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The relationship between business cycles and capital structure choice: The case of the international shipping industry

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ABSTRACT

Research on capital structure choice depicts firm size, profitability, and asset tangibility as the main determinants of capital structure. The trade-off and pecking order theories of optimal capital structure predict contradictory relationships between each of these determinants and firm leverage. We attempt to reconcile the conflicting results in the literature by incorporating the impact of different phases of the economic cycle upon the choice of capital structure in a concentrated ownership setting. Studying 117 internationally listed shipping companies (about 60% of the entire population), we explore potential determinants of capital structure choice in periods of expansion (2003Q4), peak (2007Q4), trough (2008Q4), and sideways movement (2010Q4). Our finding that size, tangibility, and corporate performance constitute the main determinants of capital structure in the shipping sector is consistent with the literature. We employ the Generalized Method of Moments (GMM) to estimate the interaction between capital structure choice, corporate profitability and structure of ownership. Our model asserts bidirectional positive relationships between *leverage and profitability* and *leverage and concentrated ownership* in the peak period of 2007, but bidirectional negative relationships amongst these variables in all other periods. We conclude that the sentiment of the shipowner during different phases of the business cycle, along with ownership concentration are key elements in explaining the relationship between profitability and leverage in the shipping sector.

1. Introduction

Within transportation research, interest in the choice and implications of capital structure has been ongoing. Research has primarily focused on the determinants of capital structure, with a large number of studies, such as Harris and Raviv (1991), Rajan and Zingales (1995), Flannery and Rangan (2006), Arvanitis, Tzigkounaki, Stamatopoulos, and Thalassinos (2012), and Drobetz, Gounopoulos, Merikas, and Schröder (2013), investigating capital structure determinants in relation to the trade-off and pecking order theories. In general, it is widely accepted that the optimal choice of capital structure is determined by

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firm size, profitability, and tangibility. However, the trade-off and pecking order theories reach opposing conclusions as to the relationship between leverage and each of the determinants and the empirical evidence is mixed.

The extent to which different phases of economic activity influence capital structure choice has received much less attention. Similarly, the inclusion of concentrated ownership as a factor that may affect the choice of capital structure has been underexplored. These gaps in the literature constitute the main motivation for conducting the present study. We set out to explain conflicting results by looking into potential effects of business cycles and ownership structure. Our focus on the choice of capital structure in shipping is attributable to the apparent resistance of the sector during the downturn of the cycle, as the sector demonstrates robust business activity internationally.

This study adds to the existing literature in two ways. First, we investigate the choice of capital structure in four distinct phases of the shipping cycle. In addition, we explore the particular role that concentrated ownership, a major tenet of the international shipping industry, exerts on that decision. We use the financials of 117 international listed shipping companies, a sample size that corresponds to 60% of the entire listed population. The four points of the cycle under scrutiny are the fourth quarter of 2003, 2007, 2008 and 2010, representing expansion, peak, trough and sideways movement respectively. Consistent with previous research, we find that size, tangibility and corporate performance comprise the main determinants of capital structure in the shipping sector (Frank & Goyal, 2003; Rajan & Zingales, 1995).

We proceed to develop a simultaneous equation model where leverage, measured by the ratio of total liabilities to equity, is treated as an endogenous variable. We employ the Generalized Method of Moments (GMM) to estimate the interaction between capital structure choice and corporate profitability. In support of the trade-off theory, our results indicate a bidirectional negative relationship between leverage and profitability during the expansion period of 2003, the trough of 2008, as well as the period of sideways movement (2010). By contrast, a bidirectional positive relationship between leverage and profitability appears to be characteristic of the peak period of 2007, which attests to the pecking order theory. More importantly, our model shows that leverage is positively related with concentrated ownership during the 2007 peak. Our contribution to the literature lies in shedding light upon an untouched so far dimension of capital structure choice, namely the unique relationship between leverage and ownership concentration at the peak of the economic cycle.

The remaining of the paper is organized as follows. A review of related literature is conducted in Section 2. In the third section we lay out our hypotheses. Our sample and methodology are presented in Section 4. Section 5 presents and discusses our empirical findings. Concluding remarks and suggestions for further research are given in Section 6.

