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Financial crisis and determinants of the capital structure of Spanish maritime transport firms

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ABSTRACT

The purpose of this article is to analyze how the financial crisis affects the determinants of the capital structure of Spanish maritime transport firms according to both the trade-off and pecking order theories. Additionally, we test whether these effects differ between short and long-term debts. Using a sample of 225 firms (1,805 observations) between 2001 and 2015, we find that firms' liquidity and profitability are the main drivers of leverage before the crisis, whereas, during the crisis, leverage is also explained by non-debt tax shields and the level of tangible assets. Besides, our results show that the capital structure decisions of Spanish maritime transport firms are mainly determined by the pecking order theory, especially during the crisis. In this way, the pecking order theory plays an important role on total and short-term debts both before and during the crisis. However, the pecking order theory is only relevant in explaining long-term debt during the crisis. Before the crisis, there are no conclusive results about whether long-term debt is determined by the trade-off or the pecking order theory.

1. Introduction.

Capital structure has been a recurrent topic since the seminal work of Modigliani and Miller (1958). These authors acknowledged that capital structure is irrelevant in perfect capital markets and, hence, a firm's value does not depend on the way assets are financed. However, if the assumption of perfect capital markets is relaxed, capital structure becomes a key issue in corporate finance decisions. In this regards, two traditional approaches have emerged attempting to explain capital structure decisions: the trade-off and the pecking order theories. The trade-off theory asserts that, when deciding their optimal capital structure, firms balance the benefits of debt, achieved through tax savings, against bankruptcy costs, which also increase with the level of debt (Jensen and Meckling, 1976; Myers, 1977). However, the pecking order theory postulates the existence of a hierarchy of financial resources, so firms do not target optimal capital structures. Firms can use three main sources: retained earnings, equity and debt. Whereas retained earnings have no adverse selection problem, both equity and debt have an adverse selection risk premium because of information asymmetries between managers and investors. Investors demand higher returns on equity than on debt. Thus, if firms do not have enough retained earnings to finance their investments, they will prefer debt to equity (Myers and Majluf, 1984).

Since the onset of the financial crisis in 2008 there has been a renewed interest in analyzing capital structure decisions and their determinants. The crisis produced strong credit restrictions, increased risk aversion and reduced firms' perspectives. In this regards, banks experienced funding problems that led them to both reduce and increase the cost of the loan supply (Proença et al., 2014). Besides, firms tended to use less debt to reduce risk perceptions and avoid a bad reputation in the markets (Zeitun et al., 2017).

Capital structure decisions are very important in the mar-

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itime transport industry, especially in periods of crisis, since this sector presents relevant peculiarities in relation to other industries. Firstly, the maritime transport industry is fragmented, with a great number of smaller firms that have difficulties in accessing the capital markets. So, debt has traditionally played a prominent role in the financial structure (Stopford, 2009; ABN AMRO, 2011). Secondly, these firms already have industry-specific tax incentives unrelated to debt, such as the tonnage tax and several other fiscal benefits (PricewaterhouseCoopers, 2009). Thirdly, the maritime transport industry is greatly exposed to market risks, since freight rates and vessel prices are highly volatile and dependent on the economic cycle, which is why avoiding financial distress is of vital importance (Albertijn et al., 2011). Besides, leverage is not necessarily determined by the high level of tangible assets firms held, since these assets are difficult to sell in crises due to the volatility of vessel prices (Campello and Giambona, 2013).

The analysis of capital structure decisions in the maritime transport industry is even more relevant in the case of Spain, due to the strategic importance of this sector for the country's economy. Spanish ports play a key role in international maritime traffic due to their geographical location (Fernández-Macho et al., 2015). Moreover, location and the popularity of recreation cruises serve to foster tourism in the country, one of the key sectors of the economy (Vayá et al., 2016).

There are a great number of empirical studies regarding capital structure and its determinants (Titman and Wessels, 1988; Ozkan, 2001; De Miguel and Pindado, 2001; Cassar and Holmes, 2003; Bancel and Mittoo, 2004; Deesomsak et al., 2004; Tong and Green, 2005), and more recent ones focus on the effects of the financial crisis (Harrison and Widjaja, 2014; Proença et al., 2014; Morri and Artegiani, 2015; Zeitun et al., 2017). However, capital structure decisions and the effects of the crisis in the maritime transport industry have scarcely been explored. To our knowledge, only Drobetz et al. (2013) examined the capital structure decisions of a sample of globally-listed shipping firms between 1992 and 2010, but they do not include Spain in their sample and do not directly analyze the effects of the current global crisis.

In this regards, this article provides two contributions to the existing literature. First, we analyze how the financial crisis affects the determinants of the capital structure of Spanish maritime transport firms according to the trade-off and the pecking order theories. Second, we test whether these effects differ between short- and long-term debts.

The sample for our empirical analysis comprises 225 firms (1,805 observations) over the period 2001-2015. The analysis is performed using the System-GMM methodology for panel data (Arellano and Bond, 1991). This methodology allows for the use of instruments to control both unobservable heterogeneity and the problems of endogeneity between leverage and the firms' characteristics. In addition, this methodology yields consistent and unbiased estimates of the relationship between the macroeconomic variables, firm-specific characteristics and leverage.

