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The exposure of shipping firms' stock returns to financial risks and oil prices: a global perspective

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Shipping is an industry that is highly geared towards international trade and therefore, would seem to be highly susceptible to fluctuations in macroeconomic factors. This article investigates the impact of exchange rates, interest rates and oil prices on stock returns of 143 shipping companies from 16 countries. We also investigate the factors which determine the extent to which firm are sensitive to macroeconomic variables. Our results indicate that the low incidence of significant exposure to exchange rate and interest rates suggests that most shipping firms have utilised reasonably successful hedging strategies to reduce the impact of these macroeconomic risks. Finally, we find that, for the minority of shipping firms significantly affected by oil price increases, the effects have usually been beneficial.

1. Introduction

The global economy has witnessed rapid changes in the last few decades. Barriers that have hindered the free flow of goods, services and capital are gradually being removed, while countries that were initially opposed to liberal economic policies are now beginning to adopt them. These developments suggest that the world is shifting towards an economic system that will be more beneficial for international business Yet, this global economic advancement also comes with unprecedented economic risks [1], some of which have been aggravated by the breakdown of the Bretton Woods agreement, incessant fluctuations in interest rates and oil price shocks.

The financial exposure associated with these economic risks especially those pertaining to exchange rate, interest rate and oil price exposure has continued to attract widespread attention by academic researchers, investors and business organisations over the last few decades. This is probably because if these risks are not appropriately managed, their impact on the business' continued existence can be detrimental. Venaik *et al*. [2] proposes that the demands of global integration are customarily known to be vital determinants of strategic positioning, organisational structure, processes and performance of both the domestic and multinational firm. Therefore, a firm that desires to enhance its ability to capitalise on the benefits that can be derived from global integration needs to devise detailed long-term risk management strategies that are compatible with its internal functional capabilities, and regularly review and amend these strategies, especially as its economic environment changes [1].

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In effect, risk management has often been utilised by finance directors, corporate treasurers and portfolio managers to reduce the firm's risk exposure. The aim of covering exposure is to minimise the volatility of the firm's profits or cash flows and thereby reduce the volatility of the firm's value. If the firm is at risk because of changes in the exchange rate, interest rate or oil price, then hedging can act as a buffer preventing the firm from the unexpected loss of cash flow [3, 4]. However, corporate management of financial risk (foreign exchange risk, interest rate risk, oil price risk) is a crucial task for any organisation. The increased volatility in global business operations and financial markets, developments of new instruments and techniques such as derivatives, and the misuse of these as risk management tools have resulted in large losses and bankruptcies by firms such as Barings Bank and Sumitomo Corporation [5, 6]. This might suggest that one of the major problems with which business managers and investors are confronted is recognising these risks and implementing the appropriate technique that is compatible with their business operations [7].

Shipping is an expanding business operating globally, facilitating the movement of bulk materials around the world at very economical prices. Invariably, the greatest volume of international trade is transported *via* the sea [8]. The World Bank and other international developmental organisations anticipate that world seaborne trade is expected to grow at the rate of 4% annually over the next decade. Consequently, this would lead to a twofold increase of current trade volumes by the year 2010. This is expected to engender a corresponding growth in the demand for transportation services, notably shipping [9]. However, this realisation might be endangered by the fact that the business operations of shipping firms are highly susceptible to financial risks since the industry is heavily geared towards international trade [10].

We will subsequently review some of the key literature on exchange rate, interest rate and oil price risk that typically affect both national and multinational companies. However, although there are useful insights to be gained from these studies, it needs to be stated at the outset that there are specific attributes to shipping companies that make them different from other firms engaged in international trade. One key attribute is that for many shipping firms, the revenues are denominated in dollars. Akatsuka and Leggate [11] explain that the distinctive market structure of the dollar-denominated freight rate revenues is not compatible with the domestic currency costs of shipping firms. Invariably, fluctuations between these domestic currencies and the US dollar can influence the performance of the shipping industry positively or negatively. We will subsequently review some of the key literature on exchange rate, interest rate and oil price risk that typically affect both national and multinational companies. However, although there are useful insights to be gained from these studies, it needs to be stated at the outset that there are specific attributes to shipping companies that make them different from other firms engaged in international trade. One key attribute is that for many shipping firms, the revenues are denominated in dollars.

Then again, the business of shipping is highly capital intensive and often financed by debt. Therefore, an increase in interest rates will have a negative effect on the value of the firm. But, a further attribute is that given an international financial market for shipping companies, loans can be chosen from a selection of currencies. When dollar loans are raised, for example, the dollar interest can be offset against the dollar revenues, net of dollar-denominated labour costs, which again provide a natural hedge. Clearly, the hedge is far from perfect, but this nevertheless suggests

a lower exchange rate risk than would otherwise be the case. Furthermore, differences in forward *versus* spot exchange rates can reflect underlying differences in interest rates across currencies. It follows that an investigation of exchange rates should also encapsulate interest rates, which we attempt to address.

Furthermore, Stopford [12] established that fuel accounted for 13% of the ship's total cost in 1970. However, when oil prices rose by 950% between 1970 and 1985, expenditure on fuel rose to 34% which was more than any other individual cost item. Jalali-Naini and Manesh [13] reveal that during the period 1987 to 2005, fluctuations in crude oil prices exceeded by far that of other commodity prices.

Joseph [14] illustrates that changes in exchange rates and interest rates can have a considerable effect on the value of the firm through their impact on cash flows, investments, profitability and domestic and international competitiveness. He examines the impact of fluctuations in foreign exchange and interest rates on UK firms in the chemical, electrical, engineering and pharmaceutical industries for the period 1988 to 2000. His results suggest that industry returns are more negatively affected by changes in interest rate than by changes in foreign exchange rates. His findings are supported by Choi and Prasad [15], who study the impact of exchange rate and interest rate risk exposure on the equity valuations of industry portfolios in Germany, Japan, the United Kingdom and United States. They find greater instances of significant exposure for changes in interest rates than exchange rates. Loudon [16] investigates financial risk exposure comprising exchange rate, interest rate and fuel prices for the airline industry. He finds no significant exposure of the airlines' stock returns to exchange rates or interest rates in the short term. However, a significant negative exposure towards oil prices is detected.

