Understanding the Capital Structure of Thai companies in the Shipping Sector

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Abstract

The purposes of this paper are to understand the factors that determine capital structure decisions and examine how the family business structure affects the decision-making process in the sea and coastal freight water transport companies in Thailand. The hypotheses draw upon two academic theories: the trade off-theory and the pecking order theory. We test the hypotheses by employing the sample panel of 77 non-listed companies. The findings show that tangibility, operating leverage, and size are positively associated with capital structure whereas profitability is negatively correlated. For family shipping firms, the result is in the same manner of overall data except for the change in sign in operating leverage. This indicates that the role of family ownership exists. Additionally, growth appears to be positively significant for family firms. However, the significance of tangibility and growth disappears for non-family shipping firms. Overall, our empirical results provide a mixed interpretation between trade-off and pecking order theory. Nevertheless, the findings reinforce the uniqueness of shipping sector that the impact of being in the sector is greater than being family firms.

Keywords: Capital Structure, Maritime Financial Management, Shipping Company, Family Business, Trade-Off Theory, Pecking Order Theory

1. Introduction

The maritime industry is an industrial industry, driven by international trade and vice versa. However, the maritime business requires a high value of asset investment, including the building and purchasing of ships, thus making it a capital-intensive business. Therefore, an understanding of the mechanism relating to optimal investment decision making; for example, financing through debt or equity, is crucial especially in light of the slowdown in global trade and global sea freight. Additionally, in early 2017, a South Korean court declared Hanjin Shipping to be bankrupt due to liquidity shortage and debt restructuring. This case of shipping insolvency creates a negative impact not only for the shippers, but also for the creditor banks and investors. The high level of capital investment, low asset flexibility, and high operating business risk generating low returns make the maritime business unique. The firms operate in a perfectly or near perfectly competitive market if they are tramp shipping companies. Consequently, the cash flow generation is uncertain due to the highly volatile market. The business owners need to generate sufficient revenues to cover the operating costs of the vessels and repay the debt. Simultaneously, the ship-owners must retain a sufficiently high collateral value of assets in order to guarantee the loans (Kavussanos and Tsouknidis, 2016). To summarize, the unique characteristics of the industry, including the capital intensity, the fragmentation of the industry, especially in bulk shipping, and the highly volatile financials should be more clearly recognized and understood by business-owners, stakeholders such as banks and investors, as well as academicians.

Family owned firms have accounted for the largest proportion of maritime business, especially in countries where the maritime sector is large (Giannakopoulou, Thalassinos, and Stamatopoulos, 2016). The same authors suggest that many firms have been able to maintain their business for decades despite the high-risk nature, volatility and capital intensity of this industry. In Thailand, most firms operating in ocean transport services are small and medium enterprises (SMEs). Also, it is rare to see these firms raise funds through initial public offerings or exploiting the capital markets. Similar to several other sectors, many firms are family firms, including shipping and coastal transportation business in Thailand. For instance, they may have some unique ownership structures in which the family members own the company stocks and are involved in control and management. In general, large shareholders are family owners. They may be conservative in the decision-making process because their wealth and performance are highly sensitive. The author argues that their financial structure may be more conservative than non-family owned firms in order to reduce their risk exposure. Therefore, this unique characteristic of family firms may influence their financial growth.

A strong motivation for this study comes from the current research published in journals relating to transportation and logistics. For instance, the work of Hofmann and Lampe (2013) provides research opportunities into micro-financial aspects of asset, capital, liquidity and profitability structure of logistics service providers (LSPs) of non-quoted LSPs. However, previous studies relevant to asset tangibility and capital intensity in shipping companies are limited not only in number, but also in that the findings are rather mixed. Because of the idiosyncratic characteristics of the shipping industry, it is beneficial to investigate the effects of corporate finance. Currently, the body of corporate finance knowledge for the shipping industry in emerging countries is quite limited. As previous studies predominantly use the sample firms from developed countries, we choose to use Thai sea and coastal freight water

transport non-listed company data, that of family and non-family business. The purposes of this study is to (1) investigate factors that determine capital structure decisions in the sea and coastal freight water transport non-listed companies in Thailand; and (2) test how the family business structure affects the decision making process.