Our results reveal that firms' liquidity and profitability are the main drivers of leverage before the crisis, whereas, during the crisis, leverage is also explained by non-debt tax shields and the level of tangible assets. Besides, our results show that capital structure decisions in the Spanish maritime transport industry are mainly explained by the pecking order theory, especially during the crisis. In this regards, the pecking order theory plays an important role on total and short-term debts both before and during the crisis. However, the pecking order theory is only relevant in explaining long-term debt during the crisis. Before the crisis, there are no conclusive results about whether long-term debt is determined by the trade-off or the pecking order theory.

The remainder of the article is structured as follows: Section 2 reviews literature; Section 3 focuses on empirical analysis and results; and Section 4 concludes.

2. Literature Review.

2.1. Capital structure theories.

Initial capital structure studies are based on the Modigliani and Miller theory (1958), who posit that capital structure is not relevant in perfect capital markets. The first proposition of Modigliani and Miller (MM) theory states that the market value of a firm, which is completely independent of its capital structure, is equal to the sum of equity and debt. The second proposition of MM asserts that the cost of equity increases with the level of debt, which makes the cost of capital constant. This is because the cost of debt is always lower than the cost of equity, so any attempt to substitute cheaper debt for more expensive equity will not reduce the cost of capital.

However, capital structure is not irrelevant under market frictions, which is why alternative approaches have attempted to explain the capital structure of firms since the seminal work of Modigliani and Miller (1958). The most common approaches are the trade-off theory and the pecking order theory. On one hand, the trade-off theory posits that firms determine their capital structure by considering the costs and benefits of using debt. In this regards, a higher level of debt provides greater tax savings and reduces managerial agency costs, however, bankruptcy costs and agency costs between shareholders and creditors also increase with the level of debt (Jensen and Meckling, 1976; Myers, 1977). On the other hand, the pecking order theory asserts that the cost of financing increases with asymmetric information. Therefore, firms prefer those funding sources that are less exposed to asymmetric information. In this regards, firms use first internal sources when available, then issue debt, and finally issue equity, which is the most expensive option (Myers and Majluf, 1984).

Based on these theories, many empirical studies have analyzed the determinants of capital structure decisions. These studies are characterized by a lack of consensus about the importance of the trade-off and the pecking order. Titman and Wessels (1988) found strong evidence of the pecking order theory and showed that transaction costs, size and profitability are important determinants of American firms' capital structure. Ozkan (2001) used a sample of firms from the United Kingdom and showed that the main factors affecting leverage are liquidity, profitability, non-debt tax shields and growth opportunities. Besides, the results are consistent with both the

trade-off and the pecking order theories. Cassar and Holmes (2003) also obtained evidence of both theories in Australia and revealed that the most important determinants of debt are asset structure, profitability and growth. Tong and Green (2005) showed that profitability and past dividends significantly affect Chinese firms' leverage, but found more support for the pecking order than for the trade-off theory. Previously, De Miguel and Pindado (2001) also showed evidence of the pecking order in Spain, and revealed that both firms' characteristics and institutional factors play a part in capital structure. Bancel and Mittoo (2004) and Deesomsak et al. (2004) also found that both country and firm factors affect debt in Europe and in the Asia Pacific region respectively, however, their results are more consistent with the trade-off theory.

The financial crisis led to a strong credit reduction, sharply increased risk and limited firms' perspectives, attracting a renewed interest in analyzing capital structure choice. Harrison and Widjaja (2014) showed that the financial crisis has changed the capital structure determinants for firms in the United States. After the onset of the crisis, tangible assets and the market to book ratio exert a stronger influence on capital structure, while profitability has a lower impact. Besides, during the crisis, the pecking order theory has more explanatory strength than the trade-off theory. Iqbal and Kume (2014) used a sample of firms from the United Kingdom, France and Germany, and revealed that those with lower capital structure ratios prior to the crisis increase their leverage during the crisis, while firms with higher ratios decrease their debt. Proença et al. (2014) found a reduction in Portuguese firms' debt after the onset of the crisis, and showed that both the trade-off and the pecking order theories play an important role in capital structure. Morri and Artegiani (2015) also found support for both theories during the crisis for a sample of European real estate firms; however, these firms increase their debt after the onset of the crisis. More recently, Zeitun et al. (2017) showed that firms from the Gulf Cooperation Council (GCC) countries adjust their capital structure towards the target level much slower after the beginning of the crisis.

2.2. *Capital structure in the Spanish maritime transport industry.*

Capital structure decisions are very relevant for the Spanish maritime industry, especially for the transport sector[5], due to its strategic importance for the economy, even during the crisis, and the peculiarities of its financial structure.

On one hand, Spain is heavily dependent on the maritime transport sector, both in relation to freight and passengers, since the country is largely surrounded by water. Although in 2016 the Spanish port sector only represents the 2.07% of the Gross Domestic Product (GDP) and 1.23% of the country's employment, maritime transport is essential for the economy. Firstly, the geostrategic location of Spain means its main ports play an important role in international maritime traffic[6]. Secondly, this privileged location, along with the increasing popularity of recreation cruises, has contributed to develop tourism in the country, one of the key sectors of the economy[7]. Besides, this growing importance of freight and passengers maritime transport has been maintained during the crisis (see Figure 1). The crisis hit maritime transport volume in the first years (2008 and 2009), but lately this volume has gradually increased, especially for passengers since 2012. The recovery in freight volume started earlier (2010), since when the level of freight transport has been higher than the pre-crisis volume, despite suffering a slight reduction in 2013.