2. Prior research

All companies need to make decisions about how to build capital. The notion of capital structure choice refers to the fact that firms have to decide on how much debt they will have relative to their equity. Capital structure affects company value because it is closely related to financial risk. Therefore, optimal is the debt/equity mix that maximizes company value. Thanks to Modigliani and Miller (1958), we know that in the absence of taxes, financial distress or agency costs, the choice of capital structure does not affect company value and the cost of equity is a linear function of the firm's leverage.

Since that seminal work, two main theories attempt to explain company choice regarding capital structure by incorporating market imperfections. The first is known as the trade-off theory, developed by Kraus and Litzenberger (1973). It points to the trade-off a firm faces between the taxation advantages associated with debt and the deadweight bankruptcy costs in the event the company fails to meet its debt obligations. According to the trade-off theory, in choosing a capital structure, a company balances the value of the tax benefit from deductibility of interest with the present value of the costs of financial distress. At the optimal target capital structure, the incremental tax shield benefit is exactly offset by the incremental costs of financial distress.

The second theory on firm capital structure behavior is the pecking order theory, first introduced by Donaldson (1961). The pecking order theory claims that in the presence of asymmetric information between managers and investors, with the former possessing more information than the latter, management's choice will be the source of capital that gives out the least amount of information. This points to retained earnings as the most preferred way of raising capital and, in the event that the firm's retained earnings are inadequate, debt financing being always preferable to equity. The reason is that equity financing implies significant adverse selection, raising the costs associated with asymmetric information and thereby rendering new equity issuance the least preferred method of raising capital.

Several empirical studies have investigated the practical relevance of these two theories. In general, the results obtained are mixed. Huang and Ritter (2009) look at a sample of publicly traded US firms from 1963 to 2001. They conclude that firms turn to equity for their financing when the cost of equity is relatively low. They also find a relationship between the firms' current capital structure and their past decisions. Their findings indicate that both the market timing model and the static trade-off model explain to a large extent the optimal choice of capital structure.

By contrast, Shyam-Sunder and Myers (1999) who test the static trade-off against the pecking order theory, examining 157 US listed companies during 1971–1989, find that the pecking order model has greater time-series explanatory power than the trade-off model. More recently, Frank and Goyal (2009) test the pecking order theory by analyzing American publicly traded firms for the period 1971–1998. They find that on average, net equity issues commonly exceed net debt issues and argue that the group of large sized firms in the early years provides enough support for the pecking order theory. Flannery and Rangan (2006) use a sample of publicly traded firms from 1965 to 2001, asserting that firms target a specific capital structure (targeting behavior), but finding that market timing and pecking order considerations explain

less than 10% each. It remains an open issue, the choice of optimal capital structure across industries, during different time spans. The shipping sector, international by nature, presents a case with unique and distinct features. Under it, the diverse findings of the literature can be reconciled and explained by introducing a new vital parameter, the shippers' sentiment that goes hand in hand with concentrated ownership.

2.1. Determinants of capital structure

Independently of the measure selected (ROA, ROE or Tobin's Q), profitability appears to play an important role as a determinant of capital structure. The trade-off theory suggests that profitable firms face lower cost of debt since they have lower possibility of bankruptcy and are, therefore, expected to have a higher leverage ratio (Huang & Ritter, 2009; Flannery & Rangan, 2006). By contrast, pecking order suggests that firms prefer internal rather than external funding. Therefore, profitability leads to a decrease in the leverage ratio since firms use retained earnings for financing their activities (Rajan & Zingales, 1995).

Tangibility, measured by Fixed Assets over Total assets also seems to play an important role for capital structure. On the one hand, according to the trade-off theory, asset tangibility is positively related to leverage since the firm's tangible assets can be used as collateral to receive a loan. This way the risk of bankruptcy and, therefore, credit risk is being reduced (Frank & Goyal, 2009). On the other hand, the pecking order theory suggests that asset tangibility reduces information asymmetry, resulting in a less costly equity issuance. Thus, it predicts a negative relationship between tangibility and leverage (Shyam-Sunder & Myers, 1999).