Research paying attention to capital structure decisions in non-listed companies in emerging markets, particular in shipping sector, is thin. Specifically, the shipping sector plays an important role in the international service trade. Thus, our research contributes to maritime industry information relevant to capital structure in a developing country setting and a capital-intensive industry. Additionally, this study combines the body of knowledge from corporate finance and literature in shipping business and finance research. We found that there are further firm-specific factors determining capital structure of firms within the shipping sector which is capital-intensive. Moreover, being family or non-family business is relevant to how firms decide the proportion of debt to equity. This will help to increase our better understanding of financial structure of Thai non-listed companies in the ocean shipping sector.

The paper is structured in the following manner. Section 2 reviews relevant literature on capital structure decisions and develops research hypotheses for each variable. Section 3 describes data, methodology, and model specification. Section 4 provides empirical results and Section 5 concludes and summarizes this study.

2. Literature Review and Hypotheses Development

Three theories frequently used in capital structure decision are namely trade-off theory, pecking order theory, and market timing theory. Trade-off theory proposes that firms use the optimal mix of debt and equity to maximize the value of the firm and shareholders (see Jensen and Meckling, 1976; Jensen, 1986). Pecking order theory does not focus on optimal capital structure decision, but rather states that firms have a hierarchy of finance use, Myers (1984). Firms first use internal funds (retained earnings) followed by external funds, debt and then equity, respectively. They do so because they aim to limit adverse selection problems when one party (in this case, the firm itself) has more information than another party (outside investors). Outsiders will likely assume that a company has financial issues if it raises equity. Retained earnings can be used to avoid the problem whereas issuing debt reduces the problem. The theory is particularly fitting to SMEs because these firms face even stronger asymmetric information problems than listed firms. Also, SMEs, mainly run by family-related managers, do not want outsiders to be involved in their business as they can lose control and are afraid of business secrets being stolen. Therefore, they may think of equity funding from outsiders as their last option. Thirdly, market timing theory states that firms tend to issue equity following a stock price run-up. Companies will use whichever means is cheapest to fund its business. The theory, however, is less relevant to non-listed firms. Further details regarding the three theories can be found in Frank and Goyal (2008). However, we use two different theories: trade-off theory and pecking order theory to draw the hypotheses.

Empirical studies focusing on overall non-financial firms can be categorized into four groups. First, many empirical studies on capital structure determinants include Frank and Goyal (2009); Lemmon, Roberts, and Zender (2008), among others. The focal point of all of this

research is general industries, excluding financial institutions. Second, many studies investigate SME firms, including Daskalakis and Psillaki (2008), Hall, Hutchinson, and Michaelas (2004), Matias and Serrasqueiro (2017). Hall et al. (2004) point that the prior research using SME data is very little and they conclude that non-listed SME firms have slightly varied capital structure decisions. Thus, investigating the capital structure choices of non-listed companies fills the research gap; the results can provide a better understanding of their capital structure choices. In addition, more researchers have recently placed more emphasis on studying the family firm ownership in the maritime industry (e.g., Giannakopoulou et al., 2016).

Third, some studies relevant to Thai markets include Haron (2014), Deesomsak, Paudyal and Pescetto (2004), and Wiwattanakantang (1999), but none of these mainly emphasized on shipping industry. Fourth, in shipping industry, the study of capital structure is relatively new to the field. Some works worth mentioning include Drobetz, Gounopoulos, Merikas, and Schroder (2013) and Yeo (2016). We have collected some factors from these studies including tangibility, operating leverage, size, earnings volatility, profitability, and firm growth. We introduce one more variable to the current study, family firm dummy variable.

