Τμήμα Λογιστικής και Χρηματοοικονομικής

Μικροοικονομικοί και Μακροοικονομικοί Παράγοντες που επηρέασαν τις αποδόσεις των εισηγμένων ναυτιλιακών εταιρειών σε ανεπτυγμένες και αναπτυσσόμενες αγορές κατά την πρόσφατη χρηματοοικονομική κρίση

Νάτσης Δ. Πέτρος

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Εγκρίνουμε την εργασία του

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ΗΜΕΡΟΜΗΝΙΑ

Δηλώνω υπεύθυνα ότι η συγκεκριμένη πτυχιακή εργασία για τη λήψη του Μεταπτυχιακού Διπλώματος Ειδίκευσης στη Λογιστική και Χρηματοοικονομική έχει συγγραφεί από εμένα προσωπικά και δεν έχει υποβληθεί στο πλαίσιο κάποιου άλλου μεταπτυχιακού ή προπτυχιακού τίτλου σπουδών, στην Ελλάδα ή στο εξωτερικό. Η εργασία αυτή έχοντας εκπονηθεί από εμένα, αντιπροσωπεύει τις προσωπικές μου απόψεις επί του θέματος. Οι πηγές στις οποίες ανέτρεξα για την εκπόνηση της συγκεκριμένης διπλωματικής αναφέρονται στο σύνολό τους, δίνοντας πλήρεις αναφορές στους συγγραφείς, συμπεριλαμβανομένων και των πηγών που ενδεχομένως χρησιμοποιηθήκαν από το διαδίκτυο.

ΝΑΤΣΗΣ Δ. ΠΕΤΡΟΣ

Contents

Abstract

The aim of this dissertation is to examine the microeconomic and macroeconomic factors that influenced the excess stock returns of international shipping firms, during the recent financial crisis and if the different sectors have different risk-return profiles. Another thing examined is if shipping sectors in developed markets have the same sources of risk as sectors in emerging markets. For this reason a sample of 86 shipping companies from 21 developed and emerging countries was selected. Shipyards, shipping companies operating passenger ships, companies operating drilling ships, supply vessels and inland vessels were excluded from the sample. The period covered starts from the collapse of Lehman Brothers, in September 2008 that fired the recent financial crisis and end in December 2015.

The set of variables includes the a) Morgan Stanley Capital International All Country World Index as a proxy for the market portfolio, the unexpected changes, b) in Brent oil prices, c) in the US dollar value against a basket of major trading partners' currencies, d) in industrial production and e) inflation in OECD countries, f) in the ClarkSea Index, g) in the world orderbook measured in dead weight tonnage, h) the current ratio, i) the price to cash flow ratio, j) the price to book value ratio, k) the common equity to total assets ratio, and l) the size as measured by the logarithm of the annual sales of each company. The Ordinary Least Squares method is employed to establish the relation between this set of variables and the shipping stock returns.

The results suggest that the shipping companies had sensitivities to different factors not only across sector but also across market classification during the period examined. The results also demonstrate that a multifactor model explains the excess shipping stock returns better than the Capital Asset Pricing Model.

The results could be beneficial for the investor who wants to diversify her/his portfolio by including or excluding sectors according to her/his risk averse, and for the corporate manager who has a model to calculate the cost of equity capital and assess investment projects.

Introduction

Shipping is of paramount importance for people and a key sector for the international economy since the ancient time. It enabled people to carry goods from one place to another, develop trade and consequently improve their economic and living conditions.

Maritime transport handles over eighty percent of the volume of global, and about ninety percent of that of the developing countries (UNCTAD, Review of Maritime Transport 2015) and this is because shipping enables the efficient movements of materials around the globe at very low prices, compared to other ways of transport. Without these advantages of the shipping industry the international trade would be almost infeasible. Thereafter, one can say that the demand for seaborne transport is a direct derivative of global trade and linked to the business cycle. This makes the shipping industry highly cyclical and risk loaded with specific idiosyncratic characteristics, such as high financial and operating leverage (Drobetz et al 2013). As Stopford (1997) mentioned, the accurate reading of the market by the ship-owner and the good timing of selling, purchasing and chartering ships are crucially important for the survival of the shipping company, as the market price of a vessel can change by millions of dollars within just a few months.

All the above mentioned facts may indicate why even when shipping companies the decision to go public they do not attract number of investors as all these ups and downs are perceived negatively by them, and why the majority of these companies is privately owned.

In order to achieve the highest efficiency of transport possible, the shipping industry is divided into separate sectors with few things in common and each one specialising in different kinds of goods being transported. Even the ships that are employed have totally different characteristics, ranging from the type and size up the distance that can be covered.

A major separation based on the type of cargo being carried is between bulk and liner shipping. Bulk shipping specialises in the transport of large cargo parcels that can be carried on a one ship one cargo basis. Bulkers have no specific route but are in constant search of cargoes to transport all around the globe.

Liner ships carry smaller cargo parcels, usually in containers, and serve on specific routes around the world. Containerisation was proposed as a solution to the escalating volume of world trade during the 1960s and is held as a technical revolution in shipping.

What makes these two sectors different, among others, is the way their shore-based activities are organised. While the liners need a lot of personnel for the everyday activities, the bulkers need fewer, but the decisions taken need the close control and attention of the ship-owner. Another characteristic of the latter is that large companies, shipping large quantities of bulk materials, e.g. oil companies, often run their own shipping fleets to handle a proportion or all of their transport requirements and ensure a predictable cost without the need to resort to the charter market.

The volatile shipping market with all these ups and downs of the freight rates, offers a great chance to those who want to speculate and buy low and sell high. But this requires close attention and ability to forecast and predict the peaks and troughs of the market. The difficulty lies in that each shipping cycle is different than the previous and the next. As almost everything in the free economy, freight rates are determined by the demand and supply for shipping services. Stopford (1997) mentions five variables affecting each side of the freight market. The world economy, seaborne commodity trades, average haul, political events and transport costs on the demand side and the world merchant fleet, its productivity, the shipbuilding production, scrapping and loses, and freight rates on the supply side.

The ups and downs of the shipping market stem from the fact that demand is volatile, quick to change and unpredictable, while on the other hand supply reacts slowly to changes. In this way, even small imbalances in demand and supply are amplified, creating the volatility in the freight rates market.

During the last decades the world has seen rapid changes like never before. Barriers and borders are being removed, the free movement of goods, services, capital and people is allowed and the international business seems to be benefited by this situation. As the world becomes even more and more integrated, severe risks seem to arise, sometimes threatening the same existence of the company. A couple of these risks are the exchange rate risk, the interest rate risk and the risk coming for the oil price fluctuations.

Shipping, as a predominantly international and capital intensive industry, sensitive to macroeconomic factors (Cullinane 1991), could not be an exception. Its main revenue, freight rates and oil, which consists the major expenses for the movement of the vessels, are both denominated in US dollars, while a proportion of the costs is in a variety of other currencies, meaning that fluctuations in these currencies impact the operating profit and the company value.

Also, ships cost millions of dollars, meaning that the capital availability at reasonable cost and the careful project selection are crucial (Cullinane and Panayides 2000). The need to borrow high amounts of money makes shipping companies vulnerable to interest rate fluctuations.

The benefits of the global integration are unquestionable and if a company wants to take advantage of these, needs to plan a risk management strategy that reduces the impacts of the above mentioned risks. One possible way is by using derivative products, but the careful use of those is essential, as otherwise the company may face large losses or even go bankrupt (Bartram, Dufey and Frenkel 2005).

From the microeconomic point of view, the financial leverage of the firm is an important risk factor, as the higher the debt, the higher the probability of default. Hamada (1969, 1972) has shown that the risk of a firm's common stock should be positively correlated with the firm's leverage.

Furthermore, larger firms are perceived as being less risky, as they grow gradually in their existing size and hence, the probability of bankruptcy is smaller than in the case of newly founded smaller firms. Also, larger companies have most probably diversified their operations compared with smaller ones.

Despite the fact that new capital regulations for banks have drained bank financing for new vessels, bank lending still plays the most important role in shipping finance. However, shipping companies adjusted the methods and tools they use to fund their investments and since the 1990s a lot of interest has been placed in raising funds from the public, either by borrowing through bonds or by selling shares through the stock exchanges around the world. This affects not only the capital structure, but also the corporate governance of the firms, as they are transformed from family-owned to publicly listed, multi-shareholder entities (Syriopoulos and Theotokas 2007).

As investors, who are interested in shipping companies stocks, analyse the opportunities and prospects of each firm, they buy and sell stocks thus affecting their prices. One kind of analysis they use, is the fundamental analysis, which is the study of a stock's value using microeconomic and macroeconomic data. The main concept of this kind of analysis is that each one stock has an intrinsic value, which is a function of the general state of the economy, the market and the industry the company operates in and company's fundamental microeconomic factors. Some of the factors, on which the investors focus, are the aforementioned, exchange rates, interest rates, oil prices, leverage and size. King (1966) was the first to argue that stock price changes can be explained by market, industry and company effects.

In modern finance, a well-diversified investor expects to be compensated only for the additional systematic risk an individual security adds to his/her portfolio, as the non-systematic risk can be diversified away. As a result, no extra reward can be earned by bearing diversifiable risk.

One way to control one asset's source of systematic risk and measure its sensitivity to this is by its beta. Then this beta is used in the Capital Asset Pricing Model of Sharpe (1964), Lintner (1965) and Mossin (1966) or other multifactor models which contain macroeconomic or accounting variables (Chen et al 1986, Fama and French 1992,1995) and these are subsequently used to compute one firm's cost of equity, assess single investment projects and evaluate the entire company.

While the Capital Asset Pricing Model suggests that the market is the only source of systematic risk for investors who hold fully diversified portfolios, Ross (1976), Roll (1977), Roll and Ross (1980) and Chen et al. (1986) criticised it and tried to find factors other than the market that may influence asset prices, thus proposing the Arbitrage Pricing Theory. The Arbitrage Pricing Theory suggests that the expected return of a financial asset can be modelled as a function of a set of economic state variables which are candidates as sources of systematic asset risk.

As Hamada (1969, 1972) and Mandelker and Rhee (1984) suggest, someone would expect that companies with high financial leverage, such as those of the shipping industry, should have relatively high systematic risk. But, surprisingly, market betas lower than the unity have been reported (Kavussanos and Marcoulis 1997a,b,

Kavussanos and Marcoulis 2000a,b, Grammenos and Arkoulis 2002, Kavussanos et al 2003, Gong et al. 2006 and Drobetz et al. 2010)

Some studies, like Officer (1973) suggest that the CAPM's market factors changes intertemporally or even disappears for the period 1962-1981 (Lakonishok and Shapiro 1986). Regarding the shipping industry Gong et al. (2006) have documented time-varying market betas.

In this Dissertation, the main effort will be to find macroeconomic sources of systematic risk and microeconomic variables affecting the returns of the shipping companies and if the companies belonging to different subsectors of the shipping industry and being listed in developed or emerging markets, as being classified by Morgan Stanley Capital International, have different determinants of stock returns, during the most recent financial crisis, starting from the collapse of Lehman Brothers.

