Corporate Cash Holdings in the Shipping Industry

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Abstract

We examine the corporate cash holdings of listed shipping companies and show that shipping firms hold more cash than similar firms in other asset-heavy industries. Higher cash holdings in the shipping industry are not attributable to firm- or country-level characteristics, but rather to the higher marginal value of cash. Shipping firms value an additional dollar of cash higher than matched manufacturing firms, regardless of their financial constraints status, but depending on their cultural background and the cyclicality of their expansion opportunities. Less procyclical shipping firms have a higher marginal value of cash, and this valuation effect is most pronounced in bad times of the business cycle when external capital supply tends to become scarce. Overall, it appears that shipping companies are more conservative than their peers in managing their cash positions.

Keywords: Maritime financial management, cash holdings, business cycle, growth opportunities

JEL Classification Codes: G30, G32

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1. Introduction

Cash holdings and other liquid assets have always been important for the strategic decisions of shipping companies. For example, in May 2007, well before the outbreak of the global financial crisis, Navios Maritime Holdings Inc. purchased the Belgian maritime transport company Kleimar N.V. for $165.6 million in cash to get hold of Capesize and Panamax vessels used in the transportation of cargoes to China. More recently, Maersk Line acquired Hamburg Süd for €3.7 billion on a cash and debt-free basis in December 2016 to capture additional market share at times when poor conditions in the liner industry forced some rivals to underinvest. In May 2017, Scorpio Tankers and Navig8 Product Tankers announced their merger, which will create the world's largest product tanker player. In a first step, Scorpio Tankers will acquire four long range vessels from Navig8 for $42.2 million in cash, net of assumed debt. This cash, working as bridge financing, will form part of the balance sheet of the combined firm to signal financial strength.[1]

The extant literature identified several motives for corporations to hold cash, which can explain the use of cash in the above examples from the shipping industry. For example, by using cash to make payments firms can save on transaction costs associated with having to liquidate assets. Miller and Orr (1966) document that brokerage costs induce firms to hold more liquid assets. Myers and Majluf (1984) argue that in the presence of asymmetric information, raising external financing is more costly than using internal funds, which makes it optimal for firms to hold a certain level of cash to meet their investment requirements.

Another motive for firms to reserve cash is to hedge the risk of future cash shortfalls, which is known as the precautionary motive for cash holdings. Opler et al. (1999) show that firms tend to hold more liquid assets if the average cash flow volatility of their industry is higher. Mikkelson and Partch

[1] For detailed empirical evidence on merger and acquisition (M&A) activities in the shipping industry, see Andreou, Louca, and Panayides (2012) and Alexandrou, Gounopoulos, and Thomas (2014).

(2003) document that firms that persistently hold large cash reserves do not underperform when compared with their peer firms. These studies suggest that firms use internally generated funds to hedge against future cash flow uncertainty and increase their cash holdings in response to increases in cash flow volatility. Supporting this hedging argument, Almeida, Campello, and Weisbach (2004) find that financially constrained firms save more cash during bad business cycle periods than their unconstrained peers. Similarly, Han and Qiu (2007) directly examine the link between a firm's cash holdings, cash flow uncertainty, and financial constraints and find that constrained firms have a stronger tendency to increase cash holdings when experiencing an upturn in cash flow volatility.[2]

Motivated by the specific features that characterize companies operating in the shipping sector, in this study we extend the empirical evidence on corporate cash holdings by looking at the case of shipping companies. Shipping firms operate in an environment with a high degree of asymmetric information, face high cash flow and business (covariance) risks, and tend to work with high financial as well as operating leverage.[3] It has been documented empirically that these characteristics are related to corporate cash holdings (Opler et al., 1999; Ferreira and Vilela, 2004; Ozkan and Ozkan, 2004).

In addition, raising external capital became more difficult for shipping companies following the 2007-2009 financial mortgage crisis since banks' borrowing facilities for asset-based lending have

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[2] We note two alternative views on why companies should hold cash. The first one is related to agency costs (Jensen, 1986). Several studies (Harford, 1999; Kalvecha and Lins, 2007; Harford, Mansi, and Maxwell, 2008; Tong, 2011) find that high excess cash holdings are manifestations of agency problems in firms where managers use cash holdings for their own benefit and to undertake value-decreasing acquisitions. Repatriation of cash for the purposes of optimizing tax liabilities may be another motive; this may be the case for international conglomerates that diversify their operations so as to arbitrage differences in tax regimes across various jurisdictions (Fole, Hartzell, Titman, and Twite, 2007; Pinkowitz, Stulz, and Williamson, 2012). However, the same would not apply to shipping companies, which operate in an environment where tax liability is assessed based on a tonnage tax or are given special dispensations against paying tax.

[3] These special characteristics of the shipping industry are discussed in Albertijn, Bessler, and Drobetz (2011), Alizadeh and Nomikos (2011), Drobetz, Richter, and Wambach (2012), Drobetz et al. (2013), Nomikos et al. (2013), Kalouptsidi (2014), Papapostolou et al. (2014), Greenwood and Hanson (2015), and Drobetz, Menzel, and Schroeder (2016), among others.

been shrinking due to stricter bank regulation (Albertijn, Bessler, and Drobetz, 2011). The increased dependence of shipping firms on direct financing through the capital markets has created a challenging environment for shipping companies which will likely also impact their cash holdings. For example, on an aggregate basis, Bessler, Drobetz, and Grueninger (2011) observe a correlation between changes in cash holdings and changes in net equity. They show that firms tend to issue larger volumes of equity when adverse selection costs are temporarily low to build up or preserve cash reserves.

Finally, another major characteristic of the shipping industry is its high degree of asset tangibility. On the one hand, due to the implementation of fair value accounting, vessel price risks have become more visible and integrated into a comprehensive corporate risk management process (Albertijn, Bessler, and Drobetz, 2011). On the other hand, modern commercial ships are highly industry-specific assets, and asset tangibility does not necessarily imply asset redeployment (Shleifer and Vishny, 1992; Campello and Giambona, 2013).[4] Drobetz, Haller, and Meier (2016) document that the high asset-specificity of vessels affects the ability of shipping firms to raise external capital, which in turn affects their investment activity even during benign liquidity conditions. Their empirical findings emphasize the importance of excess cash holdings, particularly in periods of crisis. While the post-crisis decline in investment activity was particularly severe in the shipping industry, excess cash holdings of some firms shipping offered financial flexibility and helped mitigate the negative effects.[5]

[4] Computing the fire sale discount as the difference between the transacted price of an arrested vessel and the counterfactual price from a hedonic model, Franks, Sussman, and Vig (2015) estimate an average fire sale discount of 26% compared with ships of similar age and use. While half of this fire sale discount is driven by market illiquidity, they show that the other half is due to low maintenance of vessels and is concentrated in low valued vessels and corrupt ports.

[5] Drobetz et al. (2016) use a multi-equation model that incorporates all sources and uses of funds and examine what shipping firms do with an additional dollar of cash flow. While their findings also emphasize the strategic importance of cash in the shipping industry (e.g., an additional dollar of cash flow is added partly to cash holdings rather than paid out as dividends), they do not estimate the market value of cash on firms' balance sheets.

Using propensity score matching, we construct a matched sample consisting of 144 globally listed shipping firms paired with manufacturing firms that are most similar. Shipping firms hoard more cash than their manufacturing matches in almost every year of our sample period, their average cash holdings being almost three times higher. Using standard target cash regressions, we find that these differences in the level of cash are not driven by firm- or country-level characteristics. Instead, an explanation is that shipping firms exhibit a higher market value of an additional dollar of cash than matched manufacturing firms. We find that shipping firms value an additional dollar of cash significantly higher than their peers in the manufacturing sector. We note that, while our valuation results for manufacturing firms are driven by financial constraints, all shipping firms, independent of their financial status, tend to have problems accessing the capital markets and thus have a higher marginal value of cash. Moreover, including Hofstede's (2001) cultural dimensions into our baseline regression shows that shipping firms value cash higher when they originate from a country with lower individualism and higher uncertainty avoidance scores. Overall, it seems that shipping firms are more conservative on how they manage their cash holdings relative to their peer group.

Finally, the higher marginal value of cash for shipping firms can also be attributed to the cyclicality of their growth opportunities. Successions of good times with easy access to capital markets and bad times with limited capital market access are a key characteristic of the shipping industry. Supporting evidence in Ahrends, Drobetz, and Puhan (2016), we find that shipping firms with less procyclical expansion opportunities have a higher marginal value of cash, especially in bad times of the business cycle when external capital supply becomes scarce. We show that low correlation shipping firms have a higher marginal value of cash because they use it for investment and effectively have higher investments out of their cash holdings. This benefit of cash holdings for shipping firms with less procyclical expansion opportunities creates a novel motive for precautionary savings. In particular, cash serves as a corporate hedging device in the shipping industry, e.g., building up a 'war chest' to ensure the ability of 'asset players' to acquire vessels at fire sale prices during periods of industry weakness. The availability of cash provides a cushion that protects firms from underinvestment and allows increasing the market share during market-wide downturns (Ahrends, Drobetz, and Puhan, 2017). This is an important motive since asset play creates the opportunity for significant profits, which often compensate for the lackluster profit margins from operating in the freight market (Thanopoulou, 2010).

The remainder of this paper is organized as follows: Section 2 describes the data set. Section 3 shows our main empirical results for shipping firms' cash holdings, the value of cash, and the impact of cash holdings on investment. Section 4 provides robustness tests, and section 5 concludes.

2. Samples and descriptive statistics

We use two different samples in our empirical analyses. The first sample consists of 155 listed shipping firms from 33 countries with 1,716 firm-year observations (shipping sample). The data for these shipping firms is taken from Compustat Global and Compustat North America annual files and includes the 1983-2014 period. The underlying universe of shipping firms was identified using Thomson Datastream business descriptions as well as publicly available information from websites and annual reports. The condition for firms to be included in the sample is that they own or operate commercial ships. Our sampling procedure thus ensures that the sample only comprises shipping firms in the sense of freight shipping companies.[6]

To compare shipping firms in this sample to firms that are 'similar' but operate in a different industry (control group), we construct a matched sample using propensity score matching (PSM;

[6] This selection implies that shipyards as well as passenger ships, drilling ships, and inland vessels are excluded since these firms are fundamentally different in the nature of their operations. In addition, the sample is restricted to firms with consolidated balance sheet data, and positive values for total book value and market value of assets. All variables are denominated in U.S. dollars.

Rosenbaum and Rubin, 1983). PSM aims to find the best match for every shipping firm among other (asset-heavy) manufacturing firms from Compustat Global and Compustat North America.[7] Appropriate matches for shipping firms that allow estimating the unobserved counterfactual and recovering the treatment effects of interest are manufacturing firms that are registered in the same country. In particular, for every shipping firm, the propensity score is calculated based on its mean values in firm size, sales growth, market-to-book, leverage, and fixed assets ratio.[8] The best matched control for a shipping firm among the possible matches is the manufacturing firm with a propensity score closest to the score of the shipping firm. The PSM process is conducted without replacement, i.e., if a match for some shipping firm is found among manufacturing firms, this peer firm cannot be matched to another shipping firm. If no match can be found (i.e., if no manufacturing firm from the shipping firm's country exists or if its propensity score differs by more than 20%), the shipping firm is excluded from the matched sample. The PSM process leads to a matched sample of 144 shipping firms and 144 manufacturing firms, with 1,641 and 1,173 firm-year observations, respectively.[9]

Table 1 shows descriptive statistics of the variables used in our cash level regressions. All variables are winsorized at the 1st and 99th percentile. Our main variable of interest, *Cash*, is defined as cash and short-term investments divided by total assets. *SalesGr* is the one-year change in sales. *Div* is an indicator variable that takes the value of 1 if the firm paid dividends in a given year, and 0

[7] Most studies on firms' investment and financing decisions limit their samples to manufacturing firms, such as Fazzari, Hubard, and Petersen (1988), Gatchev, Pulvino, and Tarhan (2010), and Chen and Chen (2012). Both the manufacturing and the shipping sector are capital intensive, operate assets with long economic lives, and the assets can be easily collateralized. Manufacturing firms include all firms with the first-digit SIC code equal to two or three, but exclude firms with a two-digit SIC code of 39 (Miscellaneous Manufacturers).