Tangibility: Tangibility is the measure collateralized value of a firm. Firms with higher tangible assets will be subject to lower financial distress cost leading to lower cost of debt. Therefore, one can expect a positive relationship between tangibility and financial leverage. If following, the pecking order theory, one can infer that tangibility leads to relatively more symmetric information. This leads to lower cost of equity, so firms with higher tangibility should show a negative relationship with leverage. Detthamrong, Chancharat and Vithessonthi (2017) use 493 non-financial, listed firms in Thailand and report that the tangibility is not related to financial leverage. However, most empirical studies including those that focus on capital structure of shipping companies (Drobetz et al., 2013; Yeo, 2016) report a positive relationship between tangibility and leverage. Daskalakis and Psillaki (2008), nevertheless, report the opposite result and explain that firms with large amounts of tangible assets may have already found a stable source of return so that they do not need external financing. We follow empirical studies from the global shipping industry and expect the following relationship.

Hypothesis 1: Asset tangibility has a positive relationship with company capital structure.

Operating leverage: Although operating leverage is not tested in regular capital structure studies, it is documented as an important factor to determine capital structure in capital-intensive industries. Operating leverage can be viewed as a measure of a company's business risk. If there is higher operating leverage, the trade-off theory suggests that a firm will have a higher financial distress cost, leading to a negative relationship between this variable and debt ratio. Using capital-intensive real estate investment trusts (REITs) industry data from the U.S., Harrison, Panasian, and Seiler (2011) report that operating leverage is inversely related to capital structure decision. However, Drobetz et al. (2013) provide evidence that global-listed shipping companies have a negative relationship between operative leverage and debt ratio. Following their research, we hypothesize the same relationship.

Hypothesis 2: Operating leverage has a negative relationship with company capital structure

Firm size: Firms with greater size tend to be more diversified and have lower cost of capital, leading to a positive relationship between firm size and debt use. However, if following the pecking order theory, the larger the firm size, the more information there is available to outsiders. Less asymmetric information leads to less cost of equity, so bigger firm should have lower leverage. Frank and Goyal (2009), among others, report evidence on firm size evidence to capital structure decision. Research using Thai public firm dataset including Wiwattanakantang (1999), Deesomsak et al. (2004), Haron (2014) and Detthamrong, et al. (2017) find that firm size is positively correlated with a firm's financial leverage. We also expect a direct association between firm size and capital structure decision.

Hypothesis 3: Firm size has a positive relationship with company capital sturcutre.

Company risk: Firms with higher volatility should have higher bankruptcy cost, leading to higher cost of debt. When viewed through the trade-off theory, this suggests a negative relation between volatility and financial leverage. Drobetz et al. (2013) use an unleveraged annualized standard deviation of a firm's daily stock price returns as a proxy of company risk and find an inverse relationship between risk and capital structure decisions. Yeo (2016), using global listed shipping company data, however, defines risk as earnings volatility and finds a positive relationship. This supports the pecking order theory instead. He explains that outside investors avoid volatile shipping companies so that firms have to borrow even if borrowing costs are high. As the majority of our data is comprised of family firms, we follow variable definition as of Yeo and conjecture a negative relationship.

Hypothesis 4: Earnings volatility has a negative relationship with company capital structure.

Profitability: Trade-off theory suggests that a firm with high profitability should be able to borrow at a lower cost compared to firms with lower profitability. Firms should then prefer the use of debt over equity which will lead to higher financial leverage. Pecking order theory, instead, suggests that more profitable firms will become less levered over time. Firms with high profits can easily use internal funds, creating a situation with almost no need to raise capital, leading to lower financial leverage ratio. Empirical evidence, including data from non-financial companies (see, e.g., Lemmon et al., 2008, Frank and Goyal, 2009; Haron, 2014), shipping companies (Drobetz et al., 2013), listed companies in Thailand (Detthamrong et. al. 2017) and SMEs (see, e.g., Daskalakis and Psillaki, 2008; Matias and Serrasqueiro, 2017) supports the pecking order theory. Therefore, we expect the following association.

