comparison of the Rates of Demand and Supply Change in the Container Shipping Industry from 2007 to 2022



Source: UNCTAD "Review of Maritime Transport 2O22, https://unctad.org/system/files/official-document/rmt2022_en.pdf, (accessed 15 December 2022).

2. Literature Review

Corporate performance measurement has received considerable attention in the literature because corporate performance is the bottom line of a company. As such, several studies have examined the determinants of financial performance measurement using a variety of evaluation methods. Chou and Liang conducted one such study in 2001. They analyzed the performance of four shipping companies using fuzzy set theory, AHP, and entropy, which is a type of multi-criteria decision-making method. This paper showed that the problem of measuring a shipping company's performance consists of subjective, vague, and ambiguous judgments and that standard MCDM techniques are not as good at showing the vagueness or lack of precision. In a separate study, Lin and Liu (2005) examined the operational effectiveness of the shipping industry to shed light on the existing state of operational performance with the goal of helping managers or regulators make improvements. They used Data Envelopment Analysis (DEA) to determine how efficient fourteen shipping companies were in their operations. Four of the companies were found to be efficient, and the overall level of efficiency is quite high. Chiang and Hwang (2007) used data from 2003 to 2005 to evaluate the performance of Taiwan's three leading container shipping companies. They used financial measures and intellectual capital, selected the representative indicators using Grey's relational analysis, and then ranked the performance using TOPSIS. According to their findings, the financial health of these three box carriers was quite comparable. Konsta and Plomaritou (2012) used a questionnaire method to find out if and how key performance indicators (KPIs) could be used to monitor and evaluate the performance of shipping management in Greek tanker shipping companies. The study revealed the shipping industry's need for efficiency and the role of KPIs in achieving it. Seventy-two percent of respondents value KPIs, but only 22% of tanker companies use them in daily management. Haddadi and Yaghoobi (2014) also used key performance indicators (KPIs) to measure financial performance in a telecommunications company in Iran, using the Balanced Scorecard (BSC) framework to determine objectives and the Analytic Hierarchy Process (AHP) to rank performance indicators.

Furthermore, Hadi and Ayuma (2016) analyzed the factors, especially inflation and financial leverage, which affect the financial health of shipping corporations in Mombasa County using a questionnaire method that was completed by numerous top executives, department heads, mid-level directors, and general employees of shipping corporations. They found that leverage and the annual inflation rate affected the financial efficiency of Kenyan shipping companies. The results of their paper also showed that firms with more foreign ownership were worth more, and firms with more government ownership did not perform as well. Kang et al. (2016) used panel data analysis to investigate the effect of financial strategies on performance in three market categories for sixty-four international shipping companies that are listed in the Bloomberg Shipping Indices. In addition, Anarfi et al. (2016) examined the factors affecting return on equity for industrial firms in the Czech Republic from 2005 to 2014. In contrast to financial leverage ratios, their analysis revealed that profit margins and net asset turnover ratios positively increased ROE. The research also found that there were strong negative correlations between ROE and macroeconomic indicators such as GDP growth and interest rates, but not with unemployment, inflation, or the value of the currency.

