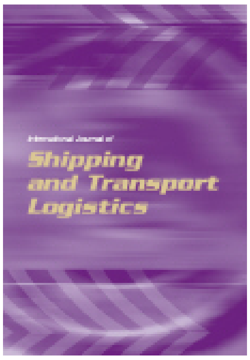

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Corporate social responsibility as sustainability management: international shipping firms and financial performance

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Corporate social responsibility as sustainability management: international shipping firms and financial performance

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Abstract: Sustainability shipping management is analysed via the relationship between corporate social responsibility (CSR) activities and financial performance. Panel data analysis with mixed-effect models is applied for the study period from 2008 to 2016. Container shipping shows significant positive influences of environmental and social activities on asset utilisation efficiency and improvements of current financial performance compared with only environmental activities. Moreover, dry bulk and tanker firms show significant positive influences from social activities on improving the expected financial performance. East Asia-Pacific shipping firms show significant influence from environmental activities on improving financial performance, while their counterparts derive from environment and social activities to improve asset utilisation efficiency and current financial performance. Despite the insignificant influence from CSR activities on expected financial performance, social activities exert significant negative influence on American, European, and South African shipping firms. Investors evaluate asset utilisation efficiency and current financial values via returns on assets and returns on equity in CSR engagement for shipping firms.

Keywords: corporate social responsibility; CSR; sustainability management; environmental performance; social performance; financial performance; return on equity; Tobin's Q; shipping firms; container shipping; dry bulk shipping; tanker shipping; panel data regression; fixed-effect model; random-effect model.

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1 Introduction

Sustainable shipping management often causes resource allocation difficulties related to asset utilisation or corporate social responsibility (CSR) activities (Yuen et al., 2018). Despite the significant reliance on efficient shipping services (Trapp et al., 2020), the maritime industry encounters heavy regulations on environmental concerns, plus strong associations with sustainability development goals that include an overall CSR performance (Raza, 2020; Wang et al., 2020). Consequently, stakeholder perspectives and concerns significantly determine the critical success of the shipping industry in terms of environmental and social performance (Tran et al., 2020). However, the high business operational risks related to high asset tangibility and equity risk environment not only cause the development of debt-driven capital structure but also hinders CSR activities for sustainability (Alexandridis et al., 2020).

Characterised by cyclicality, capital intensity, and high financial leverages, the shipping industry[1] (Pettit et al., 2018; Alexandridis et al., 2020) relies on intensive investments in advanced-technology vessels and fleets for competitive business operations to reduce pollution and improve energy consumption (Pettit et al., 2018; Raza, 2020). High financial leverage risks and long asset investment durations also cause cyclicality in business operations (Drobetz et al., 2016; Alexandridis et al., 2020). Moreover, the shipping industry relies on public debt for strategic financing to overcome business and operational risks that affect financial performance (Alexandridis et al., 2020).

However, the financial performance of shipping firms suffers from market over-supply, in turn influencing short-term profitability and long-term business sustainability (Lim and Lim, 2020). Viewed as high air-polluting transportation, the shipping industry is heavily regulated to adopt energy-efficient systems for green innovation (Raza, 2020). This industry is also limited in shipping capacity scale via ship size, fuel usage, and technological improvements that hinder sustainable management (Tran and Haasis, 2015; Pettit et al., 2018). Asian shipping companies thus focus on green technological innovations via energy-efficient systems to improve environmental performance (Raza, 2020) whereas European shipping companies adopt diversification strategies in liquid natural gas carriers (Lim and Lim, 2020). Moreover, the shipping industry focuses on various sustainability development goals, including environmental safety, green technology and transport, and responsible waste and water management for sustainability (Wang et al., 2020).

Different from previous literature in using surveys or interviews for qualitative sustainability analysis (Yuen et al., 2018; Poulsen and Sampson, 2019; Raza, 2020), this study proposes the adoption of Thomson's Reuters Asset4 ESG (economic, social, and governance) database to quantitatively analyse the influence of CSR activities on the financial performance of the international shipping industry. This approach is thus far novel to shipping sustainability research.

The internal and external financial performance of shipping industry via return on assets (ROA), return on equity (ROE), and Tobin's Q (TOBQ) with CSR activities are also analysed. With foundations related to slack resource theory for internal corporate financing and stakeholder theory for external corporate financing, the panel data method is applied via fixed- and random-effect models for CSR activities, including economic and social categories that contribute to their international shipping industry. Different from their counterparts focusing on environment category, container shipping with significant CSR activities in environmental and social categories are identified for asset utilisation efficiency and current financial performance improvements. This focus is related to Tran et al. (2020), who show the significant influence of stakeholders on sustainable shipping management. East Asia-Pacific (EAP) shipping firms show more significant influences from environmental category, whereas those for American, European, and South African (AES) shipping firms are derived from environment and social categories to improve asset utilisation efficiency and current financial performance. This finding is related to those of Raza (2020) and Fjørtoft (2020) regarding the CSR activities of regional shipping companies. However, only dry bulk (DB) and tanker firms achieve successful social categories to improve their expected financial performance. Moreover, AES shipping firms show significant negative influence from social category on improving the expected financial performance. This finding is related to those of Fasoulis and Kurt (2019) and Wang et al. (2020) on increasing CSR policies in shipping management and providing sustainability reports to investors.