Hypothesis 5: Profitbailtiy has a negative relationship with company capital structure.

Firm growth: Growing firms have higher cash flows and can use them to internally fund their future business. Therefore, the variable should have a negative relationship with capital structure decisions. Yeo (2016) confirms the hypothesis using global listed shipping company data. We hypothesize the following:

Hypothesis 6: Firm growth has a negative relationship with company structure.

Family business: Family firm is defined by the majority of family ties between members owned shares. As stated earlier, the pecking order theory, rather than trade-off theory, should associate more closely with family firm capital structure decision. Romano, Tanewski, and Smyrnios (2000), document the importance of family business to capital structure decision. Therefore, family business is directly relevant to the test whether capital structure decision follows pecking order theory. Overall, we expect family dummy to negatively affect company use of financial leverage.

Hypothesis 7: Family business moderates the relationship between tangibility and company capital structure.

Hypothesis 7a: A family firm with a high degree of tangibility has negative relationship with company capital structure.

Hypothesis 7b: A family firm with a high degree of operating leverage has negative relationship with company capital structure

3. Data and methodology

3.1. Data

We collect annual financial data of Thailand's shipping companies from Business Online (BOL) database with TSIC code of 50121 (Sea and coastal freight water transport). We only select firms which have more than 20 million Baht in revenues. The data ranges from 2008 to 2016, including both active and inactive firms with a total of 77 firms and 633 firm-year observations. This data set is unbalanced panel data in order to get rid of survival bias.

Table 1 lists the variables and their definitions used in this study. Independent variables are defined as follows: tangibility is the ratio of fixed assets to total assets; profitability is the operating income before depreciation and amortization to total assets; firm size is the natural logarithm of total assets; earnings volatility is the percentage change of operating income; growth is percentage change of total assets. The dummy variable of one represents a family firm and zero represents a non-family firm.

*** Table 1 is here. ***

Table 2 reports the descriptive statistics for the variables used in the analyses. We report the number of observations, mean, standard deviation, minimum and maximum values over the entire period from 2008 to 2016. On average, the firms in our sample have debt-to-asset ratio of 34.9%, showing that slightly more than one third of the firms use of capital structure comes from a combination of short-term and long-term debts. This number is not greatly different from the 37.6% reported in Wiwattanakantang (1999) who uses Thai listed companies in her study. Drobetz et al. (2013), using global listed shipping company data, however, report average DTA of 40.7%. Considering only long-term debt to asset, we found that on average, firms use 22.5% to fund their long-term business. Total liabilities to assets are reported at the level of 51.3%.

We chose the selected shipping firms that use fixed assets on average of 56.3% to total assets. Deesomsak et al. (2004) report average tangibility of Thai listed firms (excluding financial firms) of 43.3% whereas Drobetz et al. (2013) evidence the ratio of 63.0%. In other words, Thai sea and coastal freight water shipping companies in the selected period depend more on fixed assets compared to most Thai listed firms, but they are still conservative when compared with global firms. Operating leverage equals 63.4% compared with 50.0% from Drobetz et al. (2013). The profitability figure from our data is 9.7%, not much different from 11.3% as the global benchmark. However, this is not surprising as bigger companies may benefit from economies of scale, leading to higher profitability.

*** Table 2 is here. ***

From the total amount of data included in this research, 64.9%, or almost two thirds, are considered as family firms whereas the rest are non-family firms. Overall, dependent and independent variables' standard deviations vary extremely. This result is not shocking bearing in mind the nature of SMEs and non-listed firms.