Evidently, there have been very few studies investigating the financial risks associated with the shipping industry. Even for the few studies available, academic researchers tend to have taken a mutually exclusive approach towards the investigation of these risks. Grammenos and Arkoulis [10] emphasise that investigating the impact of these macroeconomic factors on the return/risk profile of the shipping industry will be of considerable benefit for portfolio adjustments to shipping equities. Therefore, our study extends previous literature on the shipping industry, first, by examining across 16 countries the exposure of shipping firms' stock returns to exchange rates, interest rates and oil prices. Second, using firm-specific variables as proxies, we investigate the determinants of shipping firms' exposure to exchange rates, interest rates and oil prices. Our motive for investigating shipping firms from various countries is based on the premise that different countries exhibit different economic characteristics. Customarily, a firm's level of exposure to financial risks will to a large extent depend on the potency of economic conditions available in the firm's country of origin. Our proposition is supported by Faff and Marshall [17] who investigated the exchange exposure of multinational companies (MNCs) in Asia Pacific, UK and the USA. These results suggest that firms in different countries exhibit different levels of exchange exposure. Our focus is on the financial risks that influence the stock returns of shipping firms. Therefore, to shed more light on the impact of these risks, we intend to resolve the following questions:

1. What is the impact of fluctuating exchange rates, interest rates and oil prices on the stock returns of shipping firms?
2. Considering the ideology that the business of shipping is capital intensive, will shipping firms be more susceptible to long-term interest rates?

3. What are the determining factors responsible for the exposure of the shipping firm to exchange rates, interest rates and oil prices?

Following a review of previous literature and hypotheses development in Section 2, the methodology and data sources are explained in Section 3, empirical results are presented in Section 4 and, finally, a conclusion is reached in Section 5.

2. Literature review and hypotheses development

2.1. *Exposure to exchange rates, interest rates and oil prices*

According to Jorion [18] and Loudon [19], the degree to which fluctuations in exchange rates impinge on the performance of an industry depends on its level of international business, the competitive nature of its input markets and its foreign investments. Bodnar and Gentry [20] conduct an industry level exchange exposure for Canada, Japan and the United States. Their results reveal that for Canada and the US, 4 out of 19 industries (21%) and 11 out of 39 industries (28%), respectively, had significant levels of exposure. However, the results for Japan indicate that 7 out of 20 industries (35%) exhibited a significant exchange exposure at the 10% level. In this instance, they suggested that the impact of exchange rate fluctuations on an industry was dependent on the industry's connection with the global economy.

Fang and Loo [21] examine the effect of unexpected changes in the US trade weighted exchange rate on the stock returns of 20 US industries for the period January 1981 to December 1990. They found significant negative betas for the chemical, food and beverage, mining, petroleum and utilities industries. However, positive exchange rate related betas were detected for banking, finance and real estate, department stores, machinery, other retail trade, textile and apparel, transportation equipment and miscellaneous industries.

Loudon [22] investigates the sensitivity of monthly Australian stock returns to foreign exchange operating exposure between 1984 and 1989. A sample of 141 firms was taken from all 23 industries in the ASX indices. A negative exposure was found for resource stocks, while industrials exhibited a positive exposure to exchange risk. El-Masry [23] explores the foreign exchange exposure of UK industries to exchange rates for the periods 1981 to 2001. He finds that a higher percentage of UK industries' stock returns display significant positive exchange rate exposure. Despite this, some of the empirical studies on exchange exposure have failed to perceive a strong relationship between fluctuations in exchange rate and the firm's stock returns. Jorion's [18] examination of 287 US multinational companies to changes in exchange rate for the period January 1971 to December 1987 revealed that only 5% of firms demonstrated a significant contemporaneous exposure to exchange rates. These results were consistent with findings by Amihud [24], who also found no significant contemporaneous relationship between monthly variations in nominal and real exchange rates and monthly stock returns for the 32 largest US exporting companies for the period January 1979 to December 1988.

Faff and Marshall [17] examine the exchange exposure of 123 MNCs' stock returns from Asia Pacific, UK and the USA during the period 1997 to 1998. Their sample was comprised of 35 MNCs from USA, 51 from UK and 37 from Asia Pacific. They find that 6, 3 and 1 MNCs from Asia, UK and USA, respectively, exhibited significant positive exchange rate exposure coefficients; on the other hand, only 2, 12 and 16 MNCs from Asia, UK and USA, respectively, had significant

negative exposures to exchange rates. Doidge *et al*. [25] investigate the exchange exposure of nonfinancial firms in 18 countries, including the UK and the USA. They find that, for most of the countries apart from the USA, the exchange rate effect is insignificant. Jong *et al*. [26] point out that since it is usual for some firms to use derivatives to mitigate the exchange exposure, it logically follows that low exposure coefficients will be found. This line of argument is congruent with the views of Allayannis and Ofek [27]. From the previous discussion, we propose testable hypotheses as follows.

Hypothesis 1: There is a negative relationship between stock returns of shipping firms and the dollar exchange rate of the domestic currency, expressed as an indirect quote. The unique structure of the global operations of the shipping industry entails that freight rate revenues are dollar denominated, which may not be equivalent to the domestic currency cost to the shipping firm. Even when operational hedges or derivatives are utilised, it is unlikely that the whole exposure will be covered.

According to Bodnar and Gebhardt [28] and Bartram [29], the impact of interest rate risk on the value of nonfinancial organisations has rarely been investigated. Many studies have focused on financial institutions despite the fact that interest rates are not less volatile than exchange rates and also embody an important source of risk for nonfinancial firms.

Ceglowski [30] examines the interest rate exposure of some US firms. Her findings suggest that the impact of changes in interest rate on a firm's stock returns depends on the nature of its industrial structure. However, Haugen *et al*. [31] and Sweeney and Warga [32] disagree with this finding in that a substantial number of US corporations do not display significant exposure to interest rates at the industry level. Prasad and Rajan [33] reiterate the results from these earlier studies as they point out that industry portfolios in the US did not exhibit a significant level of interest rate exposure. These findings were also applicable to Japan and the UK, but not to Germany where 16.7% of their industry portfolios showed significant levels of exposure to interest rates. On the other hand, Oertmann *et al*. [34] found significant interest rate exposures, mainly due to variations in long-term interest rates and also to the global interest rate index, for nonfinancial corporations in France, Germany, Switzerland and UK. From this discussion, we can propose the following testable hypothesis:

Hypothesis 2: There is a negative relationship between shipping stock returns and interest rates, both long term and short term. Generally, nonfinancial firms are net borrowers. Therefore, the commonest type of interest rate risk for them is that of debt servicing. An increase in interest rates reduces the earnings of the firm. Thus, we propose a negative relationship between the stock returns of shipping firms' short- and long-term interest rates.

