

# Global risk factors of NYSE- and NASDAQ-listed shipping companies' stock returns

Nikiforos T. Laopodis

*Department of Acct, Econ and Finance, The American College of Greece,  
Athens, Greece*

## Abstract

**Purpose** – This paper aims to investigate the impact of global macro and other risk factors of the New York Stock Exchange (NYSE)- and National Association of Securities Dealers Automated Quotation (NASDAQ)-listed shipping companies' stock returns from January 2001 to December 2019.

**Design/methodology/approach** – The methodological design includes multi-factor regressions for individual companies, augmented versions of these regressions to examine the likely impact of additional factors and finally panel regressions to assess the impact risk factors on all companies simultaneously. Estimations are done via ordinary least squares and the generalized method of moments.

**Findings** – Multi-factor model results showed that some of the US-specific and global macro risk factors surfaced as statistically significant for most of the companies and appeared to exhibit a consistent pattern in the way they affected shipping stocks. Thus, these companies' exposures emanate mostly from the general US market's movements and to a lesser extent from other firm-specific factors. Second, from the results of panel specifications, this study observes that domestic risk factors such as unemployment, inflation rates and industrial production growth emerged as significant for the NYSE-listed companies. As regard, the NASDAQ-listed ones, it was found that Labor and the G20 inflation rate were also affecting their stock returns.

**Research limitations/implications** – Companies examined are listed only in the US's NYSE and NASDAQ. Hence, companies listed elsewhere were excluded. It may be concluded that these US exchange-listed companies abide mostly by domestic fundamentals and to some extent to selected global factors.

**Practical implications** – The significance of the findings in this study pertains to global investors and shipping companies' managers alike. Specifically, given the differential sensitivities of the shipping companies to various risk factors (and the global business cycle, in general), it is possible to view the shipping companies' stocks as a separate, alternate asset class in a global, well-diversified portfolio. Thus, such a broader portfolio would permit investors to earn positive returns and reduce overall risk. Managers of shipping companies would also benefit from the findings in this study in the sense that they should better understand the varying exposures of their companies to changing global and domestic macro conditions and successfully navigate their companies through business cycles.

**Originality/value** – Research on the global shipping industry has lagged behind and was mainly concentrated on the investigation of the sources of shipping finance and capital structure of shipping companies, investment and valuation, corporate governance and risk measurement and management. Empirical research on the potential micro and macro determinants of the stock returns of shipping companies, however, is scant. This paper fills the gap in the literature of identifying and evaluating the various macroeconomic, US and international risk, factors that affect shipping companies' stock returns in a highly financially integrated world.

**Keywords** Panel analysis, Shipping companies, Multi-factor models, Macro risk factors, Panel  
**Paper type** Research paper



## 1. Introduction

This paper investigates the impact of national and global macroeconomic risk factors such as inflation, stock markets, major economies' industrial productions, oil shocks, exchange rates and interest rate spreads, on the stock returns of all the shipping companies listed on the New York Stock Exchange (NYSE) and National Association of Securities Dealers Automated Quotation (NASDAQ). Early work on the potential determinants of stock returns was mostly done using the CAPM specification but later it was augmented with local macro and micro factors (Chen *et al.*, 1986; Chen and Jordan, 1993 and Fama and French, 2015). Over time, interest grew in examining the influences of stock returns at the global level, in view of the increasing pace of global market integration. However, research on the global shipping industry has lagged behind and was mainly concentrated on the investigation of the sources of shipping finance and capital structure of shipping companies, investment and valuation, corporate governance and risk measurement and management (Alexandridis *et al.*, 2018).

Grammenos and Marcoulis (1996), Poulakidas and Joutz (2009), Grammenos and Arkoulis (2002), Drobetz *et al.* (2010, 2016), El-Mashry *et al.* (2010) and Westgaard *et al.* (2017) found that factors such as inflation, industrial production, exchange rates, interest rates and oil prices were important for stock returns of global shipping companies. Kavussanos *et al.* (2002a, 2002b) investigated 38 international industries and found that various macroeconomic, global risk factors have had different impacts on industries as determined by their unique characteristics.

This paper fills the gap in the shipping industry literature of identifying and evaluating the various US and international macroeconomic risk factors that can potentially affect US shipping companies' stock returns. This paper is the first to examine all NYSE- and NASDAQ-listed shipping companies. Thus, one may derive insights particular to these companies and then compare/contrast them with global companies' sensitivities to global macro risks. Second, given that little work has been done on the impact of global inflation terms and credit spreads on shipping companies' stock returns, this paper empirically investigates their impact. The global nature of shipping companies necessitates the exploration of the influences of world inflation and global financing costs on their stock returns. Finally, this paper adds to the already scant literature on the subject by using multi-factor models and panel analyzes which could provide unique insights to all interested market agents in understanding the market and setting prudent policy policies.