Wang et al. (2016), on the other hand, assessed the economic health of sixty-four global shipping companies included in the Bloomberg Shipping Indices by employing both EVA and Tobin's Q. The influence of financing tactics on efficiency in the dry bulk, tanker, and container shipping industries was evaluated using a panel regression, and the results determined that operational, profitability, and leverage ratio factors were performance-determining factors. Ben Aissa and Goaied (2016) investigated the importance of operational efficiency on hotel profitability (ROA) for twenty-seven hotel companies in Tunisia using financial data and Data Envelope Analysis (DEA). ROA was found to be affected by geographical and operational factors, as well as the size of the hotel, its level of debt, its susceptibility to crisis events, and the education level of its managers. Kharatyan et al. (2017) used the OLS approach to investigate the characteristics that influence return on equity for the ninety largest non-financial companies in the NASDAQ-100 index and across several industry sectors. Tax burden, interest burden, operating margin, asset turnover, and financial leverage (extended DuPont components) were revealed to be important ROE factors. Also, Hoang et al. (2019) use quantile regression and OLS to look at the factors that affected the fiscal performance of 269 companies trading on the Vietnam Stock Exchange from 2010 to 2016. As per the findings of their study, the size of the company, its capital structure, its short-term liquidity, its long-term asset investments, its annual growth, and how it manages its receivables are all crucial factors in a company's financial success. Even though capital structure, short-term liquidity, and long-term investments in assets all have a positive effect on fiscal effectiveness, size has a positive effect as well. Nguyen and Nguyen (2020) also looked at the factors that affected the financial health of 1,343 firms in six separate groups over a four-year period, from 2014 to 2017, by using STATA software from the Vietnamese Stock Exchange. In this study, the financial health of a business is examined by using three ratios: ROA, ROE, and ROS. The size of the company, its liquidity, solvency, leverage, and financial adequacy are all seen as factors that affect these ratios, and all the criteria (company size, adequacy ratio, and leverage) were found to have a positive effect on ROA. However, the effects

of company size, adequacy, leverage, and solvency have a negative impact on ROE. ROS was affected positively by company size, adequacy, and solvency, contrary to leverage and liquidity. Besides, Lim and Lim (2020) assessed not only the three economic and fiscal benefits of a shipping company expanding into LNG shipping, including the company's profitability, efficiency, and stock return performance, but also the existence of an early mover advantage. Their results showed that adding LNG carriers to a fleet made it more profitable and efficient, and that the stock returns of listed shipping companies increased when their LNG exposure was diversified. The results also showed that the early mover advantage led to higher profitability. Similarly, several studies have been conducted on the factors affecting the financial performance of companies in different industries and countries (Zeitun and Titan, 2007; Onaolapo and Kajola, 2010; Almajali et al., 2012; Pouraghajan and Malekian, 2012; Siminica et al., 2012; Khalifa and Zurina, 2013; Nguyen, 2013; Chu et al., 2015; Ahmed et al., 2018).

3. Data and Methodology

3.1. Data and the Panel Regression Model

Table 1 shows the factors selected after an extensive review of the existing academic literature. The sample consists of eleven prominent container shipping companies. The financial data for the sample were obtained from the official websites and annual reports of each company, covering the period from 2010 to 2021.

Table 1. The Variables and Definitions

Variables	Symbol	Definitions
Dependent Variable		
Return on Sales	ROS	EBIT to net revenues
Explanatory Variables		
Profitability ratios		
Profitability (1)	ROA	Percentage change in return on assets
Profitability (2)	EBIT	Percentage change in EBIT
Solvency ratios		
Leverage	LEV	Total liabilities to total assets
Size	SIZE	Natural logarithm of total assets
Volatility	VOL	Percentage change in revenues
Liquidity ratios		
Current ratio	CUR	Current assets to current liabilities
Cash ratio	CSH	Cash & cash equivalents to current liabilities
Turnover ratios		
Receivable turnover rate	RTR	Net credit sales to average accounts receivable
Inventory turnover rate	ITR	Cost of goods sold to average value of inventory
Growth ratios		
Assets growth rate	FXAS	Percentage change in net fixed assets

Table 1 presents the utilization of panel data analysis as an equation for linear regression (1).

$$y_{it} = \alpha + \beta x_{it} + \varepsilon_{it} \ (\varepsilon_{it} = \mu_i + \lambda_t + \nu_{it}) \quad (1)$$

Where, μ_i is an unobserved individual effect; λ_t is an unobserved time effect; $v_{it}$is the remainder stochastic disturbance term. Equation (2) is formulated to estimate the return on sales model that demonstrates financial effectiveness.

$$ROS_{it} = \alpha + \beta_1 ROA_{it} + \beta_2 LEV_{it} + \beta_3 SIZE_{it} + \beta_4 VOL_{it} + \beta_5 CSH_{it} + \beta_6 RTR_{it} + \beta_7 ITR_{it} + \beta_8 FXAS_{it} + \beta_9 EBIT_{it} + \varepsilon_{it} \quad (2)$$

In addition, Table 2 presents descriptive statistics for each variable, including the number of company-year observations and other statistics. Table 3 also shows the correlation coefficients for all factors; unlike leverage, all variables are positively correlated with return on sales.