On the other hand, the capital structure of the maritime transport industry has some important peculiarities in relation to other industries. First, firms require large volumes of funding due to the intensity of the assets they held. However, the maritime industry is fragmented and contains a large number of smaller firms with limited access to capital markets (Stopford, 2009). Hence, debt has traditionally been the most important source of external finance (ABN AMRO, 2011). Second, although debt has traditionally played a prominent role, most shipping companies already enjoy industry-specific tax incentives not related to debt (PricewaterhouseCoopers, 2009)[8]. Thirdly, maritime transport firms operate in a risky environment because both freight rates and vessel values are highly volatile and dependent on the business cycle. These facts make avoiding financial distress and maintaining financial flexibility main concerns for these firms (Albertijn et al., 2011). Fourthly, although maritime transport firms exhibit a large volume of tangible assets, these assets do not necessarily drive leverage, especially in periods of crises. This is because these assets are not easily sold in times of difficulty due to the cyclicality of vessel prices (Campello and Giambona, 2013; Drobetz et al., 2013).

Since the financial situation of the maritime transport industry is highly sensitive to the economic cycle, the crisis will affect its capital structure. In this regards, the pecking order theory will play a more important role than the trade-off theory in explaining capital structure decisions, regardless of the economic cycle. Most shipping firms have special industry-specific tax benefits, which will reduce the tax incentives of using debt and, consequently, the explanatory power of the trade-off theory (De Miguel and Pindado, 2001; PricewaterhouseCoopers, 2009). However, this prominent role of the pecking order theory will be intensified during the crisis years. The value of vessels responds to demand and supply factors in the secondary markets, which makes them saleable in normal times (Campello and Giambona, 2013). However, the financial crisis has shown that, for shipping firms, the capacity to sell tangible

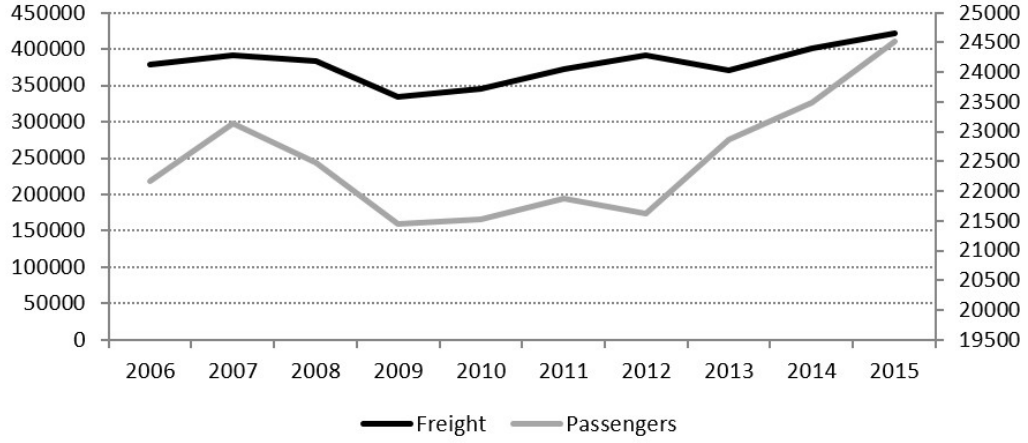
[5] Within the maritime industry in Spain, transport is one of the most productive activities (36%), slightly behind shipbuilding (42%), and followed by living resources (22%) (Fernández-Macho et al., 2015).

[6] Spanish ports handle 44% of the total maritime freight traffic in the European Atlantic Arc (Fernández-Macho et al., 2015).

[7] As for the number of passengers, the Port of Barcelona has become the leading cruise port in the Mediterranean area (Vayá et al., 2016).

[8] Many countries, including Spain, have introduced a tonnage tax regime where the payable tax depends on the tonnage of the vessel instead of the profits from the exploitation of the vessel. Besides, shipping incentive regimes in several countries reduce the tax burden for shipping firms by either lowering the tax base, the tax rate, or providing total tax redemption (Drobetz et al., 2013).

Figure 1: Evolution of maritime transport volume in Spain (2006-2015).



The left axis shows the gross weight of goods transported (in thousand tonnes) to/from main ports. The right axis shows the number of passengers (in thousands) embarked and disembarked in all ports.

Source: Own elaboration based on Eurostat data.

assets may be limited due to their strong link to the volatility of vessel prices (Albertijn et al., 2011; Drobetz et al., 2013). This stronger asset risk exposure, price volatility and the uncertainties caused by the crisis will reduce firms' access to debt and make them prefer more stable funding sources which are less subject to information problems. Since maritime firms are usually smaller companies with limited access to capital markets (Stopford, 2009), they will use more internal funds instead of more expensive equity, which will reinforce the importance of the pecking order theory.