[8] These matching variables are part of the set of traditional capital structure determinants (Rajan and Zingales, 1995; Frank and Goyal, 2008). Firm size is defined as a firm's total assets, sales growth is the percentage change in sales over the last year, market-to-book is market equity divided by book equity, leverage is the sum of long term debt and short term debt divided by total assets, and the fixed assets ratio is property, plant and equipment divided by total assets. In a robustness test, given the cyclicality of the shipping industry, we additionally match according to a firm's cash flow volatility. All our results (not shown) remain similar.

[9] The difference in the number of firm-year observations between shipping and manufacturing firms in the matched sample is because shipping firms, on average, have a longer sample history than manufacturing firms.

otherwise. *NWC* is net working capital, calculated as current assets minus cash and current liabilities divided by total assets. *CF* is earnings before interest, taxes, depreciation, and amortization divided by lagged total assets. *Capex* is capital expenditures divided by total assets. *Size* is the natural logarithm of total assets. *Lev* is total debt divided by total assets. Lev^2 is leverage squared. *Rec* is receivables divided by total assets. *Inv* is inventories divided by total assets. *PPE* is property, plant and equipment divided by total assets. *Profit* is operating profit divided by total assets. *1/Z* is the inverse of Altman's (1968) *Z*-score. *CashCC* is the cash conversion cycle, calculated as the ratio of receivables to sales plus the ratio of inventories to the cost of sales minus the ratio of accounts payable to the cost of sales, multiplied by 360. *MTB* is market equity divided by book equity. *CFVola* is the volatility of operating cash flow, scaled by the absolute mean over the past four years and divided by 100.

As expected, all values for matched shipping firms are similar to the values in the original shipping sample; 92% of the shipping firms in the shipping sample are also included in the matched sample. Therefore, we focus on the difference between matched shipping firms and matched manufacturing firms. Most importantly, for shipping firms in the matched sample *Cash*, on average, is 12.6% (12.4% in the original shipping sample), while matched manufacturing firms only hold 7.3% in cash. This difference is also reflected in the median values of *Cash*, where matched shipping firms and matched manufacturing firms exhibit a value of 9.2% and 4.0%, respectively.[10]

[Insert Table 1 here]

To analyze the development of cash holdings of shipping firms and their manufacturing matches over time, Figure 1 illustrates the annual average cash holdings of matched shipping and

[10] In addition, shipping firms boast higher profitability (*Profit*) than their manufacturing peers, which may imply that they are able to accumulate higher cash holdings over time. Leverage (*Lev*) is also higher for matched shipping firms than for matched manufacturing firms. We further note that shipping firms, on average, have lower *Z*-scores (or higher 1/*Z*-values) and therefore suffer from higher default risk than matched manufacturing firms, which may be another motive for shipping companies to hold more cash.

matched manufacturing firms. Corporate cash holdings have increased over time in both samples, a pattern that is consistent with earlier findings in Bates, Kahle, and Stulz (2009). The average level of cash holdings for shipping firms coincides with the shipping cycles, as it increased from the late 1990's to 2007 and then dropped again in 2008. It thus appears that shipping firms spent (or had to spend) their cash holdings in response to the sharp drop in freight rates. Most importantly, we observe that matched shipping firms hold, on average, 2.9 times more cash than matched manufacturing firms in each sample year except 1994. However, in the aftermath of the recent financial crisis, the drop in cash holdings was more pronounced for shipping firms than for manufacturing firms.

[Insert Figure 1 here]

We note that Figure 1 also highlights the importance of matching for proper identification. In particular, when we compare our matched sample to the full Compustat Global sample of all manufacturing firms (326,221 firm-year observations), the average manufacturing firm holds more cash than both the average shipping firm and the average matched manufacturing firm in every sample year since 1985. However, the full sample of manufacturing firms includes firms that are markedly different to the shipping firms. In our matching process, we identify manufacturing firms that are most 'similar' to shipping firms (i.e., have the highest probability of receiving the treatment conditional on covariates) yet operate in a different industry. We can thus recover the treatment effect of interest and attribute any differences between shipping firms and manufacturing matches – as estimates of the unobserved counterfactuals – to the fact that they operate in different industries.

3. Main empirical results

In this section, we start by examining which factors determine the level of cash holdings in the shipping industry and whether these demand-side factors are different from other industries. We proceed by estimating the marginal value of cash and test factors that drive the valuation differences between shipping and matched manufacturing firms.

3.1. Cash holdings

To analyze the level of cash holdings of shipping firms and their manufacturing matches, we base our methodology on prior studies (Kim, Mauer and Sherman, 1998; Opler et al., 1999; Kalcheva and Lins, 2007; Drobetz and Grueninger, 2007; Han and Qiu, 2007; Harford, Mansi and Maxwell, 2008; Gao, Harford and Li, 2013; Chen et al., 2015b) and estimate the following baseline regression:

$$(1) \quad Cash_{i,t} = \alpha_0 + \alpha_1 SalesGr_{i,t} + \alpha_2 Div_{i,t} + \alpha_3 NWC_{i,t} + \alpha_4 CF_{i,t} + \alpha_5 Capex_{i,t} + \alpha_6 Size_{i,t} + \alpha_7 Lev_{i,t} + \alpha_8 Lev_{i,t}^2 + \alpha_9 Rec_{i,t} + \alpha_{10} Inv_{i,t} + \alpha_{11} PPE_{i,t} + \alpha_{12} Profit_{i,t} + \alpha_{13} 1/Z_{i,t} + \alpha_{14} CashCC_{i,t} + \alpha_{15} MTB_{i,t} + \alpha_{16} CFVola_{i,t} + \epsilon_{i,t}$$

We include both year and firm fixed effects in all our estimations. Table 2 shows the results for the matched sample, divided into shipping firms and manufacturing firms. In columns (1) and (5), we follow Chen et al. (2015b) and regress *Cash* on the most basic firm characteristics. In columns (2) and (6), we extend the set of firm level control variables. The next columns, (3) and (7), further add country level controls. Country level control variables include GDP per capita, stocks traded, credit to private sector, law enforcement from World Development Indicators (WDI) provided by the World Bank, and the country corruption index from Trading Economics.[11] Finally, in columns (4) and (8), we estimate a variation of the model in columns (2) and (6) by applying Arellano and Bond's (1991) Generalized Method of Moments (GMM) estimator.[12]

[Insert Table 2 here]

[11] For the sake of brevity, the country variable estimates are not reported in Table 2.

[12] We include three lags of *Cash* as instruments. AR(1) and AR(2) are the *z*-statistics for first-order and second-order serial correlation, respectively.

A comparison of the results for shipping firms (columns 1-4) with those for matched manufacturing firms (columns 5-8) does not reveal notable differences in the importance (and the signs) of the various determinants of cash levels. Therefore, firms' demand function for cash seems to be the same across industries. Most of the estimated coefficients are in line with prior studies, and thus we omit a detailed discussion. As an example, the positive impact *CFVola* exerts on *Cash* for both shipping firms and their manufacturing matches likely reflects the precautionary motive behind cash holdings (Opler et al., 1999; Han and Qiu, 2007). In contrast, the significantly positive impact of *CF* on *Cash* (Opler et al., 1999; Kalcheva and Lins, 2007; Drobetz and Grueninger, 2007; Han and Qiu, 2007; Harford, Mansi and Maxwell, 2008; Gao, Harford and Li, 2013) is consistent with the pecking order theory, which in short posits that internal funds represent the cheapest source of financing (Myers and Majluf, 1984).

Overall, the estimates and their similarity for shipping firms and matched manufacturing firms indicate that the demand function for cash is the same across industries. We next run several robustness tests (not shown for the sake of brevity). First, we estimate our baseline regression model for the full matched sample and interact each explanatory variable with a dummy variable, $Shipping_i$, which marks each firm as a shipping or manufacturing firm. Most interaction term estimates are statistically insignificant. Second, we add the shipping dummy to verify that shipping firms hold more cash than their manufacturing matches. As expected, the estimate of the shipping dummy is positive. Third, we estimate our baseline regressions for matched shipping firms and only include additional explanatory variables that are related to the shipping industry.[13] The results remain unchanged.

[13] We consider the following monthly control variables for the dry-bulk shipping market: the ratio of five-year old second-hand to newbuilding vessel prices (SH/NB); the total number of second-hand sale & purchase transactions; and the total number of new orders for newbuilding vessels that are placed each month. All shipping-related variables are taken from Clarksons' Shipping Intelligence Network (SIN).

3.2. The value of cash holdings

Our analyses using standard level of cash regressions indicate that the demand function for cash is the same in both industries, yet they cannot provide an answer to the question why shipping firms hold so much more cash than their manufacturing matches. Next, we examine whether shipping firms hold higher levels of cash because they have a higher valuation for an additional dollar of cash than manufacturing firms. Our methodology to estimate the value of cash holdings is based on Faulkender and Wang's (2006) approach, who measure the effect one additional dollar of cash has on a firm's excess stock return. The baseline regression is:

$$(2) \quad r_{i,t}^{E} = \alpha_0 + \alpha_1 \Delta Cash_{i,t} + \alpha_4 Cash_{i,t-1} \times \Delta Cash_{i,t} + \alpha_5 Lev_{i,t} \times \Delta Cash_{i,t} + \alpha_6 Lev_{i,t} + \alpha_7 \Delta E_{i,t} + \alpha_8 \Delta NA_{i,t} + \alpha_9 \Delta RD_{i,t} + \alpha_{10} \Delta I_{i,t} + \alpha_{11} \Delta D_{i,t} + \alpha_{12} Cash_{i,t-1} + \alpha_{13} NF_{i,t} + \epsilon_{i,t},$$

where $r_{i,t}^{E}$ is the excess stock return of firm *i* in year *t*, defined as a firm's one-year stock market return minus the risk-free rate.[14] ΔX is the change in variable *X* over the previous year. *Cash* is cash and short term investments. *Lev* is market leverage, calculated as total debt over the sum of total debt and the market value of equity. *E* is earnings, calculated as earnings before extraordinary items plus interest, deferred income taxes and investment tax credit. *NA* is net assets, defined as total assets minus cash and short term equivalents. *RD* is investments in research and development, *I* is interest expenses, *D* is common dividends, and *NF* is net financing, measured as total equity issuance minus repurchases plus debt issuance minus debt redemption. Since we scale a firm's change in market equity by the lagged market equity of this firm to get the one-year stock market return, we also scale all independent variables (right-hand side), except *Lev*, *B/M*, and *Size*, by lagged market equity.[15]

[14] We obtained data on the risk-free rate from Thomson Reuters Datastream and IMF International Finance Statistics. Faulkender and Wang (2006) used the 25 Fama-French benchmark returns instead of the risk-free rate. When replicating their study for Compustat North America merged with CRSP, we find that the results hold for both definitions of excess stock return.

[15] In a robustness test (not reported), we estimate the same valuation regression for matched shipping firms and only include additional shipping-related control variables. Our results do not change qualitatively.