Furthermore, firm size has been found to significantly impact the choice of optimal capital structure. In this case, the trade-off theory predicts a positive relationship between the size of the firm and its leverage. Its reasoning is based on the fact that larger companies possess low default risk which leads to higher leverage. In contrast, pecking order implies that being better known, larger firms have easy access to capital and so an inverse relationship exists between the size of the firm and the leverage ratios. It is worth noting that most empirical studies support the trade-off theory (Frank & Goyal, 2009).

Concentrated ownership, as measured by the percentage held by the largest shareholder has evolved as an important determinant of capital structure choice. Businesses with highly concentrated ownership reduce agency costs between shareholders and managers, thus leading to easier equity issuances. As a result, a negative relationship between concentrated ownership and leverage is expected (see Tsionas, Merikas, & Merika, 2012; Andrikopoulos, Merika, Triantafyllou, & Merikas, 2013). It follows that firms with low concentration of ownership (higher agency costs) prefer more risky investments that may lead to higher returns, as creditors are the ones to assume losses in the event of default, thus pushing the cost of debt at higher levels. It follows that the relationship between concentrated ownership and leverage is positive.

2.2. Capital structure in the shipping sector

A distinct feature of the shipping industry is that it typically consists of a large number of small firms with concentrated ownership. However, listed shipping companies tend to be holding companies, with as many as 60 or 70 ships (individual companies) each. The shipping sector is strongly dependent upon the international economic environment. It is a highly cyclical sector, but in its own distinct way: it does not necessarily follow the business cycles of individual economies, but rather global economic cycles.

A second unique tenet of the shipping sector is highlighted by Drobetz et al. (2013). They show that shipping companies have twice as high a leverage ratio compared to listed industrial firms. Shipping companies appear to use high levels of leverage, a fact that makes examination of their capital decisions all the more interesting. Analyzing a sample of 115 publicly traded shipping companies, the authors argue that the shipping industry is characterized by high leverage, which tends to be adjusted counter-cyclically. Their results suggest that asset tangibility is positively related to corporate leverage, while profitability and leverage are inversely related. They also establish a weak relationship between firm size and leverage and assert that growth and leverage are inversely related. In addition, they find that the speed with which the shipping firms on average return to their targeted capital structure is higher than the other industries, except in periods of economic downturn, when it is significantly lower than in other industries.

Finally, Arvanitis et al. (2012) investigate European Maritime Enterprises by using a sample of 32 European traded companies during 2005–2010. Their findings suggest that the pecking order theory is able to explain the companies' financial decisions. The authors argue that profitability and debt are negatively correlated, while a positive relationship exists between tax benefits arising from depreciations and the debt ratio. They also find that firm size and growth are negatively correlated with leverage, while tangibility is positively related. With respect to profitability, the authors note that it is found to be negatively related to the leverage ratio.

Overall, the literature of corporate finance offers rich insights into the optimal capital structure choice. We embark on investigating the relationship between profitability and leverage through a set of theoretical statements that are specific to the case of shipping.

3. Hypotheses

In this section we lay our hypotheses, relating each proposition that we make with respective literature findings. As pointed out earlier, according to the trade-off theory, profitable firms have a lower probability of bankruptcy and, therefore, are expected to have lower cost of debt, hence higher leverage ratio (Frank & Goyal, 2009). In contrast, the pecking order theory predicts that since firms prefer to use internal rather than external funds, higher profitability is going to lead to a decrease of the leverage ratio. Most empirical studies support the pecking order theory (Fama & French, 2002; Titman & Wessels, 1998; Wald, 1999). In the case of shipping, Drobetz et al. (2013) assert that profitability and leverage are inversely related. Based on all of the above and taking into account a distinct and generally recognized feature in shipping, namely the sentiment of the ship-owner during different phases of the business cycle, we form the following hypotheses:

Hypothesis Ia. Ceteris paribus, leverage is inversely related with profitability in the expansion, trough and sideways movement periods.

Hypothesis Ib. Ceteris paribus, leverage is positively related with profitability in the peak of the cycle.