3. Empirical Analysis.

3.1. Selection of the sample.

We use a sample of 225 Spanish maritime transport firms (1,805 observations) between 2001 and 2015. Since we use the System-GMM methodology for panel data and calculate the growth rate of several variables, we analyze only those firms for which data is available for a minimum of five consecutive years between 2001 and 2015. This is essential to test for second-order serial correlation, which is performed to ensure the robustness of the estimates made by System-GMM (Arellano and Bond, 1991). Table 1 shows the sub-sector breakdown and the temporary distribution of the sample. The financial information on each firm is taken from the SABI database, and the macroeconomic information from the OECD statistics.

3.2. Econometric model and data.

We propose the following model based on the approach of previous articles to the determinants of capital structure (Deesomsak et al., 2004; Drobetz et al., 2013; Harrison and Widjaja, 2014; Balios et al., 2016; Zeitun et al., 2017).

$$LEV_{i,\ t} = \alpha_0 + \alpha_1 CRISIS_t + (\alpha_2 + \alpha_3 CRISIS_t) * SIZE_{i,t} \ldots$$
$$\ldots + (\alpha_4 + \alpha_5 CRISIS_t) * PROFIT_{i,t} + (\alpha_6 + \alpha_7 CRISIS_t) * \ldots$$

Table 1: Sample.

PANEL A: NUMBER OF FIRMS PER SUB-SECTOR																
				Number of observations									Number of firms			
Freight Transport				1,265									154			
Passengers Transport				540									71			
Total				1,805									225			
PANEL B: TEMPORARY DISTRIBUTION OF THE SAMPLE																
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total Obs.
N. of Obs.	92	109	125	134	139	140	132	114	123	132	129	122	115	105	94	1,805

Source: Authors.

$$\ldots NDTS_{i,t} + (\alpha_8 + \alpha_9 CRISIS_t)$$
$$* LIQ_{i,t} + (\alpha_{10} + \alpha_{11} CRISIS_t) * \ldots$$
$$\ldots TANG_{i,t} + (\alpha_{12} + \alpha_{13} CRISIS_t) * GROWTH_{i,t} + (\alpha_{14} \ldots$$
$$\ldots + \alpha_{15} CRISIS_t) * RISK_{i,t} + \alpha_{16} \Delta GDP_t + \varepsilon_{i,t} \qquad (1)$$

In Equation (1), leverage (*LEV*) is the dependent variable. We use three measures of leverage: total leverage, short-term leverage and long-term leverage. Total leverage (*TOTLEV*) is the ratio of total debt to total assets (Drobetz et al., 2013; Zeitun et al., 2017). Short-term leverage (*SHORTLEV*) is calculated as the ratio of current liabilities to total assets (Drobetz et al., 2013; Proença et al., 2014). Long-term leverage (*LONGLEV*) represents the proportion of non-current liabilities to total assets (Deesomsak et al., 2004; Proença et al., 2014).

CRISIS is a dummy variable that takes the value of 1 between 2008 and 2015, and 0 otherwise. It, therefore, represents the years after the outbreak of the crisis and serves to control for the effects of the crisis on firms' leverage. During the crisis, lending became scarce and more expensive for the shipping industry (Lloyds, 2011). So, we expect a negative relationship between *CRISIS* and leverage (Zeitun et al., 2017).

We also include several firm-specific variables and their interactions with *CRISIS*:

SIZE is the logarithm of total assets (Iqbal and Kume, 2014; Morri and Artegiani, 2015). To analyze if the effects of firm size

on leverage are different before and after the outbreak of the crisis, we include in Equation (1) the interaction term between the size indicator and the crisis variable ($SIZE_{i,t}$*$CRISIS_t$). The effects of firm size on leverage before the crisis (*CRISIS* dummy = 0) are measured by the coefficient α_2, while the effects during the crisis (*CRISIS* dummy = 1) are reflected by the sum of the coefficients $\alpha_2 + \alpha_3$. According to the trade-off theory, larger firms usually have a lower likelihood of default and, hence, lower financial distress costs (Titman and Wessels, 1988). Thus, there can be a positive relationship between *SIZE* and leverage. However, the pecking order theory posits that larger firms tend to experience less information asymmetries, which lower the cost of equity. This fact allows these firms to issue more equity to finance their assets (Zeitun et al., 2017). Therefore, a negative relationship between *SIZE* and leverage can also be expected.

PROFIT is the ratio of earnings before interest, tax and depreciation (EBITD) to total assets, and serves to measure profitability (Ozkan, 2001; Deesomsak et al., 2004). We also interact the variable *PROFIT* with the *CRISIS* dummy ($PROFIT_{i,t}$* $CRISIS_t$). The effects of *PROFIT* on leverage before the crisis are measured by the coefficient α_4 (*CRISIS* dummy = 0), while the effects after the onset of the crisis are reflected by the sum of the coefficients $\alpha_4 + \alpha_5$ (*CRISIS* dummy = 1). On the one hand, the trade-off theory states that more profitable firms usually have lower costs of financial distress and more benefits of the tax shield. Besides, profitable firms have more cash, which leads them to use more debt to exert closer monitoring on managers to avoid an inadequate use of free cash-flows. Thus, according to this theory, a positive coefficient for the variable *PROFIT* can be expected (Drobetz et al., 2013; Zeitun et al., 2017). On the other hand, the pecking order theory asserts that larger profits imply more internal resources to finance projects and, hence, less debt is required (Myers and Majluf, 1984; Deesomsak et al., 2004). So, the relationship between profitability and leverage would be negative.