The sample contains 60 shipping companies for the 2001–2019 period. Briefly, the findings show that some of the US and global macro risk factors have surfaced as significant for most of the companies and appeared to exhibit a consistent pattern in the way they affected shipping stocks. Thus, it may be inferred that these companies' exposures emanate mostly from the general US market's movements and to a lesser extent from other factors (such as own financial factors). The examination of the various risk factors of the global shipping industry yields important insights for shipping owners, managers, existing and prospective investors and policymakers. For example, prospective investors in the shipping industry should understand how shipping companies could alter their portfolio's risk-return profile when the shipping industry is viewed as a separate asset class in a well-diversified, global portfolio.

The paper is organized as follows. Section 2 contains the methodological designs of the study and the data sources. Section 3 contains some preliminary results, factor construction and model estimations and some robustness tests. Finally, Section 4 summarizes the findings of the study.

## 2. Methodology and data

### 2.1 Sample characteristics and data

Monthly data on 60 (41 NYSE- and 19 NASDAQ-listed) shipping companies' stock prices were collected, from January 2001 to December 2019, from *Bloomberg*. The raw variables are as follows: the stock prices for each of the companies, the US NYSE and NASDAQ stock market indices, the global benchmark stock market index Morgan Stanley Capital International (MSCI), the US consumer and commodity price indices, two major US dollar exchange rates, several industrial production indices, several US and global short- and long-term interest rates and the Clarksea index. These companies deal in various sectors such as tanker, energy, dry bulk, container, diversified and cruise. [Table 1](#) displays these companies, their data periods, sector(s) and country of their headquarters.

Stock prices and all three market indices were converted into continuously compounded returns and then as excess returns, after subtracting the 3-month US Treasury bill. Variables such as a global commodity price index, the Brent and West Texas Intermediate (WTI) crude oil price indices, the trade-weighted US dollar indices for major currencies and goods and the industrial production indices for the US, G7, Europe and EMU were converted into log returns. Log returns of the consumer prices are inflation rates and rates of return of industrial production indices are industrial production growth rates. Some of these variables are then constructed into factors in Subsection 3.2.

Several interest rates, some short-term and some long-term were also collected. The short-term interest rates are the US 3-month Treasury bill (3m T-bill) and the London interbank offered rate (Libor) both of which are used as proxies for the risk-free rate. The long-term interest rates are the 2-year US Treasury Note (T-note), the 10-year US Treasury Note (10 yr T-note), the AAA-rated and BAA-rated US corporate bond yields. With these rates, several spreads were constructed: two US term spreads (10-year T-note *minus* T-bill and 10-year T-note *minus* 2-year T-note) and two US credit spreads (BAA *minus* 10-year T-note and BAA *minus* AAA corporate bond yields). Finally, a measure of the shipping companies' freight rates is the Clarksea index. Variations in freight rates impact a firm's earnings, and thus stock prices (returns).

### 2.2 Econometric specifications

Typically, one begins with the simple CAPM ([Sharpe, 1964](#) and [Lintner, 1965](#)) specified as follows:

$$(R_{it} - R_f) = \alpha_{it} + \beta_{it}(R_{mt} - R_f) + \varepsilon_{it} \quad i = 1, \dots, n \text{ and } t = 1, \dots, T \quad (1)$$

where  $R_{it}$  is the actual return on the stock price of the company  $i$  in period  $t$ ,  $R_f$  is the risk-free rate,  $R_{mt}$  is the actual return on the equity market portfolio in period  $t$  and  $\varepsilon_{it}$  is the error term (or the residual). Parameter  $\alpha_{it}$  is the alpha of stock and implies that if the stock's price is fair its value would be zero, if it is undervalued its value would be positive and if overvalued it would be negative and parameter  $\beta_{it}$  is the beta of the stock and measures the sensitivity of the stock's returns to market movements (or the stock's systematic risk).

However, a more robust specification would be to augment it with additional factors, macro and financial, in assessing the various sensitivities of a shipping company's stock returns to such factors. Following [Chen et al. \(1986\)](#), a general model can be expressed as:

$$er_{it} = \alpha_{it} + \beta_{1t}emr_t + \beta_{2t}uip_t + \beta_{3t}cs_t + \beta_{4t}ucp_t + \beta_{5t}\Delta sf_t + \varepsilon_{it} \quad (2)$$

where  $er_{it}$  is a company's excess stock returns,  $emr_t$  is a market excess return ( $R_m - R_f$ ),  $uip_t$  is the unexpected change in global industrial production,  $cs_t$  is a credit spread,  $ucp_t$  is the

Table 1.