This approach allows us to interpret the coefficients in the following way: the coefficient of the change in cash represents the change in a firm's market value from a one dollar increase in cash. We expect the coefficient of $\Delta Cash$ to be positive and close to 1 since one additional dollar of cash on the balance sheet should increase firm value by approximately one dollar. An estimated coefficient higher than one could be explained by the precautionary motive (cash provides additional financial flexibility), whereas a market value of one additional dollar of cash lower than 100 cents might be attributable to the agency motive (managers waste cash for value decreasing projects).[16]

Our results for the matched sample are shown in table 3. Columns (1) and (2) focus on matched shipping firms. Column (1) shows the results of our basic regression without interaction terms. The coefficient of $\Delta Cash$ is positive and significant at the 1% level as expected. On average, one additional dollar of cash is worth $0.89 for the shipping firms in our sample. Including the interaction terms in column (2) leads to a coefficient of $\Delta Cash$ of 1.611 and, as expected, negative coefficients for both interaction terms (but only the coefficient on $Cash_{i,t-1} \times \Delta Cash_{i,t}$ is statistically significant). Taking the mean value of $Cash_{t-1}$ (0.390) and the mean value of Lev_t (0.530) in our sample, these estimates imply a market value of $1.20 of one additional dollar of cash in the mean shipping firm.[17]

[Insert Table 3 here]

Columns (3) and (4) show the results for the same regression specifications using the matched manufacturing sample. Both columns show significant coefficients of $\Delta Cash$. When we calculate the

[16] The regression model includes two interaction terms. The first interaction term ($Cash_{i,t-1} \times \Delta Cash_{i,t}$) captures the cash level that already exists in a firm, and the second interaction term ($Lev_{i,t} \times \Delta Cash_{i,t}$) incorporates the level of a firm's leverage. Incorporating the existing cash and leverage levels is important for marginal utility considerations. For a firm that already holds a large amount of cash, one additional dollar of cash will be worth less compared to a firm that has not saved cash at all and could use the extra cash for investments (thus providing financial flexibility). Similarly, as firms have more leverage, less of the value created by the presence of an additional dollar of cash accrues to shareholders. Therefore, the more funding a firm already has in the form of cash or leverage, the lower will be the marginal value of cash. The coefficients of both interaction terms are expected to be negative.

[17] The marginal value of cash in column (2) is calculated as $1.611 + (-0.354 \times 0.390) + (-0.511 \times 0.530) = \$1.20$.

value of one additional dollar of cash for manufacturing firms, we find a market value of \$0.74 (column 3) and \$0.99 (column 4).[18] These estimates are notably lower than those for shipping firms.

In column (5), we run our valuation regression for the full sample, including both shipping and matched manufacturing firms. For the average firm, one additional dollar of cash in the full sample is worth \$1.18.[19] Most importantly, column (6) adds an interaction term between $\Delta Cash_{i,t}$ and the shipping dummy ($Shipping_i$). The coefficient of this interaction term is positive and statistically significant at the 10% level, further supporting our conjecture that shipping firms have a higher marginal value of cash than matched manufacturing firms. One dollar of extra cash is worth \$1.27 for shipping firms, and only \$0.90 for manufacturing firms.[20] We thus conclude that shipping firms hold more cash than their manufacturing matches because the market value of one additional dollar of cash is higher, indicating that shipping firms have a higher need for cash than firms in other industries and that the views of managers, who choose the level of cash, match with those of their shareholders, who attribute a higher value to the marginal dollar of cash (Orlova, Rao, and Kang, 2017).

3.3. The value of cash and financial constraints

Next, we examine if there are groups of firms for which cash is more valuable than for others. For example, several studies find that financially constrained firms hold more cash than unconstrained firms because they face difficulties in obtaining external funding (Kim, Mauer and Sherman, 1998; Harford, 1999; Opler et al., 1999). Confirming this notion, Figure 2 shows that matched shipping and

[18] The marginal value of cash in column (4) is calculated as 1.481 + (–0.279×0.201) + (–1.078×0.403) = \$0.99.
[19] The marginal value of cash in column (5) is calculated as 1.573 + (–0.317×0.313) + (–0.620×0.479) = \$1.18.
[20] The marginal value of cash in column (6) is 1.315 + (0.370×1) + (–0.344×0.313) + (–0.646×0.479) = \$1.27 for shipping firms and 1.315 + (0.370×0) + (–0.344×0.313) + (–0.646×0.479) = \$0.90 for manufacturing firms.

manufacturing firms that are financially constrained hold more cash than unconstrained firms in most sample years.[21]

[Insert Figure 2 here]

Building on these observations, several studies focus on the relationship between financial constraints and the value of cash and find that cash is worth more for financially constrained than unconstrained firms (Faulkender and Wang, 2006; Pinkowitz and Williamson, 2006; Denis and Sibilkov, 2010). We examine the impact of financial constraints on the value of cash in both shipping and manufacturing firms. Following Almeida, Campello, and Weisbach (2004), Acharya, Almeida, and Campello (2007), Faulkender and Wang (2006), and Denis and Sibilkov (2010), we classify firms into constrained and unconstrained firms according to their payout ratio and firm size. A firm is financially constrained if its payout ratio is lower than 33% of the distribution, and unconstrained otherwise. As for firm size, a firm is classified as financially constrained if it belongs to smallest 33% of firms, and unconstrained if it belongs to the largest 33%. Given these classifications, we re-estimate our value of cash regression for subsamples of financially constrained and unconstrained firms.

The results are shown in Table 4. In columns (1)-(4) of Table 4, we include only manufacturing firms of the matched sample, divided into constrained and unconstrained firms. The estimated coefficient of $\Delta Cash$ is only positive and statistically significant for constrained firms, but not for unconstrained firms. Accordingly, constrained manufacturing firms with their limited access to capital markets have a higher need for cash, and thus an additional dollar of cash is more valuable for them compared to unconstrained firms. This result corroborates Denis and Sibilkov's (2010) finding that valuation effects related to $\Delta Cash$ are strongly driven by financial constraints.

[21] The data in Figure 2 starts only in 1990 because dividing the sample into four subgroups leads to insufficient observations for the 1983-1989 period.

[Insert Table 4 here]

Columns (5)-(8) show results for the same models using the sample of shipping firms. Again, the coefficient of $\Delta Cash$ is positive and significant for constrained shipping firms. More importantly, unlike for manufacturing firms, in the shipping sample even seemingly unconstrained firms seem to have problems to raise external funds, and thus an additional dollar of cash is highly valuable for them, as indicated by the significantly positive estimate for $\Delta Cash$. These results are also consistent with findings for asset-heavy industries, where industry-wide liquidity shocks, independent of a firm's financial health, have a strong negative impact on firms' investment and financing activities; such liquidity shocks may even trigger a 'collateral channel' effect, in which bankrupt firms impose negative externalities on non-bankrupt competitors through the impact of bankruptcy on collateral values (Shleifer and Vishny, 1992; Benmelech and Bergman, 2011; Campello and Giambona, 2013).[22]

3.4. *The value of cash and culture*

To capture the effect of culture on the value of cash, we add Hofstede's (2001) cultural dimensions *Individualism* and *Uncertainty Avoidance* to our analyses. Countries with high values for *Individualism* represent a society where individuals are expected to take care of only themselves and their closest family. Countries with high *Individualism* scores also tend to be more optimistic and confident (Titman, Wei, and Xie, 2010; Chen et al., 2015a). In contrast, countries with low values for *Individualism* are societies with close family ties, where individuals are expected to look out for each other and are very loyal. With regard to cash holdings, one would expect that countries where individuals see themselves as a group that takes care of its members and are less confident (low *Individualism*) hold more cash opposed to cultures where managers are more confident and optimistic

[22] Drobetz, Haller, and Meier (2017) show that the negative effects from declining collateral values during crisis times are more pronounced in the shipping industry than in manufacturing. Given the decline in collateral values during the recent financial crisis, shipping firms were able to increase long-term debt in order to avoid fire sale discounts in spite of the fact the credit markets were 'frozen.' At the same time, however, they also find that excess cash offers financial flexibility and mitigates those negative effects on investment (see Section 4 below).

regarding the firm's financial condition (high *Individualism*). Similarly, *Uncertainty Avoidance* is defined by the degree to which a society feels comfortable with uncertainty. Countries that want to avoid uncertainty (high *Uncertainty Avoidance*) appear to have inflexible rules and principles and are rather risk averse, whereas countries with low *Uncertainty Avoidance* are more tolerant to divergent behavior and ideas. Therefore, countries that want to avoid uncertainty are expected to hold more cash.

Supporting these arguments, previous studies find that *Individualism* has a negative impact on the level of cash holdings, and *Uncertainty Avoidance* a positive one (Chang and Noorbakhsh, 2009; Chen et al., 2015a). Applying this intuition to our value of cash regressions, we assume that managers and investors share the same view (Orlova, Rao, and Kang, 2017). If managers' culture-based impacts on cash holdings are value maximizing from the investors' perspective, we expect firms from countries with high *Individualism* scores to have a lower marginal value of cash than firms from countries with low *Individualism* scores. Similarly, we expect firms from high *Uncertainty Avoidance* countries to have a higher marginal value of cash than firms from low *Uncertainty Avoidance* countries.

To include the effect of culture on the value of cash, we form subsamples based on *Individualism* and *Uncertainty Avoidance*. A firm is divided into the subsample of high (low) *Individualism*, if the *Individualism* score of its country of origin is within the top (bottom) 33% of the distribution. The same partition applies to *Uncertainty Avoidance* allocation. To test whether low *Individualism* firms and high *Uncertainty Avoidance* firms have a higher value of cash, and whether the effect is different for shipping firms and their manufacturing matches, we re-estimate our value of cash regression for subsamples and include the interaction term between $\Delta Cash$ and the shipping dummy.

The results are shown in Table 5. The coefficient of $\Delta Cash$ is positive and significant for three out of four subsamples; only for firms from countries with low *Uncertainty Avoidance* the estimate of $\Delta Cash$ is insignificant. Focusing on the difference between shipping firms and manufacturing matches, the interaction term $\Delta Cash_{i,t} \times Shipping_i$ is significantly positive for low *Individualism* and high *Uncertainty Avoidance* firms, suggesting that shipping firms exhibit an even higher marginal value of cash than matched manufacturing firms when they originate from a low *Individualism* or a high *Uncertainty Avoidance* country.[23]

[Insert Table 5 here]

Overall, our findings indicate that the country of origin and the associated cultural background have an even higher impact on the marginal value of cash for shipping firms than for firms from other industries. A possible explanation for our results is that the shipping industry exhibits a concentrated ownership structure. Tsionas, Merikas, and Merika (2012) show that ownership in the shipping industry remains concentrated even in countries with strong minority shareholder protection. Using ownership data on 107 listed shipping firms, they find that, on average, the largest shareholder holds 36% of the firm in the year of its IPO. Concentrated ownership implies a strong influence of the largest shareholder's cultural background on financing decisions, and thus the views of managers and large shareholders are more closely aligned. For the two cultural traits examined (*Individualism* and *Uncertainty Avoidance*), the sign of the relationship between the cultural characteristic and the marginal value of cash, which reflects investors' perspective, is the same as that found with respect to the level of cash holdings, which is chosen by firms' managers. These cultural traits are shared both by managers and by investors and thus can be considered as value maximizing (Orlova, Rao, and Kang, 2017).

[23] In particular, for shipping firms, the value of one additional dollar of cash is as high as \$1.62 for the low *Individualism* subsample, and \$1.11 for high *Individualism* firms. One additional dollar of cash is worth \$1.45 for high *Uncertainty Avoidance* firms, but only \$0.81 for firms with low *Uncertainty Avoidance*.

3.5. *The value of cash and cyclicality*

Another factor that can result in a higher marginal value of cash for shipping firms is the cyclical nature of the shipping industry. Successions of good times with easy access and bad times with limited access to capital markets are a key feature of the shipping industry. Firms with a low correlation between their growth opportunities and the aggregate business (or shipping) cycle tend to have less procyclical growth opportunities. These firms are more adversely affected by supply-side financial constraints during crisis periods, thus they should hold more cash and also value an additional dollar higher compared to firms with more procyclical expansion opportunities. From this perspective, cash serves as a hedging device. For example, for market participants with an 'asset play' strategy, it can ensure the ability to acquire vessels at 'fire sale' prices during periods of industry weakness.