NDTS represents non-debt tax shield and is the ratio of depreciation to total assets (Deesomsak et al., 2004; Proença et al., 2014). The interaction term between *NDTS* and the *CRISIS* dummy is included in Equation (1) ($NDTS_{i,t}$*$CRISIS_t$). The effects of *NDTS* on leverage before the crisis are measured by the coefficient α_6 (*CRISIS* dummy = 0), and the effects during the crisis are reflected by the sum of the coefficients $\alpha_6 + \alpha_7$ (*CRISIS* dummy = 1). The trade-off theory states that one of the incentives for firms to use debt is to save tax. Firms can use non-debt tax shields such as depreciation to reduce taxes. Higher non-debt tax shield reduces the tax benefits of debt, so a negative relationship between *NDTS* and debt could be expected (De Miguel and Pindado, 2001).

LIQ is the ratio of current assets to current liabilities and denotes liquidity (Harrison and Widjaja, 2014; Zeitun et al., 2017). To study if the effects of liquidity on leverage are different before and after the onset of the crisis, we include interaction terms between *LIQ* and the *CRISIS* dummy ($LIQ_{i,t}$*$CRISIS_t$). The effects of *LIQ* on leverage before the crisis are measured by the coefficient α_8 (*CRISIS* dummy = 0), while the effects during the crisis are reflected by the sum of the coefficients $\alpha_8 + \alpha_9$ (*CRISIS* dummy = 1). According to the trade-off theory, firms with more liquid assets tend to use more debt to monitor managers so that they take the right investment decisions instead of wasting resources. Hence, a positive relationship between liquidity and leverage can be expected (Jensen, 1986). As regards the pecking order theory, firms with more liquid assets can use them as an alternative source of finance to debt, thus the relationship between *LIQ* and debt would be negative (Ozkan, 2001).

TANG is the ratio of tangible assets to total assets and serves to capture firms' tangibility (Deesomsak et al., 2004; Proença et al., 2014). We include interaction terms between *TANG* and the *CRISIS* dummy ($TANG_{i,t}$*$CRISIS_t$). The effects of *TANG* on leverage before the crisis are represented by the coefficient α_{10} (*CRISIS* dummy = 0), and the effects after the outbreak of the crisis are reflected by the sum of the coefficients $\alpha_{10} + \alpha_{11}$ (*CRISIS* dummy = 1). On one hand, according to the trade-off theory, firms with more tangible assets can use them as collateral in case of bankruptcy, so these firms are expected to issue more debt (Titman and Wessels, 1988). On the other hand, the pecking order theory states that more tangible firms tend to have less information asymmetry, which reduces the cost of equity, so the relationship between *TANG* and leverage can also be negative (Frank and Goyal, 2008).

GROWTH represents the growth opportunities of the firm and is calculated as the change in total assets (Balios et al., 2016). To capture the different effects of the variable *GROWTH* on leverage before and after the onset of the crisis, we include the interaction between *GROWTH* and the *CRISIS* dummy - ($GROWTH_{i,t}$*$CRISIS_t$). The effects of *GROWTH* on leverage before the crisis are measured by the coefficient α_{12} (*CRISIS* dummy = 0), while the effects during the crisis are reflected by the sum of the coefficients $\alpha_{12} + \alpha_{13}$ (*CRISIS* dummy = 1). The trade-off theory suggests that firms with better growth opportunities normally have higher financial distress and agency costs between shareholders and creditors, because the former have a great incentive to under-invest (Jensen and Meckling, 1976; Myers, 1977). Therefore, these firms experience a negative relationship between growth opportunities and debt. According to the pecking order assumptions, firms with higher growth opportunities tend to have more leverage since these firms require more funding to finance future investments (Myers and Majluf, 1984). So, a positive relationship could also be expected.

RISK is calculated as the volatility of earnings and serves to capture the risk of the firm. The volatility of earnings is defined as the absolute difference between the annual percentage change in earnings before interest and taxes and the average of this change over the sample period (Deesomsak et al., 2004). We include the interaction between *RISK* and *CRISIS* ($RISK_{i,t}$*$CRISIS_t$). The influence of *RISK* on debt before the crisis is measured by the coefficient α_{14} (*CRISIS* dummy = 0), while the effect during the crisis is reflected by the sum of the coefficients $\alpha_{14} + \alpha_{15}$ (*CRISIS* dummy = 1). The trade-off theory assumes that firms with higher volatility of their earnings have higher financial distress costs, which negatively impacts on debt (Bancel and Mittoo, 2004). On the opposite, the pecking order theory posits that firms with volatile earnings suffer

more from adverse selection, which leads to an increase in lending (Zeitun et al., 2017).

ΔGDP represents the Gross Domestic Product (GDP) growth. On one hand, a high GDP growth offers better opportunities for firms, which leads to a reduction in leverage. On the other hand, firms in countries with higher GDP growth are more profitable, which positively impacts leverage (Zeitun et al., 2017).