Tangibility can be considered as a measure of collateral value and information. From a trade-off standpoint, tangibility is positively related with leverage, because tangible assets can be used as collateral and decrease the cost of debt. Based on the pecking order theory tangibility is inversely related with leverage, because tangibility is considered a proxy for information. Thus, the higher the tangibility the less the information asymmetry and, therefore, the firm enjoys lower equity issuance costs. Regarding the issue of tangibility, some empirical studies support the trade-off theory (Frank & Goyal, 2009), while others support the pecking order theory (Bauer, 2004) or produce inconclusive results (Serrasqueiro & Nunes, 2009). In shipping, the study of Drobetz et al. (2013) demonstrates that tangibility is positively related to leverage. Based on all of the above, we form the following hypothesis:

Hypothesis II. Ceteris paribus, leverage is positively related with tangibility.

According to the trade-off theory, because larger firms are more diversified they have lower probability of bankruptcy and, therefore, lower cost of debt. Consequently, larger firms are expected to have higher leverage. By contrast, the pecking order theory argues that because of their size, which is considered a measure of information, firms are well known, therefore there is a reduction in information asymmetry which, in turn, leads to lower equity issuance costs. Most empirical studies support the trade-off theory on this issue (Frank & Goyal, 2009; Bevan & Danbolt, 2002; Bevan & Danbolt, 2004; Gaud, Elion, Hoesli, & Bender, 2005). In shipping, Drobetz et al. (2013) find that firm size displays a weak relation with leverage. Based on all of the above, we form the following hypothesis:

Hypothesis III. Ceteris paribus, leverage is positively related with firm size.

We advance the literature by setting out to explore the particular role that concentrated ownership exerts on the optimal capital structure decision in the shipping industry. The effect of ownership concentration, i.e. the incidence of a few major stockholders is ambiguous. On the one hand, major shareholders monitor efficiently their agents and reduce agency costs between managers and shareholders, allowing for easier equity issuances (Tsionas, Merikas, & Merika, 2012; Andrikopoulos, Merika, Triantafyllou, & Merikas, 2013). On the other hand, a high level of leverage is discouraging any potential acquisition towards the firm (Rajan & Zingales, 1995). Firms with dispersed ownership tend to prefer more risky investments that may lead to higher returns, since creditors are the ones that are going to incur most of the losses in case of bankruptcy. Consequently, creditors are going to demand higher compensation for the funds that they will provide and thus the cost of debt is going to increase. Based on all of the above, we form the following hypotheses:

Hypothesis IVa. Ceteris paribus, leverage is negatively related with concentrated ownership in the expansion, trough and sideways movement periods.

Hypothesis IVb. Ceteris paribus, leverage is positively related with concentrated ownership in the peak of the cycle.

4. Sample description and methodology

Our sample consists of 117 shipping companies listed in major international stock markets such as NYSE, NASDAQ, London Stock Exchange, Singapore Stock Exchange and Oslo Stock Exchange. This number accounts for roughly 60% of the entire population of shipping companies listed in these stock markets. For the remaining of the companies, we had no access to some or all of the financial data required for this study. We selected firms in the sample on the basis of ownership and/or operation of merchant ships, excluding tourism, oil drilling and conglomerates where shipping is not

Table 1
Definition of dependent and independent variables.

Dependent variables	
PROFITABILITY (ROA)	Return on Assets
LEVERAGE (LEV)	Natural logarithm of total liabilities over equity
Explanatory variables	
SIZE (LTAS)	Natural logarithm of total assets
CONCENTRATED OWNERSHIP (OWN)	Percentage of the largest shareholder
TANGIBILITY (LTAN)	Natural logarithm of fixed over total assets
GROWTH (LGRO)	Natural logarithm of total assets in year $t+1$ over total assets in year t
LFAS	Natural logarithm of fixed assets
PRM	Profit Margin

Table 2
Descriptive statistics.