The separation between developed and emerging markets is done because of the different characteristics they have, the low correlation between these two type of markets been historically reported (Harvey 1995, Bekaert and Harvey 2000) and the high participation of local investors in the emerging markets who are likely to evaluate their portfolios in light of local economic and market conditions (Bekaert and Harvey 1997b).

The findings would be useful for investors considering investing in shipping equities, either for diversification or for speculation and corporate managers willing to assess possible investment projects from the company's point of view.

The rest of this dissertation is organised as follows. Section 2 includes the literature review, Section 3 includes the data description, Section 4 analyses the empirical methodology, Section 5 presents the empirical results and Section 6 provides a conclusion.

Literature Review

The Capital Asset Pricing Model

King (1966) was the first who tried to find out what determines the stock price returns and ended up concluding that the stock prices fluctuate due to changes at the macroeconomic level, which in turn affect the industry in which the company under research operates and the general condition of the stock market, and at the company's microeconomic level affecting its fundamentals and consequently its value.

Sharpe (1964), Lintner (1965) and Mossin (1966) by introducing independently the Capital Asset Pricing Model, presented King's findings in a more formal way and suggested that the stock returns can be expressed as a linear function of just one factor, the market portfolio of assets.

The Capital Asset Pricing Model divides the asset's risk into two parts, the market or systematic risk, representing the asset's risk related to the market's riskiness and the residual or non-systematic risk, which is unrelated to the market riskiness.

The proposed equation calculating the excess expected return is the following:

$$R_{it} - R_{ft} = \beta_i * (R_{Mt} - R_{ft}) + \varepsilon_{it,}$$

where R_{it} is the expected return to stock i, R_{ft} is the risk free rate, R_{Mt} is the expected return of the market portfolio, the three of them measures over time t, β_i is the stock's beta or systematic risk, a measure of the stock's co-movement with the market portfolio and finally ε_{it} is a zero mean disturbance term, representing the portion of the stock return that cannot be explained by the regression with the market portfolio.

The stock's beta is calculated through the single index market model of Markowitz (1959, pp. 98-101) and Sharpe (1963) from historical data and is equal to:

$$\beta_i = \text{cov}(\hat{R}_i, \hat{R}_M)/\sigma^2(\hat{R}_M).$$

The next equation represents the market model:

$$\hat{R}_{it} = \alpha_i + \beta_i * \hat{R}_{Mt} + \varepsilon_{it},$$

where $\hat{R}_{it}$ is the raw return to stock i at time t, $\hat{R}_{Mt}$ is the market portfolio's return at time t and α_i and β_i are parameters estimated via Ordinary Least Squares. It is expected

that α_i has a value equal to zero and any deviation from that, means possible mispricing of the stock. More specifically, if α_i is bigger than zero it means that the stock is underpriced for the period examined. On the other hand, a negative value of this parameter means that the stock is overpriced for the period.

The Market Beta

Black, Jensen and Scholes (1972) find evidence of a positive simple relation between average stock returns and β for the period prior to 1969. Fama and MacBeth (1973) give support to these findings, proposing that an investor should have in mind that a positive trade-off between risk and return exists and that the relation between risk and expected return is linear.

Friend and Blume (1970) as well as Black, Jensen and Scholes (1972) report that portfolios with low systematic risk, meaning lower betas, earn on average significantly higher returns that predicted by the CAPM, and that portfolios with higher systematic risk earn less than predicted by the model.

As regarding the shipping industry, a number of studies suggest an unexpected low beta, considering the riskiness of this industry. Grammenos and Marcoulis (1996) report a positive and highly significant market beta, when the stock returns are regressed only with the market portfolio, suggesting that it has some explanatory power over the shipping stocks returns. But when the book value of leverage and the average age of the company's fleet are added in the regression, the market beta loses its explanatory power.

Kavussanos and Marcoulis (1997a) find for the period from 1985 to 1994 an industry beta coefficient equal to 0,92 but not statistically different from the unity. Even when splitting the period to two sub periods they find betas lower that one. They find similar results (Kavussanos and Marcoulis 1997b) suggesting a lower than the average systematic risk, even when employing other microeconomic variables as possible explanatory factors.

Examining for the period July 1984 till June 1994 (Kavussanos and Marcoulis 2000a) and for the period July 1984 till June 1995 (Kavussanos and Marcoulis 2000b) they find positive and statistically significant values of the alpha coefficient, suggesting

underpricing for the water transportation stocks, and positive and statistically significant but lower than the unity market betas.

Grammenos and Arkoulis (2002) examining for the period December 1989 to March 1998, report negative and statistically significant alpha coefficient, thus providing evidence of possible overpricing of the shipping stocks during this period. In agreement with the abovementioned they find positive and statistically significant betas, but again lower than one.

Kavussanos et al (2003) ended up to similar findings for the period 1996-1999, reporting negative alphas and lower than unity betas.

Gong et al (2006) attributed these unexpectedly low beta values to possible thin trading biases, and used the Scholes-Williams (1977) correction for thin trading firms' betas but again found values lower than one.

Finally, Drobetz et al. (2010) examined the period January 1999 till December 2007 and documented positive and strongly significant alphas and lower than the unity values for the systematic risk.

Weaknesses of the Market Beta

The beta coefficient of a stock is most possible to change over different time frames. Fabozzi and Francis (1979) examined a sample of 694 New York Stock Exchange stocks over the period from December 1965 to December 1971 and found that the betas may vary significantly through different sub-periods of their study.

In another study, Bos and Newbold (1984) suggested that macroeconomic factors such as changes in inflation rate, general market conditions and expectations about relevant future events or microeconomic changes in the company or in the business environment peculiar to the company can cause variations to the beta coefficient through time.

Furthermore, Fama and French (1992) find that there exists no relation between the beta and the average returns for the period from 1963 till 1990 and that this relation is weak for the period from 1941 till 1990.

As regarding the emerging markets, Chui and Wei (1998) examined the stock markets of Hong Kong, Korea, Malaysia, Taiwan and Thailand from July 1977 to June 1993 and reported a weak relation between average stock returns and market betas.

Other studies indicate that the beta coefficient may be biased due to non-synchronous or infrequent trading. Scholes and Williams (1977) find evidence that Ordinary Least Squares estimators are biased when referring to non-synchronous trading of securities and proposed the following adjustment for the beta coefficient:

$\beta_i^{SW}=(\beta_i^{-1} + \beta_i + \beta_i^{+1})/(1+2\rho_{1M})$,

where β_i^{-1},β_i and β_i^{+1} are obtained from an Ordinary Least Squares regression for one period lagged, contemporaneous and one period lead market return respectively, and ρ_{1M} is the correlation coefficient of market returns.

Dimson (1979) and Cohen et al (1983) find support to the previous findings and propose that the problem is getting worse for thinly traded stocks with the reduction in sampling interval.

Hawawini (1983) in his study presents a model describing how a change in the sampling interval affects the direction and size of changes in beta. The main concept is that as the interval gets longer, betas of thinly traded stocks increase, while those of frequently traded stocks decrease. Brailsford and Josev (1997) find evidence from the Australian stock market that give support to this prediction.

Roll (1992) suggests that the correlation of a stock's returns with a market index depends on how well the industry, in which the company belongs, is represented in the relevant market index. More specifically, a company's stock returns may be underestimated if its industry is not adequately represented in the market index.

A possible way to avoid thin-trading biases, which are more severe for smaller and illiquid companies, is to construct stock portfolios, thus achieving a better estimation of the beta coefficient (Gong et al 2006 and Sercu, Vandebroek and Vinaimont 2008).

Macroeconomic Factors

During the late seventies and early eighties some scepticism has risen against the validity of the Capital Asset Pricing Model. Roll (1977) suggested that the composition of the true market portfolio is not known to the researcher and that the measurement of beta is subject to the selection of the relevant market portfolio, meaning that if two investors choose two different market portfolios the same stock will have two different beta values.

Chen, Roll and Roll (1986) setted the foundations of the Arbitrage Pricing Theory arguing that any economic factor that influences the expected cash flow ending up to the investor or affecting the discounting factor should be employed in order to explain the stock price fluctuations. It is obvious that they cannot claim to have found all the possible variables necessary to explain the stock returns. After their work a series of papers tried to find various other explanatory macroeconomic factors for asset pricing.

Oil Price

One possible important economic factor they investigated was the oil price, but they found no significance of the oil betas for pricing in the overall period they examined.

Hamao (1988) examined if the oil price changes were priced in the Japanese stock market for the period January 1975 to December 1984 but like Chen et al (1986) found no evidence of such a relation.

On the other hand, Chen and Jordan (1993) included the early 1970s in their sample period so that to capture the oil price shocks of this period on the US stocks and found a negative relation.

The shipping stocks returns could be affected by the oil price changes due to two reasons. Firstly, oil is a major input factor as it is an important part of the voyage cost and without it any carriage service would be almost infeasible, and secondly, tanker freight rates are closely linked to oil prices.

Kavussanos and Marcoulis (2000a,2000b) report positive and statistically significant betas for the unanticipated oil price changes, meaning that an increase in oil prices is beneficial for shipping firms.

Contrary to these findings, Grammenos and Arkoulis (2002) found that shipping stock returns are negatively related to oil prices.

Two more studies, Drobetz et al (2010) and El-Masry et al (2010), find positive oil betas for the shipping stocks, but the former only for the container ships sector.

Basher and Sadorsky (2006) examine a sample of 21 emerging markets from December 1992 to October 1995 and document a strongly a strong positive relation between the oil price beta and market returns.

Industrial Production

It is expected that higher industrial production, meaning improving economic conditions, should lead to higher stock returns.

Contrary to that, Chen et al (1986) in their study find no relation between industrial production and stock returns. Hamao (1988) reports a positive association between the variable and the Japanese equities, but surprisingly, Poon and Taylor (1991) find that exists a negative relation between the unexpected changes in industrial production and the United Kingdom stock market. In line with Chen et al (1986), Chen and Jordan (1993) find no association between the variable and the stock returns for the period they examined.

Concerning the shipping industry, Stopford (1997 p.118) mentions the close relation between the growth rate of sea trade and the OECD industrial output for the years from 1963 till 1995, as the world industrial production creates most of the demand for commodities traded by sea.

After that, a positive exposure of the shipping industry to the industrial production should be expected. But a number of studies end up to the opposite results. Kavussanos and Marcoulis (2000a, 2000b) find that the industry is negatively related to monthly growth rates in industrial production. Grammenos and Arkoulis (2002)

document no effect of the industrial production on shipping stock returns and Drobetz et al (2010, 2016) report a negative relation between them two.

Foreign Exchange

As the world becomes more integrated and companies from one country acquire activities in another country the foreign exchange fluctuations can impact their operating results, cash flows, investments, profitability and domestic and international competiveness and subsequently their value.

In his study Hamao (1988) found that the unanticipated changes in foreign exchange do not have any impact on the returns of the stock listed in the Tokyo Stock Exchange.

Abell and Krueger (1989) examined a sample of 17 industry portfolios for the period 1980 to 1986 and concluded that the weighted US dollar exchange rate as measured by the Federal Reserve Bank is not significantly related to beta.