Following Arnold, Hackbarth, and Puhan (2016) and Ahrends, Drobetz, and Puhan (2016), we calculate the cyclicality of growth opportunities by looking at the correlation of a firm‘s growth opportunities with the business cycle (*Corr*); in our case, we consider the five-year rolling correlation of a firm's Tobin‘s Q at time *t* and the ClarkSea index at time *t-1*. The idea is that the correlation between Tobin's Q and the ClarkSea index captures how firm-individual investment opportunities (Tobin's Q) move with the state of the shipping industry (ClarkSea index). A high correlation between a firm's growth opportunities and the ClarkSea index indicates more procyclical expansion opportunities. In contrast, a low or negative correlation directs to a firm whose business model offers less procyclical (or even countercyclical) expansion opportunities. The mean (median) value of *Corr* in our sample is -0.10 (-0.09), and its distribution (not shown) spans over the entire possible range.

To incorporate the novel *Corr* variable in our value of cash regression, we add an interaction term ($\Delta Cash_{i,t} \times Corr_{i,t}$) to measure the effect of the cyclicality of expansion opportunities on the marginal value of cash. We expect the coefficient of the interaction term to be negative. In good states of the shipping industry, which to some extent is also an indicator for the overall economic situation, firms have easier access to external capital, since banks and other lenders tend to be more willing to provide funding. In contrast, in bad business cycle states, with supply-side frictions, external funding may be harder to acquire since capital is scarce, prohibitively costly, or not available at all. Therefore, the ability to invest in profitable projects without relying on external funding should be more important for less procyclical (low *Corr*) firms, and the value they attribute to an additional dollar of cash will be higher compared to high correlation firms.

Table 6 shows the results. In column (1), the estimate of the interaction term ($\Delta Cash_{i,t} \times Corr_{i,t}$) is negative and statistically significant, which confirms that shipping firms with less procyclial expansion opportunities tend to have a higher marginal value of cash. As an example, to assess the economic impact, assume two firms, one with *Corr* = –1 and one with *Corr* = +1. The value of one extra dollar of cash for the low correlation firm is \$1.58, but only \$0.32 for the high correlation firm.[24] Columns (2) and (3) confirm these results. We divide the sample into high *Corr* firms (top 33% of the *Corr* distribution) and low *Corr* firms (bottom 33% of the *Corr* distribution) and find that the coefficient of $\Delta Cash$ is only significant for low *Corr* firms, but not in the subsample of high *Corr* firms.

Our hypothesis is that shipping firms find it harder to obtain external funding during bad times of the business cycle. Less procyclical shipping firms, which need external funds the most when capital supply is scarce, suffer even more from these frictions. Therefore, low *Corr* firms should have a higher value of cash in bad times compared to good times, and should also have a higher value of cash than high *Corr* firms in a bad business cycle state. We test these patterns in columns (4) and (5) by constructing two subsamples. In column (4), we include only bad state years (bottom 33% of the

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[24] The value of cash for *Corr* = –1 is calculated as 0.710 + (0.176×0.394) + (0.321×0.530) + (–0.630×–1) = \$1.58. For *Corr* = +1, we have 0.710 + (0.176×0.394) + (0.321×0.530) + (–0.630×1) = \$0.32.

distribution of the growth in the ClarkSea index). In column (5), only good state years are included (top 33% of the distribution of the growth in the ClarkSea index). The coefficient of the interaction term ($\Delta Cash_{i,t} \times Corr_{i,t}$) is only significant in the bad state subsample. As expected, an additional dollar of cash is worth more for less procyclical firms in bad times of the business cycle, when these firms tend to have relatively more growth opportunities. Conversely, the cyclicality of expansion opportunities does not impact the value of cash in good times, as firms can obtain funding from external sources.

[Insert Table 6 here]

3.6. Cash holdings, cyclicality, and investment behavior

Our results show that investors in firms with less procyclical growth opportunities place a higher value on cash holdings. Next, we analyze directly whether these precautionary savings can provide financial flexibility. We expect the investment spending of firms with less procyclical growth opportunities to be more sensitive to cash holdings compared to more procyclical firms. Our setup allows us to test whether low correlation firms have a higher marginal value of cash because they need it for investment and effectively have higher investments out of their cash holdings.

We follow Kim, Mauer, and Sherman (1998) and Denis and Sibilkov (2010) to examine whether firms spend cash on investments using a three-stage least squares (3SLS) regression. To account for the endogeneity between cash and investment, we estimate the following system of equations:

(3a) $$NetInv_{i,t+1} = \gamma_0 + \gamma_1 Cash_{i,t} + \gamma_2 CF_{i,t} + \gamma_3 MTB_{i,t} + \gamma_4 PrSalesGr_{i,t} + \varepsilon_{i,t}$$

(3b) $$Cash_{i,t} = \theta_0 + \theta_1 CF_{i,t} + \theta_2 MTB_{i,t} + \theta_3 Size_{i,t} + \theta_4 Lev_{i,t} + \theta_5 CFVola_{i,t} + \theta_6 CCDur_{i,t} + \theta_7 Z_{i,t} + \theta_8 RetSpread_{i,t} + \theta_9 AggSalesGr_t + \varepsilon_{i,t}$$

The dependent variable in equation (3a) is *NetInv*, which is calculated as capital expenditures and investment in research and development minus depreciation scaled by total assets at time *t*+1. In equation (3b) the dependent variable is *Cash*, cash and short-term investments divided by total assets. *CF* is EBITDA divided by sales. *MTB* is the ratio of market equity to book equity. *PrSalesGr* is the natural logarithm of sales growth over the previous two years. *Size* is the natural logarithm of total assets. *Lev* is total debt divided by total assets. *CFVola* is cash flow volatility, calculated as the median of the firm-level standard deviation of first differences in earnings before interest, taxes, depreciation and amortization over the prior five years. *CCDur* is the cash cycle duration at time *t*, calculated as the sum of average inventory age and average collection period less the average payment period. *Z* is Altman's (1968) *Z*-score. *RetSpread* is the return on investment minus the risk-free rate. The return on investment is earnings before interest and taxes divided by total assets. Finally, *AggSalesGr* is the natural logarithm of (aggregate) mean sales growth.

Firm fixed effects are included in all our three-stage least squares (3SLS) regressions. Applying a 3SLS-model for our estimations of *Cash* and *NetInv* is necessary to address the endogeneity between these variables. *Cash* and *NetInv* are both dependent on a firm's investment opportunities: On the one hand, a firm with great investment opportunities has a higher need for cash holdings to fund these investments, and thus will hold more cash. On the other hand, a firm with good investment opportunities is likely to have higher cash flow from these investments, which can be used to pile up liquidity. Estimating the *Cash* and *NetInv* equations simultaneously helps us to identify the direct effect cash holdings have on investment.

The results of our estimation for the shipping sample are presented in Table 7. Our main focus is on the results of equation (3a), which are reported in panel A of Table 7. In particular, we expect *Cash* to have a positive influence on *NetInv*. In column (1), we run the regression for the full shipping sample and find that the coefficient of *Cash* is positive and highly significant (at the 1% level). The higher a firm's cash holdings are, the more it spends on investment. In the next two columns, we split the sample into high *Corr* firms and low *Corr* firms to see whether *Cash* is more important for either of the two groups. Comparing the results of columns (2) and (3), we observe that *Cash* is only significant for low *Corr* firms, but not for high *Corr* firms. Firms with more procyclical expansion opportunities may not necessarily need cash holdings to fund their investment activities. In contrast, less procyclical firms, which neither have sufficient cash flows nor the possibility to raise cash from external sources exactly when they need it the most, are strongly dependent on liquidity savings for their investments activities. Therefore, an additional dollar of cash is worth more to those firms and, as expected, they also exhibit a higher sensitivity of investment to cash holdings.

[Insert Table 7 here]

In columns (4) and (5), we run the simultaneous equations model for two definitions of a bad economic state. In column (4), the bad state is defined in the same way as above: a year is classified as a bad state year if the growth in the ClarkSea index is within the bottom 33% of its distribution. Alternatively, in column (5), a year is defined as a bad state year if the level (rather than the growth rate) of the ClarkSea index is within the bottom 33% of its distribution. In both cases, the coefficient of *Cash* is positive, whereas it is only statistically significant in column (5).

Finally, we keep our initial bad state definition in columns (6) and (7) and divide the subsample further into high *Corr* and low *Corr* firms (conditional on being in a bad state). This specification allows us to test whether less procyclical firms need more cash for their investment activities during bad times. Confirming this conjecture, the coefficient of *Cash* in column (7) is positive and statistically significant, i.e., for low *Corr* (less procyclical) firms cash is more important for investments during bad states. In contrast, conditional on being in a bad state, cash is less valuable for high *Corr* (more procyclical) firms, as indicated by the coefficient of *Cash* in column (6), which is insignificant.

4. Robustness tests

As already explained, the importance of cash holdings for investment is expected to be highest in times when the supply of external capital is scarce and cash is the only available source of funding. Recognizing that the capital markets 'froze' during the recent financial crisis (Campello, Graham, and Harvey, 2010; Ivashina and Scharfstein, 2010), we focus on the 2007-2009 liquidity crisis and exploit it as a natural experiment. We reduce our matched sample to a subsample that only includes the shorter period 2004-2010, and we classify the period 2008-2010 as the crisis period. While several studies concur that the recent financial crisis started in 2007 (Almeida et al., 2012; Kahle and Stulz, 2013), the shipping industry was not affected until the last quarter of 2008, when the BDI dropped by more than 90%. A consensus is that the crisis only lasted until 2009, but the shipping sector was affected until at least 2010 (Albertijn, Bessler, and Drobetz, 2011). Therefore, we consider the period from 2008 to 2010 as the crisis period, and the period 2004 to 2007 as the non-crisis period.[25].

Based on Duchin et al.'s (2010) methodology, we run a difference-in-differences model for our matched sample consisting of both shipping and manufacturing firms:

$$(4) \quad NetInv_{i,t+1} = \vartheta_0 + \vartheta_1 Crisis_t + \vartheta_2 Crisis_t \times Shipping_i + \vartheta_3 Shipping_i + \vartheta_4 Cash_{i,t} + \vartheta_5 Cash_{i,t} \times Crisis_t + \vartheta_6 Cash_{i,t} \times Crisis_t \times Shipping_i + \vartheta_7 Cash_{i,t} \times Shipping_i + \vartheta_8 Q_{i,t} + \vartheta_9 OCF_{i,t} + \varepsilon_{i,t},$$

where *NetInv*, *Cash*, and *Shipping* are defined as above. *Crisis* is an indicator variable that takes the value of 1 during crisis years (2008-2010), and 0 during non-crisis years (2004-2007). Q is

[25] In results not shown, we find that changing the crisis period to the years 2007-2009 for manufacturing firms does not qualitatively change our findings.

Tobin's Q, and *OCF* is operating cash flow, defined as earnings before interest, taxes, depreciation, and amortization divided by total assets.[26]

In our analyses above, shipping firms have been shown to have a greater marginal value of cash than their manufacturing matches, and we expect that this effect was strongest during the recent crisis. In crisis times, shipping firms may have a significantly higher need for cash than manufacturing firms in order not to be forced to cut investments. Accordingly, the coefficient of the triple interaction term ($Cash_{i,t} \times Crisis_t \times Shipping_i$) is expected to be positive.

The results are shown in Table 8. In column (1), we regress the crisis dummy, *Crisis*, on net investment, *NetInv*. As expected, the estimate is negative and statistically significant, indicating that firms generally invested less during the recent crisis. Adding the shipping dummy in column (2) indicates that shipping firms boasted higher investments than matched manufacturing firms (positive coefficient of *Shipping*), and were subsequently more affected in their investment behavior by the crisis (negative coefficient of interaction term $Crisis_t \times Shipping_i$). The high volume of newbuilding orders during the pre-crisis period, combined with time-to-build delays (and other adjustment costs) and partial negligence of the endogenous investment responses of competitors, supports the view that shipping firms overinvested in good times (which were associated with rising freight rates and vessel prices). As a result, the low demand for tonnage during the subsequent crisis has hit shipping firms harder than comparable manufacturing firms (Kalouptsidi, 2014; Greenwood and Hanson, 2015).