	LEV	ROA	OWN	LTAS	LGRO	LTAN
EXPANSION YEAR 2003						
Mean	1.087796	0.072871	0.268307	6.265683	0.277485	0.94455
Median	0.821919	0.056385	0.162050	6.279523	0.196567	0.764324
Maximum	10.09958	0.883631	0.957500	9.297653	1.357072	11.81217
Minimum	−1.739665	−0.184809	0.000300	2.729812	−0.579082	0.17159
Std. Dev.	1.411561	0.123450	0.266150	1.531509	0.371047	1.36295
PEAK YEAR 2007						
Mean	1.150539	0.093135	0.312135	7.060994	0.437890	0.656680
Median	0.720639	0.058409	0.292000	6.782487	0.225886	0.720627
Maximum	6.044173	0.501121	0.901800	11.06987	3.029223	1.175578
Minimum	0.000000	−0.071981	0.005000	4.179298	−0.269496	0.128316
Std. Dev.	1.268596	0.120421	0.199923	1.378662	0.709881	0.249378
TROUGH YEAR 2008						
Mean	0.551286	0.103468	0.246479	6.200041	0.277668	0.647222
Median	0.419861	0.060971	0.183300	6.244943	0.150873	0.465016
Maximum	3.218222	0.883631	0.633100	8.851447	2.607154	11.81217
Minimum	0.000000	−0.475353	0.000851	2.947592	−0.688893	0.041398
Std. Dev.	0.523302	0.173637	0.241304	1.357902	0.546885	1.221210
SIDEWAYS MOVEMENT YEAR 2010						
Mean	3.256469	0.015101	0.313760	7.115561	0.165851	0.755945
Median	0.692896	0.020395	0.289900	7.211099	0.096698	0.775582
Maximum	262.5775	0.143278	0.901800	11.11624	2.499499	1.809660
Minimum	−55.62500	−0.375723	0.013900	4.050044	−0.695837	0.032426
Std. Dev.	25.73667	0.082035	0.207866	1.302950	0.473423	0.224110

their major focus. Merchant ships of listed companies comprise tankers, dry bulk and containers. It is worth noting that the global nature of the shipping industry permits pooling of firms from different markets.

From the several different definitions of leverage in the literature, the one selected to be the dependent variable in our model is the natural logarithm of the sum of long term debt and current liabilities of the firm over the equity of the firm. Table 1 provides definitions of all variables used in the analysis. Table 2 presents the descriptive statistics for the chosen variables in each year.

Financial data were retrieved from company records and websites. Accounting figures are measured in millions of dollars. Following the approach of Ettredge, Richardson, and Scholz (2002) and Debreceny, Gray, and Rahman (2002), we proxy size with the logarithm of each firm's total assets. Consistent with previous work in the literature (see, for example, Leuz & Verrecchia, 2000), we measure profitability in terms of the return on assets (ROA). Finally, we measure ownership concentration with the proportion of equity that is owned by the largest shareholder.

Our relationship of interest is

$$\text{LEV} = z(\text{ROA}, \text{LTAS}, \text{LTAN}, \text{OWN})$$

The first question to ask in a situation where one or more of the regressors may be endogenous is what is the model that determines the endogenous regressors. This question suggests that our single econometric equation should be thought of as part of a system of simultaneous equations that jointly determine both our Y and our endogenous X variables. In our case ROA is endogenous, as it is determined by variables that are part of our initial relationship, including LEV (Fama & French, 2002; Titman & Wessels, 1998; Wald, 1999; Drobetz, Gounopoulos, Merikas, & Schröder, 2013).

We set up a model of simultaneous equations:

$$\text{LEV} = f(\text{ROA, LTAS, LTAN, OWN, LGRO})$$

$$\text{ROA} = z(\text{OWN, LEV, LTAS, LGRO})$$

where ROA and LEV are endogenous variables, LTAS is total assets expressed in logarithms, OWN is the percentage ownership, LGRO is the change in total assets expressed in logarithms, LTAN is fixed over total assets expressed in logarithms, which are sluggish and therefore can be considered as predetermined. GMM was chosen over IV because in the presence of heteroskedasticity it is more efficient than the simple IV estimator and, even in the absence of heteroskedasticity, it is asymptotically no worse than the IV estimator.