Jorion (1990) revealed that in his sample of 287 United States multinational companies, the degree of foreign involvement playing a positive and significant role in their exposure to foreign exchange fluctuations for the period from January 1971, when the exchange rates started to fluctuate, till December 1987.

In their studies Dumas and Solnik (1995) and De Santis and Gerard (1998) justify the existence of foreign exchange risk premia in securities' returns in the international financial markets, while He and NG (1998) and Nydahl (1999) give support to Jorion's (1990) findings by proposing that higher foreign sales faction leads to higher foreign exchange exposure.

One possible way for companies to hedge against the foreign exchange exposure is by using derivative products but the careful use of those is essential, as otherwise the company may face large losses or even go bankrupt (Bartram, Dufey, Frenkel 2005).

Allayannis and Ofek (2001) and De Jong et al (2006) provide support to that, proposing that the exposure to foreign exchange fluctuations of non-financial companies can be reduced through on-balance sheet hedging.

The main revenues of the shipping companies, the freight rates, and the main expense, the fuel necessary for the movement of the ships, are both denominated in US dollar, meaning that a possible source of systematic risk for these companies are the fluctuations of their local currencies against the US dollar. Leggate (1999) tried to measure the impact of such movements on the operating results of the Norwegian shipping companies, concluding that they can be dramatically affected, both positively and negatively, depending on the direction of the movement in the exchange rate. Akatsuka and Leggate (2001) documented the exposure of the shipping companies to foreign exchange changes, and suggested that the impact of those changes on the stock prices depends on the level of exposure of each company.

Grammenos and Arkoulis (2002) examining for the period from December 1989 till March 1998 documented a positive coefficient between stock returns and the monthly unanticipated global exchange rate against the US$ in 10 industrialised countries, which means that a dollar depreciation implies higher returns since exchange rates are measured in US dollars per national currency units. Kavussanos et al (2002) find no connection between these two.

In contrast to Grammenos and Arkoulis (2002), Drobetz et al (2010) report a negative sign for the exchange rate for the period from 1999 to 2007, implying that a stronger US dollar has a negative effect on shipping stock returns.

El Masry et al (2010) seem to be in line with Grammenos and Arkoulis (2002) finding a positive exposure coefficient for most of the companies in their sample, but they find no support that a higher portion of foreign sales means higher exchange rate exposure, contrary to what has been reported by He and NG (1998) and Nydahl (1999).

Finally, Drobetz et al (2016) find that the exchange rate volatility has little explanatory power over the systematic risk levels.

Inflation

Fisher's hypothesis (1930) suggests that expected rates of return consist of a real return plus the expected rate of inflation, meaning that investors will be fully

compensated for any loss in their purchasing power caused by the rise of inflation. Thus, one would expect that stocks returns move directly with the inflation rate.

But a number of studies witness exactly the opposite. Miller Jaffe and Mandelker (1976), Nelson (1976) and Fama and Schwert (1977) examined the relation between stock returns and inflation for the period 1953 to 1971 and found a negative one. In line with the previous Chen et al (1986) document a negative coefficient.

On the other hand, Burmeister and McElroy (1988), as well as Kavussanos and Marcoulis (2000a,b) and Grammenos and Arkoulis (2002) find no impact of inflation on shipping stock returns.

These findings are surprising, considering that inflation affects both the expected cash flows and the discount rate that determine the stock prices.

Dead Weight Tonnage and Freight Rates

Zannetos (1966) has shown that a bigger laid up capacity of tanker vessels is accompanied with lower freight rates. In line with that Stopford (1997) proposed that shipbuilding production, scrapping and loses, and freight rates are some of the factors affecting the supply side of the supply side of the freight rate market. McConville (1999) suggested that laid up tonnage is a barometer of the economic and commercial condition of the shipping industry. Furthermore, Grammenos and Arkoulis (2002) found a negative relation between laid up tonnage and shipping stock returns, while Drobetz et al (2016) concluded that a higher freight rate volatility results into higher market beta values for the shipping stocks.

Microeconomic Factors

Some empirical studies have shown that not only macroeconomic variables can explain some of the stock returns, but also financial and accounting can prove to be useful for the prediction of future returns. Some of these "anomalies" which suggest that the Capital Asset Pricing Model is misspecified and that not all available information is fully reflect in stock prices, are the size effect of Banz (1981), the leverage effect of Bhandari (1988), the book equity to market equity witness by

Stattman (1980), Rosenberg, Reid and Lanstein (1985) and finally E/P effect documented by Basu (1977). The previous stock market "anomalies" could question the Efficient Market Hypothesis but their longevity proposes that they are most possibly evidence of a pricing model misspecification rather than a market inefficiency.

Size Effect

Ben-Zion and Shalit (1975) examined if the size of a firm is a determinant of risk and found a negative relation between size and beta. This means that bigger firms are perceived as being less risky than the smaller ones. They measured the firm's size by the logarithm of its sales rather that its equity market value, as the latter is correlated with leverage and is not independent of risk.

Banz (1981) finds that for the 1936-1975 period, small New York Stock Exchange firms earn, on average a higher return than the larger ones, even after adjusting for risk. But, he cannot explain if the factor is a proxy for any other possible factors correlated with size or it is size itself.

Fama and French (1992) found that market equity, a measurement of size, can explain some of the average stock returns and their variation. Fama and French (2012) suggested that there are larger value premiums for smaller stocks in North America, Europe and Asia Pacific regions.

Kavussanos and Marcoulis (1997b) came to the same results with the previous studies, suggesting that small water transportation companies in the United States significantly outperformed their larger counterparts and that medium and larger companies seem to have similar returns. Regarding size and total and systematic risk, they found an inverse relation, in line with Ben-Zion and Shalit (1975) meaning that smaller water transportation companies are riskier than the larger ones.

In contrast to the majority of literature, Kavussanos and Marcoulis (2000b) found a positive size effect, proposing that bigger water transportation companies outperform the smaller ones.

Examining 17 emerging markets, Fama and French (1998), proposed a premium for smaller firms. Chui and Wei (1998) found a significant size effect in Hong Kong, Korea, Malaysia and Thailand. Similarly to them, Rouwenhorst (1999) suggested that smaller stocks earn on average bigger returns their larger counterparts.

Leverage

Another factor that was found to be related to common stocks returns is the leverage ratio. Hamada (1969, 1972) shown that a company's systematic risk should be positively related with the company's leverage.

Bhandari (1988) , suggested that risk averse investor should ask a greater compensation for more leveraged firm's and came to the same results as Hamada(1969,1972), defining the company's leverage ratio as (Book Value of Total Assets – Book Value of Total Equity) / (Market Value of Equity).

Fama and French (1992) used two measurements for leverage. The first was defined as book assets to book equity (book leverage) and was found to be negatively associated average returns. The second defined as book assets to market equity (market leverage) and Fama and French, in line with Bhandari (1988), suggested that higher market leverage is associated higher average returns. To make the interpretation of the ratios' role easier Fama and French used their natural logarithm.

Regarding the shipping industry, Grammenos and Marcoulis (1996) concluded that Bhandari's (1988) measure is statistically insignificant. On the other hand, they found a positive and statistically significant at the 1% level coefficient for the book leverage. Contrary to the previous, Kavussanos and Marcoulis (1997b) found a negative relation between asset to book equity ratio and average stock returns. Kavussanos and Marcoulis (2000b) came to the same results, proposing a negative sign for the book leverage. They furthermore found no significance for the market leverage ratio.

Drobetz et al (2013) confirmed the common conjecture that shipping is a highly leveraged industry, as they found higher leverage ratios for the shipping companies compared with large samples of industrial firms, thus proposing a higher financial risk. Drobetz et al (2016) proposed a positive and statistically significant at the 1% level relation between financial leverage and corporate systematic risk.

Book Equity to Market Equity Ratio

One more ratio that has been found able to add to the cross- section of average is the book equity to market equity ratio. A company with a book to market ratio greater than one is perceived as being undervalued, while when the ratio is lower than one the company is overvalued.

Stattman (1980), examining for U.S. stocks found a positive relation between the ratio and the stocks' average returns. Rosenberg, Reid and Lanstein (1985) came to the same results as the previous.

Chan, Hamao and Lakonishok (1991), examined for any similar relation in the Japanese market, and found that book to market ratio has a significant role in explaining the cross-section of average returns. Fama and French (1992) proposed that stocks with higher book to market ratios seem to outperform those with lower values of the ratio.

As for the shipping companies, Kavussanos and Marcoulis (1997b, 2000b) found no significant relation between stock returns and the ratio.

Chui and Wei (1998), examining five Pacific-Basin emerging markets, proposed that the book to market ratio can explain the variation of expected stock returns in Hong Kong, Korea and Malaysia. In line with the previous, Lam (2002) documented a positive book to market- return relation for the Hong Kong stock market.

Earnings to Price and Cash Flows to Price Ratios

One factor that has been consistently examined for its relation with the expected stock returns is the Earnings to Price Ratio. Basu (1977, 1983) showed that stock portfolios with lower Earnings to Price Ratios earned higher returns than portfolios with higher values of this ratio. Stocks with high Earnings to Price Ratio are characterised as value stocks and those with low values as growth stocks.

Ball (1978) and Reinganum (1981) suggested that this ratio is likely to be higher for stocks with higher risks and expected returns, as it works as a catch-all proxy for all the undetermined sources of risk.

Kavussanos and Marcoulis (1997b, 2000b) examined a sample of shipping stocks and found no evidence any possible relation between the ratio and the stock returns.

In line with the previous, Fama and French (1998) as well as Rouwenhorst (1999) document a premium for value stocks in a sample of emerging markets, while Lau, Lee and McInish (2002) find a positive relation in the Malaysian market.

Shipping is a highly capital intensive industry and as vessels, which cost millions of dollars, are the main assets of the shipping companies it is expected that they have high depreciation expenses, that tend to substantially distort earnings. So, another ratio could possibly be appropriate to be examined. This ratio is the Cash Flows to Price Ratio.

Wilson (1986) and Bernard and Stober (1989) found that stocks seem to react more at news regarding the cash flows rather that the earnings. Rayburn (1986) examined stocks in the United States for the period 1957 to 1982 and found a positive and significant coefficient.

Similarly to Rayburn (1986), Lakonishok et al (1994) documented that the ratio has a positive and highly significant effect on expected returns. Lau, Lee and McInish (2002) examining for Singapore and Malaysia found no evidence of such a relation.

Data

Companies and Categorisation

The sample period extends from September 2008 to December 2015. The reason for choosing September 2008 as the beginning of the period is the collapse of the Lehman Brothers investment bank that triggering the most recent financial crisis.

The sample consists of 86 firms listed in 22 stock exchanges around the world ,which were selected on the condition that they owned and operated commercial freight vessels and been actively traded in stock markets during this period. Under this condition, shipyards, shipping companies operating passenger ships, companies operating drilling ships, supply vessels and inland vessels were excluded from the sample. The operating activities of shipping firms were identified using DataStream and Clarkson's Shipping Intelligence Network, as well as publicly available descriptions from companies' websites and annual reports.