2 Literature review

Maritime shipping firms mainly rely on the efficient uses of assets and debt financing to improve corporate performance (Andrikopoulos et al., 2019; Alexandridis et al., 2020). Shipping firms also face trade-offs in resource allocations via asset utilisations or CSR engagement (Yuen et al., 2018). However, satisfied employees assist in improving the corporate reputation for the overall CSR and financial performance for greater productivity (Yuen et al., 2018). The shipping industry also diversifies into liquid natural gas tanker transport for environmental performance via clean energy and carries out transport capacity improvement for financial performance (Lim and Lim, 2020). Shipping capacity and efficient fuel usage also significantly influence corporate performance related to technological innovations for CSR engagement (Pettit et al., 2018). Shipping firms therefore focus on community, employees, and shareholders as social performance to improve sustainability management (Fjørtoft et al., 2020). Moreover, shipping firms engage in technological innovations via energy-efficient systems and water treatment as environmental performance for improved sustainability (Raza, 2020). Social and environment CSR activities thus improve financial performance via asset utilisation efficiency, plus current and expected financial performance. Hypotheses 1, 2, and 3 are developed as follows:

Hypothesis 1 CSR activities have significant positive influence on asset utilisation efficiency.

Hypothesis 2 CSR activities have significant positive influence on current financial performance.

Hypothesis 3 CSR activities have significant positive influence on expected financial performance.

2.1 CSR-related theories

Slack resource theory (Waddock and Grave, 1997) is viewed as under-utilisation of resources for socially responsible activities, causing financial performance declines that affect sustainable shipping management. Corporate assets, including financial resource, sustainable knowledge, and organisational culture, are thus regarded as corporate resources for efficient use in sustainable shipping management (Tran et al., 2020). By contrast, stakeholder theory focuses on stakeholder pressure on shipping firms to implement sustainable practices to improve business performance (Yuen et al., 2017; Govindan et al., 2021). Stakeholders are external factors that influence organisational and managerial practices to improve corporate governance (Tran et al., 2020; Govindan et al., 2021). From the perspectives of slack resource and stakeholder theories, this study examines the causal relationship between CSR activities and financial performance of the international shipping industry.

Table 1 Shipping firms

Panels	*Company*	*Country**	*Years of data*
Container shipping	AP Moller-Maersk	Denmark^{AES}	2008–2016
	Bolloré	France^{AES}	2008–2016
	C.H. Robinson Worldwide	USA^{AES}	2008–2016
	Cosco Shipping	China^{EAP}	2008–2016
	Evergreen Marine	Taiwan^{EAP}	2010–2016
	Hanjin Shipping	South Korea^{EAP}	2010–2015
	Kuehne und Nagel International	Switzerland^{AES}	2008–2016
	Neptune Orient Lines	Singapore^{EAP}	2008–2015
	Nippon Express	Japan^{EAP}	2008–2016
	Toll Group	Australia^{EAP}	2008–2014
	Yang Ming Marine Transport	Taiwan^{EAP}	2010–2016
DB and tanker shipping	Asciano	Australia^{EAP}	2008–2015
	Maritime Belge	Belgium^{AES}	2008–2014
	Dampskibsselskabet Norden	Denmark^{AES}	2008–2016
	Grindrod	South Africa^{AES}	2011–2016
	Pacific Basin Shipping	Hong Kong^{EAP}	2008–2016

Notes: *: ^{AES} represents America, European, and South African regions and ^{EAP} represents EAP regions.

3 Methodology

3.1 Sample selection

Complete statistical data are collected from the Thomson Reuters DataStream database and Thomson Reuters Asset4 ESG (economic, social, and governance) database for the study period from 2008 to 2016. The latter database is well-recognised as a diligent and trustworthy source of CSR data (Utz, 2018; Adegbite et al., 2019); different from the CSR index-construction proposed by Drobetz et al. (2014). Initially, we search for 42 shipping firms and exclude those with multiple business operations that cause unclear service type segmentations. The shipping firms are segmented in terms of commercial freight shipping into container shipping panel (CT_{Ship}) and DB and tanker shipping panel ($DBTK_{Ship}$) in accordance to Pettit et al. (2018). Another segmentation is into America, Europe, and South-Africa panel (AES panel) and EAP panel. Thus, a total of 16 shipping firms (11 container firms and five bulk and tanker firms) are selected with 128 firm-year observations. The selected firms are in good agreement with Govindan et al. (2021) and Andrikopoulos et al. (2019) to represent containers, DB, and tanking shipping firms in various regions for international generalisability. Table 1 presents the list of shipping firms.

3.2 Variables

The shipping industry is characterised as capital-intensive where asset tangibility critically influences firm performance (Alexandridis et al., 2020; Lim and Lim, 2020). Following the works of Andrikopoulos et al. (2019), Lim and Lim (2020), and Govindan et al. (2021), we select *ROA*, *ROE*, and *TOBQ* to identify the relationship between firm and CSR performance. *ROA*, *ROE*, and *TOBQ* represent asset utilisation efficiency, current financial performance, and expected financial performance, respectively.

3.2.1 Corporate social responsibility

The business operations of maritime industry closely relate to the United Nations sustainable development goals (SDGs), which include pollution reduction, improvements of working conditions, and sustainable community development (Wang et al., 2020). We refer to Wang et al. (2020) and Govindan et al. (2021) in adopting CSR scores related to environmental (*ENV*) and social (*SOC*) performances, and their scores are summed up into an overall CSR score (*CSR*).

3.2.2 Control variables – leverage, firm size, and age

Following Alexandridis et al. (2020), we select a leverage ratio defined as total liabilities divided by total assets to identify the relationship between CSR and financial performance for the shipping industry. Increases in leverage have significant negative influence on firm value toward financial performance (Govindan et al., 2021). We also follow the works of Yuen et al. (2017) and Andrikopoulos et al. (2019) for firm size and age, respectively. Firm size is calculated as the log of market capitalisation to determine the causal relationship with financial performance (Saeidi et al., 2015). Although shipping firms generally employ a large number of employees with various operational specialties to achieve greater sustainability, the firm size is often identified as the number of employees with direct influence on service performance (Yuen et al., 2017). Firm age is selected to indicate the duration of business operations in the number of firm years since its establishment (Kavussanos and Tsouknidis, 2016).