The error term is $\varepsilon_{i,t}$; $i = 1,2,\ldots, N$ indicates a specific firm i and $t = 1,2,\ldots, T$ indicates a particular year t[9]. Table 2 summarizes all the independent variables and their expected relationships with leverage according to each of the capital structure theories. Table 3 presents the descriptive statistics of the variables used in the analysis. Table 4 shows the correlations between variables to identify potential collinearity problems.

Table 2: Independent variables and expected relationships with leverage.

VARIABLE	PROXY	TRADE-OFF	PECKING ORDER
CRISIS	Crisis dummy (1: 2008-2015; 0: otherwise)	-	-
SIZE	Log(Total assets)	+	-
PROFIT	Earnings before interest, tax and depreciation/Total assets	+	-
NDTS	Depreciation expense/ Total assets	-	+/-
LIQ	Current assets/ Current liabilities	+	-
TANG	Non-current assets/ Total assets	+	-
GROWTH	Annual growth of firm's total assets	-	+
RISK	Volatility of earnings	-	+
ΔGDP	Gross Domestic Product growth	+/-	+/-

Source: Authors.

Table 3: Sample statistics.

Variable	Mean	Standard deviation	Minimum	Maximum
TOTLEV	0.6189	0.2434	0.0082	1.0000
SHORTLEV	0.3450	0.2346	0.0002	0.9731
LONGLEV	0.2739	0.2124	0.0000	0.9666
SIZE	7.6219	2.2025	3.5670	14.8088
PROFIT	0.0388	0.0922	-0.6828	0.8596
NDTS	0.0502	0.0440	0.0000	0.3147
LIQ	5.1885	40.2095	0.0011	1,199.0000
TANG	0.5001	0.2772	0.0000	0.9998
GROWTH	0.1663	2.4115	-0.8513	79.9901
RISK	5.0928	34.2586	0.0016	1,051.9910
ΔGDP	0.0335	0.0980	-0.1281	0.2319

Source: Authors.

Table 4: Correlations.

	SIZE	PROFIT	NDTS	LIQ	TANG	GROWTH	RISK	ΔGDP
SIZE	1							
PROFIT	-0.0184	1						
NDTS	-0.1205	0.0462	1					
LIQ	0.0100	-0.0292	-0.0486	1				
TANG	0.2410	-0.0826	0.1728	-0.0103	1			
GROWTH	0.0228	0.0620	-0.0422	-0.0071	-0.0429	1		
RISK	0.0867	-0.1333	0.0190	-0.0087	-0.0014	0.0860	1	
ΔGDP	0.0086	0.0052	-0.0270	-0.0061	0.0114	-0.0514	0.0097	1

Source: Authors.

[9] We do not include time dummies in Equation (1) since they present collinearity problems with the CRISIS dummy, which already controls for time effects.

The model in Equation (1) is estimated using two-steps System-GMM with robust errors, which is consistent in the presence of any pattern of heteroscedasticity and autocorrelation. This method allows for controlling the problems of endogeneity using lagged independent variables as instruments (Arellano and Bond, 1991). Firm-specific characteristics and their interactions are considered to be endogenous, whereas the GDP growth indicator and the *CRISIS* dummy are exogenous. For the endogenous variables, we use from the second to the fourth lag as instruments. The exogenous variables are instrumented by themselves[10].

4. Empirical results.

Table 5 shows the results. In model (a) we analyze the total leverage of firms (*TOTLEV*), in model (b) we examine short-term leverage (*SHORTLEV*) and in model (c) long-term leverage (*LONGLEV*).

In Table 5, model (a), the variable *CRISIS* is not significant. Thus, the financial crisis itself does not directly affect the total leverage of Spanish maritime transport firms. Despite the direct irrelevance of the financial crisis to total leverage, our results show that the financial crisis affects the determinants of firms' debt. The variable *PROFIT*, which measures the effect of profitability on leverage before the crisis, is not significant. It implies that profits do not determine firms' debt level before the crisis. However, after the crisis more profitable firms use less debt because the linear restriction test of the coefficient associated to the variable *PROFIT* (*LR Test. PROFIT*), which captures the effects of profitability on total leverage during the crisis, is negative and significant. These results indicate that, during the crisis, firms would finance their investments more internally than through external debt, which supports the pecking order theory. Credit restrictions caused by the crisis and the great exposure of the maritime sector to the economic cycle may have increased firms' needs for less risky funds, such as retained earnings.

Apart from the variable *PROFIT*, the crisis affects other determinants of firms' debt. In this regards, the variable *NDTS*, which measures the influence of non-debt tax shields on total debt before the crisis, is not significant. Nevertheless, *LR Test. NDTS*, which captures the effects of *NDTS* on leverage during the crisis, is positive and significant. This result would reflect that firms with more non-debt tax shields during the crisis use more debt, which contradicts the trade-off theory assumptions. Previously, we proposed that the trade-off theory is not relevant in explaining capital structure in the maritime transport sector because firms already enjoy industry-specific tax benefits not related to debt (PricewaterhouseCoopers, 2009), which is why the existence of other tax deduction sources, such as depreciation, would not impact negatively on leverage.