Assume our set of instruments is $X = [\text{LTAS, LTAN, PRM}]$, where LTAS and PRM are external instruments and LFAS does not appear explicitly on the left hand side of our equations. To provide more orthogonality conditions we use not only X but also the squares and cross-products of the variables in X. In our case this would mean 9 instruments in total.

Given the linear system:

$$\text{ROA}_i = f(\text{OWN}_i,\ \text{LEV}_i,\ \text{LTAS}_i,\ \text{LGRO}_i) + u_{i1}$$

$$\text{LEV}_i = z(\text{ROA}_i,\ \text{LTAS}_i,\ \text{LTAN}_i,\ \text{OWN}_i) + u_{i2},$$

we chose LTAN as one of the external instruments based on evidence that fixed assets are an important determinant of financial performance in the transport industry (see Pires Capobianco & Fernandes, 2004).

The use of cross-sectional data imply that the error terms may be correlated and exhibit arbitrary patterns of heteroskedasticity. The orthogonality conditions are made up of a vector of parameters in the linear models f and z. This implies a total of 2K (18 in our case) equations for the 12 parameters (including constant terms) and provides the fundamental basis for GMM. Thus, we run GMM estimations for our model.

An important challenge in GMM estimation is the issue of weak instruments. If instruments are weak, two-stage least squares and GMM can lead to biases even in large samples and the distributions can be far from normality. This issue is dealt with in Stock and Yogo (2005). As noted by Stock and Watson (2003), a simple guide is the calculated F-statistic in the first stage (reduced form) regression. If F is greater than 10, we need not worry, although the value of F also depends on the number of instruments used. On the weak instrument problem, Wooldridge (2002) demonstrates that in certain instances the problem of weak instruments can result in the (biased) OLS estimator being preferred.

In our application the critical value of the F-statistic is 10.80; LEV passes the test comfortably in all estimated models, while ROA less so. In the model where ROA is the dependent variable, the weak instruments problem has been effectively dealt with only in two out of the four estimated models.

5. Empirical findings and discussion

Tables 3–6 that follow give the GMM estimation of our model.

Our findings support our hypotheses and are consistent with the literature. In the models presented in Tables 3–6, all variables have the expected signs. Moreover, the impact of ROA (profitability), and LTAN (fixed assets over total assets) on LEV respectively is highly significant in all years under consideration. During the peak year 2007 the impact of all regressors, ROA (profitability), OWN (ownership dispersion), LTAN (fixed assets over total assets) and LTAS (total assets) on LEV is highly significant. It, therefore, appears that optimal capital structure choice (lower debt and more equity) in this study goes hand in hand with enhanced financial performance, during all shipping cycles' phases apart from the peak where the opposite relationship holds. Furthermore ownership concentration, is strongly significant in the peak and quite significant in the trough, in both cases with a positive sign.

Table 3
Year 2003 (expansion).

Dependent variable **LEV**		Dependent variable **ROA**	
	Coefficient		Coefficient
Constant	−0.272980	Constant	0.176157
	(0.108121)**		(0.014268)***
ROA	−2.730364	LEV	−0.005535
	(0.166339)***		(0.000520)***
LTAN	0.213817	LTAS	−0.021356
	(0.014226)***		(0.001770)***
LTAS	0.218250	OWN	0.036969
	(0.015414)***		(0.009253)***
OWN	−0.085189	LGRO	0.092231
	(0.114157)		(0.006159)***

J-Statistic: 0.346722.

*** Significant at the 1% level, ** significant at the 5% level.

Table 4
Year 2007 (peak).

Dependent variable **LEV**		Dependent variable **ROA**	
	Coefficient		Coefficient
Constant	−6.073329	Constant	−0.099083
	(1.332988)***		(0.067946)
ROA	2.178115	LEV	0.025708
	(0.640706)***		(0.010047)**
LTAN	4.744572	LTAS	0.007945
	(0.845703)***		(0.004720)*
LTAS	0.341210	OWN	0.001289
	(0.113028)***		(0.000614)**
OWN	0.047441	LGRO	0.134928
	(0.006947)***		(0.084612)

J-Statistic: 0.394020.
*** Significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

Table 5
Year 2008 (trough).