3.3 Panel data analysis

We refer to Kavussanos and Tsouknidis (2016) and Govindan et al. (2021) for the financial performance estimation via panel data analysis. Thus, the relationship between CSR and financial performance for shipping firms is analysed. We also determine the fixed- or random-effect models via variance component. The regression function indicative of CSR influence on current financial performance via ROA and ROE is expressed as follows:

$$ROA_{it} \text{ or } ROE_{it} = \beta_0 + \beta_1 CSR_{it*} + \beta_2 SIZE_{it} + \beta_3 LEV_{it} + \beta_4 AGE_{it} + \varepsilon_{it}, \quad (1)$$

where for firm i at time t, ROA_{it} or ROE_{it} is the current financial performance, CSR_{it*} is the sum of environmental and social scores (sub-panel variables for CSR also include ENV_{it} and SOC_{it}, which represent environmental and social scores, respectively), $SIZE_{it}$ is the market capitalisation, LEV_{it} is the financial ratio of total liabilities divided by total assets, AGE_{it} is the years of establishment, β_0 is the intercept value, β_i is the coefficient for each independent variable, and ε_{it} is the random error.

The regression function indicative of CSR influence on the expected financial performance via TOBQ can be expressed as follows:

$$TOBQ_{it} = \gamma_0 + \gamma_1 CSR_{it*} + \gamma_2 SIZE_{it} + \gamma_3 LEV_{it} + \gamma_4 AGE_{it} + \varepsilon_{it}, \quad (2)$$

where for firm i at time t, $TOBQ_{it}$ is the expected financial performance, CSR_{it*} is the sum of environmental and social scores (sub-panel variables for CSR also include ENV_{it} and SOC_{it}, which represent environmental and social scores, respectively), $SIZE_{it}$ is the market capitalisation, LEV_{it} is the financial ratio of total liabilities divided by total assets AGE_{it} is the years of establishment, γ_0 is the intercept value, γ_{i} is the coefficient for each independent variable, and ε_{it} is the random error.

4 Results

4.1 Descriptive statistics

Table 2 shows the descriptive statistics results of the full, CT_{Ship}, and DBTK_{Ship} panels. While CT_{Ship} shows a greater mean value in *ROA*, DBTK_{Ship} shows a greater mean value in *ROE*. CT_{Ship} shows greater asset utilisation efficiency whereas DBTK_{Ship} show greater equity returns. CT_{Ship} and DBTK_{Ship} show similar mean values in *TOBQ*. However, CT_{Ship} shows greater *CSR*, *ENV*, and *SOC* scores than DBTK_{Ship}; mean values are approximately 4.0 for the former and approximately 3.5 for the latter. CT_{Ship} also demonstrates greater mean values in *SIZE*, *LEV*, and *AGE* than DBTK_{Ship}. Table 3 shows the correlation matrix of variables for *ROA*, *ROE*, and *TOBQ* panels. All absolute values of correlations for most panels are less than 0.5, which indicates an absence of significant relationship among the variables. Except for the *TOBQ* panel, *LEV* shows an absolute value of 0.648. Table 4 presents the variance inflation factors (VIF) of variables. All the VIF values are lower than 10, which indicates an absence of multicollinearity.

Table 2 Descriptive statistics

Full panel	*ROA*	*ROE*	*TOBQ*	*CSR*	*ENV*	*SOC*	*SIZE*	*LEV*	*AGE*
Mean	0.025	0.021	0.267	3.925	3.941	3.851	16.71	0.560	3.003
Median	0.020	0.049	0.237	4.141	4.176	4.126	16.17	0.542	2.995
Maximum	0.328	0.443	0.665	4.532	4.533	4.549	21.90	0.935	4.709
Minimum	–0.214	–1.108	0.003	1.951	2.193	1.597	13.11	0.102	0.000
Std. dev.	0.082	0.247	0.173	0.624	0.625	0.744	1.933	0.153	0.872
Skewness	0.281	–1.587	0.275	–1.699	–1.524	–1.484	0.570	–0.337	–0.323
Kurtosis	4.331	7.782	2.215	5.423	4.539	4.444	2.699	4.336	3.731
Jarque-Bera	11.14***	175.7***	4.902*	92.93***	62.23***	58.17***	7.421**	11.96***	5.090*
Probability	0.003	0.000	0.086	0.000	0.000	0.000	0.024	0.002	0.078
Observation	128	128	128	128	128	128	128	128	128
CT_{Ship} panel	*ROA*	*ROE*	*TOBQ*	*CSR*	*ENV*	*SOC*	*SIZE*	*LEV*	*AGE*
Mean	0.029	0.021	0.267	4.047	4.031	4.004	17.34	0.608	3.177
Median	0.019	0.049	0.215	4.193	4.201	4.211	17.33	0.598	3.044
Maximum	0.211	0.443	0.665	4.532	4.533	4.549	21.90	0.935	4.709
Minimum	–0.145	–1.108	0.003	2.750	2.256	2.468	14.33	0.381	1.098
Std. dev.	0.075	0.276	0.179	0.456	0.539	0.545	1.905	0.128	0.761
Skewness	0.318	–1.634	0.321	–1.282	–1.501	–1.127	0.362	0.528	0.228
Kurtosis	3.144	7.051	2.168	3.947	4.840	3.211	2.121	2.913	3.350
Jarque-Bera	1.582	100.4***	4.098	27.71***	45.98***	19.03***	4.810*	4.173	1.231
Probability	0.453	0.000	0.128	0.000	0.000	0.000	0.090	0.124	0.540
Observation	89	89	89	89	89	89	89	89	89
$DBTK_{Ship}$ panel	*ROA*	*ROE*	*TOBQ*	*CSR*	*ENV*	*SOC*	*SIZE*	*LEV*	*AGE*
Mean	0.015	0.022	0.266	3.646	3.736	3.503	15.27	0.452	2.604
Median	0.026	0.055	0.317	4.035	4.026	4.020	15.52	0.494	2.708
Maximum	0.328	0.394	0.647	4.423	4.447	4.471	16.63	0.730	3.988
Minimum	–0.214	–0.334	0.007	1.951	2.193	1.597	13.11	0.102	0.000
Std. dev.	0.097	0.167	0.160	0.840	0.757	0.993	1.013	0.152	0.982
Skewness	0.362	–0.147	0.114	–1.136	–1.222	–0.900	–1.013	–0.989	–0.475
Kurtosis	4.934	3.565	2.267	2.798	2.992	2.213	2.810	3.553	2.772
Jarque-Bera	6.934**	0.661	0.957	8.454***	9.711***	6.278**	6.731**	6.863**	1.553
Probability	0.031	0.718	0.619	0.014	0.007	0.043	0.034	0.032	0.459
Observation	39	39	39	39	39	39	39	39	39