The companies were categorised according to the sector of activity, meaning Tanker Ships including LNG and LPG Carriers, Container Ships, Dry Bulk Ships and Diversified if they were active in two or more sectors. The reason for this separation was to examine the way the different sectors of shipping industry were affected by the set of variables been chosen, thus making anyone interested aware of the sources of systematic risk of each sector. The companies, the country being listed and the market classification are shown in Table 1.

Another categorisation criterion was the classification of the market in which the companies were listed according to Morgan Stanley Capital International. Thus, they were further separated into companies listed in Developed and Emerging Markets. The idea behind this separation was to examine if companies in the same sector reacted differently at the same possible sources of systematic risk, thus enhancing any possible investor to further diversify her/his portfolio.

Companies' prices and financial ratios, as well as MSCI All Country World Index prices measured in US dollars were obtained from DataStream. The macroeconomic variables and the industry specific variables, i.e. ClarkSea Index and World Orderbook measured in DWT, were obtained from Clarkson's Shipping Intelligence Network.

The Macroeconomic and Microeconomic variables were selected on the basis of previous literature and intuition.

Macroeconomic Data

Description

Company prices (P_{it}) adjusted for stock splits and stock dividends, and dividend yields (DY_{it}) were collected and used to calculate the holding period return per company using the equation $STOCK\_RET_{it}=100*\ln[(P_{it}+ (P_{it}*DY_{it}/1200))/P_{it-1}]$. All non-US dollar prices were converted to US dollars using the average monthly dollar exchange rate, as been collected from DataStream. Natural logarithms were used to capture the continuous compounding effect.

Returns on the MSCI All Country World Index, which is used as the market portfolio, were calculated using the formula $MSCI\_WORLD_t=\ln(PI_t-PI_{t-1})$, where WI is the return on the index at time t and PI_r,PI_{t-1} is the price of the index at time t and t-1 respectively. The MSCI ACWI is a free float-adjusted market capitalisation weighted index that is designed to measure the equity market performance of 23 developed and 23 emerging markets.

For companies and the market portfolio the excess returns, STOCK_EX_RET and MSCI_WORLD_EX_RET respectively, were calculated using the 4 week US T-bill as the risk free asset.

USD_VALUE is a measure of the value of the U.S. dollar relative to the value of a basket of 7 major currencies and is defined as foreign currency per US dollar. These currencies include the Euro, Canadian Dollar, Japanese Yen, British Pound, Swiss Franc, Australian Dollar, and Swedish Krona. The variable was derived by calculating the logarithmic first differences.

INFLATION is the monthly change of inflation, as measured by Consumer Price Index, in the countries members of the Organisation for Economic Co-operation and Development (OECD). This variable was derived by calculating the logarithmic first differences, too.

BRENT_OIL is the Brent Crude Oil Price as $/barrel FOB, and IND_PROD is a measurement of the industrial production in the OECD countries and both are derived as the monthly percentage change.

CLARKSEA_INDEX and WORLD_ORDERBOK_DWT are two industry specific variables. The first one is a weighted average index of earnings for the main vessel types where the weighting is based on the number of vessels in each fleet sector, while the second measures the order book in dead weight tonnage capacity. The choice of these two variables is based on the idea that both of them affect the supply side of the freight market (Stopford 1997) and most probably affect the returns on shipping stocks returns. Having in mind the high volatility of the freight rates and the uncertainty this brings about future earnings, one should expect that investor require a compensation for this uncertainty, reflected in a significant coefficient. Both were calculated as the monthly percentage change.

Unit Root Tests and Autoregressive Moving Average Models

In an efficient market, all the available information should be reflected in prices at any point of time. Thus, as Wasserfallen (1989) and Poon and Taylor (1991) suggested only unanticipated changes in the macroeconomic factors are the relevant explanatory variables of the risk premia awarded in the stock market.

In order to examine which of these variables are stationary Augmented Dickey-Fuller tests were conducted. The only factor that was found to have a unit root was the WORLD_ORDERBOK_DWT and was transformed into a stationary process after calculating first differences. (Table 2)

After ensuring stationarity, Autocorrelation Coefficients were calculated for each of the variables, and all, except MSCI_WORLD_EX_RET and CLARKSEA_INDEX, were found to be serially correlated. MSCI_WORLD_EX_RET and CLARKSEA_INDEX seem that can be treated as pure innovations. (Table 3a)

Following the Box-Jenkins method the best ARMA model for USD_VALUE, INFLATION, BRENT_OIL, IND_PROD and WORLD_ORDERBOK_DWT was selected. The residuals from the fitted processes were used as proxies of the unanticipated changes in these series, creating the new variables UN_BRENT_OIL,

UN_USD_VALUE, UN_IND_PROD, UN_INFLATION and UN_WORLD_ORDERBOOK_DWT. The Autocorrelation Coefficients for these 5 variables appearing in Table 3b reveal that there is no systematic part left in the series.

Microeconomic Data

Regarding the SIZE of each company, the Ben-Zion and Shalit (1975) approach was used, meaning that the SIZE was calculated as the natural logarithm of the sales of each company denominated in US dollars. This way was followed, because as they mention the equity market value is correlated with leverage and is not independent of risk

As a measurement of leverage the ratio of common equity to total assets (C. EQUITY/ T. ASSETS) was used as in Fama and French (1992).

Another variable used is the price to cash flows (P/CF) from operating activities instead of earnings to price. This was done three reasons. The first one is that as shipping is an industry where million dollar vessels are the main assets of each company, high amounts of depreciation and capital expenses are expected. This possibly enables managers to manipulate earnings at their willingness, which is not that easy with the cash flows. The second is that during periods of severe crises, like this examined here, it would be expected that investors would reward companies that can generate big cash flows which will help the company to survive. The third reason is that as companies from different countries were examined, the different accounting standards they used leading to different earnings estimations could possibly affect the comparability of the results.

Drobetz et al (2016) suggested that companies with higher corporate liquidity exhibit lower systematic risk. Furthermore, companies with a higher liquidity ratio may be more flexible in crisis periods and less sensitive to fluctuations in the economy. For this reason the CURRENT_RATIO of each was included in the sample variables.

The last microeconomic variable included was the price to book value ratio (P/B).

Correlation Matrix

Table 4 displays the correlation coefficients among the relevant macroeconomic variables. Most of the correlation coefficients are relatively small indicating a weak relation among the relevant factors. The largest, 0.4214, is between the unanticipated changes in inflation (UN_INFLATION) and the unanticipated changes in Brent oil prices (UN_BRENT_OIL). Cologni and Manera (2008) and O'Neill, Penm and Terrell (2015) indicated a positive and statistically significant impact of oil prices on inflation. As pointed by Chen, Roll and Ross (1986), the market index should reflect the information contained in the variables affecting the asset pricing, there a significant correlation among them should be expected. As can be seen, the market index (MSCI_WORLD) is correlated with Brent oil prices (UN_BRENT_OIL) and industrial production (UN_IND_PROD). The positive relation between oil prices and the market index is somewhat surprising as it is expected that a rise in oil prices would have a negative impact on stock returns (Nandha and Faff 2008 and Park and Ratti 2008). Furthermore, unanticipated changes in Brent oil prices (UN_BRENT_OIL) and unanticipated changes is the US dollars against major currencies (UN_USD_VALUE) were found to be negatively correlated. Table 4, suggests that the macroeconomic factors are not perfectly correlated and can be used here without the need to replace anyone.

Summary Statistics

Table 5a displays the summary statistics if all companies were including a stock portfolio and the summary statistics of the macroeconomic variables. As can be seen, an investor would earn -1.70% per month or -20.4% per year holding this imaginary portfolio, while by holding the MSCI ACWI portfolio she/he would earn 0.49% per month or 5.16% per year. By looking at the standard deviations of the returns of these two portfolios, one can conclude that the shipping companies' portfolio has a higher overall risk and a reward to variability ratio (Sharpe 1966,1975) equal to -0.1055, while the market portfolio's ratio is 0.0714. High volatility for a leverage and highly cyclical industry during a period of severe crisis in something one should expect. The distributions for these two returns are leptokurtic meaning that extreme events happen more frequently than suggested by the normal distribution.

Besides that, a high variability and a negative monthly mean for the returns of the ClarkSea Index can be observed. The distribution for this variable seems to be normal.

The positive mean return of the USD_VALUE means that the US dollar realised a monthly depreciation against the currency basket of its major trade partners. Brent oil had negative mean monthly returns, like did industrial production. Finally, the negative sign for WORLD_ORDERBOOK_DWT indicates that the ship-owners reduced their orders for ship deliveries during the period examined.

In Table 5b the summary statistics for Container Ship companies in developed and emerging markets are shown. Companies listed in developed countries have a mean return -0.0276% per month or -0.3312% per year, while those listed in emerging markets have a return of -0.0121% per month or -0.1452% per year for this period. It seems that companies in emerging markets outperformed those in developed markets, as the latter had more than twice the losses of the former. Besides that, they have a lower overall risk, as measured by standard deviation of the stock returns, compared to those in developed markets. The Sharpe ratios are -0.093 and -0.197 respectively.

The comparison of the microeconomic variables shows that the companies in emerging markets were more leveraged during this period, as those in developed countries kept a higher common equity to total assets ratio. A possible explanation for that could be the lending restrictions implied to banks as a result of the more rigorous regulation in developed countries. Interesting is the fact that a company in developed markets had a ratio equal to 7.74% and in the emerging markets there was a company with a ratio of -101.54%. These values are an indication of how leveraged a shipping company can be.

Also, it seems that companies in developed countries are bigger in size, based on sales, compared to those in emerging markets. Furthermore, those in developed markets seem to be undervalued compared to those in emerging markets, as they have a price to book ratio equal to 1.05 and 3.64 respectively.

Companies in emerging markets kept a higher corporate liquidity as measured by the current ratio and had a negative price to cash flow ratio. The respective ratios are 1.35 and -16.32, while those for companies in developed markets are 1.28 and 0.75.

Table 5c shows the statistics of the Dry Bulk companies. The companies in developed markets had a monthly return of -3.5% or -42% yearly, while those in emerging markets -1.12% and -13.44% respectively. The Dry Bulk companies in emerging markets outperformed those in developed markets, as in the case of Container Ship companies. This was accompanied by a lower overall risk, as measured by the standard deviation of the stock returns. The former have a Sharpe ratio equal to -0.098 and the latter one equal to -0.175.

Companies in developed markets seem to be undervalued compared to those in emerging markets, as the former have a price to book ratio of 0.77 and the latter one equal to 1.10. They also seem to hold a higher corporate liquidity, as the current assets are 1.92 times the current liabilities. The respective ratio for the companies in emerging markets is 1.37.

The Dry Bulk companies listed in emerging markets seem to be bigger in size, measured by sales, and less leveraged than those in developed markets.

Table 5d contents the statistics for the Tanker Ship companies. Like in the previous cases, the companies in the emerging markets outperformed these in the developed markets, with a monthly return equal to -1.05% and -2.15% respectively. The former have a standard deviation of stock returns smaller than the latter and a Sharpe ratio equal to -0.099, while the companies in developed markets have a Sharpe ratio equal to -0.1183.