NYSE- and  
NASDAQ-listed  
shipping companies

| NYSE-listed                              | Sample begins<br>from | Sector                       | Country headquarters |
|------------------------------------------|-----------------------|------------------------------|----------------------|
| Ardmore Shipping Corporation (ASC)       | 9/2013                |                              | Bermuda              |
| Buckeye Partners Ltd (BPL)               | 1/2008                | Diversified                  | USA                  |
| Brookfield Infrastructure Partners (BIP) | 1/2001                | Infrastructure network       | USA                  |
| Carnival Corporation (CCL)               | 1/2001                | Cruise                       | USA                  |
| SEACOR Holdings, Inc. (CKH)              | 1/2001                | Marine services              | USA                  |
| Costamare Inc. (CMRE)                    | 11/2012               | Containers                   | Greece               |
| Danaos Corporation (DAC)                 | 9/2006                | Containers                   | Greece               |
| DHT Holdings, Inc. (DHT)                 | 11/2005               | Tankers                      | Bermuda              |
| Diana Shipping Inc. (DSX)                | 11/2005               | Transport services           | Greece               |
| Dynagas LNG Partners (DLNG)              | 9/2013                | Carriers                     | Monaco               |
| Euronav NV (EURN)                        | 1/2015                | Transport services           | Belgium              |
| Frontline Ltd. (FRO)                     | 1/2001                | Tankers                      | Bermuda              |
| GasLog LP. (GLOP)                        | 5/2014                | Carriers (LNG)               | Monaco               |
| Global Ship Lease, Inc. (GSL)            | 9/2008                | Containers lessor            | Marshall Islands     |
| Huntington Ingalls Ind., Inc. (HII)      | 12/2010               | Transport services           | USA                  |
| Hoegh LNG Partners (HMLP)                | 5/2014                | Carriers (LNG)               | Monaco               |
| Hornbeck Offshore Services (HOS)         | 2/2004                | Transport services           | USA                  |
| International Seaways, Inc. (INSW)       | 10/2016               | General shipping             | USA                  |
| Kenon Holdings Ltd. (KEN)                | 1/2015                | Shipping services            | Singapore            |
| Kirby Corp. (KEX)                        | 1/2001                | Tankers and barges           | USA                  |
| KNOT Offshore Partners (KNOP)            | 2/2013                | Tankers                      | UK                   |
| Dorian LPG Ltd. (LPG)                    | 4/2014                | Carriers (LPG)               | USA                  |
| Matson, Inc. (MATX)                      | 1/2001                | Shipping services            | Hawaii               |
| Marine Products Corp. (MPX)              | 1/2001                | Boats                        | USA                  |
| Nordic American Tankers Ltd (NAT)        | 1/2001                | Tankers                      | Bermuda              |
| Navios Maritime Holdings Inc. (NM)       | 1/2005                | Shipping and logistics       | Greece               |
| Navios Maritime Partners (NMM)           | 6/2007                | Shipping and logistics       | Greece               |
| Navios Maritime Acquisitions Corp. (NNA) | 6/2007                | Transportation and bulk      | Greece               |
| Navigator Holdings Ltd. (NVGS)           | 1/2007                | Transport gas                | UK                   |
| Overseas Shipholding Group, Inc. (OSG)   | 1/2015                | Energy transport services    | USA                  |
| Royal Caribbean Cruises Ltd. (RCL)       | 1/2001                | Cruise                       | USA                  |
| Scorpio Bulkers Inc. (SALT)              | 11/2013               | Dry bulk                     | Monaco               |
| Safe Bulkers, Inc. (SB)                  | 3/2008                | Dry bulk                     | Monaco               |
| Ship Finance Int'l Ltd (SFL)             | 5/2004                | Tankers, bulk and containers | Norway               |
| Seaspan Corp. (SSW)                      | 7/2005                | Containers                   | Hong Kong            |
| Tidewater Inc. (TDW)                     | 1/2001                | Petroleum services           | USA                  |
| Teekay LNG LP (TGP)                      | 5/2005                | LNG services                 | Canada               |
| Teekay Corp. (TK)                        | 1/2001                | Crude and LNG tankers        | Bermuda              |
| Teekay Tankers Ltd. (TNK)                | 12/2007               | Tankers                      | Bermuda              |
| Teekay Offshore LP (TOP)                 | 12/2006               | Marine and oil transport     | Norway               |
| Tsakos Energy Navig. Ltd (TNP)           | 1/2002                | Energy transport services    | Greece               |
| NASDAQ-listed                            |                       |                              |                      |
| Capital Product Partners LP (CPLP)       | 2/2007                | Carriers                     | Greece               |