Notes: ***, **, and * indicate statistical significance at 1%, 5%, and 10%, respectively.

Table 3 Correlation coefficients matrix

	ROA	*ROE*	*TOBQ*	*CSR*	*ENV*	*SOC*	*SIZE*	*LEV*	*AGE*
ROA	1	-	-						
ROE	-	1	-						
TOBQ	-	-	1						
CSR	–0.187**	–0.140	–0.129	1					
ENV	–0.177**	–0.047	–0.161*		1				
SOC	–0.167*	–0.175**	–0.111			1			
SIZE	–0.117	–0.247***	0.160*	0.488***	0.359***	0.499***	1		
LEV	–0.268***	–0.397***	0.648***	0.128	0.029	0.172*	0.345***	1	
AGE	0.000	0.016	–0.187**	0.176**	0.172*	0.170*	0.324***	–0.011	1

Notes: ***, **, and * indicate statistical significance at 1%, 5%, and 10%, respectively.

Table 4 VIF of variables

	CSR	*SIZE*	*LEV*	*AGE*
CSR category	1.316	1.620	1.159	1.140
Envir. category	1.164	1.459	1.169	1.142
Social category	1.331	1.619	1.157	1.139

Table 5 ROA industry results

CSR category	*Full panel*		*Panel I-CT$_{Ship}$*		*Panel II-DBTK$_{Ship}$*	
	Coefficient	*t-statistics*	*Coefficient*	*t-statistics*	*Coefficient*	*t-statistics*
Intercept	–0.155 (0.619)	–0.497	0.024 (0.869)	0.165	–0.307 (0.476)	–0.720
CSR	0.085*** (0.002)	3.139	0.066*** (0.001)	3.419	–0.090 (0.137)	–1.522
SIZE	0.020 (0.237)	1.188	0.006 (0.457)	0.747	0.047 (0.273)	1.113
LEV	–0.301*** (0.000)	–3.448	–0.302*** (0.000)	–4.617	–0.131* (0.068)	–1.882
AGE	–0.112*** (0.000)	–3.532	–0.058** (0.020)	–2.363	–0.003 (0.776)	–0.285
Obs.	128		89		39	
Adj. R^2	0.471		0.228		0.075	
F-stats.	6.961		7.512		1.773	
Durbin Watson	1.599***		1.917		1.082	
Hausman test	0.003 (fixed effect)		0.250 (random effect)		0.327 (random effect)	

Notes: ***, **, and * indicate statistical significance at 1%, 5%, and 10%, respectively.

Table 5 ROA industry results (continued)

Environmental category	*Full panel*		*Panel I-CT_{Ship}*		*Panel II-$DBTK_{Ship}$*	
	Coefficient	*t-statistics*	*Coefficient*	*t-statistics*	*Coefficient*	*t-statistics*
Intercept	–0.071 (0.820)	–0.227	0.083 (0.581)	0.553	–0.626 (0.199)	–1.311
ENV	0.066*** (0.006)	2.777	0.032* (0.057)	1.925	0.188*** (0.017)	2.524
SIZE	0.016 (0.369)	0.901	0.004 (0.565)	0.577	0.034 (0.223)	1.242
LEV	–0.298*** (0.001)	–3.366	–0.261*** (0.000)	–3.957	–0.377*** (0.022)	–2.401
AGE	–0.088*** (0.002)	–3.122	–0.033 (0.157)	–1.424	–0.163** (0.046)	–2.081
Obs.	128		89		39	
Adj. R^2	0.461		0.161		0.165	
F-stats.	6.731		5.246		1.943	
Durbin Watson	1.608***		1.951		1.627**	
Hausman test	0.007 (fixed effect)		0.545 (random effect)		0.043 (fixed effect)	
Social category	*Full panel*		*Panel I-CT_{Ship}*		*Panel II-$DBTK_{Ship}$*	
	Coefficient	*t-statistics*	*Coefficient*	*t-statistics*	*Coefficient*	*t-statistics*
Intercept	–0.133 (0.676)	–0.418	0.039 (0.792)	0.264	–0.397 (0.404)	–0.843
SOC	0.043** (0.032)	2.171	0.057*** (0.000)	3.789	–0.073 (0.173)	–1.392
SIZE	0.023 (0.188)	1.324	0.006 (0.405)	0.836	0.046 (0.292)	1.070
LEV	–0.269*** (0.002)	–3.056	–0.307*** (0.000)	–4.719	–0.112** (0.041)	–2.117
AGE	–0.085*** (0.005)	–2.809	–0.054** (0.024)	–2.295	0.005 (0.622)	0.497
Obs.	128		89		39	
Adj. R^2	0.447		0.248		0.091	
F-stats.	6.409		8.283		1.958	
Durbin Watson	1.512***		1.779		1.022	
Hausman test	0.036 (fixed effect)		0.270 (random effect)		0.423 (random effect)	

Notes: ***, **, and * indicate statistical significance at 1%, 5%, and 10%, respectively.