Furthermore, companies in emerging markets seem to be, on average, bigger on size and more leveraged. Finally, the companies in developed markets appear to have a higher corporate liquidity, as measured by the current ratio.

A possible problem referring this sub-sample might be that it contains only two companies for the companies in emerging markets, which means that possibly it is not representative of the sector in these markets.

Table 5e hold the statistics for the Diversified companies of the sample. Companies in both developed and emerging appear to have almost the same monthly returns during the period examined. The respective returns are -1.38% and -1.35%. Furthermore, they appear to be of almost the same size. In contrast to the previous cases, the

companies in emerging markets seem to have a higher overall risk than those in developed markets. The respective Sharpe ratios are -0.081 and -0.1048.

Companies in emerging markets seem to have a slightly higher corporate liquidity, and to be more leveraged than those in developed markets. The latter seem to be undervalued compared to the former, as measured by the price to book value.

In all cases companies listed in emerging markets outperformed their counterparts in developed markets, while all the mean monthly returns were negative. Sorting the sectors by performance from highest to lowest, the Container Ships in emerging markets came first followed by the Container Ship in developed markets, and the Dry Bulk in developed markets was last.

Sorting the sectors by common equity to total assets ratio, from highest to lowest, it seems that the least leveraged was the Dry Bulk in emerging markets followed by Diversified and Dry Bulk in developed. The more leveraged was the Tankers in emerging markets.

If the criterion was the corporate liquidity, the sector with the highest mean current ratio would be the Tankers Ships in developed markets, followed by the Diversified in emerging markets, and the one with the lowest would be the Container Ships in developed markets.

Finally, the listing according to the Sharpe ratio, from the highest to the lowest, is the following. Diversified in emerging had the highest, followed by Container Ships in emerging. Third was the Dry Bulk in emerging markets, fourth the Tanker Ships in emerging markets. The last four belong to the developed markets, with the Diversified being fifth, Tanker Ships sixth, Dry Bulk seventh and last the Container Ships. It seems that the companies in these markets did not reward the investors for the risk bearing, as did their emerging markets counterparts.

The extremely negative minimum values documented in variables like price to cash flows, price to book value and common equity to total assets may indicate the severity of the problems the shipping companies faced during the recent financial crisis.

Empirical Methodology

Modern finance theory suggest than the diversified investor should be compensated only for the systematic risk her/his investments bear, and not for the total risk as expressed by standard deviation. This happens as through diversification the company specific risk is eliminated.

The Capital Asset Pricing Model of Sharpe (1964), Lintner (1965) and Mossin (1966) provides a measure of this systematic risk through the market beta, which is the sensitivity of each asset to the fluctuations of the market portfolio. The Capital Asset Pricing Model suggests that a firm's expected returns are a linear function of the expected return on the market portfolio.

Despite its popularity among academics and professionals, the Capital Asset Pricing Model has been subject to several critics. One of these was Roll's Critique (1977), which suggested that it is impossible to create or observe a truly diversified portfolio containing all the assets in every economy. In the empirical asset pricing literature a broad index of stocks must be chosen to represent the market portfolio.

Chen, Roll and Ross (1986), setting the basis for the Arbitrage Pricing Theory, examined a set of macroeconomic variables and suggested that any economic factor that influences the expected cash flow ending up to the investor or affecting the discounting factor should be employed in order to explain the stock price fluctuations.

Other studies, like Stattman (1980), Banz (1981), Basu (1983), Bhandari (1988) and Fama and French (1992) among others, reported several "anomalies" regarding the Capital Asset Pricing Model, proposing microeconomic factors other than the market portfolio that help explain the risk-return profile of stocks.

Here both approaches are followed to examine the risk-return structure of the global shipping stocks, trying to help anyone interested better understand this relationship. In order to examine this return-return relation even deeper the companies in the sample were separated according to the sector they belong and the classification of the market they are listed in. This separation created eight different sub-samples. As the companies in the sample are listed in markets all over the world the assumption that the capital markets are fully integrated has to be made. This means that stocks in

different countries and have the same risk, have the identical expected return, too (Bekaert Harvey 1995).

Under this assumption a set of global macroeconomic factors was chosen, including the inflation indicator of the OECD countries, the industrial production in the OECD countries, the price of Brent oil measured in dollars per barrel, the value of the US dollar against a basket of currencies of its major trading partners, the Morgan Stanley Capital International All Country World Index to represent the global market portfolio, the ClarkSea Index and the world orderbook measured in dead weight tonnage. As the Efficient Market Hypothesis (Fama 1970) suggests, the stock prices should fully reflect all available information at any point in time. Therefore, the unexpected changes in the above factors are included as explanatory variables.

Also, a set of microeconomic variables was chosen, including the price to book ratio of the stocks, the price to cash flows ratio, the common equity to total assets ratio, the current ratio, and the size of the firms as measured by natural logarithm of the sales.

As there is no consensus about the choice of the risk variables in the asset pricing literature, it was based on the previous studies and intuition. Besides that, no prediction regarding the sign of the impact, if any, can be made and the question will be answered empirically.

In a first step, the Capital Asset Pricing Model will be employing to examine the sensitivities of the different categories of the sample on the MSCI All Country World Index alone. This sensitivity is measured by the market beta, the stock's co-movement with the market portfolio. If a stock has a market beta greater than the unity, the investor requires a higher expected return and vice versa.

The following equation expresses the Capital Asset Pricing Model:

$$STOCK\_EX\_RET_{it} = \alpha_i + \beta_i \, MSCI\_WORLD\_EX\_RET_t + \varepsilon_{it} \quad , E(\varepsilon_{it}) = 0 \qquad (1)$$

Where $STOCL\_EX\_RET_{it}$ the continuously compounded excess return of the sector, $MSCI\_WORLD\_EX\_RET_t$ the continuously compounded excess return of the market portfolio, β_i is the estimated beta, and α_i is a constant with expected value equal to 0 if there is no mispricing. A positive constant means under pricing and opportunity for profit, while a negative constant means overpricing.

In a second step, the other possible risk factors are added, to explore the sensitivity of each sector, if any, on this variable.

The following formula expresses the proposing model:

$$STOCK\_EX\_RET_{it} = \alpha_i + \beta_1 MSCI\_WORLD\_EX\_RET_t + \beta_2 UN\_BRENT\_OIL_t + \beta_3 UN\_USD\_VALUE_t + \beta_4 UN\_IND\_PROD + \beta_5 UN\_INFLATION + \beta_6 CLARKSEA\_INDEX_t + \beta_7 UN\_WORLDORDERBOOK\_DWT + \beta_8 \ln(P/CF) + \beta_9 \ln(P/B) + \beta_{10} \ln(C.EQUITY/T.ASSETS) + \beta_{11} SIZE + \beta_{12} \ln(CURRENT\_RATIO) + \varepsilon_{it} \quad ,E(\varepsilon_{it})=0 \qquad (2)$$

The estimation method used is the Ordinary Least Squares. In order to make the coefficients of the microeconomic variables more easily interpretable, the natural logarithms are employed. For example, this means that a 1% change in SIZE, if found statistically significant, is associated with a β_{11}% change in STOCK_EX_RET.

One possible problem to the right estimation of the coefficients could be any thin-trading biases, a problem more severe for smaller and illiquid stocks that could be present in the sample. However, using monthly returns alleviates this problem.

Empirical Results

Capital Asset Pricing Model results

As long as the investor can diversify away the firm-specific risk, she/he should consider only for the market or systematic risk, as measured by the market beta, rather than the total risk, as measured by the standard deviation of the returns. Table 6a and Table 6b show the results of market model regressions with the Morgan Stanley Capital International All Country World Index as a measure of the market portfolio, for the developed and the emerging markets respectively, as produced by Equation (1).The market betas of seven out of eight, using the Ordinary Least Squares method, are statistically significant at the 1% level and greater than one, which indicates that the shipping stocks should be considered as riskier than the average stock during the period from September 2008 until December 2015, something expected assuming the high cyclicality and leverage that characterise the shipping industry and the severity of the financial crisis during this period .

More specifically, regarding the developed markets, the Container Ships sector has a market beta equal to 1.437, the Dry Bulk sector 1.703, the Tanker Ships sector 1.339 and the Diversified sector a market beta equal to 1.1158. The last finding could be an indication of the diversification benefits that lead to lower investment risk.

As for the emerging markets, the Container Ships sector has a market beta equal to 1.072, the Dry Bulk equal to 1.079 and the Diversified a market beta equal to 1.322. The Tanker Ships sector's market beta was found to be 0.709 but statistically insignificant at any significance level, meaning that the global market portfolio has no explanatory power over this sector's returns. This could be a result of the very small sample of companies in this sector, as there were only two available to represent the sector.

No previous study separates the shipping companies into categories according to their market classification but it would useful to compare with these results. Grammenos and Marcoulis (1996) employing the CAPM documented market betas lower than one, in three out of four countries they examined. Kavussanos and Marcoulis (1997b) documented an average beta for the companies they examined with a value of 0.920. They found betas lower than one even after splitting into two sub-periods. In line with

their previous work, Kavussanos and Marcoulis (1997a, 2000a,b) using the market model find a beta lower than one. Grammenos and Arkoulis (2002 also documented a market beta equal to 0.8113. Kavussanos et al (2003) examined the different sectors of shipping industry and documented for the sectored examined here market betas lower than one too. Gong et al (2006) attributed these unexpectedly low beta values to possible thin trading biases, and used the Scholes-Williams (1977) correction for thin trading firms' betas but again found values lower than one. Drobetz et al (2010) found slightly higher betas than the previous with values around one. By comparing the betas of each sector according to each market classification one could conclude the following. It seems like the Container Ships companies in developed markets are of higher market risk compared to their counterparts in emerging markets, if the market portfolio is assumed to be the Morgan Stanley Capital International All Country World Index. The former have a market beta equal to 1.437 while the latter have one equal to 1.072. The same holds for the Dry Bulk companies as those in developed markets have a market beta equal to 1.703 and those in emerging markets have a beta equal 1.079. As regard the Tanker Ships companies, no conclusion can be made as it seems that the market portfolio has no explanatory power over the sector. This is probably to the very small sample of listed companies in the emerging markets, as only two companies have been found. Finally, the Diversified sector is the developed markets is of lower markets risk, as its market beta is 1.158, while that of the sector in emerging markets is 1.322. These results could be helpful in the diversification process of any interested investor.

The constant terms in the market model regressions are all negative and statistically significant, indicating an overpricing of the stocks in a securities market line (SML) analysis. A similar result has been reported in Kavussanos et al (2003).

The R-squared of the market model regressions range between 0.202 and 0.381for the developed markets and between 0.167 and 0.283for the emerging markets. This suggests that a larger proportion of the variance of the shipping stocks in developed markets is attributable to a single stock market factor than that of stock in emerging markets. In every way, this observation suggests that a multifactor model like this one in Equation (2) could probably provide a better description of the risk-return relation of shipping stocks than the market model.

Multifactor Model results

Here, the multifactor model of Equation (2) is employed to explore the possible sources of systematic risk that affect the returns of shipping stocks. Table 7a and Table 7b contain the regression results using the Ordinary Least Squares method for the developed and the emerging markets respectively. The general-to-specific modelling procedure is used to select the 'best' model for each sector. This means that Equation (2) is estimated by OLS for each sector including the full set of possible explanatory variables and then it is again estimated including only the significant factors for each sector separately.