Table 2. Descriptive Statistics

Variables	Obs.	Mean	Std. Deviation	Median	Min.	Max.
ROS	110	1.325	3.588	0.515	-1,961	31.132
ROA	110	0.028	0.079	0.014	-0.099	0.331
LEV	110	0.532	0.201	0.551	0.119	0.911
SIZE	110	17.937	2.149	17.067	15.653	24.379
VOL	110	0.128	5.253	0.014	-25.633	24.480
CUR	110	1.719	1.487	1.209	0.543	7.795
CSH	110	0.617	0.450	0.449	0.076	2.143
RTR	110	11.814	6.705	10.702	2.192	41.659
ITR	110	38.437	13.216	38.585	8.371	69.855
FXAS	110	0.091	0.251	0.018	−0.346	1.373
EBIT	110	0.401	0.355	0.365	-0.305	1.888

Furthermore, in financial econometric research, it is essential to meet certain criteria to use the panel data approach, which allows the simultaneous study of cross-sectional and time-series dimensions. For instance, there should be no cross-sectional dependence in the series. And the series should be stationary, and there should be no difficulties with heteroscedasticity, multicollinearity, or autocorrelation in time series. In this context, the primary step in analyzing the argued circumstances was to evaluate the multicollinearity problem.

As is well known, Ragnar Frisch coined the term "multicollinearity" to define a "perfect" or exact linear relationship between some or all the independent variables of a regression model, which leads to estimation errors in studies using time and cross-sectional series (Gujarati and Porter, 2008). In two-dimensional (typically cross-sectional and longitudinal) panel data analysis, if the relevant variables have only a marginal effect on the regressand and if they are highly correlated (i.e., the variance inflation factor (VIF) is larger), the bias in the coefficients of the variables already included in the model can be reduced by removing the independent variables with a high degree of association with the VIF, one of the common measures of collinearity. Therefore, although multicollinearity is usually not a significant issue when there are diverse types of entities in panel data, the correlation matrix or VIF tests should be performed to ensure that there is no multicollinearity that could be problematic. Consequently, in this study, the VIF method was used to determine the variables that may cause multicollinearity, and the presence of multicollinearity was rejected by using a variance inflation factor-based test (VIF test).

	ROS	ROA	LEV	SIZE	VOL	CUR	CSH	RTR	ITR	FXAS	EBIT
ROS	1 -----										
ROA	0.65 *(0.00)*	1 -----									
LEV	-0.12 *(0.19)*	-0.27 *(0.00)*	1 -----								
SIZE	0.12 *(0.20)*	0.08 *(0.40)*	0.17 *(0.07)*	1 -----							
VOL	0.28 *(0.00)*	0.31 *(0.00)*	-0.25 *(0.00)*	-0.02 *(0.87)*	1 -----						
CUR	0.14 *(0.15)*	0.16 *(0.09)*	-0.58 *(0.00)*	-0.31 *(0.00)*	0.06 *(0.52)*	1 -----					
CSH	0.29 *(0.00)*	0.33 *(0.00)*	-0.25 *(0.00)*	-0.11 *(0.25)*	0.09 *(0.37)*	0.51 *(0.00)*	1 -----				
RTR	0.52 *(0.00)*	0.28 *(0.00)*	0.25 *(0.01)*	0.09 *(0.34)*	0.07 *(0.45)*	-0.19 *(0.05)*	0.35 *(0.00)*	1 -----			
ITR	0.07 *(0.44)*	0.10 *(0.30)*	0.26 *(0.00)*	0.14 *(0.13)*	0.01 *(0.93)*	-0.45 *(0.00)*	0.00 *(0.97)*	0.29 *(0.00)*	1 -----		
FXAS	0.63 *(0.00)*	0.73 *(0.00)*	-0.15 *(0.11)*	0.15 *(0.13)*	0.26 *(0.01)*	0.09 *(0.35)*	0.30 *(0.00)*	0.40 *(0.00)*	0.11 *(0.27)*	1 -----	
EBIT	0.24 *(0.01)*	0.27 *(0.00)*	-0.36 *(0.00)*	0.05 *(0.62)*	0.10 *(0.30)*	0.29 *(0.00)*	0.12 *(0.22)*	-0.10 *(0.28)*	-0.25 *(0.01)*	0.22 *(0.02)*	1 -----