[Insert Table 8 here]

In column (3), we add *Cash* to our regression model. As expected, we find that *Cash* has a positive impact on investment; holding cash is one way to fund investments. When we interact *Cash*

[26] The results are qualitatively similar when we use pre-crisis cash holdings as in Duchin et al. (2010) instead of the contemporaneous $Cash_t$ variable.

with the *Crisis* dummy in column (4), we find no significant relation for the matched sample. Therefore, for the average firm in our sample, cash is not more important for investment during crisis times. This finding is surprising, as one expects that investments are more sensitive to cash holdings during times when the supply of capital is scarce. In order to differentiate between shipping firms and matched manufacturing firms, in column (5) we include the shipping dummy to construct a triple interaction term ($Cash_{i,t} \times Crisis_t \times Shipping_i$). The coefficient of this triple interaction term is positive, indicating that cash is more important for investment during a crisis, but only for our sample of shipping firms.

As another robustness test, we run the value of cash regression again on the full shipping sample, now forming subsamples of high and low correlation firms coupled with high levels of investment. A firm is classified as high investment when its *NetInv* is within the top 33% of the distribution. High and low correlation firms are classified as described above. The results are presented in Table 9. The first two columns replicate our basic value of cash regression. We again find a positive and significant coefficient of $\Delta Cash$ in both columns, and a negative estimate of the interaction term ($\Delta Cash_{i,t} \times Corr_{i,t}$), confirming that less procyclical firms have a higher marginal value of cash.

Next, dividing the sample into high *Corr* (column 3) and low *Corr* (column 5) firms, we find that the coefficient of $\Delta Cash$ is higher for low *Corr* firms, which again confirms that low correlation firms have a higher marginal value of cash. The value of one additional dollar of cash should be even higher for firms with high investment activities. We form two additional subsamples, one consisting of high *Corr* firms with high investments (column 4), and one consisting of low *Corr* firms with high investments (column 6). Both high and low *Corr* firms with high investment activities have high marginal values of cash. However, we note that the increase in the marginal value of cash is higher for the high investment-low *Corr* firms. A caveat is that sample size is small in some of the subsamples.

[Insert Table 9 here]

5. Conclusions

This study analyses the level and value of cash holdings for shipping companies. We construct a sample consisting of 144 globally listed shipping companies paired with matched manufacturing companies that are most 'similar.' Overall, shipping companies seem to manage their cash positions more conservatively and hold up to three times more cash than their manufacturing matches in almost every year of our sample period. Given that the shipping industry is generally considered as risky due to its cyclicality, its high information asymmetry, and its high financial as well as operating leverage, the high level of cash holdings is consistent with a precautionary motive.

We document that shipping companies hold more cash because they value an additional dollar of cash higher than their manufacturing peers, irrespective of whether they are financially constrained or not. It seems that even seemingly unconstrained shipping companies have problems raising external funds, and thus an additional dollar of cash is highly valuable for them. The country of origin and the associated cultural background also have an impact on their marginal value of cash. In particular, shipping companies exhibit a higher marginal value of cash when they originate from a country with lower individualism and higher uncertainty avoidance scores. This finding can be explained by the more concentrated ownership evidenced in shipping, which implies a strong influence of the largest shareholder's cultural traits on corporate decision making.

The higher marginal value of cash for shipping firms is also attributable to the cyclicality of expansion opportunities. Successions of good times with easy access, and bad times with limited access to capital markets are a key feature of the shipping industry. Shipping firms with less procyclical expansion opportunities are expected to require more cash for their investment activities than more procyclical firms. Supporting this conjecture, we find that an additional dollar of cash is worth more for less procyclical firms in bad times of the business cycle, when these firms tend to have relatively more growth opportunities. Conversely, the cyclicality of expansion opportunities does not have an impact on the value of cash in good times, as firms can easily obtain funding from external sources. Cash holdings serves as a hedging device in the shipping industry, e.g., by ensuring the ability of ‘asset players’ to acquire vessels at fire sale prices and increase market share during periods of industry weakness. This creates a novel motive for precautionary savings, since asset play creates the opportunity for significant profits, which often compensate for the lackluster profit margins from operating in the freight market.

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Tables

Table 1
Descriptive statistics

This table reports descriptive statistics of all manufacturing firms, matched manufacturing firms, all shipping firms, and matched shipping firms from 1983 to 2014. Data are from the Compustat Global and Compustat North America annual files. All variables are reported in USD. The table includes all variables of the level of cash regression. X_t is the level of a variable at time *t*. *Cash* is cash and short-term investments divided by total assets. *SalesGr* is the one-year change in sales. *Div* is an indicator variable that takes the value of 1 if the firm paid dividends at time *t*, and 0 otherwise. *NWC* is net working capital, calculated as current assets minus cash and current liabilities divided by total assets. *CF* is EBITDA at time *t* divided by total assets at time *t-1*. *Capex* is capital expenditures divided by total assets. *Size* is the natural logarithm of total assets. *Lev* is total debt divided by total assets. Lev^2 is leverage squared. *Rec* is receivables divided by total assets. *Inv* is inventories divided by total assets. *PPE* is property, plant and equipment divided by total assets. *Profit* is operating profit divided by total assets. *1/Z* is the inverse of Altman's (1968) Z-score. *CashCC* is the cash conversion cycle, calculated as the ratio of receivables to sales plus the ratio of inventories to the cost of sales minus the ratio of accounts payable to the cost of sales, multiplied by 360. *MTB* is market equity divided by book equity. *CFVola* is the volatility of cash flow, calculated as the standard deviation of operating cash flow scaled by the absolute mean over the past four years divided by 100.

	All manufacturing			Matched manufacturing			All shipping			Matched shipping		
	Mean	Median	S.D	Mean	Median	S.D	Mean	Median	S.D	Mean	Median	S.D
$Cash_t$	0.162	0.101	0.177	0.073	0.040	0.094	0.124	0.088	0.115	0.126	0.092	0.116
$SalesGr_t$	0.120	0.072	0.380	0.111	0.060	0.369	0.126	0.065	0.434	0.115	0.062	0.412
Div_t	0.441	0.000	0.497	0.452	0.000	0.498	0.522	1.000	0.500	0.514	1.000	0.500
NWC_t	0.072	0.078	0.199	-0.042	-0.015	0.174	-0.082	-0.051	0.155	-0.083	-0.051	0.150
CF_t	0.078	0.099	0.195	0.101	0.097	0.111	0.116	0.102	0.115	0.116	0.102	0.112
$Capex_t$	0.052	0.037	0.051	0.079	0.055	0.079	0.122	0.087	0.174	0.119	0.086	0.171
$Size_t$	5.064	4.986	1.935	5.506	5.369	1.767	6.468	6.514	1.452	6.471	6.507	1.460
Lev_t	0.228	0.199	0.198	0.306	0.287	0.191	0.431	0.427	0.215	0.430	0.426	0.211
Lev^2_t	0.091	0.040	0.143	0.130	0.082	0.149	0.232	0.182	0.246	0.230	0.181	0.219
Rec_t	0.192	0.180	0.112	0.120	0.108	0.072	0.059	0.044	0.058	0.060	0.046	0.058
Inv_t	0.166	0.146	0.113	0.092	0.081	0.066	0.011	0.007	0.016	0.012	0.007	0.017
PPE_t	0.299	0.278	0.185	0.614	0.638	0.171	0.683	0.718	0.192	0.674	0.711	0.191
$Profit_t$	0.022	0.055	0.186	0.036	0.044	0.136	0.049	0.047	0.085	0.049	0.047	0.083
$1/Z_t$	0.437	0.367	0.739	0.659	0.535	7.160	1.420	0.719	15.710	1.044	0.707	3.862
$CashCC_t$	126.81	101.67	136.87	91.95	72.25	135.73	16.87	15.85	95.86	17.59	16.09	95.64
MTB_t	2.030	1.345	2.618	1.750	0.985	9.982	1.162	0.897	6.039	1.148	0.897	4.179
$CFVola_t$	0.002	0.002	0.030	0.004	0.002	0.068	0.004	0.004	0.067	0.004	0.003	0.046

Table 2
Level of cash regressions

This table shows the results of the level of cash regressions of the matched sample divided into shipping firms and manufacturing firms with *Cash* as the dependent variable and firm characteristics as independent variables. X_t is the level of a variable at time *t*. *Cash* is cash and short-term investments divided by total assets. *SalesGr* is the one-year change in sales. *Div* is an indicator variable that takes the value of 1 if the firm paid dividends at time *t*, and 0 otherwise. *NWC* is net working capital, calculated as current assets minus cash and current liabilities divided by total assets. *CF* is EBITDA at time *t* divided by total assets at time *t-1*. *Capex* is capital expenditures divided by total assets. *Size* is the natural logarithm of total assets. *Lev* is total debt divided by total assets. Lev^2 is leverage squared. *Rec* is receivables divided by total assets. *Inv* is inventories divided by total assets. *PPE* is property, plant and equipment divided by total assets. *Profit* is operating profit divided by total assets. *1/Z* is the inverse of Altman's (1968) Z-score. *CashCC* is the cash conversion cycle, calculated as the ratio of receivables to sales plus the ratio of inventories to the cost of sales minus the ratio of accounts payable, multiplied by 360. *MTB* is market equity divided by book equity. *CFVola* is the volatility of cash flow, calculated as the standard deviation of operating cash flow scaled by the absolute mean over the past four years divided by 100. Firm and year fixed effects (FE) are included. Standard errors are heteroscedasticity-consistent and clustered at the firm level. t-statistics are shown in parentheses. Regressions (3) and (7) include country controls (unreported for brevity). *, **, and *** correspond to statistical significance at the 10%, 5%, and 1% level, respectively.

	Matched shipping firms				Matched manufacturing firms			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$SalesGr_t$	-0.012**	-0.007	-0.009	-0.008	0.000	-0.015**	0.004	-0.035**
	(-2.036)	(-1.116)	(-1.051)	(-0.485)	(0.015)	(-2.410)	(0.601)	(-2.130)
Div_t	0.014**	0.015***	0.018***	0.035*	0.000	0.001	0.003	0.007
	(2.430)	(2.926)	(2.794)	(1.811)	(0.075)	(0.145)	(0.516)	(0.440)
NWC_t	-0.003	-0.026	-0.021	-0.048	-0.035**	-0.012	0.027	0.081
	(-0.181)	(-1.473)	(-0.947)	(-0.673)	(-2.183)	(-0.685)	(1.313)	(1.147)
CF_t	0.059**	0.117***	0.216***	0.141**	0.115***	0.146**	0.136**	0.084
	(2.228)	(2.929)	(4.579)	(2.061)	(3.754)	(2.557)	(2.214)	(0.633)
$Capex_t$	0.024*	-0.020	-0.029	-0.089	-0.032	-0.065*	-0.001	-0.045
	(1.839)	(-0.974)	(-1.141)	(-1.187)	(-1.074)	(-1.921)	(-0.022)	(-0.598)
$Size_t$	-0.022***	-0.003	0.006	-0.043***	-0.015***	-0.005	-0.006	-0.018
	(-4.686)	(-0.748)	(0.604)	(-2.852)	(-3.302)	(-1.053)	(-0.855)	(-0.800)
Lev_t	-0.142***	0.002	-0.077*	-0.465***	-0.116***	-0.267***	-0.335***	-0.075
	(-8.234)	(0.050)	(-1.656)	(-2.984)	(-6.826)	(-6.280)	(-5.436)	(-0.527)
Lev^2_t		-0.058**	0.022	0.404***		0.196***	0.318***	0.035
		(-2.006)	(0.499)	(2.708)		(4.314)	(3.979)	(0.215)
Rec_t		-0.416***	-0.325***	-1.714***		-0.241***	-0.462***	-0.476**
		(-5.918)	(-3.092)	(-4.686)		(-4.585)	(-7.597)	(-2.450)
Inv_t		-0.097	-0.932***	-1.552		-0.482***	-0.652***	-0.692***
		(-0.592)	(-2.754)	(-1.440)		(-6.876)	(-8.362)	(-3.251)
PPE_t		-0.438***	-0.426***	-0.690***		-0.315***	-0.411***	-0.262***
		(-24.050)	(-17.089)	(-8.654)		(-12.909)	(-14.842)	(-2.729)
$Profit_t$		0.020	-0.186***	-0.100		-0.098	-0.146**	0.130
		(0.404)	(-2.698)	(-1.032)		(-1.630)	(-2.282)	(0.843)
$1/Z_t$		-0.000	-0.000	-0.002		0.001	0.001	-0.008
		(-0.124)	(-0.183)	(-1.329)		(0.973)	(1.200)	(-1.365)
$CashCC_t$		-0.000***	0.000	0.000		-0.000***	0.000	-0.000
		(-3.601)	(0.869)	(0.822)		(-2.705)	(0.016)	(-0.183)
MTB_t		0.001	-0.002	0.003		0.000	0.002	-0.001
		(0.467)	(-0.702)	(0.450)		(0.556)	(1.004)	(-1.004)
$CFVola_t$		0.107***	0.083	0.339**		0.107***	0.077***	0.163***
		(2.793)	(1.514)	(2.440)		(4.299)	(3.379)	(2.739)
$Cash_{t-1}$				-0.026				-0.014
				(-0.529)				(-0.220)
$Cash_{t-2}$				-0.001				-0.086*
				(-0.032)				(-1.796)
$Cash_{t-3}$				0.088				-0.405***
				(1.304)				(-4.377)
Constant	0.247***	0.390***	0.995***		0.292***	0.393***	-0.006	
	(5.045)	(8.893)	(5.714)		(4.005)	(4.693)	(-0.043)	
FE: year, firm	yes	yes	yes	no	yes	yes	yes	no
AR(1)				-2.89				-2.91
AR(2)				-2.14				0.01
Observations	1,641	1,166	593	1,003	1,173	764	393	618
Adjusted R^2	0.544	0.753	0.822	-	0.628	0.759	0.823	-