Poulakidas and Joutz [35] indicate that in a period of high oil prices, shipping tankers can increase their rates since the increased price in oil partly signifies paucity in the supply of tankers. More so, if tanker supply is low in a period of high demand, tanker price becomes inelastic as shippers are prepared to pay higher rates. In this way, they surmise that the demand for tankers is an offshoot for the demand for oil.

Drobetz *et al.* [36] explain that oil prices may possibly be a prospective return driver of shipping stock returns for the reasons that oil is the major input factor for generating carriage service and second, the demand for tanker freight is an initiated demand from oil. Consequently, if the price of oil is high, so will have been the demand for oil and the demand for tanker transport. Intuitively, they posit that the impact of oil prices on shipping returns could be positive or even negative.

They find for their sample of 48 shipping firms in the period 1999 to 2007 that a change in oil price has a significant positive effect on shipping stock returns. We believe that this finding may have been influenced by the apparent rise in oil prices during the period of their study. Furthermore, other empirical studies, investigating the impact of oil price on stock returns, seem to suggest that there is a significant relationship, and especially for notable oil-related industries, including industries that are sensitive to the price of oil, such as the Oil and Gas industry and transportation industry. Scholtens and Wang [37] explain that oil prices have increased sharply over the past few years, and so has the global demand for oil. They point out that this has resulted into extraordinarily high levels of profits for oil companies. Subsequently, the returns of most Oil and Gas companies have experienced dramatic increase. Similarly, Sadorsky [38] found that oil prices have a significant positive impact on the returns of the Canadian Oil and Gas Industry. This finding is also congruent with those of Manning [39] who finds that changes in oil price has a positive effect on the stock returns of UK oil corporations, Faff and Brailsford [40] who detect that oil has a positive influence on the Australian Oil and Gas sector returns and Hammoudeh and Li [41] who find a positive relationship between oil and the returns of US Oil industries. Additionally, Boyer and Filion [42] indicate that the returns of Canadian energy stock are beneficially connected to the appreciation in the price of oil. Then, Oberndorfer [43] finds that oil price is positively related to the returns of Eurozone energy stocks. On the contrary, Grammenos and Arkoulis [10] find that international shipping stock returns are negatively influenced by oil prices. However, their finding also suggests that shipping returns benefit form a depreciation of the US$. Likewise, Hammoudeh and Li [41] show that there is a negative relationship between oil price and the returns of the US transportation industry. Nevertheless, in this study, we classify the price of oil as an expenditure item for the shipping firm, as this constitutes an outflow. In our study, despite the fact that for oil tanker businesses oil is a revenue-related driver, we classify the price of oil as an expense item for the shipping firm. Since this constitutes an outflow, an increase in the price of oil should have negative effects on the firms' earnings. From the above discussion, we will test the following hypothesis:

Hypothesis H3: There is a negative relationship between shipping firms' stock returns and oil price changes.

2.2. *Determinants of exchange rate, interest rate and oil price exposure*

He and Ng [44] investigate the foreign exchange exposure of 171 Japanese multinationals over a period from 1978 to 1993. They established that a quarter of the firms with a foreign sales ratio of at least 10% were significantly affected by

exchange exposure. Nydahl [45] also finds that for Swedish firms, the foreign exchange exposure increased with the fraction of foreign sales.

Dominguez and Tesar [46] point out that a firm's level of exposure is highly correlated to its size and the degree of its foreign operations, such as foreign assets, foreign sales and any other international activity. Studies by Harris *et al*. [47], Miller and Reuer [48], Allayannis and Ofek [27] and Bartram [49] also concur with this hypothesis as they find that exchange rate exposure for firms increase with the extent of foreign operations. He and Ng [44] and Adedeji and Baker [50] also indicate that size is an important determinant of exchange and interest rate exposure; indeed they find it has a positive influence on derivative usage.

Froot *et al*. [51] and Geczy *et al*. [52] suggest that firms with higher growth opportunities and investment opportunities are more likely to hedge because of the need to reduce the volatility of their cash flows. Choi and Kim [53] found that US firms with higher leverage positions, lower liquidity and higher growth opportunities are usually more inclined to hedge. Consequently, they should all have lower exposure to changes in exchange rates. However, El-Masry and Abdel-Salam [54] find that exchange exposure has a significant positive correlation with the growth opportunity proxies used for UK industries.

Davies *et al*. [55] find for Norwegian exporting firms that the dividend payout ratio has a negative relationship with exchange rate exposure, while a positive relationship is found for the quick ratio and the exchange exposure coefficient. This signifies that firms with a lower dividend ratio and higher quick ratio are less likely to hedge and may therefore be more susceptible to exchange exposure. However, Chow and Chen's [56] findings conflict with these results as they find a positive impact for dividend payout on exchange rate exposure. Nonetheless, to our knowledge no empirical study of shipping companies has investigated the determinants of exposure to oil prices. Therefore, this study aims to fill that void in the literature. For the hypotheses pertaining to the determinants of exposure, we summarise their expected relationship with the various risks examined in this study, as shown in Table 1.

Table 1. Hypotheses for determinants of exchange rate, interest rate and oil price exposure.

Determinant	Exchange rate	Short-term interest rate	Long-term interest rate	Oil prices
Size	−	−	−	−
Foreign sales	+	+/−	+/−	+
Foreign assets	+	+/−	+/−	+
Long-term debt	+	+	+	+
Payout	+	+	+	+
Quick ratio	−	−	−	+
Market-to-book value	+	−	−	−

Notes: Size is used as a proxy for economies of scale; foreign sales and foreign assets are proxies for foreign operations; hedging proxies are financial distress (long-term debt), liquidity (payout and quick ratio), growth opportunities (market-to-book value) and size.