[10] We factorize the instruments used in our estimation. Factorized instruments condense the informational content of the instrument set into a much lower number of instruments, thus lowering the risk of over fitting endogenous variables, but retaining almost all information (Merhoff, 2009).

Table 5: Results.

	(a) TOTLEV		(b) SHORTLEV		(c) LONGLEV	
$CRISIS_t$	0.0937 (0.66)		-0.0963 (-0.74)		0.2177 (1.32)	
$SIZE_{i,t}$	0.0004 (0.03)		-0.0194 (-1.30)		0.0219 (1.44)	
$PROFIT_{i,t}$	0.0438 (0.10)		-0.5855 (-1.76)	*	0.6362 (2.13)	**
$NDTS_{i,t}$	-0.6575 (-0.52)		0.2493 (0.29)		-0.7861 (-0.72)	
$LIQ_{i,t}$	-0.0007 (-4.96)	***	-0.0002 (-2.65)	***	-0.0004 (-3.32)	***
$TANG_{i,t}$	-0.0590 (-0.41)		-0.3599 (-2.98)	***	0.2880 (1.57)	
$GROWTH_{i,t}$	0.0234 (0.81)		0.0295 (1.15)		-0.0065 (-0.26)	
$RISK_{i,t}$	-0.0003 (-0.75)		-0.0003 (-1.64)		0.0001 (0.24)	
$CRISIS_t$*$SIZE_{i,t}$	-0.0071 (-0.48)		0.0178 (1.29)		-0.0275 (-1.87)	*
$CRISIS_t$*$PROFIT_{i,t}$	-0.8596 (-1.89)	*	0.2181 (0.61)		-1.0895 (-3.22)	***
$CRISIS_t$*$NDTS_{i,t}$	2.6667 (2.16)	**	0.1899 (0.21)		2.3745 (2.04)	**
$CRISIS_t$*$LIQ_{i,t}$	-0.0011 (-2.67)	***	-0.0012 (-3.41)	***	0.0000 (0.10)	
$CRISIS_t$*$TANG_{i,t}$	-0.2754 (-1.42)		-0.0974 (-0.56)		-0.1683 (-0.76)	
$CRISIS_t$*$GROWTH_{i,t}$	0.1028 (1.21)		0.0388 (0.48)		0.0652 (0.77)	
$CRISIS_t$*$RISK_{i,t}$	-0.0007 (-0.32)		-0.0001 (-0.08)		-0.0005 (-0.55)	
LR Test. SIZE	-0.0067 (-0.42)		-0.0016 (-0.14)		-0.0056 (-0.43)	
LR Test. PROFIT	-0.8159 (-4.02)	***	-0.3674 (-2.31)	**	-0.4533 (-2.98)	***
LR Test. NDTS	2.0092 (2.73)	***	0.4392 (0.84)		1.5884 (2.89)	***
LR Test. LIQ	-0.0018 (-5.04)	***	-0.0014 (-4.22)	***	-0.0004 (-1.53)	
LR Test. TANG	-0.3344 (-2.06)	**	-0.4573 (-3.10)	***	0.1197 (0.90)	
LR Test. GROWTH	0.1265 (1.57)		0.0683 (0.89)		0.0588 (0.73)	
LR Test. RISK	-0.0009 (-0.47)		-0.0004 (-0.34)		-0.0005 (-0.53)	
ΔGDP	-0.0644 (-1.36)		-0.0144 (-0.39)		-0.0511 (-1.64)	
CONS	0.6898 (5.61)	***	0.6835 (6.40)	***	-0.0170 (-0.11)	
m_2	0.391		0.447		0.791	
Hansen	0.352		0.423		0.536	

Coefficients associated with each variable. In brackets, T-student; *** indicates a level of significance of 0.01, ** indicates a level of significance of 0.05, * indicates a level of significance of 0.1. LR Test. SIZE is the linear restriction test of the sum of the coefficients associated with $CRISIS_t$ and $CRISIS_t$*$SIZE_{i,t}$. LR Test. PROFIT is the linear restriction test of the sum of the coefficients associated with $CRISIS_t$ and $CRISIS_t$*$PROFIT_{i,t}$. LR Test. NDTS is the linear restriction test of the sum of the coefficients associated with $CRISIS_t$ and $CRISIS_t$*$NDTS_{i,t}$. LR Test. LIQ is the linear restriction test of the sum of the coefficients associated with $CRISIS_t$ and $CRISIS_t$*$LIQ_{i,t}$. LR Test. TANG is the linear restriction test of the sum of the coefficients associated with $CRISIS_t$ and $CRISIS_t$*$TANG_{i,t}$. LR Test. GROWTH is the linear restriction test of the sum of the coefficients associated with $CRISIS_t$ and $CRISIS_t$*$GROWTH_{i,t}$. LR Test. RISK is the linear restriction test of the sum of the coefficients associated with $CRISIS_t$ and $CRISIS_t$*$RISK_{i,t}$. m_2 is the p-value of the 2nd order serial correlation statistic. Hansen is a test of the over-identifying restrictions, asymptotically distributed as X^2 under the null hypothesis of no correlation between the instruments and the error term. Source: Authors.