4.2 *Panel data regression analysis – ROA, ROE, and TOBQ by industry*

Tables 5 shows the panel data regression for ROA including the full, CT_{Ship}, and $DBTK_{Ship}$ panels among *CSR*, *ENV*, and *SOC* categories. The Hausman test indicates significant results for the full panel in all categories and for the $DBTK_{Ship}$ panel in the environmental category. A mixture of fixed- and random-effect model is carried out. In the full panel, *CSR*, *ENV*, and *SOC* have significant positive influences on ROA. However, *LEV* has a significant negative influence on ROA in all panels and categories while *AGE* has a significant negative influence on ROA only in the full panel in all categories and on the DBTK_{Ship} panel in *ENV*.

Table 6 shows the panel data regression for ROE, including the full, CT_{Ship}, and DBTK_{Ship} panels among *CSR*, *ENV*, and *SOC* categories. The Hausman test indicates significant results for the full and CT_{Ship} panels in all categories. However, significant results for DBTK_{Ship} panel are only obtained in *ENV*. A mixture of fixed- and random-effect model is carried out. In the full panel, *CSR*, *ENV*, and *SOC* have significant positive influences on ROE. Moreover, *SIZE* in the full panel has a significant positive influence on ROE in the *CSR* and *SOC* categories. However, *LEV* and *AGE* have significant negative influences on ROE in the full panel; the former is more negatively significant than the latter. *CSR*, *ENV*, and *SOC* have a significant positive influence on CT_{Ship} panel. *SIZE* also has a significant positive influence on the CT_{Ship} panel in *CSR* and *SOC* categories. However, *LEV* has a significant negative influences on the CT_{Ship} panel in *ENV*. *AGE* also has significant negative influence on the CT_{Ship} panel in all categories. By contrast, for the DBTK_{Ship} panel only *ENV* has a significant positive influence. *LEV* and *AGE* have significant negative influence, but specifically, *LEV* has a more significant negative influence on the CT_{Ship} panel than on the DBTK_{ship} panel whereas *AGE* has a greater influence on the DBTK_{Ship} panel than on the CT_{Ship} panel in *ENV*.

Table 6 ROE industry results

CSR category	*Full panel*		*Panel I-CTShip*		*Panel II-DBTKShip*	
	Coefficient	*t-statistics*	*Coefficient*	*t-statistics*	*Coefficient*	*t-statistics*
Intercept	–1.908 (0.135)	–1.504	–2.325 (0.156)	–1.430	–0.498 (0.466)	–0.736
CSR	0.213*** (0.001)	3.266	0.281*** (0.000)	5.138	–0.149 (0.128)	–1.556
SIZE	0.134* (0.076)	1.789	0.169* (0.069)	1.841	0.073 (0.279)	1.098
LEV	–0.552** (0.032)	–2.171	–0.413 (0.347)	–0.945	–0.154 (0.227)	–1.228
AGE	–0.281** (0.017)	–2.417	–0.465*** (0.000)	–4.036	0.005 (0.819)	0.230
Obs.	128		89		39	
Adj. R^2	0.538		0.602		0.077	
F-stats.	8.796		10.54		1.799	
Durbin Watson	1.730***		1.676***		1.259	
Hausman test	0.001 (fixed effect)		0.012 (fixed effect)		0.218 (random effect)	

Notes: ***, **, and * indicate statistical significance at 1%, 5%, and 10%, respectively.

Table 6 ROE industry results (continued)

Environmental category	*Full panel*		*Panel I-CT$_{Ship}$*		*Panel II-DBTK$_{Ship}$*	
	Coefficient	*t-statistics*	*Coefficient*	*t-statistics*	*Coefficient*	*t-statistics*
Intercept	–1.691 (0.169)	–1.382	0.243 (0.415)	0.817	–1.149 (0.237)	–1.204
ENV	0.198*** (0.000)	4.173	0.171*** (0.004)	2.950	0.349** (0.034)	2.214
SIZE	0.119 (0.117)	1.576	0.008 (0.752)	0.316	0.055 (0.278)	1.104
LEV	–0.581** (0.016)	–2.434	–1.131*** (0.005)	–2.823	–0.618** (0.038)	–2.161
AGE	–0.245*** (0.004)	–2.892	–0.117*** (0.005)	–2.852	–0.268* (0.087)	–1.766
Obs.	128		89		39	
Adj. R^2	0.543		0.185		0.205	
F-stats.	8.965		6.009		2.224	
Durbin Watson	1.789***		1.463***		1.927*	
Hausman test	0.002 (fixed effect)		0.055 (random effect)		0.021 (fixed effect)	
Social category	*Full panel*		*Panel I-CT$_{Ship}$*		*Panel II-DBTK$_{Ship}$*	
	Coefficient	*t-statistics*	*Coefficient*	*t-statistics*	*Coefficient*	*t-statistics*
Intercept	–1.851** (0.039)	–2.087	–2.484** (0.025)	–2.288	–0.650 (0.366)	–0.916
SOC	0.105* (0.061)	1.886	0.197*** (0.010)	2.617	–0.122 (0.149)	–1.473
SIZE	0.141*** (0.005)	2.825	0.183*** (0.003)	3.042	0.072 (0.281)	1.095
LEV	–0.470* (0.058)	–1.913	–0.357 (0.331)	–0.977	–0.122 (0.228)	–1.226
AGE	–0.211** (0.013)	–2.503	–0.393** (0.024)	–2.301	0.019 (0.332)	0.982
Obs.	128		89		39	
Adj. R^2	0.520		0.595		0.093	
F-stats.	8.267		10.24		1.975	
Durbin Watson	1.665***		1.561***		1.180	
Hausman test	0.010 (fixed effect)		0.009 (fixed effect)		0.319 (random effect)	

Notes: ***, **, and * indicate statistical significance at 1%, 5%, and 10%, respectively.