Like in the previous cases, market betas are greater than one, as expected for a leveraged and cyclical industry during a crisis period like the shipping industry. In most cases, it is lower than that of the market model, but in some other it is slightly higher. The values in developed markets range from 1.090 for the Dry Bulk sector to 1.450 for the Container Ships sector. This relatively high riskiness of the Container Ships sector could be a result of the reduction in seaborne trade between the developed countries hit by the recent severe financial crisis. The range of the market beta values in the emerging markets is from 1.084 for the Dry Bulk sector to 1.316 for the Diversified sector. In both cases, the Dry Bulk sector seems to bear the lowest market risk. A possible explanation could be that the main importer of dry bulk material during this period was China that seemed not to be affected by the global financial crisis as did other countries, but this explanation needs further examination that is not in the context of this dissertation. Like in the market model regression, the Tanker Ships sector in emerging markets seems not to be affected by the market portfolio. In their study, When Grammenos and Marcoulis (1996) employed a multifactor model to examine the risk-return profile of shipping stocks, found statistically insignificant values for the market betas. Kavussanos and Marcoulis (1997b) find no difference between the water transportation market beta estimated with the Capital Asset Pricing Model and their multifactor model, suggesting a value equal to 0.941. Kavussanos and Marcoulis (2000a,b) find, in line with the previous a market beta equal to 0.94. In contrast to that, Kavussanos et al (2002) find that the market beta of the water transportation industry is 1.2067 while Grammenos and Arkoulis (2002) and Drobetz et al (2010) find a market beta value lower than one.

The coefficient of the unanticipated changes in oil prices is surprisingly found to be significant only in the Dry Bulk in developed countries and shows no significance in any other sector. The positive sign indicates that an increase in oil prices leads to higher returns on the shipping stocks. As oil is one of the main input factors in the production of freight services, one could expect a negative sign. Besides that an influence on the Tanker Ships sector would be more expected. A possible explanation in that the oil prices do not affect the Tanker Ships sector is the use of derivatives for hedging against oil prices fluctuations from the companies. Kavussanos and Marcoulis (2000a,b) document a positive of oil prices on shipping stocks returns, while Kavussanos et al (2002) find an insignificant coefficient for this variable. Contrary to the previous Grammenos and Arkoulis (2002) find a negative coefficient and finally Drobetz et al (2010) find a significant and positive relation between oil prices and shipping stock returns only for the Container Ships sector.

The Dry Bulk sector in developed markets seems to be the only one affected by unanticipated changes in the value of the US dollar against other currencies. The negative sign shows a negative relation between the US dollar and the stock returns, as the dollar is the denominator, meaning that an appreciation of it leads to lower stock returns. An explanation could be that most shipping related contracts are denominated in US dollars, which means that a higher dollar value implies higher operating costs for non-US shipping companies. Leggate (1999) and Akatsuka and Leggate (2001) suggested that ship-owners could develop hedging strategies to eliminate currency fluctuations, and this could be the reason why the other sectors have to exposure to unexpected currency movements. Kavussanos et al (2002) find no exposure of the shipping stocks they examined to currency fluctuations. Grammenos and Arkoulis (2002) find a positive relation, but their variable is defined as US dollar per national currency. El-Masry et al (2010) find both negative and positive exposures to foreign exchange risk depending on the country the firm is incorporated. Finally, Drobetz et al (2010) find a negative coefficient for the sectors they examined.

The industrial production in the OECD countries is found to be significant in the Diversified the Dry Bulk and the Tanker Ships sectors in developed countries, and the Dry Bulk sector in emerging markets. The negative sign however is something surprising as increases in industrial production are associated with better economic conditions and thus higher stock returns. The findings are in line with Kavussanos and

Marcoulis (2000a,b) who document a negative relation between monthly changes in industrial production and stock returns but are in contrast with Kavussanos et al (2002) who find a positive relation. Grammenos and Arkoulis (2002) find no effect of the industrial production on the stock returns while Drobetz et al (2010) find a positive and marginally significant coefficient only for the Container Ships sector.

The coefficient of the unanticipated changes in inflation in the OECD countries is significant only for the Dry Bulk sector in emerging markets and has a negative sign. These findings, except the significant and negative coefficient, are in line with the existing literature as Kavussanos and Marcoulis (2000 a,b), Kavussanos et al (2002) Grammenos and Arkoulis (2002) and Drobetz et al (2010) find no influence of the unexpected changes in inflation on the shipping stock returns.

The coefficient of the ClarkSea Index is statistically significant and positive for the sectors of Diversified, Dry Bulk and Tanker Ships companies in developed markets and Dry Bulk companies in emerging markets. The positive sign indicates that investors require a higher return when freight rate are higher. This seems to be a result of the equilibrium in freight rate market. Short term higher demand leads to higher freight rates, but also the elasticity of the freight rates becomes higher. Thus, a small change in demand leads to bigger changes in freight rates, and as result of this volatility and uncertainty investors require a higher compensation to hold shipping stocks. Drobetz et al (2016) examined the impact the freight rate volatility has market beta and found a positive and significant coefficient.

The unexpected changes in the orderbook as measured in DWT have a positive impact on all the sectors of developed markets except the Container Ships. It seems that it has no explanatory power over any sector in the emerging markets. The positive relation could be explained as the investors perceived any increase in the orderbook as a good sign about the future prospects of the sectors and increased their expected returns. Grammenos and Arkoulis (2002) examined for the impact of laid up tonnage on shipping stock returns and found a negative sign for this coefficient.

Now turning to the microeconomic results, a size effect in the Dry Bulk sector in the emerging markets seems to exist, as size is measures by the logarithm of the annual sales. This effect appears in no other sector. The negative sign means that the higher the size, as measured by the annual sales, the lower the expected returns. Kavussanos

and Marcoulis (1997a) have shown that companies with lower market value of equity outperformed their bigger counterparts, but Kavussanos and Marcoulis (1997b) find no size effect in water transportation stocks. Kavussanos and Marcoulis (2000b) on the other hand, suggest a positive size effect in the water transportation industry, meaning that companies with higher value of market equity perform better than the stocks of the smaller companies.

Regarding the price to book value ratio a positive and statistically significant sensitivity appears for all sectors in developed markets, while this relation holds for the Diversified and Dry Bulk sectors in emerging markets. These findings are in line with the literature regarding other industries but Kavussanos and Marcoulis (1997b) and Kavussanos and Marcoulis (2000b) find no relation between this ratio and shipping stock returns.

The last variable that seems to significantly affect the returns in any sector is the common equity to total assets, as a measurement of leverage, for the Diversified sector in developed markets and holds a, surprisingly, positive sign. Grammenos and Marcoulis (1996), measuring the financial leverage as (book value of total asset- book value of equity) / book value of equity find a positive and statistically significant coefficient. Kavussanos and Marcoulis (1997b, 2000b) measuring the financial leverage as it is here, find in contrast a negative coefficient for the water transportation companies. Financial leverage is a double edged sword: in times of prosperity it increases shareholders' returns, while in times of recession, like this examined, it increases the losses in such an extent that even threat the existence of the company.

The current ratio and the price to cash flows ratio have no explanatory power over the sample for the period examined.

Regarding the constants of each regression, a negative and statistically significant coefficient is found for the Diversified sector in emerging markets and the Diversified and Dry Bulk sector for in developed markets, suggesting overpricing of the companies in these sectors. A positive and statistically significant alpha coefficient is found in the Dry Bulk sector in emerging markets, indicating an underpricing of this sector. In some cases the Capital Asset Pricing Model seems to overestimate the constant when compared to the multifactor model, which probably means that the

inclusion of other factors than the market portfolio may take away some of the mispricing suggested by the CAPM. However, this mispricing documented in both models may be a result of other missing variables that could explain a higher proportion of the shipping stock returns, as it cannot be claimed that the full set of possible variables is examined here.

The R-squared ranges from 0.249 to 0.395 for the developed markets and from 0.251 to 0.32 for the emerging markets. These values could be perceived as relatively low but in all cases the additional factors seem to explain a bigger proportion of the stock prices fluctuations than does the Capital Asset Pricing Model.

Conclusion

This dissertation examines some macroeconomic and microeconomic factors that could add to the explanation of the risk-return profile of shipping stocks listed in stock exchanges around the world. In order to further investigate this relation, the sample is separated according to two categorisations. One categorisation is based on the sector in which each company belongs, i.e. Container Ships, Dry Bulk, Tanker Ships, and Diversified if the company is active in two or more sectors. The second categorisation is based on the classification of the market in which each company is listed according to Morgan Stanley Capital International, meaning developed and emerging market. This results in eight sub-samples. The period being covered starts from September 2008, after the collapse of Lehman Brothers until December 2015. The set of macroeconomic variables includes the MSCI All Country World Index as a proxy to the market portfolio, the Bren oil prices, the trade weighted value of the US dollar, the industrial production and the inflation indicator of the OECD countries, the ClarkSea Index as a measurement of the average earnings of the shipping companies and the world order book measured in dead weight tonnage. The unexpected changes in these variables were used here. The set of microeconomic variables includes the current ratio of each company, the price to cash flows ratio, the price to book value ratio, the common equity to total assets ratio, and the size of each company as measured by the annual sales.

The findings, using the Ordinary Least Squares method, suggest that not only different sectors have exposures to different sources of risk, but also the same sectors have different sources of risk depending on its market classification. More specifically, regarding the developed markets, the Dry Bulk sector has a positive exposure in factors like the market portfolio, the Brent oil prices, the ClarkSea Index, the world orderbook, the price to book value ratio and a negative for the US dollar value and the industrial production. The Container Ships sector returns have a positive relation with the market portfolio and the price to book value ratio. The Tanker Ships and the Diversified sectors are exposed in the same way, meaning a positive relation with the market portfolio, the ClarkSea Index, the world order book and the price to book value ratio, while the latter seems to have a positive exposure to leverage, as measured by the common equity to assets ratio.

As for the sectors in the emerging markets things seem to be different. The Dry Bulk sector has a positive relation with the market portfolio, the ClarkSea Index and the price to book value ratio. The Container Ships sector's return seem to be explained only the market portfolio and no other factor in these sets used here, while the Diversified sector has a positive coefficient for the market portfolio and for the price to book value ratio. Finally, the Tanker Ships sector seems to be explained by no factor used here. Most probably this is due to the small sample of companies, as only two were found to be publicly listed in the emerging markets.

The stock returns of all the companies in the previously mentioned sub-samples are found to have to significant relation with the current ratio and the price to cash flows. The opposite was expected as they both are associated with the corporate liquidity, something crucial in periods of severe financial crises like the period examined.

These findings suggest that the Capital Asset Pricing Model alone is not sufficient to price a stock, as there are other macroeconomic and microeconomic factors beyond the market portfolio which are significant in explaining stock returns, and that the use of a multifactor model is more appealing than the CAPM.