Table 3
Value of cash regressions

This table shows the results of the value of cash regressions of matched shipping firms, matched manufacturing firms, and the full matched sample with the excess stock as the dependent variable and firm characteristics as independent variables. X_t is the level of a variable at time t. ΔX_t is the one-year change in variable X. *Cash* is cash and short-term investments divided by lagged market equity. *Shipping* is an indicator variable that takes the value of 1 if the firm operates in the shipping industry, and 0 otherwise. *Lev* is market leverage. *E* is earnings before extraordinary items plus interest, deferred income taxes and investment tax credit divided by lagged market equity. *NA* is total assets minus cash and short term investments divided by lagged market equity. *RD* is investments in research and development divided by lagged market equity. *I* is interest expenses divided by lagged market equity. *D* is common dividends paid divided by lagged market equity. *NF* is net financing, calculated as total equity issuance minus repurchases plus debt issuance minus redemption. *B/M* is book equity divided by market equity. *Size* is the natural logarithm of total assets. Standard errors are heteroscedasticity-consistent and clustered at the firm level. t-statistics are shown in parentheses. *, **, and *** correspond to statistical significance at the 10%, 5%, and 1% level, respectively.

	Matched shipping firms		Matched manufacturing firms		Full matched sample	
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta Cash_t$	0.887***	1.611***	0.744***	1.481***	1.573***	1.315***
	(5.401)	(4.388)	(3.908)	(3.534)	(5.660)	(4.631)
$\Delta Cash_t \times Shipping$						0.370*
						(1.819)
$Cash_{t-1} \times \Delta Cash_t$		-0.354**		-0.279	-0.317**	-0.344**
		(-2.274)		(-0.635)	(-2.168)	(-2.321)
$\Delta Cash_t \times Lev_t$		-0.511		-1.078*	-0.620	-0.646
		(-1.034)		(-1.701)	(-1.582)	(-1.601)
Lev_t	-1.129***	-1.078***	-0.556***	-0.548***	-0.761***	-0.758***
	(-8.328)	(-8.669)	(-5.730)	(-5.764)	(-10.120)	(-9.835)
ΔE_t	0.278**	0.229**	0.251**	0.248**	0.246***	0.243***
	(2.155)	(2.130)	(2.050)	(2.061)	(2.746)	(2.735)
ΔNA_t	0.101**	0.108**	0.258***	0.260***	0.163***	0.164***
	(1.971)	(2.289)	(4.097)	(4.116)	(4.102)	(4.109)
ΔRD_t	-35.147	-77.433	-2.463	-2.197	-2.087	-1.859
	(-1.160)	(-1.026)	(-0.928)	(-0.859)	(-0.891)	(-0.824)
ΔI_t	-0.785**	-0.667*	-1.281*	-1.252*	-0.734**	-0.739**
	(-2.095)	(-1.735)	(-1.817)	(-1.736)	(-2.031)	(-2.045)
ΔD_t	0.898*	0.744	0.537	0.374	0.640	0.681*
	(1.888)	(1.596)	(0.770)	(0.509)	(1.516)	(1.717)
$Cash_{t-1}$	0.709***	0.696***	0.513***	0.445***	0.566***	0.562***
	(5.188)	(6.023)	(4.284)	(3.892)	(6.218)	(6.051)
NF_t	0.009	-0.004	-0.044	-0.050	-0.025	-0.027
	(0.146)	(-0.066)	(-0.501)	(-0.623)	(-0.536)	(-0.582)
B/M_t	-0.010	-0.011	-0.007	-0.008	-0.010*	-0.010*
	(-1.488)	(-1.521)	(-0.733)	(-0.772)	(-1.864)	(-1.861)
$Size_t$	-0.019	-0.015	-0.007	-0.008	-0.009	-0.009
	(-0.819)	(-0.683)	(-0.605)	(-0.695)	(-0.926)	(-0.852)
Shipping						-0.004
						(-0.090)
Constant	0.561***	0.497***	0.258***	0.264***	0.339***	0.342***
	(2.825)	(2.743)	(3.271)	(3.396)	(4.193)	(4.185)
Observations	1,299	1,299	881	881	2,180	2,180
Adjusted R^2	0.272	0.291	0.190	0.197	0.255	0.256

Table 4
Value of cash regressions and financial constraints

This table shows the results of the value of cash regressions of the matched sample with the excess stock as the dependent variable and firm characteristics as independent variables. X_t is the level of a variable at time *t*. ΔX_t is the one-year change in variable *X*. *Cash* is cash and short-term investments divided by lagged market equity. *Lev* is market leverage. *E* is earnings before extraordinary items plus interest, deferred income taxes and investment tax credit divided by lagged market equity. *NA* is total assets minus cash and short term investments divided by lagged market equity. *RD* is investments in research and development divided by lagged market equity. *I* is interest expenses divided by lagged market equity. *D* is common dividends paid divided by lagged market equity. *NF* is net financing, calculated as total equity issuance minus repurchases plus debt issuance minus redemption. *B/M* is book equity divided by market equity. *Size* is the natural logarithm of total assets. Companies are classified as financially constrained or unconstrained based on the payout ratio or firm size. Standard errors are heteroscedasticity-consistent and clustered at the firm level. t-statistics are shown in parentheses. *, **, and *** correspond to statistical significance at the 10%, 5%, and 1% level, respectively.

	Matched manufacturing firms				Matched shipping firms			
	Payout ratio		Firm size		Payout ratio		Firm size	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Constrained	Unconstr.	Constrained	Unconstr.	Constrained	Unconstr.	Constrained	Unconstr.
$\Delta Cash_t$	1.798***	0.450	1.879***	2.001	1.758***	1.326***	2.036***	1.862***
	(3.843)	(0.654)	(4.629)	(1.148)	(3.405)	(4.007)	(3.393)	(3.531)
$Cash_{t-1} \times \Delta Cash_t$	-0.560	0.231	-0.810**	0.507	-0.530***	0.207	-0.217	-0.608***
	(-1.193)	(0.308)	(-2.515)	(1.454)	(-3.143)	(1.089)	(-1.381)	(-4.027)
$\Delta Cash_t \times Lev_t$	-0.933	-0.179	-1.239**	-2.024	-0.379	-0.806*	-1.534**	-0.518
	(-1.260)	(-0.130)	(-1.998)	(-0.834)	(-0.554)	(-1.670)	(-2.002)	(-0.601)
Lev_t	-0.632***	-0.302*	-0.330***	-1.087***	-1.053***	-0.533***	-0.857***	-1.234***
	(-6.106)	(-1.843)	(-2.635)	(-2.963)	(-6.801)	(-4.328)	(-3.523)	(-7.874)
ΔE_t	0.129	0.836*	0.165	0.335	0.136	0.575***	0.023	0.351**
	(1.274)	(1.716)	(0.893)	(1.406)	(1.225)	(3.745)	(0.279)	(2.574)
ΔNA_t	0.228***	0.509***	0.194***	0.697***	0.061	0.427***	0.095	0.162**
	(3.082)	(3.657)	(3.046)	(4.931)	(1.237)	(5.729)	(1.139)	(2.454)
ΔRD_t	-1.657	-6.634	2.455	-25.155***	-283.006***	17.707***	-758.074	-100.502
	(-0.779)	(-0.956)	(1.056)	(-4.042)	(-4.512)	(2.745)	(-0.907)	(-1.063)
ΔI_t	-1.254*	-1.383	-1.624	-1.657	-0.463	-3.124***	-0.762**	-0.190
	(-1.924)	(-0.452)	(-1.487)	(-1.525)	(-1.136)	(-3.002)	(-2.067)	(-0.190)
ΔD_t	-1.555	0.663	1.358	1.650	-0.249	0.824*	0.249	0.768
	(-0.873)	(0.968)	(0.697)	(0.764)	(-0.426)	(1.647)	(0.373)	(1.076)
$Cash_{t-1}$	0.452***	0.414***	0.479**	1.406***	0.610***	0.707***	0.488***	0.664***
	(3.890)	(3.174)	(2.302)	(3.210)	(5.093)	(7.694)	(3.010)	(5.450)
NF_t	-0.019	-0.507***	-0.089	-0.482***	-0.018	-0.128	-0.084	-0.037
	(-0.185)	(-2.790)	(-0.912)	(-5.207)	(-0.321)	(-0.943)	(-0.805)	(-0.359)
B/M_t	-0.003	-0.085***	-0.017	-0.124***	-0.010*	-0.263***	-0.013	-0.008
	(-0.417)	(-3.891)	(-1.576)	(-5.091)	(-1.659)	(-7.709)	(-0.934)	(-1.071)
$Size_t$	-0.016	0.006	-0.004	-0.111***	-0.022	0.017	-0.079	-0.070
	(-1.228)	(0.285)	(-0.125)	(-2.789)	(-0.883)	(0.773)	(-0.706)	(-1.562)
Constant	0.345***	0.133	0.164	1.330***	0.577***	0.237	0.681	1.023***
	(3.651)	(0.985)	(1.147)	(3.146)	(2.833)	(1.361)	(1.155)	(2.780)
Observations	538	343	443	186	737	562	258	561
Adjusted R^2	0.206	0.260	0.232	0.457	0.294	0.459	0.161	0.392

Table 5
Value of cash regressions and culture

This table shows the results of the value of cash regressions of the matched sample with the excess stock as the dependent variable and firm characteristics as independent variables. X_t is the level of a variable at time *t*. ΔX_t is the one-year change in variable *X*. *Cash* is cash and short-term investments divided by lagged market equity. *Shipping* is an indicator variable that takes the value of 1 if the firm operates in the shipping industry, and 0 otherwise. *Lev* is market leverage. *E* is earnings before extraordinary items plus interest, deferred income taxes and investment tax credit divided by lagged market equity. *NA* is total assets minus cash and short term investments divided by lagged market equity. *RD* is investments in research and development divided by lagged market equity. *I* is interest expenses divided by lagged market equity. *D* is common dividends paid divided by lagged market equity. *NF* is net financing, calculated as total equity issuance minus repurchases plus debt issuance minus redemption. *B/M* is book equity divided by market equity. *Size* is the natural logarithm of total assets. logarithm of total assets. Based on Hofstede (2001), companies are classified on the country level based on their *Individualism* or *Uncertainty Avoidance* scores. Standard errors are heteroscedasticity-consistent and clustered at the firm level. t-statistics are shown in parentheses. *, **, and *** correspond to statistical significance at the 10%, 5%, and 1% level, respectively.