3. Methodology

3.1. *Models and variables*

3.1.1. *Stock returns.* In order to estimate the impact of exchange rates and interest rates simultaneously on stock returns, a multi-factor ordinary least square (OLS) model is adopted. This methodology without the oil price effects is used in studies by Prasad and Rajan [33], Joseph [14] and Guay and Kothari [57]. The regression coefficients measure the responsiveness of stock returns to interest rates, exchange rates, oil prices and the domestic market portfolio, respectively. Therefore, the OLS model is represented as follows:

$$R_{jt} = \alpha_j + \beta_{i,j}\mathrm{XG}_t + \beta_{ii,j}\mathrm{SH}_t + \beta_{iii,j}\mathrm{LG}_t + \beta_{iv,j}\mathrm{OL}_t + \beta_{v,j}\mathrm{RM}_t + \varepsilon_{j,t} \quad (1)$$

where R_{jt} is the stock return for firm j in period t, XG_t the percentage change in the exchange rate variable, SH_t the return on the short-term (3-month Treasury bills) interest rate series, LG_t the return on the long-term (10-year Government bond) interest rate series, OL_t the percentage change in the oil price variable, RM_j the return on the domestic market portfolio, $\beta_{i,j}$ the exchange rate exposure of firm j, $\beta_{ii,j}$ the short-term interest rate exposure of firm j, $\beta_{iii,j}$ the long-term interest rate exposure of the firm j, $\beta_{iv,j}$ the exposure coefficient of firm j with respect to oil prices, $\beta_{v,j}$ the exposure coefficient of firm j with respect to the market portfolio, and ε_{jt} the random error term for firm j.

3.2. *The determinants of shipping firms' stock returns to exchange rate, interest rate and oil price exposure*

Since data on hedging activities are usually incomplete and difficult to obtain, we adopt proxies [23, 52, 58] to simulate the firm's motives for hedging. Various studies [26, 28, 59–62] suggest that larger firms are more exposed than smaller firms. However, since larger firms have more resources than smaller firms, they are better able to manage their exposures. We adopt the methodology of Adedeji and Baker [50] and El-Masry and Abdel-Salam [54] by using the log of total assets as a proxy for size. To test the impact of the firm's international activities on its exposure, we adopt the foreign sales ratio (foreign sales to total sales) and foreign assets ratio (foreign assets to total assets) used in studies by Allayannis and Ofek [27], Dominguez and Tesar [46], and Chiang and Lin [62] and El-Masry and Abdel-Salam [54].

Berkman and Bradbury [63] and Mayers and Smith [64] posit that hedging has the potential of reducing the firm's probability of bankruptcy and invariably the expected cost of financial distress. We use a firm's long-term debt ratio (long-term debt to total equity and reserves) as a proxy for the probability of financial distress. Therefore, firms with a high long-term debt ratio are more likely to be prone to larger costs of financial distress and are probably more motivated to engage in hedging activities. Nance *et al.* [65] posit that firms can reduce the cost of financial distress and agency costs by sustaining a high liquidity position and a low dividend payout ratio. It is thought that this strategy enhances the availability of funds to pay fixed-claim holders, thereby reducing agency conflict. Therefore, following Chow and Chen [56] and El-Masry and Abdel-Salam [54], we assess the impact of liquidity on exposure using the dividend payout ratio and the quick ratio as proxies. Froot *et al.* [51] point out that hedging mitigates the problem of underinvestment caused by the firm's reliance on costly external sources of finance. We investigate the firm's

growth opportunities, following Geczy *et al.* [52] and Choi and Kim [53], by using the ratio of the market-to-book value of its equity and the ratio of research and development cost to sales as proxies. According to their findings, firms with lower market-to-book value usually have smaller exposures, because they are more likely to hedge so as to reduce underinvestment costs.

For the determinants of exchange risks, the exchange exposure coefficient, already derived from Equation (1), will be used to measure a new dependent variable, while for interest rate and oil prices, the respective coefficients also taken from Equation (1) will be included in the new model. Therefore, cross-sectional regressions of the determinants of exchange rate, short- and long-term interest rate and oil price risk, respectively, are as follows:

$$\beta_{i,j} = \lambda_{0,i} + \lambda_{1,i}\mathrm{SIZE}_j + \lambda_{2,i}\mathrm{FSALES}_j + \lambda_{3,i}\mathrm{FASSETS}_j + \lambda_{4,i}\mathrm{LTDEBT}_j + \lambda_{5,i}\mathrm{MVALUE}_j + \lambda_{6,i}\mathrm{PAYOUT}_j + \lambda_{7,i}\mathrm{QUICK}_j + \mu_{i,j} \quad (2)$$

$$\beta_{ii,j} = \lambda_{0,ii} + \lambda_{1,ii}\mathrm{SIZE}_j + \mathrm{i}_{2,ii}\mathrm{FSALES}_j + \lambda_{3,ii}\mathrm{FASSETS}_j + \lambda_{4,ii}\mathrm{LTDEBT}_j + \lambda_{5,ii}\mathrm{MVALUE}_j + \lambda_{6,ii}\mathrm{PAYOUT}_j + \lambda_{7,ii}\mathrm{QUICK}_i + \mu_{ii,j} \quad (3)$$

$$\beta_{iii,j} = \lambda_{0,iii} + \lambda_{1,iii}\mathrm{SIZE}_j + \lambda_{2,iii}\mathrm{FSALES}_j + \lambda_{3,iii}\mathrm{FASSETS}_j + \lambda_{4,iii}\mathrm{LTDEBT}_j + \lambda_{5,iii}\mathrm{MVALUE}_j + \lambda_{6,iii}\mathrm{PAYOUT}_j + \lambda_{7,iii}\mathrm{QUICK}_j + \mu_{iii,j} \quad (4)$$

$$\beta_{iv,j} = \lambda_{0,iv} + \lambda_{1,iv}\mathrm{SIZE}_j + \lambda_{2,iv}\mathrm{FSALES}_j + \lambda_{3,iv}\mathrm{FASSETS}_j + \lambda_{4,iv}\mathrm{LTDEBT}_j + \lambda_{5,iv}\mathrm{MVALUE}_j + \lambda_{6,iv}\mathrm{PAYOUT}_j + \lambda_{7,iv}\mathrm{QUICK}_j + \mu_{iv,j} \quad (5)$$

where $\beta_{i,j}$ is the exchange rate exposure coefficient of firm j, correspondingly, $\beta_{ii,j}$ the short-term interest rate exposure, $\beta_{iii,j}$ the long-term interest rate exposure and $\beta_{iv,j}$ the exposure to oil prices. For hedging proxies, SIZE is measured as the natural log of the firm's total assets, FSALES the foreign sales to total sales ratio, FASSETS the foreign assets to total assets ratio, LTDEBT the firm's long-term debt to total equity and reserves ratio (leverage) and a proxy for the probability of financial distress, MVALUE the ratio of the firm's market-to-book value of equity and a proxy for the firm's growth opportunities, PAYOUT the dividend payout ratio and QUICK the current assets less stock all divided by current liabilities. These two are proxies for liquidity. Finally $\mu_{i,j} \ldots \mu_{iv,j}$ are the error terms.