The variable *TANG*, which represents the influence of tangibility on total leverage before the crisis, is not significant. However, LR *Test. TANG*, which denotes the effects of tangibility on total leverage during the crisis, is significant with a negative coefficient. Consequently, firms with more tangible assets after the onset of the crisis have less debt, which constitutes evidence of the pecking order theory. Tangible assets in the maritime sector are not readily saleable during recessions, so they cannot act as collateral and, hence, reduce firms' access to debt (Campello and Giambona, 2013).

The variable *LIQ*, which denotes the effects of liquidity on total debt before the crisis, is significant with a negative coefficient. Besides, *LR Test. LIQ*, which captures these effects during the crisis, is also negative and significant. Thus, firms with more liquid assets before and during the crisis can use them as a source of finance instead of debt, which supports the pecking order theory.

To sum up, prior to the crisis total leverage is negatively determined by liquidity, as the pecking order theory proposes. However, during the crisis, apart from liquidity, there are more determinants that negatively affect total debt, thus increasing support for the pecking order: profitability and tangibility. Besides, non-debt tax shields positively affect total leverage after the onset of the crisis, against the trade-off theory. As we previously proposed, these results would indicate that the pecking order theory is more relevant than the trade-off theory, especially during the crisis. Probably, the existence of industry-specific tax incentives limits the explanatory power of the trade-off theory. Moreover, asset risk and strong exposure to the economic cycle may boost maritime firms' needs for less risky funds during crises, thus intensifying the pecking order.

In Table 5, model (b), we analyze short-term leverage. The variable *CRISIS* is not significant, as it is in model (a), so the financial crisis itself does not affect short-term debt. The variables *PROFIT*, *LIQ* and *TANG* which respectively measure the effects of profitability, liquidity and tangibility on short-term debt before the crisis, are negative and significant. Besides, *LR Test. PROFIT*, *LR Test. LIQ* and *LR Test. TANG*, which capture respectively the same effects during the crisis, are negative and significant too. Thus, there are no differences in the determinants of short-term debt before and after the onset of the crisis. Moreover, these results support the pecking order both before and during the crisis. Maritime firms have a high level of tangible assets, so they need less short-term funds. Besides, firms can use their liquid assets and profits to finance investments, instead of more risky short-term debt, which could explain these results.

In Table 5, model (c), long-term leverage is analyzed. Similar to models (a) and (b), the variable *CRISIS* is not significant. The variable *PROFIT*, which captures the influence of profitability on long-term debt before the crisis, is positive and significant. So, more profitable firms use more long-term debt as the trade-off theory suggests. However, *LR Test. PROFIT*, which measures the effects of profitability during the crisis, is negative and significant, thus supporting the pecking order theory.

The variable *LIQ*, which captures the impact of liquidity on long-term debt before the crisis, is negative and significant, whereas *LR Test. LIQ*, which measures this impact during the crisis, is not significant. This result would support the pecking order theory before the crisis; however, the variable *PROFIT* previously supported the trade-off theory prior to the crisis, thus we cannot conclude which theory is more relevant.

Finally, the variable *NDTS*, which captures the effects of non-debt tax shields on long-term leverage before the crisis is not significant, whereas *LR Test. NDTS*, which measures these effects during the crisis is positive and significant. This result during the crisis is against the assumptions of the trade-off theory.

In summary, short-term debt is negatively influenced by profitability, liquidity and tangibility both before and during the crisis, confirming the pecking order. Before the crisis, long-term debt is positively affected by profitability and negatively by liquidity, thus supporting the trade-off and the pecking order respectively. So, there is no conclusive evidence of which theory is more relevant. During the crisis, long-term debt is negatively affected by profitability, supporting the pecking order, and positively affected by non-debt tax shields, which is against the trade-off. Thus, the effects of the pecking order on long-term debt strengthen during the crisis, as we suggested.

Conclusions

The financial crisis that started in 2008 has led to a growing body of research about capital structure and its determinants. The crisis produced a strong decline in bank lending, greater uncertainties and risk aversion, which affected the funding patterns of firms. This topic is especially relevant in the Spanish maritime transport industry, due to the strategic role this sector plays in the economy. Besides, corporate finance aspects in the maritime industry have important peculiarities, mainly in recession periods, which is why capital structure decisions in this sector deserve special attention. This paper studies how the crisis affects the determinants of the capital structure of Spanish maritime transport firms according to the trade-off and the pecking order theories. We also study how these effects differ between short- and long-term debts.

Using a sample of firms from 2001 to 2015, we find that, prior to the crisis; leverage is mainly explained by liquidity and profitability, whereas, during the crisis, leverage is also determined by non-debt tax shields and tangibility. Besides, the capital structure of these firms is mainly explained by the pecking order theory, especially after the onset of the crisis. The pecking order theory explains total and short-term debts both before and during the crisis. Long-term debt is also explained by the pecking order theory, but only during the crisis. Before the crisis, there is no conclusive evidence about whether long-term debt is determined by the trade-off or the pecking order theory. These results question the traditional strong dependence on debt in the maritime transport sector. Alternative funding sources less exposed to information problems seem to be essential in periods of crises to deal with the interdependencies between freight rates volatility, asset risk and economic conditions. This

paper has tried to shed light on the determinants of capital structure in the Spanish maritime transport sector. However, further research is needed to fully understand corporate finance decisions in this sector.

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