3.2. Methodology

We will apply panel data with company and year fixed effects. The general model to be estimated is of the following form:

$$\text{Lev}_{it} = c + \sum_{j=1}^{J} \beta_j X_{it}^{j} + \varepsilon_{it}, \quad \varepsilon_{it} = \upsilon_i + u_{it} \tag{1}$$

where Lev_{it} is the financial leverage, defined as total debt to total assets, of firm i at time t, with $i = 1,\ldots, N$, $t = 1,\ldots, T$, c is a constant term, X_{it}'s are the explanatory variables and $\_\_{it}$ the disturbance, with υ_{it} the unobserved firm-specific heterogeneity and u_{it} the idiosyncratic error.

We also form another model, bringing in the family dummy variable to test whether it affects capital structure decision and, if so, how it relates to the decision. Equation 2 shows effect of family business to capital structure decisions of shipping firms in Thailand. Due to econometric construction of fixed effect model, time-invariant variables (family firm dummy in this research) cannot be used directly as variables. Thus, we use family firm dummy as interaction effect with other variables.

$$\text{Lev}_{it} = c + \sum_{j=1}^{J} \beta_j X_{it}^{j} + \beta X_{it}^{j} * FAM_{it} + \varepsilon_{it}, \quad \varepsilon_{it} = \upsilon_i + u_{it} \tag{2}$$

After we investigate the relationship among independent variables, we will compare the results with relevant empirical studies, including regular capital structure studies, those that focus on shipping industry and those that focus on the financial leverage of SMEs.

4. Empirical results

4.1. Standard capital structure regressions

Table 3 shows fixed effect regressions based on equations (1) and (2). Standard errors are clustered at the firm level to account for heteroskedasticity and autocorrelation of errors. We report the results for the standard specification as in columns 1 and 2 and for an extended model, including interaction terms between relevant variables and family dummy variable as in columns 3 and 4. Columns 2 and 4 show regressions with year fixed effects. The fixed effect results in Columns 1 and 2 indicate that the estimated coefficients on all standard capital structure variables exhibit the same signs as in general capital structure studies (Lemmon et al., 2008; Frank and Goyal, 2009) and in the shipping industry's financial leverage studies (Drobetz et al., 2013). Hypothesis 1 is statistically supported. Tangibility effect signifies a positive relationship between fixed assets use and capital structure decision, implying that collateral assets make companies more confident to accept higher levels of debt. The coefficient sign is similar to Drobetz et al. (2013), however the magnitude is different. Whereas they report the coefficient of 0.283 (Table 5, column 4), we report the coefficient of 0.196, an amount that represents two thirds of their results. The relationship is also in line with many pieces of existing literature, implying that the industry follows the trade-off theory for this variable. However, Deetahmrong et al. (2017) report that the tangibility of non-financial companies listed in Thailand is insignificant with financial leverage whereas our sample data demonstrate a positive relationship. This indicates that assets are used as collateral for loans. In other words, the higher the investment that firm has in tangible assets, the higher the leverage of the firm will be. Also, this implies that the choices of capital structure of listed firms and non-listed firms are different.

Our sample data rejects hypothesis 2. Operating leverage is positively correlated with capital structure choices. However, this variable was confirmed by Lemmon et al. (2008) and Drobetz et al. (2013) to be inversely correlated with capital structure decision. This implies that our sample firms with a high degree of operating leverage reflect a high degree of operating risk. Thus, this result supports the nature of high business risk.

Nevertheless, when controlled with family dummy variable as an interaction term, we find that family effect diminishes the impact of this variable. Compared with non-family firms, the family firms appear to more actively monitor the operating leverage ratio. Interestingly, when we test the interaction effect of the operating leverage and family, the coefficient value is not strong. However, it can add to our understanding of the importance of family participation in capital structure determination. In other words, this implies that family firms can adjust their choices between equity and debt financing more adeptly than non-family firms. A possible explanation is that family-owned companies have more incentive in closely monitoring the firm's managerial behavior.