	Individualism		*Uncertainty Avoidance*	
	(1) High	(2) Low	(3) High	(4) Low
$\Delta Cash_t$	1.087***	1.509***	1.629***	0.476
	(2.667)	(4.195)	(4.806)	(0.922)
$\Delta Cash_t \times Shipping$	0.341	0.864***	0.447*	0.341
	(1.359)	(2.740)	(1.936)	(0.713)
$Cash_{t-1} \times \Delta Cash_t$	0.027	-0.697**	-0.394*	0.435**
	(0.183)	(-2.296)	(-1.880)	(2.160)
$\Delta Cash_t \times Lev_t$	-0.655	-1.053**	-1.035**	-0.365
	(-1.188)	(-2.347)	(-2.173)	(-0.775)
Lev_t	-0.879***	-0.442***	-0.785***	-0.575***
	(-8.185)	(-3.386)	(-8.696)	(-3.117)
ΔE_t	0.301**	0.179*	0.238**	0.235
	(2.444)	(1.746)	(2.127)	(1.448)
ΔNA_t	0.134***	0.211***	0.104***	0.347***
	(3.041)	(3.649)	(2.874)	(2.906)
ΔRD_t	-2.094	0.368	-1.353	0.017
	(-0.883)	(0.097)	(-0.609)	(0.003)
ΔI_t	-0.753	-0.496	-0.802**	-1.715
	(-1.343)	(-0.870)	(-2.136)	(-1.548)
ΔD_t	0.972**	0.587	0.557	1.462
	(2.010)	(0.920)	(1.388)	(1.610)
$Cash_{t-1}$	0.687***	0.738***	0.675***	0.671***
	(6.007)	(7.594)	(6.426)	(4.794)
NF_t	0.020	-0.066	0.031	-0.246**
	(0.281)	(-1.083)	(0.621)	(-2.381)
B/M_t	-0.006	-0.084**	-0.007	-0.077***
	(-1.427)	(-2.158)	(-1.481)	(-3.101)
$Size_t$	-0.005	-0.036*	-0.008	-0.015
	(-0.395)	(-1.733)	(-0.741)	(-0.570)
Shipping	0.041	-0.125	0.018	-0.086
	(0.765)	(-1.622)	(0.390)	(-0.798)
Constant	0.327***	0.440***	0.297***	0.406**
	(3.307)	(2.990)	(3.635)	(1.978)
Observations	1,430	583	1,528	485
Adjusted R^2	0.262	0.341	0.303	0.275

Table 6
Value of cash regressions and cyclicality

This table shows the results of the value of cash regressions of the shipping sample with the excess stock return as the dependent variable and firm characteristics as independent variables. X_t is the level of a variable at time *t*. ΔX_t is the one-year change in variable *X*. *Cash* is cash and short-term investments divided by lagged market equity. *Corr* is the correlation of a firm's Tobin's Q at time *t* and the ClarkSea index at time *t-1*. *Lev* is market leverage. *E* is earnings before extraordinary items plus interest, deferred income taxes and investment tax credit divided by lagged market equity. *NA* is total assets minus cash and short term investments divided by lagged market equity. *RD* is investments in research and development divided by lagged market equity. *I* is interest expenses divided by lagged market equity. *D* is common dividends paid divided by lagged market equity. *NF* is net financing, calculated as total equity issuance minus repurchases plus debt issuance minus redemption. *B/M* is book equity divided by market equity. *Size* is the natural logarithm of total assets. The cyclicality of growth opportunities is measured as the correlation of a firm's growth opportunities with the business cycle (*Corr*); it is the five-year rolling correlation of a firm's Tobin's Q at time *t* and the ClarkSea index at time *t-1*. Bad state and good state years are defined as the bottom and top 33% of the distribution of the growth of the ClarkSea index, respectively. Standard errors are heteroscedasticity-consistent and clustered at the firm level. t-statistics are shown in parentheses. *, **, and *** correspond to statistical significance at the 10%, 5%, and 1% level, respectively.

	(1) Full sample	(2) High *Corr*	(3) Low *Corr*	(4) Bad state	(5) Good state
$\Delta Cash_t$	0.710***	0.227	1.295**	0.269	0.692**
	(2.750)	(0.846)	(2.031)	(0.540)	(2.238)
$\Delta Cash_t \times Corr_t$	-0.630***			-0.748***	-0.200
	(-3.587)			(-2.835)	(-0.916)
$Corr_t$	0.044			0.079**	0.033
	(1.353)			(2.108)	(0.727)
$Cash_{t-1} \times \Delta Cash_t$	0.176**	0.038	0.351**	0.241***	0.189
	(2.556)	(0.473)	(2.234)	(2.657)	(1.585)
$\Delta Cash_t \times Lev_t$	0.321	0.850	-0.436	0.692	0.251
	(0.762)	(1.588)	(-0.436)	(0.927)	(0.639)
Lev_t	-0.754***	-0.997***	-0.422**	-0.783***	-0.762***
	(-5.717)	(-6.689)	(-2.289)	(-5.847)	(-4.069)
ΔE_t	0.072	0.046	0.040	-0.164**	0.741***
	(0.530)	(0.390)	(0.261)	(-2.233)	(3.210)
ΔNA_t	0.103	0.027	0.140	0.053	0.268**
	(1.527)	(0.324)	(1.498)	(0.748)	(2.564)
ΔRD_t	-135.576*	8.583	-269.477	-109.215	-300.116
	(-1.827)	(0.037)	(-1.107)	(-1.105)	(-1.394)
ΔI_t	0.496	0.096	0.440	-0.283	1.611*
	(0.645)	(0.081)	(0.527)	(-0.447)	(1.856)
ΔD_t	1.191*	2.330	0.663	0.272	0.900
	(1.901)	(1.626)	(0.928)	(0.522)	(0.701)
$Cash_{t-1}$	0.784***	0.764***	1.194***	0.867***	0.833***
	(7.332)	(8.004)	(8.603)	(6.105)	(5.225)
NF_t	-0.113	-0.102	0.037	0.007	-0.299
	(-1.224)	(-1.124)	(0.332)	(0.084)	(-1.631)
B/M_t	-0.011	-0.005	-0.201***	-0.008	-0.111***
	(-1.428)	(-1.193)	(-3.918)	(-1.522)	(-3.483)
$Size_t$	0.016	0.010	0.021	0.006	0.007
	(0.860)	(0.335)	(0.915)	(0.266)	(0.290)
Constant	0.102	0.279	-0.052	0.039	0.333*
	(0.688)	(1.206)	(-0.297)	(0.216)	(1.686)
Observations	674	234	212	356	318
Adjusted R^2	0.304	0.327	0.520	0.361	0.364

Table 7
Investment-cash regressions

This table shows the results of the 3SLS investment cash regressions of the shipping sample, including two models, calculated via conditional mixed process. The dependent variables are *NetInv* (model 1) and *Cash* (model 2). *NetInv* is capital expenditures and investment in research and development minus depreciation scaled by total assets at time *t+1*. *Cash* is cash and short-term investments divided by total assets. *CF* is EBITDA divided by sales. *MTB* is the ratio of market equity to book equity. *PrSalesGr* is the natural logarithm of sales growth over the previous two years. *Size* is the natural logarithm of total assets. *Lev* is total debt divided by total assets. *CFvola* is cash flow volatility, calculated as the median of the firm-level standard deviation of first differences in earnings before interest, taxes, depreciation and amortization over the prior 5 years. *CCDur* is the cash cycle duration at time *t*, calculated as the sum of average inventory age and average collection period less the average payment period. *Z* is Altman's (1968) Z-score. *RetSpread* is the return on investment minus the risk free rate. The return on investment is calculated as earnings before interest and taxes divided by total assets. *AggSalesGr* is the natural logarithm of mean sales growth. The cyclicality of growth opportunities is measured as the correlation of a firm's growth opportunities with the business cycle (*Corr*); it is the five-year rolling correlation of a firm's Tobin's Q at time *t* and the ClarkSea index at time *t-1*. Bad state and good state years are defined as the bottom and top 33% of the distribution of the growth (definition 1) or the level (definition 2) of the ClarkSea index, respectively. Firm fixed effects are included. Standard errors are heteroscedasticity-consistent and clustered at the firm level. t-statistics are shown in parentheses. *, **, and *** correspond to statistical significance at the 10%, 5%, and 1% level, respectively.

	(1) Full sample	(2) High *Corr*	(3) Low *Corr*	(4) Bad state (definition 1)	(5) Bad state (definition 2)	(6) Bad state & high *Corr*	(7) Bad state & low *Corr*
Panel A: NetInv regression							
$Cash_t$	0.215***	0.236	0.428***	0.099	0.230**	0.159	0.430***
	(3.005)	(1.038)	(2.802)	(1.441)	(2.030)	(1.231)	(2.943)
CF_t	0.039***	0.086	0.016	0.027	0.047	-0.011	-0.028
	(2.953)	(1.505)	(0.319)	(1.227)	(1.367)	(-0.248)	(-0.591)
MTB_t	0.002***	0.037***	0.001	0.014***	0.006	0.041***	0.003
	(7.387)	(3.010)	(0.103)	(2.802)	(0.756)	(3.914)	(0.207)
$PrSalesGr_t$	0.011***	0.014*	0.000	0.011***	0.009	0.022***	0.007
	(3.534)	(1.750)	(0.012)	(3.339)	(1.492)	(2.947)	(1.009)
Panel B: Cash regression							
CF_t	-0.034	0.081	-0.091*	-0.042	-0.014	0.113*	-0.069
	(-1.356)	(1.480)	(-1.818)	(-1.307)	(-0.459)	(1.785)	(-0.993)
MTB_t	0.002	0.031**	0.006	0.003	0.002	-0.014	0.000
	(1.633)	(2.295)	(1.032)	(0.618)	(1.111)	(-1.103)	(0.049)
$Size_t$	-0.005	-0.017**	-0.001	-0.003	-0.001	0.002	-0.003
	(-1.071)	(-2.316)	(-0.145)	(-0.614)	(-0.139)	(0.256)	(-0.243)
Lev_t	-0.162***	-0.150***	-0.130**	-0.096**	-0.060	0.053	-0.156*
	(-4.189)	(-2.653)	(-2.235)	(-2.122)	(-1.337)	(0.861)	(-1.847)
$CFVola_t$	0.497	0.866	0.843	0.778	1.261**	2.025***	-0.423
	(1.026)	(0.968)	(0.991)	(1.164)	(2.140)	(2.608)	(-0.356)
$CCDur_t$	-0.000	0.000	-0.000**	0.000	-0.000***	0.000	-0.000
	(-0.999)	(0.069)	(-2.201)	(0.094)	(-2.736)	(0.074)	(-1.492)
Z_t	0.003	0.000	0.003	0.011	0.017*	0.046***	0.001
	(1.085)	(0.172)	(0.427)	(1.549)	(1.817)	(4.518)	(0.131)
$RetSpread_t$	-0.001	-0.464*	0.148	0.049	-0.474***	-0.563**	0.137
	(-0.014)	(-1.855)	(0.668)	(0.380)	(-2.639)	(-2.134)	(0.532)
$AggSalesGr_t$	0.005**	0.013***	-0.002	0.006	-0.001	0.015**	-0.007
	(2.011)	(2.782)	(-0.392)	(1.615)	(-0.366)	(2.569)	(-0.849)
Observations	1,294	267	218	622	345	138	124