(continued)

Table 1.

| NYSE-listed                                | Sample begins<br>from | Sector                              | Country headquarters       |
|--------------------------------------------|-----------------------|-------------------------------------|----------------------------|
| Diana Containerships Inc. (DCIX)           | 1/2011                | Containers                          | Greece                     |
| DryShips Inc. (DRYS)                       | 1/2005                | Cargo and dry bulk                  | Greece/Marshall<br>Islands |
| Eagle Bulk Shipping Inc. (EGLE)            | 5/2005                | Bulk                                | USA                        |
| Euroseas Ltd. (ESEA)                       | 11/2005               | Containers                          | Greece                     |
| Globus Maritime Ltd. (GLBS)                | 1/2008                | Dry bulk                            | Greece                     |
| Golar LNG Ltd. (GLNG)                      | 6/2003                | LNG transport                       | Bermuda                    |
| Golden Ocean Group Ltd. (GOGL)             | 1/2001                | Dry bulk                            | Bermuda                    |
| Malibu Boats, Inc. (MBUU)                  | 1/2014                | Boats and general                   | USA                        |
| Genco Shipping and Trading Ltd.<br>(GNK)   | 9/2013                | Dry bulk                            | USA                        |
| MasterCraft Boat Holdings, Inc.<br>(MCFT)  | 1/2015                | Boats and general                   | USA                        |
| Norwegian Cruise Line Hold Ltd.<br>(NCLH)  | 1/2013                | Cruise                              | Norway                     |
| Odyssey Marine Exploration, Inc.<br>(OMEX) | 1/2001                | Ship salvage                        | USA                        |
| Pangaea Logistics Solutions Ltd.<br>(PANL) | 10/2013               | Maritime logistics and<br>transport | USA                        |
| Pyxis Tankers Inc. (PXS)                   | 5/2015                | Tankers                             | Greece                     |
| Star Bulk Carriers Corp. (SBLK)            | 9/2007                | Bulk                                | Greece                     |
| Seenergy Maritime Holdings Corp.<br>(SHIP) | 11/2007               | Dry bulk                            | Greece                     |
| StealthGas, Inc. (GASS)                    | 10/2005               | LNG, LPG transport                  | Greece                     |
| TOP Ships Inc. (TOPS)                      | 4/2004                | Oil and chemical transport          | Greece                     |
| EuroDry Ltd. (EDRY)                        | 2018                  |                                     |                            |
| Grindrod Shipping Holdings Ltd.<br>(GRIN)  | 2018                  |                                     |                            |
| Navios Maritime Containers LP<br>(NMCI)    | 2018                  |                                     |                            |
| TORM plc (TRMD)                            | 2018                  |                                     |                            |

unanticipated change in global commodity prices,  $\Delta sf_i$  is a change in a shipping industry-specific factor and  $\varepsilon_{it}$  is the error term. We consider this as the benchmark multi-factor model.

A variation of a basic multi-factor model would be one, which would include specific factors such as the [Fama and French \(1993\)](#) three-factor model. The three factors were the excess market return, as described above, the High *minus* Low (HML) value premium on the book-to-market factor and the Small *minus* Big (SMB) premium on the size factor. The model is expressed below:

$$(R_i - R_f)_{i,t} = \alpha + \beta_{m,i}(R_m - R_f)_t + \beta_{HML,i}HML_t + \beta_{SMB,i}SMB_t + \varepsilon_{i,t} \tag{3}$$

where factors are as explained above for stock  $i$  at time  $t$  and  $\varepsilon_{i,t}$  is the error term. Thus, the two extra factors are included in our multi-factor model estimation [1].

[Fama and French \(2015\)](#) extended their model above to include two more factors, profitability and investment, claiming that the five-factor model is superior to their original three-factor model. The measure of operating profitability, Robust *minus* Weak (RMW), is annual revenues minus the cost of goods sold, interest and other expenses during the previous fiscal year divided by the end book value of equity. The investment factor, Conservative *minus*

Aggressive (CMA), is calculated as the change in the book value of total assets from the beginning to the end of the previous period divided by the previous end book value of total assets. Finally, there is another factor, momentum (MOM), suggested by [Carhart \(1997\)](#) and refers to the cumulative return for the preceding 2–12 months. Naturally, many more factors such as other interest rate term spreads can be added to the above specifications. The idea is that common, global sources of risk may require a risk premium relative to internationally diversified risks. [Ferson and Harvey \(1994\)](#) found evidence that a number of common world-wide sources of risk in US and European stocks account for their variations.