Other controlled variables, including size (hypothesis 3), earnings volatility (hypothesis 4), and profitability (hypothesis 5) are significant and consistent with results from both recent capital structure literature (Lemmon et al., 2008; Frank and Goyal, 2009) and specific work related to Thai public firms (Wiwattanakantang, 1999; Deesomsak et al., 2004; Detthamrong, et al., 2017). However, we find that growth (hypothesis 6) is insignificantly related to financial leverage decision, whereas the majority of other papers have found a negative relationship. One possible explanation is that our definition of the variable differs from that of the existing literature which defines growth as market to book value. In light of the results

from the previous section, we observe distinct differences between the data from family and non-family businesses. For this reason, we include two interaction terms to help explain the effect of being a family firm on capital structure decision via tangibility and operating leverage. Columns 3 and 4 of Table 3 exhibit models with interaction terms between relevant variables and family dummy variable. Hypothesis 7a does not predict a negative relationship between the interaction effect of tangibility-family and company capital structure, but hypothesis 7b does. It can be seen from the table that adding the family dummy variable changed the result by making operating leverage and its interaction term with family variable significance at 0.01 level. The coefficient of the operating leverage and family interaction term also suggest a negative relationship between family business and operating leverage, implying that effect of operating leverage is reduced if the firm is managed by the family. Also, the adjusted R-squared values of the models with interaction terms improve from 30.6 percent to 32.6 percent, showing that the adjusted model added more explanation. The importance of the family dummy variable from Table 3 let us do further regression by separating between non-family and family company observations.

4.2. Family firm effects

Table 4 exhibits fixed effect regression the same as in equation (1). Here, we separate two groups of observations. Columns 1 and 2 show results based on non-family firm observations, whereas columns 3 and 4 show observations based on family firms. Columns 2 and 4 display regressions with year fixed-effects. The results from Table 5 deserve to be explained in further details. First, tangibility effect of family shipping companies is currently significant while the effect of non-family firms is insignificant. The tangibility effect of family shipping firms increases from 0.196 in Table 3 column 4 to 0.307 in Table 4 column 4, indicating the impact surge of fixed assets to capital structure. This implies that the family firms may rely on the use of debt as their tangible assets may be easily collateralized. The insignificance of non-family firms is the same as in Deetahmrong et al. (2017) who use non-financial companies listed in Thailand.

Second, operating leverage of family firms is negatively related to capital structure decision. This supports the trade-off theory. The reason for this is that family firms are more sensitive to debt burdens. However, non-family firms have a positive relationship between financial leverage and operating leverage, supporting the pecking order theory. These results are surprising because we hypothesized the opposite. In other words, we had expected family firms to follow pecking order theory whereas non-family firm behavior to follow the trade-off theory. The results suggest that the impact of being in capital-intensive industry is more important than being a family firm. In addition, the family firms do not want to lose control, a desire held by any small and medium family firm. This is consistent with the findings of Giannakopoulou et al. (2016), that a family firm with a high degree of control can influence decisions.

Third, it can be seen from Table 4 that the size effect of non-family firms is double when compared with family firms. To be exact, the coefficients increase from 0.0654 (Table 5, column 4) to 0.129 (Table 4, column 2). The coefficient magnitude of family firms is closer to what reported by studies using data of publicly listed companies in Thailand (see, e.g., Wiwattanakantang, 1999; Deesomsak et al., 2004; Haron, 2014). In shipping sector, our study suggests that the capital structure decisions of the non-listed family firms are similar to large

firms in the sense of the common business characteristics. Fourth, earnings volatility is now significant for non-family business, but is insignificant for family firms. Non-family shipping firms control their debt-equity proportion regarding volatility of their earnings. The outcome is reminiscent of studies using publicly traded company data. Lastly, growth of family firms has a significantly positive relation to capital structure decision while non-family firms do not have a relation with the decision. An explanation of this may be that the family firms are confident in their ability to pay back bank loans.