3.3. *Data sources*

The scope of this study is focused on international shipping firms for which the data used were obtained from the DataStream and Worldscope Database. The dependent variable is measured as the return on shares, i.e. the proportionate weekly change in the market price. Accordingly, weekly stock returns of 175 shipping firms from 16 countries, namely, Australia, Canada, China, Denmark, France, Germany, Hong Kong, India, Italy, Japan, Netherlands, New Zealand, Norway, Sweden, UK and the US were collected for the period 18 April 1997 to 30 September 2005. However, only 143 firms had sufficient data for the entire period and were, therefore, used as the final sample.

Given that freight rates are denominated in US$, the bilateral rates against the dollar are used for all the countries. For the United States, we utilise the Bank of

England trade weighted US$. This index is the weighted average of the foreign exchange value of the dollar against the currencies of its major trading partners. For the short-term interest rates, the 3-month Treasury bill has been utilised as a proxy, while for the long-term interest rate the 10-year Government bond is adopted. In the case of the long-term interest rate, studies by Bartram [29] and Loudon [16] found the 10-year Government bond an ideal proxy. The overall stock market index is measured by the relevant index for each of the respective countries, while regional crude oil prices in dollar/barrel for Australia Oil, Canada Oil, China Oil, Norway Oil and UK Oil have been used to characterise the price of oil for the different countries.

4. Empirical results

4.1. *Descriptive statistics*

We find that the mean weekly price changes for Australia, Hong Kong, India, New Zealand and Sweden are positive. This infers that the currencies of these countries depreciated against the US$. On the other hand, we find negative mean weekly price changes for Canada, China, Denmark, France, Germany, Italy, Japan, the Netherlands, Norway and United Kingdom. This indicates that the currencies of these countries appreciated against the dollar. We also observed a negative mean for the Bank of England trade weighted US$. In this instance, the US$ depreciated against the currencies of her major trading partners (to save space, descriptive statistics for weekly changes in bilateral exchange rates over the period 1997 to 2005 are available from the authors upon request).

We further allocate the countries into their respective continents. For Australasia, we have Australia and New Zealand. Then for the Asian continent, the representative countries are China, Hong Kong, India and Japan. The European countries are segregated into the euro zone area comprising of France, Germany, Italy and the Netherlands and noneuro Europe consisting of Denmark, Norway, Sweden and the United Kingdom. Then, for North America we have Canada and the United States, respectively. The results reveal that Australasia and the euro zone exhibit positive changes, North American countries have negative means but the results are mixed for countries in noneuro Europe and Asia.

Furthermore, we examine the volatility of the currencies by their standard deviations (SDs). We find a constant SD of 0.9% for the countries in North America, a range of 1.5% to 1.6% for Australasian countries and 1.4% for all countries within the euro zone. In noneuro Europe, the deviations are somewhat close as they range from between 1.1% for the United Kingdom and around 1.5% for Norway and Sweden, which are of course also both from the Scandinavian region. Again, we had mixed results for the Asian countries as the SDs range from almost negligible for China and Hong Kong, to 0.5% for India and to 1.7% for Japan, which had the highest measure in the sample.

The results show that for, the period investigated, increases in oil prices have ranged from 0.27% to 0.29%. This is unsurprising since the price of oil has been on the increase since 1970 and the relative fluctuations in oil prices have exceeded that of any other commodity during the period 1987 to 2005. Despite this, oil price fluctuation is highest for Canada oil at 5.2% and lowest for Australia at 3.8% (to save space, descriptive statistics for weekly changes in oil prices over the period 1997 to 2005 are available from the authors upon request).

We also find that all mean weekly changes are positive indicating that the short- and long-term interest rates generally increased during the period 1997 to 2005. It is worthy of mention that the convergence of monetary union for euro zone countries is reflected in the common relative fluctuations of their short-term interest rates (0.87%) and long-term interest rates (0.67% to 0.68%). However, for Italy, the SD of 1.44% for the short-term interest rate and 0.84% for the long-term interest rate is higher than the euro zone average. For the Asian continent, Hong Kong has the highest level of fluctuation for the short-term interest rate with 3.10%, and India with 2.63%, which has the highest for the long-term interest rate. Nonetheless, the SDs for both the 3-month Treasury bill and the 10-year Government bond were quite high for the firms in our sample (to save space, descriptive statistics for weekly changes in the short- and long-term interest rates over the period 1997 to 2005 are available from the authors upon request).

It is pertinent to note that short- and long-term interest rates can be unpredictable and volatile. Such fluctuations in interest rates are a source of potential risk which they may lead to a decline in the value of the firm. Since the business of shipping is highly capital intensive, the choice of debt finance in the light of uncertain interest rates might not be appealing to finance managers.

4.2. *Exchange rate exposure of shipping firms' stock returns*

Panel A of Table 2 provides a summary of shipping firms that exhibit significant levels of exchange rate exposure at all conventional levels, namely, 90%, 95% and 99% levels of confidence. We find no significant exchange exposure coefficients for shipping firms in Australia, Denmark, Italy and Sweden.

On the other hand, India, the Netherlands and New Zealand have the highest percentage of firms (60%) with significant exchange rate exposure. On the whole, approximately 19% of the shipping firms in our sample, i.e. 9% (13/143) with negative and 10% (15/143) with positive exposure coefficients are exposed to exchange rates at all conventional levels.

For firms that exhibit negative exposure coefficients, this implies that an appreciation in the US$ against their domestic currencies has a negative impact on their stock returns. Then, for shipping firms with positive exposure coefficients, their stock returns benefit when the US$ appreciates against their domestic currencies. Additionally, Panel B also provides information on the statistics of the exposure coefficients. We find that China has the highest exposure coefficient, mean and SD of 219.79, 17.83 and 63.63, respectively. This is followed by Hong Kong with a maximum exposure coefficient of 46.86, mean of 2.63 and SD of 22.60. Notably, these exposure statistics far exceed those of all the other countries investigated in this study.

4.3. *Interest rate exposure of shipping firms' stock returns*

Tables 3 and 4 highlight the regression results for the firms' exposure to the short- and long-term interest rates. For firms in Australia, Canada, Denmark, Germany, Italy, the Netherlands and New Zealand, we find no significant exposure coefficients at all conventional levels. The United Kingdom, with 29%, has the highest percentage of firms with exposure to short-term interest rates, while for the long-term interest rates Italy has 50% of its firms exhibiting significant exposure coefficients. Interestingly, our results show that 9.79% (14/143) of firms in our sample are exposed to both the short- and the long-term interest rates. However, the

Table 2. Exchange rate exposure of shipping firms and summary statistics.