DBTK$_{Ship}$ panels for *CSR*, *ENV*, and *SOC* categories. The Hausman test indicates significant results for the majority of panels and categories. In particular, the DBTK$_{Ship}$ panel shows significant results for all categories in the fixed-effect model. The full and CT$_{Ship}$ panels show significant results for most categories in the random-effect model. In all panels and categories, *LEV* has a more significant positive influence on *TOBQ* in

CT_{Ship} than in $DBTK_{Ship}$. *AGE*, however, has a significant negative influence on the full and $DBTK_{Ship}$ panels in all categories. *SIZE* shows insignificant influence on *TOBQ* in all panels and categories. Despite the insignificant influence of CSR activities in the full and CT_{Ship} panels in various categories, *SOC* has a significant positive influence on *TOBQ* in the $DBTK_{Ship}$ panel.

Table 7 TOBQ industry results

CSR category	*Full panel*		*Panel I-CT_{Ship}*		*Panel II-$DBTK_{Ship}$*	
	Coefficient	*t-statistics*	*Coefficient*	*t-statistics*	*Coefficient*	*t-statistics*
Intercept	–0.132 (0.429)	–0.792	–0.370* (0.076)	–1.791	0.092 (0.746)	0.326
CSR	0.010 (0.511)	0.657	–0.016 (0.407)	–0.831	0.036 (0.212)	1.274
SIZE	0.004 (0.663)	0.435	0.009 (0.385)	0.873	0.001 (0.920)	0.100
LEV	0.714*** (0.000)	13.81	0.874*** (0.000)	12.00	0.463*** (0.000)	6.782
AGE	–0.034* (0.056)	–1.926	0.004 (0.898)	0.127	–0.074** (0.001)	–3.436
Obs.	128		89		39	
Adj. R^2	0.666		0.725		0.967	
F-stats.	64.43		1.592		144.5	
Durbin Watson	1.445***		1.501***		2.288***	
Hausman test	0.596 (random effect)		0.948 (random effect)		0.000 (fixed effect)	
Environmental category	*Full panel*		*Panel I-CT_{Ship}*		*Panel II-$DBTK_{Ship}$*	
	Coefficient	*t-statistics*	*Coefficient*	*t-statistics*	*Coefficient*	*t-statistics*
Intercept	–0.128 (0.450)	–0.756	–0.386* (0.066)	–1.859	0.181 (0.551)	0.603
ENV	0.004 (0.764)	0.300	–0.014 (0.373)	–0.894	–0.009 (0.787)	–0.272
SIZE	0.004 (0.659)	0.441	0.010 (0.343)	0.952	0.002 (0.896)	0.131
LEV	0.719*** (0.000)	13.86	0.876*** (0.000)	11.97	0.468*** (0.000)	6.709
AGE	–0.029* (0.074)	–1.797	0.0009 (0.976)	0.029	–0.048** (0.037)	–2.175
Obs.	128		89		39	
Adj. R^2	0.666		0.726		0.966	
F-stats.	64.40		59.45		137.2	
Durbin Watson	1.440***		1.527***		1.999***	
Hausman test	0.834 (random effect)		0.979 (random effect)		0.000 (fixed effect)	

Notes: ***, **, and * indicate statistical significance at 1%, 5%, and 10%, respectively.

Table 7 TOBQ industry results

Social category	*Full panel*		*Panel I-CT$_{Ship}$*		*Panel II-DBTK$_{Ship}$*	
	Coefficient	*t-statistics*	*Coefficient*	*t-statistics*	*Coefficient*	*t-statistics*
Intercept	–0.133 (0.421)	–0.807	–0.377* (0.071)	–1.827	0.145 (0.290)	1.076
SOC	0.015 (0.186)	1.327	–0.002 (0.857)	–0.180	0.034*** (0.000)	4.238
SIZE	0.004 (0.646)	0.459	0.009 (0.381)	0.880	0.0001 (0.988)	0.014
LEV	0.706*** (0.000)	13.94	0.863*** (0.000)	11.90	0.448*** (0.000)	10.66
AGE	–0.040** (0.019)	–2.372	–0.009 (0.764)	–0.300	–0.078*** (0.000)	–6.929
Obs.	128		89		39	
Adj. R^2	0.669		0.723		0.971	
F-stats.	65.32		58.49		164.2	
Durbin Watson	1.464		1.499***		2.466***	
Hausman test	0.409 (random effect)		0.899 (random effect)		0.000 (fixed effect)	

Notes: ***, **, and * indicate statistical significance at 1%, 5%, and 10%, respectively.

4.3 Panel data regression analysis – ROA, ROE, and TOBQ by region

Table 8 presents the results of the AES panel and EAP panel in all categories via *ROA* and *ROE*. The Hausman test achieves significant results for most panels except EAP panel in *ENV* for *ROA*, thereby indicating that the mixed-effect models, including fixed- and random-effect models, are well built. For *ROA*, *ENV* has significant positive influence on AES and EAP panels, whereas *CSR* has a significant positive influence on the EAP panel. *SIZE* has a significant positive influence on AES and EAP panels in most categories except for EAP panel in *ENV*. *AGE* has a significant negative influence on AES panel in all categories, but only on EAP panels in *CSR*. By contrast, *LEV* has a significant negative influence on the EAP panel in all categories via *ROA*.

For *ROE*, *CSR* and *ENV* have a significant positive influence on AES and EAP panels. However, *SOC* has significant negative and positive influences on AES and EAP panels, respectively. *SIZE* and *AGE* have significant positive and negative influence on both panels in the *CSR* and *SOC* categories. The EAP panel shows greater CSR performance with *CSR* and *SOC* and the AES panel with *ENV*. The EAP panel also benefits from a younger age in the *CSR* category, followed by a greater firm size in *SOC*. Despite the AES panel having a greater firm age in the *CSR* and *ENV*, this panel benefits from superior leverage capability in *SOC*.