Dependent variable **LEV**		Dependent variable **ROA**	
	Coefficient		Coefficient
Constant	0.500932	Constant	0.287984
	(0.056306)***		(0.018523)***
ROA	−0.821623	LEV	−0.042604
	(0.060307)***		(0.002412)***
LTAN	0.067740	LTAS	−0.031727
	(0.005120)***		(0.002544)***
LTAS	0.007813	OWN	0.000459
	(0.008198)		(0.000193)**
OWN	−0.001504	LGRO	0.088370
	(0.000929)*		(0.004205)***

J-statistic: 0.268701.
*** Significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

Table 6
Year 2010 (sideways movement).

Dependent variable **LEV**		Dependent variable **ROA**	
	Coefficient		Coefficient
Constant	1.838999	Constant	−0.049722
	(0.677001)***		(0.002152)***
ROA	−2.021184	LEV	−1.38E−05
	(0.711083)***		(3.43E−06)***
LTAN	2.419568	LTAS	0.008107
	(0.319529)***		(0.000393)***
LTAS	0.469175	OWN	0.009298
	(0.079855)***		(0.003805)**
OWN	−0.488912	LGRO	0.027541
	(0.420966)		(0.002550)***

J-statistic: 0.205649.
*** Significant at the 1% level, ** significant at the 5% level.

Focusing on the LEV equation, during the peak of 2007, which passes comfortably the weak instruments test, it is evident that higher profitability contributes significantly towards greater debt in a concentrated ownership environment. It also appears that the larger the company size and the higher the proportion of fixed assets (ships) held by the firm, the greater the indebtedness of the company. The negative impact of profitability on the leverage of the shipping company in all other phases but the peak gives support to the pecking order theory, a finding reported by Tsionas et al. (2012) and Andrikopoulos et al. (2013) in relation to the shipping sector. Furthermore, our results indicate that ownership concentration affects negatively firm leverage in the shipping industry, a finding which allies with the results reported by Tsionas et al. (2012), but affects positively and strongly firm leverage during the peak period and this is a contribution of the current study. Finally, it is noted that the value of the J-statistic confirms the validity of our model in all three cases examined.

6. Concluding remarks

This paper explores the choice of capital structure in the shipping sector by conducting an investigation of the relationship between leverage and profitability in four distinct phases of the shipping cycle. Studying the financial data of approximately 60% of the population of internationally listed shipping companies, we investigate potential determinants of capital structure in 2003Q4 (expansion), 2007Q4 (peak), 2008Q4 (trough), and 2010Q4 (sideways movement). Moreover, we set out to explore the particular influence that concentrated ownership exerts on the optimal capital structure decision in the four phases of the cycle studied.

Developing a simultaneous equation model, where leverage (total liabilities over equity) is treated as an endogenous variable, we employ the Generalized Method of Moments (GMM) to estimate the interaction between capital structure choice and corporate profitability. Our finding that size, tangibility, and corporate performance constitute the main determinants of capital structure in the shipping sector is consistent with the literature.

In accordance with the trade-off theory, our model supports a bidirectional negative relationship between leverage and profitability during the expansion period of 2003, the trough of 2008, as well as the sideways movement period of 2010. However, we find a bidirectional positive relationship between leverage and profitability in the peak period of 2007. Thus, we extend previous research, which largely treats profitability as the main driver for optimal capital structure, by arguing that the higher the degree of equity financing, the more likely it is that the firm will experience enhanced profitability in all phases but the peak. This finding shows that the ship-owner is alert that a down movement will soon start, hence tends to raise cash primarily through debt.

Future research could be directed towards reexamining the determinants of capital structure in a trough phase of the shipping cycle to investigate if the stakeholders of a shipping company have adopted the lessons learned in the financial crisis of 2008. The cross-section of optimal capital structure choices will point to the idiosyncratic characteristics, which shape the shipping companies' effort to achieve sustainable legitimacy in the society, low cost of finance in the capital markets, as well as viability in the competitive terrain of transportation services.

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