Panel A: Exchange rate exposure for the period 18 April 1997 to 31 September 2005

Country	$N^*(-)$	$N^*(+)$	Total exposure	Total firms	With exposure (%)
Australia	0	0	0	3	0.00
Canada	2	0	2	5	40.00
China	1	0	1	12	8.33
Denmark	0	0	0	7	0.00
France	0	1	1	8	12.50
Germany	0	1	1	5	20.00
Hong Kong	1	2	3	9	33.33
India	3	0	3	5	60.00
Italy	0	0	0	2	0.00
Japan	3	4	7	28	25.00
Netherlands	0	3	3	5	60.00
New Zealand	3	0	3	5	60.00
Norway	0	1	1	20	5.00
Sweden	0	0	0	5	0.00
United Kingdom	0	2	2	7	28.57
USA	0	1	1	17	5.88
Total	13	15	28	143	19.58

Panel B: Summary statistics of exchange exposure for the period 18 April 1997 to 31 September 2005

Country	Number of firms	Mean	Minimum	Median	Maximum	SD
Australia	3	0.0356	−0.0975	0.0189	0.1854	0.1422
Canada	5	−0.0206	−0.6698	−0.0977	0.7324	0.5528
China	12	17.8267	−5.5454	0.0059	219.7924	63.6300
Denmark	7	0.0552	−0.2590	0.0677	0.3442	0.2280
France	8	−0.0669	−0.6450	−0.0184	0.3606	0.3061
Germany	5	0.1029	−0.0720	0.0436	0.3538	0.1683
Hong Kong	9	2.6304	−27.5770	−4.1220	46.8621	22.6022
India	5	−1.6266	−3.7483	−1.6811	0.0551	1.3912
Italy	2	−0.0017	−0.0327	−0.0017	0.0293	0.0439
Japan	28	−0.0559	−0.4900	−0.1133	0.4892	0.2192
Netherlands	5	0.3846	0.1785	0.3760	0.5988	0.2034
New Zealand	5	−0.2720	−0.4770	−0.2929	−0.0856	0.1446
Norway	20	0.3132	−0.4666	0.0971	5.4174	1.2491
Sweden	5	−0.0206	−0.2913	−0.0152	0.2680	0.2659
United Kingdom	7	0.1309	−0.2239	0.1120	0.6034	0.2733
USA	17	0.0962	−0.3908	0.0157	1.2329	0.4071

Notes: $N^*(-)$ denotes the number of firms with significant negative coefficients at all conventional levels (90%, 95% and 99% confidence levels), while $N^*(+)$ represents the number of firms with significant positive coefficients at all conventional levels.

number of firms with negative coefficients (12 firms) far outweighs those with positive coefficients (two firms) for both interest rates. We can, therefore, confidently propose that the stock returns of shipping firms are generally negatively impacted by fluctuations in interest rates.

Table 3. Short-term interest rate exposure and summary statistics.

Panel A: Exposure to short-term interests rates during 18 April 1997 to 31 September 2005

Country	$N^*(-)$	$N^*(+)$	Total exposure	Total firms	With exposure (%)
Australia	0	0	0	3	0.00
Canada	0	0	0	5	0.00
China	2	0	2	12	16.67
Denmark	0	0	0	7	0.00
France	2	0	2	8	25.00
Germany	0	0	0	5	0.00
Hong Kong	1	0	1	9	11.11
India	0	1	1	5	20.00
Italy	0	0	0	2	0.00
Japan	2	0	2	28	7.14
Netherlands	0	0	0	5	0.00
New Zealand	0	0	0	5	0.00
Norway	1	0	1	20	5.00
Sweden	1	0	1	5	20.00
United Kingdom	2	0	2	7	28.57
USA	1	1	2	17	11.76
Total	12	2	14	143	9.79

Panel B: Summary statistics for interest rate exposure for the period 18 April 1997 to 31 September 2005

Country	Number of firms	Mean	Minimum	Median	Maximum	SD
Australia	3	0.0004	−0.0018	−0.0010	0.0041	0.0032
Canada	5	−0.0012	−0.0040	−0.0012	0.0017	0.0020
China	12	0.0005	−0.0129	0.0013	0.0103	0.0073
Denmark	7	−0.0036	−0.0089	−0.0039	0.0009	0.0029
France	8	−0.0026	−0.0115	−0.0039	0.0112	0.0066
Germany	5	−0.0005	−0.0040	−0.0003	0.0025	0.0025
Hong Kong	9	0.0017	−0.0038	0.0021	0.0061	0.0038
India	5	0.0037	−0.0010	0.0034	0.0082	0.0043
Italy	2	−0.0004	−0.0013	−0.0004	0.0005	0.0013
Japan	28	−0.0112	−0.0263	−0.0146	0.0290	0.0108
Netherlands	5	−0.0045	−0.0055	−0.0049	−0.0031	0.0011
New Zealand	5	−0.0012	−0.0027	−0.0015	0.0021	0.0020
Norway	20	0.0007	−0.0046	0.0006	0.0077	0.0032
Sweden	5	−0.0081	−0.0072	−0.0038	−0.0024	0.0113
United Kingdom	7	−0.0025	−0.0056	−0.0026	0.0004	0.0019
USA	17	−0.0002	−0.0179	−0.0013	0.0286	0.0087

Notes: $N^*(-)$ denotes the number of firms with significant negative coefficients at all conventional levels while $N^*(+)$ represents the number of firms with significant positive coefficients at all conventional levels.

Panel A of Table 5 summarises the exposure of shipping firms' stock returns to oil prices. Interestingly, we find more significant positive exposure coefficients (16 firms) than negative coefficients (four firms). This result contradicts our proposed hypothesis of a negative relationship between oil firms' stock returns and oil prices.

Table 4. Long-term interest rate exposure and summary statistics.