Table 8 Regional results for ROA and ROE

CSR category	*ROA results*				*ROE results*			
	Panel I-AES		*Panel II-EAP*		*Panel I-AES*		*Panel II-EAP*	
	Coefficient	*t-stat.*	*Coefficient*	*t-stat.*	*Coefficient*	*t-stat.*	*Coefficient*	*t-stat.*
Intercept	–0.290 (0.503)	–0.674	–0.348 (0.411)	–0.827	–0.886 (0.229)	–1.218	–2.565 (0.137)	–1.506
ENV	0.083 (0.172)	1.386	0.090*** (0.001)	3.264	0.207** (0.045)	2.051	0.245*** (0.002)	3.122
SIZE	0.092*** (0.006)	2.878	0.023 (0.282)	1.084	0.142** (0.012)	2.614	0.167* (0.092)	1.709
LEV	0.049 (0.754)	0.314	–0.269** (0.022)	–2.348	0.258 (0.334)	0.974	–0.926*** (0.002)	–3.216
AGE	–0.454*** (0.000)	–4.101	–0.093*** (0.003)	–3.036	–0.672*** (0.000)	–3.595	–0.276*** (0.001)	–3.432
Obs.	58		70		58		70	
Adj. R^2	0.575		0.190		0.664		0.407	
F-stats.	8.735		2.356		12.26		4.949	
Durbin Watson	1.254***		2.283**		1.241***		1.956***	
Hausman test	0.000 (fixed effect)		0.030 (fixed effect)		0.000 (fixed effect)		0.038 (fixed effect)	

Notes: ***, **, and * indicate statistical significance at 1%, 5%, and 10%, respectively.

Table 8 Regional results for ROA and ROE (continued)

Environmental category	*ROA results*				*ROE results*			
	Panel I-AES		*Panel II-EAP*		*Panel I-AES*		*Panel II-EAP*	
	Coefficient	*t-stat.*	*Coefficient*	*t-stat.*	*Coefficient*	*t-stat.*	*Coefficient*	*t-stat.*
Intercept	–0.246 (0.557)	–0.591	–0.067 (0.174)	–1.374	–0.772 (0.275)	–1.103	0.065 (0.754)	0.313
ENV	0.085** (0.030)	2.232	0.027** (0.031)	2.193	0.181*** (0.007)	2.814	0.139*** (0.009)	2.670
SIZE	0.091*** (0.005)	2.924	0.005* (0.091)	1.715	0.139*** (0.010)	2.651	0.005 (0.747)	0.322
LEV	0.006 (0.969)	0.039	–0.198*** (0.000)	–3.872	0.179 (0.492)	0.691	–1.193*** (0.000)	–4.291
AGE	–0.458*** (0.000)	–4.612	–0.006 (0.169)	–1.388	–0.651*** (0.000)	–3.898	–0.011 (0.585)	–0.548
Obs.	58		70		58		70	
Adj. R^2	0.600		0.148		0.6868		0.365	
F-stats.	9.575		4.013		13.49		10.94	
Durbin Watson	1.348***		2.032		1.329***		1.638***	
Hausman test	0.000 (fixed effect)		0.158 (random effect)		0.000 (fixed effect)		0.063 (random effect)	

Notes: ***, **, and * indicate statistical significance at 1%, 5%, and 10%, respectively.

Table 8 Regional results for ROA and ROE (continued)

Social category	*ROA results*				*ROE results*			
	Panel I-AES		*Panel II-EAP*		*Panel I-AES*		*Panel II-EAP*	
	Coefficient	*t-stat.*	*Coefficient*	*t-stat.*	*Coefficient*	*t-stat.*	*Coefficient*	*t-stat.*
Intercept	–0.219 (0.619)	–0.500	0.014 (0.810)	0.240	–0.523*** (0.002)	–3.194	–2.429 (0.128)	–1.540
ENV	–0.021 (0.690)	–0.400	0.011 (0.341)	0.958	–0.232*** (0.000)	–8.185	0.158** (0.034)	2.169
SIZE	0.091*** (0.007)	2.785	0.004 (0.220)	1.236	0.126*** (0.000)	7.526	0.173** (0.040)	2.092
LEV	0.082 (0.603)	0.522	–0.220*** (0.000)	–3.821	0.522*** (0.000)	5.139	–0.935** (0.035)	–2.151
AGE	–0.351*** (0.003)	–3.081	–0.003 (0.699)	–0.388	–0.226*** (0.000)	–8.135	–0.232** (0.031)	–2.199
Obs.	58		70		58		70	
Adj. R^2	0.559		0.130		0.601		0.398	
F-stats.	8.251		3.578		22.53		4.809	
Durbin Watson	1.099***		1.953**		0.876***		1.940***	
Hausman test	0.043 (fixed effect)		0.059 (random effect)		0.053 (random effect)		0.031 (fixed effect)	

Notes: ***, **, and * indicate statistical significance at 1%, 5%, and 10%, respectively.

Table 9 shows the results of the AES and EAP panels in all categories via *TOBQ*. The Hausman test achieves significant results for all panels, thereby indicating that the mixed-effect models, including fixed- and random-effect models, are well built. *SOC* has a significant negative influence on the AES panel with *TOBQ*. The EAP panel shows greater significant coefficient values in *LEV* than those in the AES panel in all categories. *AGE* has a significant negative and positive influence on the EAP and AES panels, respectively.