Overall results of family firms in this subsection are equivalent to those using publicly held companies (see, e.g., Lemmon et al., 2008) and Drobetz et al. (2013) who use globally-listed shipping companies. We could summarize that the fact that these companies are in the capital-intensive shipping sector plays a more important role than the fact that they are operated by members of the same family. These firms act more like large firms and can be loosely explained by the trade-off theory rather than pecking order theory.

5. **Discussion and Conclusion**

This study examines capital structure decisions of Thai non-listed shipping companies. It is important to focus especially on tangibility and operating leverage of such firms. We found that the former positively correlates with the decision of capital structure whereas the latter leads to a more complicated interpretation. Operating leverage is positively correlated with financial leverage choices for non-family firms, but is inversely associated in the case of family firms. Except for negative relationship between asset growth and capital structure decision, other variables are in line with current studies using public firms as their observations. In other words, the impact of being in the shipping sector is greater than being a family firm. Our empirical findings reinforce the uniqueness of shipping sector. For this reason, the coefficient signs follow those of shipping companies from Drobetz et al. (2013). This follows the trade-off theory rather than the pecking order theory, which at first appeared more applicable to capital structure decision of family firms.

In summation, although the family ownership factor affects firm's capital structure, family firms do not behave differently from large firms in terms of capital structure decisions. This can possibly be explained by (1) their high tangibility ratio, accounting for 54 percent, which is consistent with Hofmann and Lampe (2013) and (2) high financial leverage due to the nature of capital-intensive in shipping sector.

It should be noted that some variables in our research differ from most literature that collects public firm data. These listed companies have market capitalization data, providing a variety of financial leverage definitions. Apart from using equity book value as part of assets, most researchers also define asset value using market value of equity. This, however, is limited to our study as our samples are private firms. Further, growth, which is generally defined by market to book value of equity in existing literature, follows a different definition in our study. This may be one of the reasons why our results report that growth has no relationship with capital structure choices. Changes in variable definition can play important roles in our results both in terms of significance, coefficient signs and magnitudes compared to existing literature. Second, although we assume there is no change in shareholding structure of selected firms, it is interesting to see if shareholding evolution may affect capital structure

decision. This again, is limited to our study because we cannot find such information in the past. Third, it is well-known that current corporate finance literature has moved to dynamic panel data regression to deal with potential endogeneity problems which may reduce reliability of statistical results. Endogeneity has its roots from omitted variables, reversal causality, and measurement errors. Unfortunately, these symptoms are typical in capital structure literature (see, e.g., Roberts and Whited, 2013). Therefore, to improve confidence in results, it is recommended that further studies use more advanced econometric techniques that can specifically deal with such problems. Finally, further research on capital structure decisions of non-listed companies in other transport sectors would be useful, as this area is still understudied.

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Table 1: Definitions of variables

Variable	Notation	Measurement	Expected Sign
Dependent variables			
Debt-to-asset ratio	DTA	Total debt / total assets	
Independent variables			
Tangibility	TANG	Fixed assets / total assets	+
Capital intensity	CAP	Total assets / total revenue	+
Firm size	SIZE	Natural logarithm of total assets	+
Operating leverage	OPER	Operating expense / total assets	-
Profitability	PROFIT	Earnings before interest, taxes, depreciation, and amortization / total assets	-
Earnings volatility	EVOL	Percentage change in operating income	-
Growth	GROWTH	Percentage change in total assets	-
Family	FAM	0 if family firm, 1 if non-family firm	+
Tangibility*family	TANG*FAM	Interaction term between tangibility and family dummy	-
Operating leverage*family	OPER*FAM	Interaction term between operating leverage and family dummy	-

Table 2: Descriptive statistics

Dependent variable	N	Mean	SD	Min	Max
DTA	633	0.339	0.395	0.000	2.395
Independent variables	N	Mean	SD	Min	Max
TANG	633	0.540	0.351	0	0.979
OPER	633	0.602	1.164	0	5.933
SIZE	633	18.88	1.592	14.03	23.25
EVOL	633	-0.719	9.286	-55.03	43.94
PROFIT	633	0.0850	0.408	-2.038	1.706
GROWTH	633	0.296	1.474	-0.721	10.91
FAM	633	0.659	0.474	0	1

The descriptive statistics exhibit the number of firm-year observations (N), the mean, the standard deviation (SD), the minimum (Min), and the maximum (Max) value of each variable. The sample consists of 77 non-listed shipping companies from BOL database with TSIC code of 50121 (Sea and coastal freight water transport) during the period from 2008 to 2016. Except for family dummy variable, all variables are winsorized at the upper and lower one percentile.