Autocorrelation and/or heteroskedasticity are very likely to be present in time-series multi-factor models because of the nature of the stock returns. If that is the case, then ordinary least squares (OLS) would provide biased estimates. A solution to avoid violations of the *iid* error term is to apply generalized methods of moments (GMM) proposed by [Hansen \(1982\)](#). GMM uses the orthogonality conditions to allow for efficient estimation in the presence of an unknown form of heteroskedasticity.

Finally, we use an unbalanced panel specification to determine if all factors' explanatory power changed over time. The basic framework for this discussion is a regression model of the form:

$$y_{it} = \alpha + \beta x_{it} + \varepsilon_{it} \quad (4)$$

where  $y_{it}$  is the dependent variable,  $\alpha$  is the intercept term,  $\beta$  is a  $k \times 1$  vector of parameters to be estimated on the explanatory variables and  $x_{it}$  is a  $1 \times k$  vector of observations on the explanatory variables,  $t = 1, \dots, T$  and  $i = 1, \dots, K$ . The simplest type of fixed effects models is to allow for an intercept in the regression model to differ cross-sectionally but not overtime, while all slope estimates are fixed both cross-sectionally and over time.

### 3. Empirical results

#### 3.1 Preliminary statistics

[Table 2](#) displays some descriptive statistics for each company's stock returns, from February 2001 to December 2019. First, more than half of the companies' stock returns were negative while the rest experienced positive average returns. This result was expected considering that the sample period includes the financial crisis subperiod and also because the shipping industry underwent serious financial problems due to lower freight rates, excess capacity, lower oil prices, etc. Second, the risk of these stocks varied considerably when one looks at their standard deviations. Third, almost all skewness values are negative implying a higher probability of extreme negative returns and all kurtosis values are all higher than 3 (the value for the normal distribution) suggesting that the likelihood of extreme values would be on either side of the mean at the expense of a smaller likelihood of moderate deviations. Finally, the Jarque–Bera (J-B) statistic for measuring the (non)normality of returns corroborates the above conclusions that all stock returns distributions deviate from normality.

[Table 3](#) in three panels displays the listed companies' stock return correlations (in Panels A and B) and the other macro variables' correlations (Panel C). For the sake of space preservation, we only report the highest and lowest (positive and negative) correlations instead of the whole matrix. From the values, it appears that stock returns correlations have a great range of values, very low positive, high positive (reaching almost 70% between TGP and TOP, in the NYSE-listed group and 77% between GLBS and SBLK, in the NASDAQ-listed group) and many negative ones. This implies that not all companies have the same sensitivity to business cycles and do not move in tandem, even though they belong to the same (or similar) line of business. This is also verified by the mixed positive and