As the global markets become more and more integrated, the risk-return profile of the international shipping stocks is important for the investor, who wants to further diversify her /his portfolio, by selecting sectors that are not exposed to risk factors she/he does not want to hold. A multifactor like this examined here is also useful for corporate managers who will to assess possible investment projects from the company's point of view as it provides a way to calculate the cost of equity capital.

One possible problem that may affect the results documented here arises from the low trading liquidity that may be present in some companies present in the sample. Another possible problem exists in case the shipping industry is not adequately presented in the Morgan Stanley Capital International All Country World Index that leads to underestimation of the market beta of the shipping companies (Roll 1992).

To conclude, it cannot be claimed that a full set of factors was employed, but the findings may help anyone interested in understanding the behaviour of shipping stock prices and her/him take better investment decisions.

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Tables

Table 1: Companies, sectors of activity, countries of listing and market classification

COMPANY	SECTOR	COUNTRY	CLASSIFICATION
SEASPAN	CONTAINER SHIPS	USA	DEVELOPED
DANAOS	CONTAINER SHIPS	USA	DEVELOPED
MATSON	CONTAINER SHIPS	USA	DEVELOPED
NAVIOS MAR. HDG	DRY BULK	USA	DEVELOPED
DIANA SHIPPING	DRY BULK	USA	DEVELOPED
SAFE BULKERS	DRY BULK	USA	DEVELOPED
DRYSHIPS	DRY BULK	USA	DEVELOPED
PARAGON SHIP.	DRY BULK	USA	DEVELOPED
SEANERGY MAR. HDG	DRY BULK	USA	DEVELOPED
STAR BULK CARRIERS	DRY BULK	USA	DEVELOPED
GLOBUS MARITIME	DRY BULK	USA	DEVELOPED
TEEKAY TANKERS	TANKER SHIPS	USA	DEVELOPED
TSAKOS ENERGY NAV.	TANKER SHIPS	USA	DEVELOPED
DHT HOLDINGS	TANKER SHIPS	USA	DEVELOPED
NAVIOS MAR. ACQ.	TANKER SHIPS	USA	DEVELOPED
NORDIC AMER. TANKERS	TANKER SHIPS	USA	DEVELOPED
TEEKAY LNG CARRIERS	TANKER SHIPS	USA	DEVELOPED
SHIP FINANCE INTL.	DIVERSIFIED	USA	DEVELOPED
NAVIOS MAR. PTNS	DIVERSIFIED	USA	DEVELOPED
GOLDEN OCEAN GROUP	DRY BULK	NORWAY	DEVELOPED
JINHUI HOLDINGS	DRY BULK	NORWAY	DEVELOPED

Table 1 (continued)

COMPANY	SECTOR	COUNTRY	CLASSIFICATION
WILSON	DRY BULK	NORWAY	DEVELOPED
BELSHIPS	DRY BULK	NORWAY	DEVELOPED
AMERICAN SHIPPING CO.	TANKER SHIPS	NORWAY	DEVELOPED
FRONTILE	TANKER SHIPS	NORWAY	DEVELOPED
STOLT-NIELSEN	TANKER SHIPS	NORWAY	DEVELOPED
TEAM TANKERS INTL.	TANKER SHIPS	NORWAY	DEVELOPED
ODFJELL	TANKER SHIPS	NORWAY	DEVELOPED
GOLAR LNG	TANKER SHIPS	NORWAY	DEVELOPED
SOLVANG	TANKER SHIPS	NORWAY	DEVELOPED
I.M. SKAUGEN	TANKER SHIPS	NORWAY	DEVELOPED
D'AMICO INTL. SHIP.	DIVERSIFIED	ITALY	DEVELOPED
PREMUDA	DIVERSIFIED	ITALY	DEVELOPED
MARENAVE SCHIFFAHRTS	DIVERSIFIED	GERMANY	DEVELOPED
SLOMAN NEP. SCHIF.	DIVERSIFIED	GERMANY	DEVELOPED
A.P. MOLLER-MAERSK	CONTAINER SHIPS	DENMARK	DEVELOPED
TORM	TANKER SHIPS	DENMARK	DEVELOPED
DMPKBT NORDEN A/S	DIVERSIFIED	DENMARK	DEVELOPED
EURONAV	TANKER SHIPS	BELGIUM	DEVELOPED
EXMAR	TANKER SHIPS	BELGIUM	DEVELOPED
CONCORDIA MARITIME	TANKER SHIPS	SWEDEN	DEVELOPED
KYOEI TANKER	DIVERSIFIED	JAPAN	DEVELOPED
KAWASAKI KISEN KAISHA	DIVERSIFIED	JAPAN	DEVELOPED
MITSUI OSK LINE	DIVERSIFIED	JAPAN	DEVELOPED
LATVIJAS KUG	TANKER SHIPS	LATVIA	EMERGING

Table 1 (continued)

COMPANY	SECTOR	COUNTRY	CLASSIFICATION
ULJANIK PLOVIDBA	DIVERSIFIED	CROATIA	EMERGING
BAHRI	DIVERSIFIED	S. ARABIA	EMERGING
RICKMERS MARITIME	CONTAINER SHIPS	SINGAPORE	DEVELOPED
NEPTUNE ORIENT LINES	CONTAINER SHIPS	SINGAPORE	DEVELOPED
COURAGE MARINE GP.	DRY BULK	SINGAPORE	DEVELOPED
FIRST SHIP LEASE TRUST	DIVERSIFIED	SINGAPORE	DEVELOPED
SAMUDERA SHIP. LINE	DIVERSIFIED	SINGAPORE	DEVELOPED
HEUNG-A SHIPPING	DIVERSIFIED	KOREA	EMERGING
KOREA LINE	DIVERSIFIED	KOREA	EMERGING
PANOCEAN	DIVERSIFIED	KOREA	EMERGING
HYUNDAI MERCH. MARIME	DIVERSIFIED	KOREA	EMERGING
KSS LINE	DIVERSIFIED	KOREA	EMERGING
YANG MING MAR. TRAN.	CONTAINER SHIPS	TAIWAN	EMERGING
EVERGREEN MARINE	CONTAINER SHIPS	TAIWAN	EMERGING
WAN HAI LINES	CONTAINER SHIPS	TAIWAN	EMERGING
SHIH WEI MAVIGATION	DRY BULK	TAIWAN	EMERGING
U-MING MARINE TRAN.	DRY BULK	TAIWAN	EMERGING
SINCERE NAVIGATION	DRY BULK	TAIWAN	EMERGING
TAIWAN NAVIGATION	DRY BULK	TAIWAN	EMERGING
FIRST STEAMSHIP	DRY BULK	TAIWAN	EMERGING
REGIONAL CONTAINERS L.	CONTAINER SHIPS	THAILAND	EMERGING
PRECIOUS SHIPPING	DRY BULK	THAILAND	EMERGING
JUTHA MARITIME	DIVERSIFIED	THAILAND	EMERGING
VINASHIP	DRY BULK	VIETNAM	EMERGING
CHINA SHIP. CTNR. LIN.	CONTAINER SHIPS	HONG KONG	DEVELOPED

ORIENT OVERSEAS INTL.	CONTAINER SHIPS	HONG KONG	DEVELOPED
PACIFIC BASIN SHIP.	DRY BULK	HONG KONG	DEVELOPED
SINOTRANS SHIPPING	DIVERSIFIED	HONG KONG	DEVELOPED
TAINJIN TIANHAI INV.	CONTAINER SHIPS	CHINA	EMERGING
CHINA MRCH. EN. SHIP.	DIVERSIFIED	CHINA	EMERGING
CHINA SHIP. HAISHENG	DIVERSIFIED	CHINA	EMERGING
CHOWGULE STEAMSHIPS	DRY BULK	INDIA	EMERGING
GREAT EASTERN	DIVERSIFIED	INDIA	EMERGING
MALAYSIAN BULK CARR.	DRY BULK	MALAYSIA	EMERGING
MISC BHD	DIVERSIFIED	MALAYSIA	EMERGING
QATAR GAS TRAN. NAKILAT	TANKER SHIP	QATAR	EMERGING

Table 2: Unit root tests

Null Hypothesis: $VARIABLE_i$ has a unit root

		MSCI_WORLD		USD_VALUE		INFLATION		BRENT_OIL	
		lag length: 0		lag length: 0		lag length: 1		lag length:0	
		t-Statistics	Prob.	t-Statistics	Prob.	t-Statistics	Prob.	t-Statistics	Prob.
Augmented Dickey_Fuller test statistics		-9.08723	0.0000	-6.46536	0.0000	-3.70614	0.0000	-5.871180	0.0000
Test critical values	1% level	-3.507394		-3.506484		-3.507394		-3.506484	
	5% level	-2.895109		-2.894716		-2.895109		-2.894716	
	10% level	-2.584738		-2.584529		-2.584738		-2.584529	

		IND_PROD		CLARKEA_INDEX		WORLD_ORDERBOOK_DWT		d(WORLD_ORDERBOOK_DWT)	
		lag length: 3		lag length: 0		lag length: 1		lag length: 2	
		t-Statistics	Prob.	t-Statistics	Prob.	t-Statistics	Prob.	t-Statistics	Prob.
Augmented Dickey_Fuller test statistic		-3.895254	0.0031	-8.612092	0.0000	-2.886656	0.051	-8.59495	0.0000
Test critical values	1% level	-3.505595		-3.506484		-3.507394		-3.50928	
	5% level	-2.894332		-2.894716		-2.895109		-2.89592	
	10% level	-2.584325		-2.584529		-2.584738		-2.58517	

Table 3a: Autocorrelation Coefficients of all macroeconomic series

		Lag1	Lag2	Lag 3	Lag4	Lag5	Lag6	Lag7	Lag8	Lag9	Lag10	Lag11	Lag12	Q-Statistic (lag 20)
MSCI_WORLD_EX_RET		0.019	-0.07	0.178	0.032	-0.0115	-0.04	-0.142	-0.06	-0.054	-0.084	-0.068	0.009	22.778
	Prob.	0.856	0.783	0.331	0.475	0.443	0.552	0.437	0.507	0.578	0.6	0.643	0.722	
USD_VALUE		0.377	0.105	0.106	.0118	0.029	-0.002	-0.206	-0.205	-0.127	-0.027	-0.129	-0.104	42.087
	Prob.	0.000	0.001	0.002	0.002	0.005	0.011	0.004	0.002	0.002	0.003	0.003	0.003	
INFLATION		0.894	0.736	0.576	0.458	0.356	0.249	0.141	0.052	-0.019	-0.064	-0.095	-0.098	200.14
	Prob.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
BRENT_OIL		0.396	0.268	0.037	0.007	-0.029	-0.075	-0.111	-0.121	-0.076	-0.004	0.076	0.067	28.700
	Prob.	0.000	0.000	0.000	0.000	0.001	0.001	0.002	0.002	0.003	0.005	0.007	0.01	
IND_PROD		0.972	0.91	0.818	0.703	0.579	0.446	0.311	0.182	0.059	-0.054	-0.15	-0.226	438.66
	Prob.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
CLARKSEA_INDEX		0.081	-0.095	0.043	-0.089	0.054	0.126	0.065	-0.148	-0.102	-0.014	0.019	0.079	16.272
	Prob.	0.436	0.484	0.654	0.668	0.752	0.648	0.705	0.556	0.547	0.639	0.72	0.738	
WORLD_ORDERBOOK_DWT		0.641	0.598	0.45	0.523	0.424	0.367	0.252	0.236	0.083	0.046	-0.082	0.02	208.23
	Prob.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	

Table 3b: Autocorrelation Coefficients for correlated series.