Table 9 TOBQ regional results

CSR category	*Panel I-AES*		*Panel II-EAP*	
	Coefficient	*t-statistics*	*Coefficient*	*t-statistics*
Intercept	–0.046 (0.794)	–0.261	–0.082 (0.595)	–0.534
SOC	0.0002 (0.992)	0.009	0.024 (0.211)	1.260
SIZE	0.0007 (0.957)	0.054	–0.001 (0.851)	–0.188
LEV	0.522*** (0.000)	8.014	0.862*** (0.000)	12.78
AGE	–0.024 (0.603)	–0.522	–0.054*** (0.004)	–2.983
Obs.	58		70	
Adj. R^2	0.947		0.724	
F-stats.	104.2		46.38	
Durbin Watson	1.547***		1.659***	
Hausman test	0.047 (fixed effect)		0.182 (random effect)	
Environmental category	*Panel I-AES*		*Panel II-EAP*	
	Coefficient	*t-statistics*	*Coefficient*	*t-statistics*
Intercept	–0.047 (0.695)	–0.394	–0.102 (0.509)	–0.662
SOC	0.010 (0.330)	0.984	0.027 (0.147)	1.465
SIZE	0.0006 (0.956)	0.054	–0.001 (0.840)	–0.202
LEV	0.512*** (0.000)	3.908	0.876*** (0.000)	13.54
AGE	–0.033 (0.458)	–0.747	–0.055*** (0.001)	–3.260
Obs.	58		70	
Adj. R^2	0.948		0.727	
F-stats.	105.2		47.14	
Durbin Watson	1.573***		1.653***	
Hausman test	0.021 (fixed effect)		0.160 (random effect)	

Notes: ***, **, and * indicate statistical significance at 1%, 5%, and 10%, respectively.

Table 9 TOBQ regional results (continued)

Social category	*Panel I-AES*		*Panel II-EAP*	
	Coefficient	*t-statistics*	*Coefficient*	*t-statistics*
Intercept	0.058 (0.705)	0.379	–0.037 (0.793)	–0.262
SOC	–0.034** (0.050)	–1.999	0.017 (0.213)	1.255
SIZE	–0.014 (0.209)	–1.271	–0.002 (0.753)	–0.314
LEV	0.441*** (0.000)	7.839	0.856*** (0.000)	12.59
AGE	0.068** (0.022)	2.349	–0.053*** (0.002)	–3.169
Obs.	58		70	
Adj. R^2	0.695		0.725	
F-stats.	33.58		46.61	
Durbin Watson	1.320***		1.622***	
Hausman test	0.077 (random effect)		0.092 (random effect)	

Notes: ***, **, and * indicate statistical significance at 1%, 5%, and 10%, respectively.

5 Conclusions

This study shows that CSR activities have a significant positively influence on the financial performance of shipping firms via ROA and ROE for asset utilisation efficiency and current financial performance, respectively (Hypotheses 1 and 2). In particular, CT_{ship} obtains significant positive influences from the overall CSR, environmental, and social activities to increase asset utilisation efficiency and financial performance. By contrast, $DBTK_{ship}$ improves asset utilisation efficiency and current financial performance only through environmental activities. This finding corresponds with that of Wang et al. (2020) on CSR performance in achieving sustainability development goals for the maritime industry. Leverage and firm age have significant negative influences on CT_{ship} in asset utilisation and current financial performance, whereas firm size has a significant positive influence only on current financial performance. For expected financial performance via TOBQ, social activities have significant positive influence only on $DBTK_{ship}$ (Hypothesis 3). However, shipping firms show significant positive and negative influences from leverage and firm age, respectively. This result corresponds to those of Alexandridis et al. (2020) on high-leverage risks commonly observed in shipping firms. Therefore, container shipping firms improve asset utilisation efficiency and current financial performance via active CSR engagement in all categories at younger age. However, DB and tanker shipping firms improve asset utilisation efficiency and current financial performance via environmental activities and expected financial performance via social activities. Fasoulis and Kurt (2019) and Wang et al. (2020) indicated that shipping industry implements CSR policies in shipping management with sustainability reports provided for investors.

The results of the regional panels show the significant positive influence of CSR activities on asset utilisation efficiency and current financial performances. In particular, environmental activities improve asset utilisation efficiency and current financial performance for both AES and EAP panels (Hypotheses 1 and 2). Social activities have significant positive and negative influence on improving current financial performance for EAP and AES panels, respectively. Firm size has a significant positive influence on asset utilisation efficiency and current financial performance for both panels in most CSR categories. However, leverage has a significant negative influence on asset utilisation efficiency and current financial performances for the EAP panel whereas firm age has a significant negative influence on both EAP and AES panels. For expected financial performance, social activities have a significant negative influence on the AES panel. The majority of CSR activities show insignificant influence on expected financial performances. The Asian shipping industry focuses on green innovation for environmental performance, while the European shipping industry shows significant input in ethical business operations represented by high social performance related to corporate reputation, employee motivation, and environmental participation (Raza, 2020; Fjørtoft et al., 2020).

This study contributes to research on applying CSR performance scores segmented into environmental and social performances of international shipping industry. Slack resource and stakeholder theories are adopted to reveal the causal relationship between CSR activities and corporate performance, including asset utilisation efficiency and current and expected financial performance. In practice, the significant influence of various CSR activities on improving corporate performance in sustainable shipping management is identified. Carrier types with corresponding CSR activities are also determined for optimal corporate performance in sustainability.

With the ongoing CSR activities and engagement, the results of this study can serve as reference for strategic sustainability management and development of financial performance for the shipping industry. Moreover, the results provide guidelines on the influence of CSR on the financial performance for investment decision making and portfolio selection; mainly deriving from asset utilisation efficiency and ROE for the shipping industry. Strategic development of CSR participation can target environmental activities for container shipping; compared with both environmental and social activities for DB and tankers shipping. Future research can focus on individual CSR activities under the social and environment categories for in-depth comprehension and comparison.

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Notes

1 In terms of commercial freight shipping, the shipping industry includes dry bulk (DB), tanker (TK), and container (CT) sub-industries (Pettit et al., 2018; Trapp et al., 2020). The DB and TK sub-industries operate in raw material and crude oil transport, whereas the CT sub-industry operates in finished goods transport (Pettit et al., 2018; Raza, 2020).