| Company              | Mean   | SD     | Skewness | Kurtosis | J-B      | Obs. |
|----------------------|--------|--------|----------|----------|----------|------|
| <i>NYSE-listed</i>   |        |        |          |          |          |      |
| ASC                  | -0.127 | 10.781 | -0.108   | 0.118    | 20.121*  | 81   |
| BIP                  | 1.804  | 7.550  | 0.640    | 15.879   | 58.890*  | 140  |
| BPL                  | -0.160 | 5.554  | 0.150    | 4.321    | 10.591** | 227  |
| CCL                  | 0.691  | 8.413  | -0.561   | 1.367    | 89.239*  | 226  |
| CKH                  | 0.159  | 8.567  | -1.312   | 11.802   | 79.678*  | 226  |
| CMRE                 | 0.605  | 10.902 | -0.778   | 1.879    | 78.217*  | 106  |
| DAC                  | -0.589 | 16.123 | 0.350    | 1.977    | 98.321*  | 168  |
| DHT                  | -0.862 | 11.345 | 2.889    | 2.221    | 56.212*  | 168  |
| DSX                  | 0.221  | 13.332 | 0.723    | 3.667    | 67.321*  | 168  |
| DLNG                 | -2.200 | 11.656 | -0.231   | 3.456    | 23.321*  | 71   |
| EURN                 | 0.760  | 8.890  | -0.123   | 2.671    | 34.432*  | 60   |
| FRO                  | 0.021  | 18.452 | 0.534    | 5.109    | 96.221*  | 199  |
| GLOP                 | 1.138  | 11.334 | 0.860    | 2.110    | 88.211*  | 91   |
| GSL                  | 1.567  | 22.346 | 6.456    | 5.136    | 78.561*  | 140  |
| HMLP                 | 0.335  | 7.467  | -0.435   | 1.543    | 55.321*  | 71   |
| HOS                  | -0.077 | 17.781 | -0.177   | 1.789    | 45.167*  | 168  |
| HII                  | 1.889  | 7.198  | 0.125    | 1.542    | 66.211*  | 106  |
| INSW                 | 0.463  | 5.324  | 0.332    | 2.223    | 33.432*  | 60   |
| KEN                  | 1.443  | 15.554 | -0.945   | 8.568    | 83.678*  | 60   |
| KEX                  | 0.234  | 7.546  | -0.321   | 2.967    | 44.213*  | 60   |
| KNOP                 | 0.541  | 7.986  | -0.483   | 3.756    | 23.332*  | 60   |
| LPG                  | -0.665 | 12.667 | 0.201    | 2.367    | 15.445   | 66   |
| MATX                 | 0.265  | 9.054  | -0.273   | 2.602    | 21.332*  | 60   |
| MPX                  | 1.188  | 10.665 | -0.235   | 2.897    | 31.332*  | 60   |
| NAT                  | 0.128  | 12.013 | -0.024   | 4.987    | 57.654*  | 226  |
| NNA                  | -2.467 | 31.789 | -0.397   | 13.345   | 81.661*  | 60   |
| NM                   | -3.456 | 28.223 | -0.753   | 17.456   | 66.789*  | 60   |
| NMM                  | -2.456 | 29.667 | -0.937   | 19.314   | 78.890*  | 60   |
| NVGS                 | -0.467 | 13.671 | -0.879   | 5.136    | 21.321*  | 60   |
| OSG                  | -3.632 | 29.546 | 1.013    | 18.561   | 66.415*  | 60   |
| RCL                  | 0.775  | 14.456 | -1.134   | 11.332   | 62.189*  | 226  |
| SALT                 | -4.112 | 33.435 | -1.361   | 21.321   | 77.891*  | 73   |
| SB                   | -1.395 | 20.154 | -0.601   | 5.987    | 57.336*  | 140  |
| SFL                  | 0.902  | 10.045 | -0.712   | 5.346    | 50.778*  | 185  |
| SSW                  | 0.209  | 11.067 | -0.672   | 5.443    | 60.326*  | 172  |
| TDW                  | -1.954 | 35.678 | -1.342   | 25.556   | 89.667*  | 226  |
| TGP                  | 0.245  | 9.562  | -1.345   | 10.114   | 45.445*  | 174  |
| TK                   | -0.335 | 13.665 | -2.102   | 16.113   | 56.3218  | 225  |
| TOP                  | -1.254 | 13.867 | -0.713   | 11.443   | 47.547*  | 155  |
| TNK                  | -0.882 | 13.234 | 0.149    | 3.621    | 20.231*  | 145  |
| TNP                  | 0.044  | 11.812 | -0.034   | 4.224    | 25.445*  | 213  |
| <i>NASDAQ-listed</i> |        |        |          |          |          |      |
| CPLP                 | -2.021 | 20.412 | -1.043   | 22.324   | 33.324*  | 152  |
| DCIX                 | 5.425  | 32.234 | 1.123    | 24.435   | 41.234*  | 106  |
| DRYS                 | -5.456 | 24.556 | -0.345   | 6.789    | 35.321*  | 178  |
| EGLE                 | -4.237 | 40.334 | -0.772   | 25.324   | 33.332*  | 174  |
| ESEA                 | -2.897 | 16.556 | -0.534   | 5.089    | 44.556*  | 166  |
| GASS                 | -0.710 | 12.456 | -1.065   | 9.087    | 29.557*  | 169  |
| GLBS                 | -3.548 | 32.335 | -0.523   | 7.443    | 19.234*  | 142  |
| GLNG                 | 0.385  | 13.234 | -0.885   | 3.456    | 5.567    | 197  |

**Table 2.**  
Summary statistics  
of stock returns

(continued)

Table 2.