Numbers in italics below the coefficients indicate p-values.

Table 3. Correlation Matrix

Besides, in panel regression models, the series of each variable must also be stationary. Equation (3) is an autoregressive model, while $|\rho|<1$ is a stationary time series, and $\rho=1$ is a non-stationary time-series.

$$y_t = \rho y_{t-1} + \nu_t \quad (3)$$

Moreover, it is necessary to determine the specific unit root test for the generation unit to conduct the stationary test procedure. According to Nelson and Plosser (1982), an important observation is that the majority of time series data exhibit non-stationarity and follow a random walk pattern. This characteristic could potentially lead to misleading and inaccurate modeling results. Hence, it is essential to determine the presence of a unit root in the variables of the data set. Therefore, the presence of a unit root can be used to ascertain the stationarity of the data. Before conducting the unit root test, it is imperative to assess the cross-sectional dependency that may affect the choice of unit root test. According to Tugcu (2018), the structure for panel unit root tests comprises two generations of tests, namely the initial and second generations. Moreover, in the first generation of tests, cross-sectional units are assumed to be cross-sectionally independent. However, in the subsequent generation of panel unit root tests, cross-sectional dependence is allowed. Therefore, the test for cross-sectional dependence proposed by Pesaran (2004) was conducted at this point, and the results are presented in Table 4.

Table 4. Pesaran (2004) CD Test

Average correlation coefficients & Pesaran (2004) CD test				
Variables	**CD-test**	**p-value**	**corr.**	**abs (corr.)**
ROS	14.44	0.000	0.616	0.619
ROA	15.52	0.000	0.662	0.715
LEV	9.94	0.000	0.424	0.482
SIZE	6.79	0.000	0.290	0.568
VOL	6.55	0.000	0.279	0.333
CUR	5.59	0.000	0.080	0.340
CSH	6.17	0.000	0.263	0.424
RTR	3.18	0.001	0.136	0.445
ITR	10.73	0.000	0.458	0.533
FXAS	12.48	0.000	0.573	0.663
EBIT	5.00	0.000	0.213	0.472

Since Pesaran's (2004) second-generation unit root tests should be used to evaluate for stationarity in series with cross-sectional dependence, they were used, and all non-stationary series were found to be stationary in the first difference.

The Hausman test is also used to determine whether a panel model should use a fixed effect or a random effect. If the null hypothesis for the Hausman test that the random effect is valid is accepted, the random effect is more appropriate for the model; if the null hypothesis is rejected, the fixed effect is more appropriate. The model rejects the null hypothesis (p-value = 0.000), so the fixed effect is more appropriate.

4. Findings and Discussion

The diagnostic tests of the chosen fixed effects model indicate that the panel data model has a heteroscedasticity problem (Modified Wald test: chi2 (11) = 165,08; Prob > chi2 = 0.0000); however, the model does not have a serial correlation problem (Wooldridge test: F (1, 10) = 3.810; Prob > F = 0.0795). Therefore, I re-estimate the model using the PCSE estimator, which is useful for estimating in the presence of heteroskedasticity across panels. Table 5 shows the results of panel regression for the model.