		Lag1	Lag2	Lag3	Lag4	Lag5	Lag6	Lag7	Lag8	Lag9	Lag10	Lag11	Lag12	Q-Statistic (lag 20)
UN_USD_VALUE		-0.02	0.084	0.018	0.14	-0.054	0.083	-0.211	-0.08	-0.108	0.067	-0.143	-0.03	25.842
	Prob.		0.407	0.698	0.46	0.581	0.618	0.244	0.286	0.284	0.335	0.264	0.333	
UN_INFLATION		0.005	0.04	-0.166	0.054	0.109	-0.023	-0.032	-0.088	0.02	-0.022	0.136	-0.382	25.732
	Prob.		0.702	0.257	0.392	0.389	0.524	0.639	0.655	0.749	0.823	0.723	0.023	
UN_BRENT_OIL		-0.072	0.131	-0.134	-0.025	0.023	-0.013	-0.045	-0.056	-0.044	0.044	0.015	0.085	7.1987
	Prob.		0.152	0.155	0.285	0.428	0.57	0.669	0.737	0.803	0.854	0.905	0.902	
UN_IND_PROD		-0.108	0.058	0.229	-0.221	0.021	0.144	-0.212	0.078	0.06	-0.178	-0.055	-0.125	41.017
	Prob.		0.241	0.044	0.012	0.027	0.024	0.008	0.012	0.019	0.011	0.016	0.015	
UN_WORLD_ORDERBOOK_DWT		0	0.081	-0.172	0.204	0.06	0.094	-0.047	0.141	-0.12	-0.023	-0.255	0.248	45.107
	Prob.		0.437	0.186	0.063	0.106	0.131	0.191	0.153	0.146	0.204	0.042	0.008	

Table 4: Correlation Matrix for Economic Variables

Variable	MCI_WORLD	UN_BRENT_OIL	UN_USD_VALUE	UN_IND_PROD	UN_INFLATION	CLARKSEA_INDEX	UN_WORLD_ORD_DWT
MCI_WORLD	1.000						
UN_BRENT_OIL	0.3909	1.000					
UN_USD_VALUE	-0.5524	-0.3363	1.000				
UN_IND_PROD	0.2740	0.0999	-0.1087	1.000			
UN_INFLATION	0.1860	0.4214	-0.2436	0.1336	1.000		
CLARKSEA_INDEX	0.1091	-0.0649	-0.0114	0.2266	0.1715	1.000	
UN_WORLD_ORD_DWT	0.0771	-0.001	0.0657	0.0517	0.0864	0.0266	1.000

Table 5a: Summary statistics of all companies and macroeconomic variables

	Mean	Median	Max.	Min.	Std. Dev.	Skewness	Kurtosis
STOCK_EX_RET	-0.0170	-0.0057	1.3926	-1.6154	0.1611	-1.1909	13.5188
MSCI_WORL_EX_RET	0.0049	0.0155	0.1004	-0.3597	0.0604	-2.8318	16.9166
USD_VALUE	0.0032	0.0023	0.0647	-0.0419	0.0180	0.3711	3.8284
INFLATION	0.0171	0.0178	0.0459	-0.0060	0.0097	0.1833	3.5502
BRENT_OIL	-0.0105	0.0072	0.2190	-0.2997	0.0908	-0.6028	3.9866
IND_PROD	-0.0056	0.0079	0.0995	-0.2099	0.0679	-1.5280	5.2147
CLARKSEA_INDEX	-0.0027	-0.0125	0.3899	-0.3606	0.1420	0.1181	2.9225
WORLD_ORDERBOOK_DWT	-0.0074	-0.0097	0.0859	-0.0567	0.0202	1.0244	7.2345

Table 5b: Container Ship companies in developed and emerging markets

	Developed Markets				Emerging Markets			
	Mean	St.Dev.	Min.	Max.	Mean	St.Dev.	Min.	Max.
STOCK_EX_RET	-0.00275	0.1404	-0.7904	0.6513	-0.0012	0.1306	-0.7012	0.3775
P/CF	0.7503	45.7789	-467.37	94.23	-16.3184	168.3128	-794.79	648.65
P/B	1.0530	0.7655	0.17	5.02	3.6413	13.6527	-17.8	87.56
C. EQUITY/T. ASSETS	38.2223	14.9561	7.74	63.95	30.8399	37.7944	-101.54	94.94
SIZE	6.4390	0.7597	4.9807	7.8011	5.9477	0.7650	4.2952	6.6862
CURRENT_RATIO	1.2836	0.8179	0.12	7.8012	1.3526	1.2145	0.06	6.21

Table 5c: Dry Bulk companies in developed and emerging markets

	Developed Markets				Emerging Markets			
	Mean	St.Dev.	Min.	Max.	Mean	St.Dev.	Min.	Max.
STOCK_EX_RET	-0.03514	0.1999	-1.5967	0.7530	-0.0121	0.1224	-0.6880	0.6031
P/CF	-5.9833	66.9861	-594.49	32.41	4.2230	68.4795	-618.5	188.19
P/B	0.7786	1.3673	-19.59	13.3	1.1008	0.5851	0.08	2.93
C. EQUITY/T. ASSETS	44.3346	29.5362	-136.69	94.85	51.6921	21.4371	16.67	91.75
SIZE	5.1043	0.6282	3.3032	6.2354	5.4015	0.9167	3.9112	8.1367
CURRENT_RATIO	1.9244	3.0933	0.15	23	1.3770	1.2121	0.01	8.19

Table 5d: Tanker Ship companies in developed and emerging markets

	Developed Markets				Emerging Markets			
	Mean	St.Dev.	Min.	Max.	Mean	St.Dev.	Min.	Max.
STOCK_EX_RET	-0.0215	0.1817	-1.6021	1.3926	-0.0105	0.1057	-0.3940	0.3074
P/CF	6.3212	127.423	-667.48	1636.6	9.4582	14.6137	-26.74	69.42
P/B	0.9684	1.3415	-11.69	19.55	-55.9748	385.4929	-3153.93	7.41
C. EQUITY/T. ASSETS	38.7852	23.5169	-39.78	101.05	25.6765	16.2570	-0.02	47.16
SIZE	5.1740	0.7282	0	6.1641	5.4330	0.4615	4.1857	5.9358
CURRENT_RATIO	2.6301	4.7606	0.01	33.13	1.6010	0.7499	0.87	3.19

Table 5e: Diversified companies in developed and emerging markets

	Developed Markets				Emerging Markets			
	Mean	St.Dev.	Min.	Max.	Mean	St.Dev.	Min.	Max.
STOCK_EX_RET	-0.01375	0.1311	-0.7399	0.6159	-0.0135	0.1661	-1.3401	0.6911
P/CF	10.1486	35.7861	-84.85	389.53	4.5014	19.746	-121.88	106
P/B	0.8537	0.7271	-0.59	11.72	1.3498	1.7416	-2.98	21.63
C. EQUITY/T. ASSETS	44.7841	21.9256	-4.37	98.29	36.4221	17.3529	-12.05	74.53
SIZE	5.5636	0.7413	4.5761	7.3187	5.6494	0.7826	3.9996	6.9388
CURRENT_RATIO	2.3621	3.3315	0.07	33.88	2.4426	2.5943	0.07	16.18

Table 6a: Capital Asset Pricing Model results for developed markets

	CONTAINER SHIPS	DRY BULK	TANKER SHIPS	DIVERSIFIED
CONSTANT	-0.00894***	-0.0425***	-0.0273***	-0.0187***
	(0.000337)	(0.000567)	(0.000461)	(0.000372)
MSCI_WORLD_EX_RET	1.437***	1.703***	1.339***	1.158***
	(0.0784)	(0.132)	(0.107)	(0.0865)
R-SQUARED	0.381	0.266	0.202	0.286

Robust standard errors in parentheses

Table 6b: Capital Asset Pricing Model results for emerging markets

	CONTAINER SHIPS	DRY BULK	TANKER SHIPS	DIVERSIFIED
CONSTANT	-0.00582***	-0.0167***	-0.0136**	-0.0192***
	(0.000452)	(0.000322)	(0.000772)	0.000816)
MSCI_WORLD_EX_RET	1.072***	1.079***	0.709	1.322***
	(0.1050)	(0.0749)	(0.174)	(0.189)
R-SQUARED	0.246	0.283	0.167	0.236

Robust standard errors in parentheses

Table 7a: Multifactor model results for developed markets

	CONTAINER SHIPS	DRY BULK	TANKER SHIPS	DIVERSIFIED
CONSTANT	-0.0188*	-0.0105	-0.0177***	-0.291**
	(0.0857)	(0.00875)	(0.00179)	(0.0999)
MSCI_WORLD_EX_RET	1.450***	1.350***	1.346***	1.090***
	(0.0765)	(0.137)	(0.112)	(0.109)
UN_BRENT_OIL		0.245***		
		(0.0563)		
UN_USD_VALUE		-1.106***		
		(0.317)		
UN_IND_PROD	-0.698*	-0.997***	-0.923***	-0.615**
	(0.318)	(0.321)	(0.267)	(0.272)
UN_INFLATION				
CLARKSEA_INDEX		0.175***	0.0570***	0.0582**
		(0.0275)	(0.0199)	(0.0209)
UN_ORDERBOOK		0.978***	0.997***	0.586***
		(0.191)	(0.233)	(0.173)
ln(P/CF)				
ln(P/B)	0.0411**	0.0631***	0.0480***	0.0732***
	(0.0146)	(0.0188)	(0.0114)	(0.0159)
ln(C.EQUITY/T.ASSETS)	0.0521*			0.0805**
	(0.0245)			(0.0279)
SIZE				
ln(CURRENT_RATIO)				
R-Squared	0.395	0.336	0.249	0.347

Robust standard errors in parentheses

Table 7b: Multifactor model results for emerging markets

	CONTAINER SHIPS	DRY BULK	TANKER SHIPS	DIVERSIFIED
CONSTANT		0.438**		-0.0178***
		(0.163)		(0.000819)
MSCI_WORLD_EX_RET	1.223***	1.084***		1.316***
	(0.159)	(0.0845)		(0.189)
UN_BRENT_OIL				
UN_USD_VALUE				
UN_IND_PROD		-0.678**		
		(0.244)		
UN_INFLATION	-6.850*	-4.149***		-2.171*
	(2.590)	(1.090)		(1.070)
CLARKSEA_INDEX		0.0832***		
		(0.0239)		
UN_ORDERBOOK				
ln(P/CF)				
ln(P/B)		0.0536***		0.0370**
		(0.0109)		(0.0165)
ln(C.EQUITY/T.ASSETS)				
SIZE		-0.0830**		
		(0.0302)		
ln(CURRENT_RATIO)				
R-Squared	0.311	0.320		0.251

Robust standard errors in parentheses