| Company | Mean   | SD     | Skewness | Kurtosis | J-B     | Obs. |
|---------|--------|--------|----------|----------|---------|------|
| GNK     | -1.221 | 10.221 | 0.321    | 9.890    | 61.121* | 227  |
| GOGI    | -0.467 | 13.556 | -0.371   | 3.234    | 6.779   | 226  |
| MBUU    | 1.088  | 12.645 | -0.623   | 3.456    | 5.445   | 70   |
| MCFT    | 0.678  | 12.134 | -0.173   | 4.126    | 3.335   | 60   |
| NCLH    | 0.856  | 8.798  | -0.777   | 3.978    | 3.989   | 83   |
| OMEX    | 0.113  | 20.123 | 0.546    | 5.872    | 88.345* | 226  |
| PANL    | -1.534 | 13.445 | -0.287   | 5.534    | 19.678  | 54   |
| PXS     | -1.045 | 28.345 | 0.625    | 19.445   | 45.556* | 145  |
| SHIP    | -5.456 | 30.456 | -1.078   | 25.678   | 55.678* | 145  |
| SBLK    | -2.717 | 25.678 | -0.886   | 19.678   | 35.556* | 145  |
| TOPS    | -5.671 | 20.546 | -0.367   | 6.678    | 77.989* | 187  |

**Notes:** J-B is the Jarque-Bera statistic for detecting non-normality in the series; \*, \*\* denote statistical significance at the 5 and 10% levels, respectively

negative average returns found in Panel A of the table. The above results suggest that there is an attractive risk/return tradeoff in the global shipping sector. The finding that some companies are negatively affected and others positively affected by the general, global economic conditions implies non-synchronicity with the global business cycle and, in turn, great diversification potential. Thus, it may be worthwhile to view shipping stocks as an alternate, separate asset class for inclusion in a well-diversified, global portfolio.

Finally, Panel C contains the correlations among the macro variables. We observe several negative and positive correlations among them. For example, the highest correlations were between crude oil (CRUDE) and commodity inflation (COMINF), 0.934, EMU inflation (EMUINF) and Europe inflation (EURINF), 0.985 and the two exchange rates (EXRT or USD vs major currencies and TEXR or the trade-weighted), 0.922, as expected in all cases. The lowest correlations were observed between crude oil and the trade-weighted exchange rate (-0.441) and commodity inflation and trade-weighted exchange rate (-0.530). Note that these are the correlations among the raw variables, not the factors, which will be constructed for the subsequent empirical investigation.

### 3.2 Factor construction

At this point, it is instructive to briefly mention the results from the CAPM regressions [2]. We have found both positive (some were higher/lower than unity) and negative betas. Negative betas are useful because in case of economic slowdown people could buy them as an investment to gain significant diversification opportunities.

Before embarking on the estimation of the multi-factor models, it is important to construct the factors from the macroeconomic variables. The idea is to remove any spurious relationships among the variables and ensure that we do not have multicollinearity in the model to be estimated. There are various ways one can do that but, in this paper, we will specify various univariate AR(p) models. Then, we will take the variables' residuals (that is, the unexpected component of each series) to use as explanatory variables in the model specified earlier in equation (2). The approach of estimating AR(p) models for each macro variable was applied by Poon and Taylor (1991), Grammenos and Arkoulis (2002) and Kavussanos *et al.* (2002a, 2002b). In our case, the derivation of the factors yielded an AR(1) as the optimal specification.

**Table 3.**  
Stock return and  
macro variable  
correlations

|                                    | Lowest positive | Lowest negative | Highest positive |
|------------------------------------|-----------------|-----------------|------------------|
| <i>Panel A: NYSE-listed stocks</i> |                 |                 |                  |
| ASC & BPL                          | 0.003           | & TDW           | & DHT            |
| BPL & BPL                          | 0.001           | & DHT           | & TDW            |
| BPL & DAC                          | 0.001           | & DHT           | & NM             |
| CCL & SALT                         | 0.030           | & NMM           | & NTP            |
| CKH & KNOP                         | 0.004           | & SSW           | & SFL            |
| CL & HOS                           | 0.003           | & DLNG          | & DSX            |
| CMRE & KNOP                        | 0.007           | & HII           | & MPX            |
| DAC & SSW                          | 0.004           | & NVGS          | & NAT            |
| DHT & SALT                         | 0.030           | & DLNG          | & TOP            |
| DLNG & OSG                         | 0.006           | & NAT           | & SB             |
| DXH & NAT                          | 0.019           | & NM            | & NNA            |
| FRO & MATX                         | 0.008           | & MPX           | & KNOP           |
| GLBS & GSL                         | 0.001           | & OSG           | & NMM            |
| GLOG & KEN                         | 0.058           | & GSL           | & KNOP           |
| GNK & NVGS                         | 0.006           | & OSG           | & KEX            |
| GSL & TNP                          | 0.001           | & SALT          | & MPX            |
| HII & MATX                         | 0.001           | & TDW           | & KNOP           |
| HMLP & SSW                         | 0.047           | & SALT          | & NMM            |
| HOS & TDW                          | 0.014           | & NNA           | & SFL            |
| KEN & TNK                          | 0.036           | & KNOP          | & TOP            |
| KEX & MATX                         | 0.071           | & RCL           | & TGP            |
| LGP & MPX                          | 0.001           | & NNA           | & NVGS           |
| KNOP & TK                          | 0.012           | & MATX          | & OSG            |
| MATX & TNP                         | 0.006           | & NAT           | & SSW            |
| MPX & TNP                          | 0.005           | & TNK           | & SB             |
| NAT & TGP                          | 0.005           | & SFL           | & TNP            |
| NM & OSG                           | 0.033           | & NNA           | & SSW            |
| NMM & NNA                          | 0.003           | & OSG           | & SALT           |
| NNA & TDW                          | 0.011           | & TOP           | & TNP            |
| NVGS & OSG                         | 0.101           | & TNP           | & SSW            |
| OSG                                |                 | & SALT          |                  |
| RCL & TOP                          | 0.073           | & SSW           | & TNP            |
| SALT & SB                          | 0.042           | & SALT          | & TK             |
|                                    |                 |                 | (continued)      |