Table 8
Robustness test: Investment-cash regression and crisis

This table shows the results of the difference-in-differences regressions of the matched sample for the years 2004 to 2010. X_t is the level of a variable at time *t*. ΔX_t is the one-year change in variable *X*. The independent variable, $NetInv_{i,t+1}$, is calculated as capital expenditures minus depreciation plus R&D expenses scaled by total assets at time *t+1*. *Crisis* is a dummy variable that takes the value of 1 if *t* is between 2008 and 2010, and 0 otherwise. *Shipping* is an indicator variable that takes the value of 1 if the firm operates in the shipping industry, and 0 otherwise. *Cash* is cash and short-term investments divided by total assets *Q* is Tobin's Q. *OCF* is EBITDA scaled by total assets. Standard errors are heteroscedasticity-consistent and clustered at the firm level. t-statistics are shown in parentheses. *, **, and *** correspond to statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)
$Crisis_t$	-0.036***	-0.016*	-0.012	-0.016*	-0.003
	(-6.499)	(-1.785)	(-1.343)	(-1.669)	(-0.234)
$Crisis_t \times Shipping$		-0.038***	-0.027**	-0.031***	-0.055***
		(-3.304)	(-2.422)	(-2.648)	(-3.395)
Shipping		0.077***	0.059***	0.061***	0.078***
		(7.399)	(5.564)	(5.866)	(6.159)
$Cash_t$			0.163***	0.135***	0.261***
			(5.247)	(3.643)	(3.845)
$Cash_t \times Crisis_t$				0.059	-0.127
				(1.158)	(-1.240)
$Cash_t \times Crisis_t \times Shipping$					0.251**
					(2.124)
$Cash_t \times Shipping$					-0.181**
					(-2.252)
Q_t			0.025***	0.025***	0.023***
			(4.129)	(4.212)	(3.891)
OCF_t			0.052	0.051	0.057
			(1.385)	(1.372)	(1.555)
Constant	0.078***	0.035***	-0.013	-0.012	-0.019*
	(14.218)	(4.613)	(-1.202)	(-1.092)	(-1.715)
Observations	1,125	1,125	1,122	1,122	1,122
Adjusted R^2	0.014	0.104	0.144	0.144	0.148

Table 9
Robustness test: Value of cash, cyclicality, and investment

This table shows the results of the value of cash regressions of the shipping sample with the excess stock return as the dependent variable and firm characteristics as independent variables. X_t is the level of a variable at time *t*. ΔX_t is the one-year change in variable *X*. *Cash* is cash and short-term investments divided by lagged market equity. *Corr* is the correlation of a firm's Tobin's Q at time *t* and the ClarkSea index at time *t-1*. *Lev* is market leverage. *E* is earnings before extraordinary items plus interest, deferred income taxes and investment tax credit divided by lagged market equity. *NA* is total assets minus cash and short term investments divided by lagged market equity. *RD* is investments in research and development divided by lagged market equity. *I* is interest expenses divided by lagged market equity. *D* is common dividends paid divided by lagged market equity. *NF* is net financing, calculated as total equity issuance minus repurchases plus debt issuance minus redemption. *B/M* is book equity divided by market equity. *Size* is the natural logarithm of total assets. The cyclicality of growth opportunities is measured as the correlation of a firm's growth opportunities with the business cycle (*Corr*); it is the five-year rolling correlation of a firm's Tobin's Q at time *t* and the ClarkSea index at time *t-1*. A firm is classified as high investment when its *NetInv* is within the top 33% of the distribution. Standard errors are heteroscedasticity-consistent and clustered at the firm level. t-statistics are shown in parentheses. *, **, and *** correspond to statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	Full sample	Full sample	High *Corr*	High *Corr* & high investment	Low *Corr*	Low *Corr* & high investment
$\Delta Cash_t$	0.836***	1.089***	0.688***	1.000***	1.447***	2.603***
	(5.133)	(9.093)	(4.524)	(3.280)	(8.098)	(6.704)
$\Delta Cash_t \times Corr_t$		-0.595***				
		(-3.693)				
$Corr_t$		0.041				
		(1.200)				
Lev_t	-1.157***	-0.712***	-0.962***	-0.486	-0.397**	-0.390
	(-8.177)	(-5.718)	(-5.983)	(-1.502)	(-2.165)	(-1.022)
ΔE_t	0.207	0.037	0.033	0.659*	-0.011	-0.894*
	(1.638)	(0.290)	(0.275)	(1.717)	(-0.075)	(-1.703)
ΔNA_t	0.094*	0.097	0.045	0.274	0.136	0.896***
	(1.768)	(1.330)	(0.491)	(1.204)	(1.422)	(4.456)
ΔRD_t	-108.929	-330.072***	-2.680	5612.284	-690.727***	2822.830
	(-1.240)	(-3.609)	(-0.011)	(1.320)	(-5.489)	(0.599)
ΔI_t	-0.574	0.539	0.232	3.249	0.431	8.828***
	(-1.114)	(0.638)	(0.174)	(1.042)	(0.491)	(3.031)
ΔD_t	1.074**	1.225**	1.712	-1.277	0.775	6.368**
	(2.553)	(1.966)	(1.307)	(-0.426)	(1.082)	(2.144)
$Cash_{t-1}$	0.631***	0.700***	0.626***	0.652***	1.129***	0.353
	(3.689)	(7.611)	(7.426)	(2.848)	(8.876)	(1.475)
NF_t	0.036	-0.116	-0.113	-0.389**	0.050	-0.538
	(0.542)	(-1.152)	(-1.175)	(-2.373)	(0.431)	(-1.457)
B/M_t	-0.011	-0.012	-0.008	-0.270***	-0.196***	-0.242***
	(-1.532)	(-1.412)	(-1.226)	(-2.879)	(-3.608)	(-3.011)
$Size_t$	-0.028	0.016	0.009	0.024	0.016	0.004
	(-1.176)	(0.945)	(0.276)	(0.516)	(0.751)	(0.069)
Constant	0.682***	0.102	0.320	0.250	-0.021	0.182
	(3.329)	(0.737)	(1.439)	(0.659)	(-0.122)	(0.449)
Observations	1,360	674	234	59	212	47
Adjusted R^2	0.244	0.295	0.300	0.368	0.516	0.740

Figures

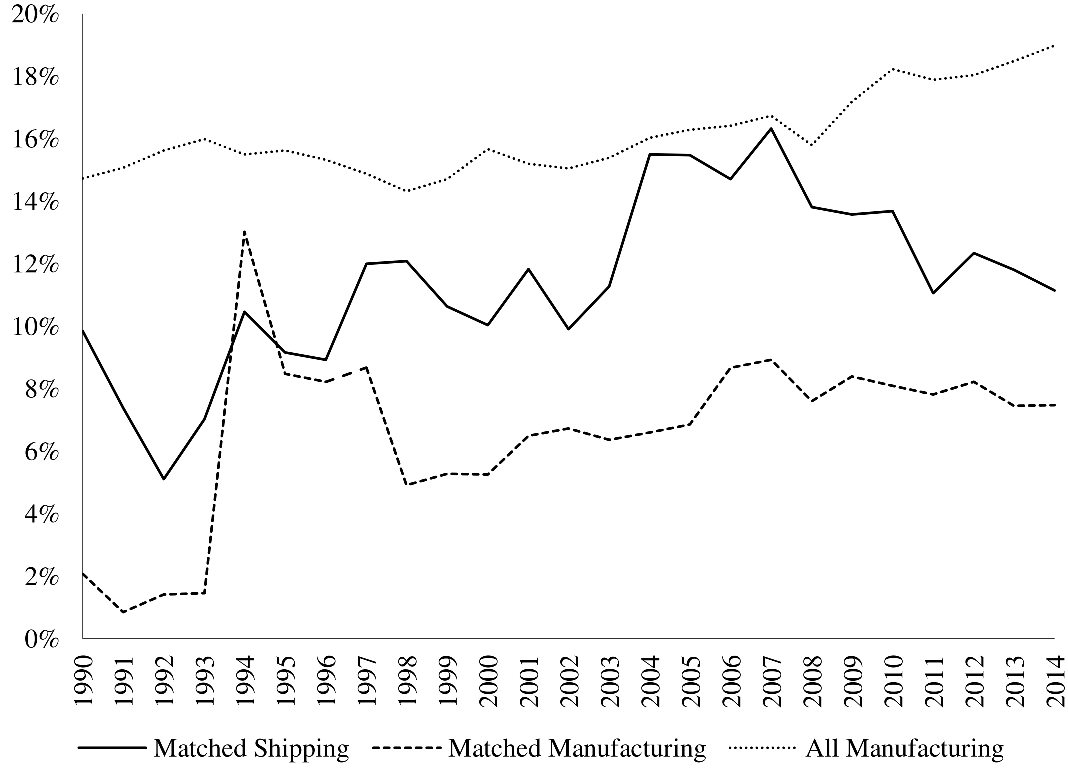

Figure 1. Cash holdings by year

This figure shows annual means of cash holdings (cash/total assets) for the matched sample divided into shipping firms (Matched shipping) and their matches (Matched manufacturing) as well as all manufacturing firms from Compustat Global (All manufacturing). Cash holdings are winsorized at the 1% and 99% level.

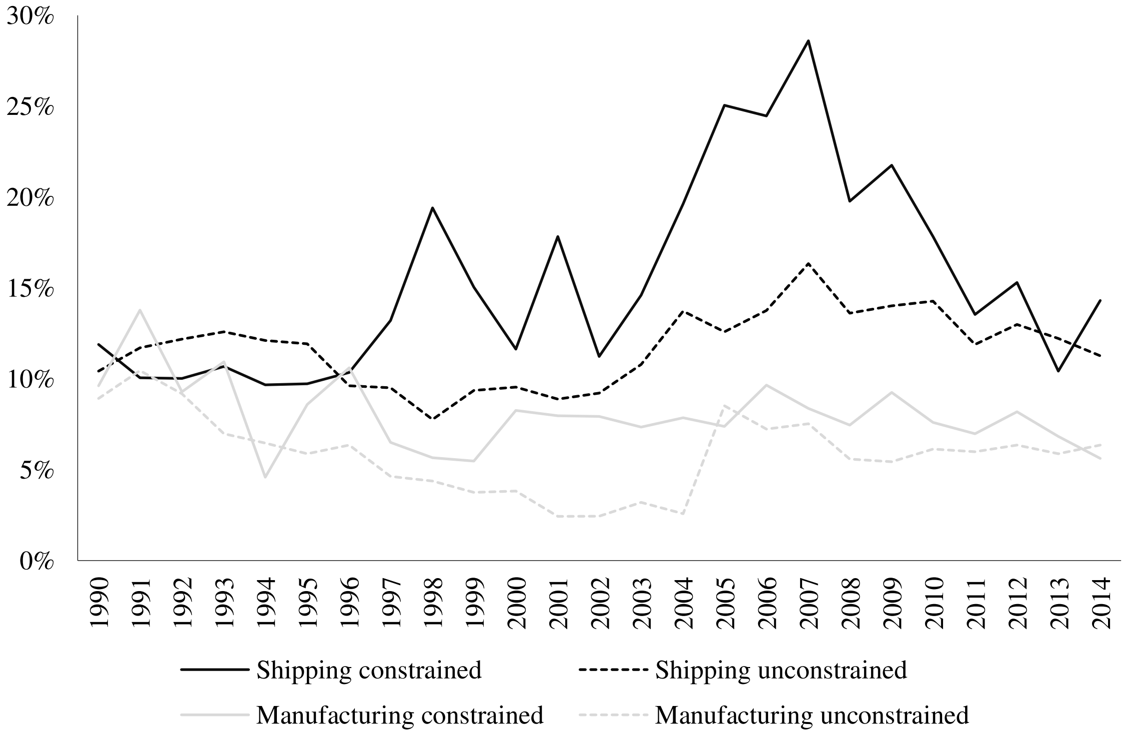

Figure 2. Cash holdings by year for constrained and unconstrained firms

This figure shows annual means of cash holdings (cash/total assets) for the matched sample divided into shipping firms (Shipping) and their matches (Manufacturing) as well as into financially constrained and unconstrained firms according to their firm size. Cash holdings are winsorized at the 1% and 99% level.