According to Table 5, the relationship between leverage and the return on sales ratio is negative. As is well known, ROS is a key metric for measuring the operational effectiveness of a company and provides insight into the amount of profit generated per unit of revenue. However, the shipping industry is a dynamic, capital-intensive, and cyclical industry. Hence, the financing of this industry should ensure the accessibility of capital resources with longer maturities. In addition, according to the pecking order theory of capital structure, companies seek to finance their operations primarily through retained earnings, followed by loans, and then lastly through equity issues (Myers, 1984; Myers and Majluf, 1984). This shows that the amount of debt is inversely related to a company's profitability, as profitable companies are conservative in their use of retained earnings to finance investment. Thus, Table 5 supports the pecking order model that companies prefer debt over equity and funds from internal sources over external sources. Size also has a negative relationship with the model, and the PCSE estimator shows that this is statistically significant. On the other hand, Table 5 also shows that explanatory variables such as the accounts receivable turnover ratio and growth rate have strong effects, and EBIT has weak but positive effects on operational efficiency.

Table 5. Panel Corrected Standard Errors (PCSE) Regression Model

Dependent Variable: ROS				
	[Coefficient]	**[Std.Error]**	**[z Statistics]**	**[p-value]**
ROA	-7.901076	5.328905	-1.48	0.138
dLEV	-21.35713	4.615418	-4.63	*0.000
dSIZE	-14.46229	6.097174	-2.37	**0.018
VOL	0.263235	0.617237	0.43	0.670
CSH	0.544054	0.454908	1.20	0.232
dRTR	0.545082	0.161678	3.37	*0.001
dITR	-0.019646	0.030328	-0.65	0.517
FXAS	13.85799	4.937939	-2.81	*0.005
EBIT	0.899163	0.504134	1.78	***0.074
CONSTANT	0.172828	0.312810	0.55	0.581
Observations	99			
Adj. R^2	0.7387			
Wald chi2 (9)	307.75			
Prob > chi2	0.0000			
The model was applied with a fixed effect according to the Hausman Test. *Statistical significance at 1% level **Statistical significance at 5% level ***Statistical significance at 10% level.				

5. Conlusion

This paper investigates the determinants of the financial efficiency of leading container shipping companies based on cargo-carrying capacity using the return on sales ratio, which is an important metric both for managers in understanding the company's strengths and weaknesses and for investors seeking profitable investments. Because shipping rates change in cycles, it is difficult to determine the length of a cycle and its extremes. Therefore, it is essential to provide some insights to analyze not only the financial performance but also the management characteristics of the industry to understand the financial behavior of shipping company decision-makers. Consequently, this paper aims to provide an alternative perspective on the operational effectiveness of shipping companies specific to the container shipping industry.

Using the panel data method, this paper investigates the key factors affecting the financial performance of leading container shipping companies from 2011 to 2020. The coefficients of the model show that leverage has a negative relationship with return on sales, which makes sense since the industry is capital-intensive and cyclical. Since most of the assets are fixed, this sector should be able to access longer-term capital resources to finance itself. However, these types of resources cannot be paid for without an increase in cash flows. An increase in cash flows depends on sales. Hence, it is challenging for companies to meet their liabilities if they are unable to increase their revenues. Besides, size is negatively related to return on sales.

On the other hand, tangibility, receivables management efficiency, and profitability have positive effects on the return on sales of the leading container companies, offsetting the negative effects of leverage and size. Shipping costs have been rising since mid-2020. By October 2021, the cost of shipping containers by maritime freight had increased by 500%, while the price of bulk commodities had tripled. There are two main factors driving this increase. One of them is the shipping capacity, which is constrained by logistical obstacles and bottlenecks, particularly from pandemic disruptions and equipment shortages; the other is the unreliable schedules and port congestion, which have also led to a surge in surcharges and fees, including demurrage and detention charges (IMF, 2022). Thus, the operating profitability and receivables management efficiency of container shipping companies are increasing due to the increase in return on sales. As a result, although modern container ships can hold up to 24,000 TEU, the capacity of the global container fleet has increased by only 4.5 percent, which is much less than the growth in demand. Hence, the freight rates and revenues of the container shipping companies in the study follow the expansion of the global container fleet in terms of fixed assets. Consequently, the results showed that leverage, profitability, tangibility, size, and accounts receivable turnover variables are critical metrics in measuring the fiscal performance management of the container shipping companies.

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