Panel A: exposure to long-term interests rates during the period 18 April 1997 to 31 September 2005

Country	$N^*(-)$	$N^*(+)$	Total Exposure	Total firms	With exposure (%)
Australia	0	0	0	3	0.00
Canada	0	0	0	5	0.00
China	1	0	1	12	8.33
Denmark	2	0	2	7	28.57
France	1	1	2	8	25.00
Germany	0	0	0	5	0.00
Hong Kong	1	0	1	9	11.11
India	1	0	1	5	20.00
Italy	1	0	1	2	50.00
Japan	1	0	1	28	3.57
Netherlands	0	0	0	5	0.00
New Zealand	0	0	0	5	0.00
Norway	3	0	3	20	15.00
Sweden	0	0	0	5	0.00
United Kingdom	1	0	1	7	14.29
USA	0	1	1	17	5.88
Total	12	2	14	143	9.79

Panel B: Summary statistics for long-term interest rate exposure for the period 18 April 1997 to 31 September 2005

Country	Number of firms	Mean	Minimum	Median	Maximum	SD
Australia	3	0.0003	−0.0014	−0.0013	0.0037	0.0029
Canada	5	0.0020	−0.0037	0.0037	0.0041	0.0033
China	12	−0.0003	−0.0084	0.0005	0.0054	0.0040
Denmark	7	−0.0040	−0.0113	−0.0001	0.0024	0.0064
France	8	0.0026	−0.0358	0.0014	0.0332	0.0191
Germany	5	−0.0007	−0.0070	−0.0024	0.0116	0.0072
Hong Kong	9	−0.0068	−0.0193	−0.0075	0.0051	0.0078
India	5	−0.0026	−0.0070	−0.0020	0.0013	0.0031
Italy	2	−0.0008	−0.0039	−0.0008	0.0022	0.0043
Japan	28	−0.0038	−0.0309	−0.0035	0.0099	0.0070
Netherlands	5	−0.0001	−0.0045	−0.0008	0.0053	0.0040
New Zealand	5	0.0008	−0.0039	0.0022	0.0043	0.0033
Norway	20	−0.0023	−0.0260	−0.0014	0.0185	0.0091
Sweden	5	0.0006	0.0012	−0.0068	−0.0003	−0.0184
United Kingdom	7	0.0033	−0.0011	−0.0066	−0.0008	0.0019
USA	17	−0.0004	−0.0092	−0.0010	0.0080	0.0054

Notes: $N^*(-)$ denotes the number of firms with significant negative coefficients at all conventional levels while $N^*(+)$ represents the number of firms with significant positive coefficients at all conventional levels.

Furthermore, we find that Norway has the maximum exposure coefficient of 41.37%. Referring back to Table 5, Panel B, we also observed that Norway had the maximum exposure to oil prices, and second highest mean (0.0929).

In Table 6, we report the overall exposure of all shipping firms in our study to exchange rate, interest rate and oil price risk.

Table 5. Exposure to oil prices and summary statistics.

Panel A: Exposure to oil prices during the period 18 April 1997 to 31 September 2005

Country	$N^*(-)$	$N^*(+)$	Total exposure	Total firms	With exposure (%)
Australia	1	0	1	3	33.33
Canada	1	0	1	5	20.00
China	0	0	0	12	0.00
Denmark	0	2	2	7	28.57
France	0	0	0	8	0.00
Germany	0	1	1	5	20.00
Hong Kong	0	0	0	9	0.00
India	0	0	0	5	0.00
Italy	0	2	2	2	100.00
Japan	1	0	1	28	3.57
Netherlands	0	0	0	5	0.00
New Zealand	0	1	1	5	20.00
Norway	0	7	7	20	35.00
Sweden	0	0	0	5	0.00
United Kingdom	1	0	1	7	14.29
USA	0	3	3	17	17.65
Total	4	16	20	143	13.99

Panel B: Summary statistics for exposure to oil prices for the period 18 April 1997 to 31 September 2005

Country	Number of firms	Mean	Minimum	Median	Maximum	SD
Australia	3	0.0541	−0.1096	−0.0504	0.3224	0.2342
Canada	5	−0.0197	−0.2674	0.0456	0.0679	0.1407
China	12	0.0170	−0.0799	0.0299	0.0890	0.0487
Denmark	7	0.0704	−0.0724	0.0685	0.1873	0.0969
France	8	0.0323	−0.0449	0.0130	0.1980	0.0762
Germany	5	0.0772	−0.0010	0.0596	0.1637	0.0621
Hong Kong	9	0.0795	−0.1069	0.1069	0.2208	0.1058
India	5	0.0224	−0.0914	0.0234	0.1248	0.0821
Italy	2	0.0990	0.0887	0.0990	0.1093	0.0146
Japan	28	−0.0064	−0.1918	0.0049	0.0843	0.0613
Netherlands	5	0.0427	−0.0318	0.0660	0.0821	0.0474
New Zealand	5	0.0185	−0.0392	0.0159	0.0658	0.0385
Norway	20	0.0929	−0.1580	0.0786	0.4137	0.1279
Sweden	5	0.0465	0.0833	0.0265	0.0192	−0.1166
United Kingdom	7	−0.0200	−0.0749	−0.0256	0.0234	0.0354
USA	17	0.0084	−0.3630	0.0315	0.3271	0.1589

Notes: $N^*(-)$ denotes the number of firms with significant negative coefficients at all conventional levels while $N^*(+)$ represents the number of firms with significant positive coefficients at all conventional levels.

In Panel A, we only find a positive (and significant) relationship between oil prices and stock returns, but this again contradicts our hypothesis of a negative association. Although the coefficient of the 10-year Government bond is negative, it is insignificant at all conventional levels. In Panel B, the results reveal that exchange rates have the highest mean coefficient of 1.66. This suggests that, on the average, the stock returns of shipping firms are more exposed to exchange rate risk. On the other

Table 6. Summary of shipping firms' total exposure exchange rates, interest rates and oil prices.

Panel A: Panel analysis of exposure of all firms to ER, SH, LG and OIL for the period 18 April 1997 to 31 September 2005

Constant	ER	TB	GB	OIL	Adjacent R^2	*F*-Statistics
0.0030	0.0099	0.0001	−0.0004	0.0338**	0.0011	10.3664**

Panel B: Summary statistics for exposure of all shipping firms to ER, SH, LG and OIL for the period 18 April 1997 to 31 September 2005

	ER	SH	LG	OIL
Mean	1.6611	−0.0026	−0.0018	0.0313
Minimum	−27.5770	−0.0263	−0.0358	−0.3630
Median	−0.0152	−0.0016	−0.0013	0.0281
Maximum	219.7924	0.0290	0.0332	0.4137
SD	19.1668	0.0080	0.0077	0.1035

Notes: **Significant at the 99% level of confidence; ER, exchange rates; SH, short-term interest rates and LG, long-term interest rate variable.

hand, the mean coefficient for the long-term interest rate is the lowest in absolute terms suggesting that stock returns of shipping firms are least exposed to this risk.