Table 3: Standard regressions

Dependent variable: DTA	(1)	(2)	(3)	(4)
tang	0.203***	0.218***	0.196**	0.196*
	(3.677)	(3.825)	(2.022)	(1.973)
oper	0.0684*	0.0690*	0.0957***	0.0963***
	(1.804)	(1.773)	(2.688)	(2.647)
size	0.119***	0.111***	0.110***	0.103***
	(3.557)	(3.367)	(3.411)	(3.193)
evol	-0.00132*	-0.00113	-0.00149*	-0.00123
	(-1.752)	(-1.452)	(-1.927)	(-1.528)
profit	-0.162***	-0.146***	-0.159***	-0.148***
	(-7.025)	(-4.514)	(-7.314)	(-4.699)
growth	0.00182	0.000966	0.00268	0.000888
	(0.118)	(0.0650)	(0.179)	(0.0613)
c.tang#c.fam			0.0388	0.0592
			(0.374)	(0.574)
c.oper#c.fam			-0.155***	-0.161***
			(-2.984)	(-3.515)
Constant	-2.054***	-1.940***	-1.868***	-1.787***
	(-3.310)	(-3.215)	(-3.136)	(-3.029)
Observations	633	633	633	633
Adj. R-squared	0.305	0.306	0.323	0.326
Number of firms	77	77	77	77
Company fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	No	Yes	No	Yes

The table shows the results of standard leverage regressions using a sample of 77 non-listed shipping companies from BOL database with TSIC code of 50121 (Sea and coastal freight water transport) during the period from 2008 to 2016. All variables are winsorized at the upper and lower one percentile. The dependent variable is financial leverage, defined as the ratio of total debt to total assets. The *t*-statistics based on standard errors robust to clustering by firms are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 4: Non-family and family regressions

Dependent variable: DTA	(1) Non-family	(2) Non-family	(3) Family	(4) Family
tang	0.169	0.178	0.279***	0.307***
	(1.513)	(1.532)	(4.199)	(4.714)
oper	0.0912***	0.0893**	-0.0676	-0.0755**
	(2.778)	(2.557)	(-1.598)	(-2.012)
size	0.131**	0.129**	0.0756***	0.0654**
	(2.628)	(2.381)	(2.882)	(2.559)
evol	-0.00242*	-0.00222*	-0.000486	0.000127
	(-2.028)	(-1.892)	(-0.444)	(0.113)
profit	-0.152***	-0.146**	-0.158***	-0.144***
	(-3.246)	(-2.234)	(-6.388)	(-4.193)
growth	-0.0191	-0.0212	0.0225**	0.0199**
	(-0.812)	(-0.884)	(2.204)	(2.070)
Constant	-2.211**	-2.202**	-1.253**	-1.124**
	(-2.445)	(-2.269)	(-2.640)	(-2.465)
Observations	216	216	417	417
Adj. R-squared	0.232	0.208	0.417	0.432
Number of firms	28	28	49	49
Company fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	No	Yes	No	Yes

The table shows the results of standard leverage regressions using a sample of 77 non-listed shipping companies from BOL database with TSIC code of 50121 (Sea and coastal freight water transport) during the period from 2008 to 2016. All variables are winsorized at the upper and lower one percentile. The dependent variable is financial leverage, defined as the ratio of total debt to total assets. The *t*-statistics based on standard errors robust to clustering by firms are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.