4.4. *The determinants of exchange rate, interest rate and oil price exposures of international shipping firms*

We find that the long-term debt variable has a mean of 197.41. This indicates that the capital requirements of shipping firms are to a large extent financed by debt (to save space, descriptive statistics of the explanatory variables are available from the authors upon request).

We also find that there is no strong correlation among the variables used to resolve the determinants of firm's exposure to exchange rate, interest rate and oil price risk (to save space, correlation coefficients of the explanatory variables are available from the authors upon request).

Table 7 shows the determinants of exchange rate, interest rate and oil price exposure of shipping firms. The table shows that sensitivity to exchange rates is not materially affected by any of the explanatory variables. Although we hypothesise that larger firms would be less exposed to exchange risk, we found that size did not affect exposure. This may suggest that most firms in the sample had sufficient resources for exchange risk management. Then again, both foreign sales and foreign assets are statistically unrelated to exchange exposure. We put forward that since freight rates are quoted in dollars, and then there are fewer currencies to manage; so this may account for the success of most firms in the sample in hedging this exposure regardless of the level of foreign sales.

The financial commitment argument suggesting a positive relationship between long-term debt and exchange rate exposure was supported in terms of the sign of the coefficient. However, it was not statistically significant at the prescribed levels. Furthermore, we find negative relationships between size and the 3-month Treasury

Table 7. Determinants of shipping firms' exposure to exchange rates, interest rates and oil prices.

	ER	SH	LG	OIL
INTERCEPT	2.5170	0.0090	0.0060	0.0580
SIZE	−0.0465	−0.0008**	−0.0005*	−0.0023
FSALES	−0.0526	−0.0001**	0.0000	−0.0002
FASSETS	−0.0024	−0.0000	−0.0000	−0.0001
LTDEBT	0.0003	−0.0000	−0.0000	−0.0000
PAYOUT	−0.8550	−0.0007	−0.0006	−0.0091
QRATIO	−0.1550	0.0010**	−0.0002	0.0214*
MVBV	0.9534	0.0001	−0.0004	−0.0130

Note: *5% level of significance; **1% level of significance.

bill and the 10-year Government bond, respectively. This corroborates our hypotheses and implies that larger firms are less sensitive to interest rate exposure both in the short term and long term. However, contrary to the stated hypotheses, firms with more cash (higher quick ratio) are more exposed to the short-term interest rate, and firms with a higher level of foreign sales are less exposed. Our hypothesis for a positive relationship between changes in oil prices and the quick ratio is also confirmed from Table 7. We suggest that for firms exposed to oil price changes, holding a larger buffer of cash (greater quick ratio) is one way of attempting to deal with the risk. Nonetheless, because of space constraints, the results for the market risk and individual companies and their coefficients have not been presented in this study, but these are available from the authors, if required.

5. Conclusion

This study investigated the exposure of shipping stock returns to exchange rates, interest rates and oil price risks. We find strong evidence that the stock returns of shipping firms are more affected by exchange rate exposure than interest rate exposure or even oil price exposure. However, contrary to our hypothesis, the results indicate that a higher proportion of shipping firms exhibit positive exposure coefficients, signifying that they benefit from an appreciation of the dollar. The same scenario was observed for exposure to oil prices. Again in this instance, we envisaged a negative hypothesised relationship between oil prices and the stock returns, but a majority of the coefficients were positive indicating that an increase in the price of oil is beneficial for shipping firms. Nonetheless, our findings for exposure to short- and long-term interest rates were as expected as we found mostly negative exposure coefficients.

Furthermore, we explored the determinants of exchange rate, interest and oil price exposure for stock returns of shipping firms. We find no support for the hypothesis that foreign sales or foreign assets are positively related to exchange rate exposure. However, we find that size influences interest rate exposure as we found significant negative coefficients for the 3-month Treasury bill and the 10-year Government bond. We posit that since most shipping firms are relatively large, they should have adequate resources to manage their exposures effectively. Therefore, this should reduce their exposure to interest rate risk and even exchange rate and oil price risk.

We also find significant positive coefficients between the quick ratio, and both the 3-month Treasury bill and oil price, suggesting that firms that are more exposed to the 3-month Treasury bill or short-term interest rates and firms that are more exposed to oil prices maintain a higher buffer of cash.

Overall, due to the low level of exposures reported, we are of the opinion that shipping firms are well able to manage and suppress the effects of these risks on their stock returns. Survey studies on the use of derivatives have found that exposure to exchange rate and interest rate risks is more important for firms and industries and therefore more managed with derivatives instruments than the risk arising from other sources, such as fluctuations in commodity prices and equity prices [23, 60, 66, 67]. As the results indicate that few companies have a significant exposure to exchange and interest rates, this suggests that most shipping firms have utilised reasonably successful hedging strategies to reduce the impact of these macroeconomic risks. Notably, shipping is an industry that is intrinsically highly geared towards international trade and *prima facie* may therefore be more susceptible to exchange rates, interest rates and oil prices. However, it was highlighted at the beginning of this study that typically dollar-denominated labour costs and the dollar-denominated interest costs on selected dollar currency loans available to international shipping companies do provide to some extent a natural hedge against exchange rate risk. Forwards, futures, options and swaps may mitigate residual risk, albeit at a cost. It is only rational that the impact of any residual risks should be constantly monitored so as to protect the existence of an industry that is very vital for national sustainability, growth and economic development. We hope that the results of this study will provide invaluable information for investors, practitioners, treasurers and finance managers engaged in the intricate but yet rewarding business of shipping. However, as the study investigates the exposure of shipping firms' stock return to exchange rate risk, interest rate risk and oil price risk in the period between 1997 and 2005, the study does not examine the effect of financial crisis on shipping market in the period of 2007 to 2009 leaving this to another research in the future. Another limitation of this study is, that this study aims to explore and estimate the exposure of international shipping firms' stock returns to only exchange rate risk, interest rate risk and oil price risk; other factors such as political variables, competitive advantages, are not examined because data availability. This suggests another idea for future research. Stock returns (as proxies for firm value) were used as dependent variable in the exposure model; we suggest using different performance measures such as profitability as dependent variable to examine the effect of those types of risk on firm performance. In addition, also to further research, taking into account that the business of shipping is cyclical, we suggest that a sub-period analysis might reveal those periods whereby shipping stock returns are more susceptible to exchange rate, interest rate and oil price risk. Furthermore, segregating the industry into its respective sectors such as container ships, dry bulk carriers and tankers might enhance the empirical results and shed more light on the exposure conundrum.

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