|                                      | Lowest positive | Lowest negative | Highest positive |
|--------------------------------------|-----------------|-----------------|------------------|
| SB & SSW                             | 0.064           |                 | 0.408            |
| SFL & TDW                            | 0.140           | -0.176          | 0.624            |
| SSW & TGP                            | 0.030           | -0.248          | 0.234            |
| TDW & TGP                            | 0.025           | -0.170          | 0.324            |
| TGP & TNK                            | 0.143           |                 | 0.699            |
| TK & TNK                             | 0.278           |                 | 0.596            |
| TNK                                  |                 | -0.047          | 0.158            |
| TOP & TNP                            | 0.154           |                 |                  |
| <i>Panel B: NASDAQ-listed stocks</i> |                 |                 |                  |
| CPLP & PANL                          | 0.037           |                 | 0.519            |
| DCIX & GASS                          | 0.021           | -0.598          | 0.286            |
| DRYS & GASS                          | 0.032           | -0.234          | 0.292            |
| EGLE & SHIP                          | 0.026           | -0.229          | 0.187            |
| ESEA & PANL                          | 0.000           | -0.709          | 0.401            |
| GASS & DCIX                          | 0.020           | -0.319          | 0.396            |
| GLBS & GLBG                          | 0.017           | -0.256          | 0.771            |
| GLNG & MCFT                          | 0.005           | -0.251          | 0.395            |
| GOGI & GLNG                          | 0.042           | -0.223          | 0.397            |
| MBUU & DCIX                          | 0.009           | -0.123          | 0.552            |
| MCFT & GLNG                          | 0.005           | -0.273          | 0.064            |
| NCLH & PXS                           | 0.027           | -0.401          | 0.552            |
| OMEX & SHIP                          | 0.021           | -0.405          | 0.296            |
| PANL & MBUU                          | 0.030           | -0.081          | 0.332            |
| PXS & DRYS                           | 0.071           | -0.186          | 0.180            |
| SBLK                                 |                 | -0.289          | 0.026            |
| SHIP                                 |                 | -0.174          | 0.474            |
| TOPS                                 |                 | -0.321          |                  |
|                                      |                 |                 | & TGP            |
|                                      |                 |                 | & TNK            |
|                                      |                 |                 | & TNK            |
|                                      |                 |                 | & TNK            |
|                                      |                 |                 | & TOP            |
|                                      |                 |                 | & TOP            |
|                                      |                 |                 | & TOP            |
|                                      |                 |                 | & TOPS           |
|                                      |                 |                 | & PXS            |
|                                      |                 |                 | & ESEA           |
|                                      |                 |                 | & TOPS           |
|                                      |                 |                 | & GOGL           |
|                                      |                 |                 | & SBLK           |
|                                      |                 |                 | & TOPS           |
|                                      |                 |                 | & GASS           |
|                                      |                 |                 | & NCLH           |
|                                      |                 |                 | & OMEX           |
|                                      |                 |                 | & MBUU           |
|                                      |                 |                 | & DRYS           |
|                                      |                 |                 | & GLNG           |
|                                      |                 |                 | & TOPS           |
|                                      |                 |                 | & TOPS           |
|                                      |                 |                 | & PANL           |
|                                      |                 |                 | & EGLE           |
|                                      |                 |                 | & SBLK           |
|                                      |                 |                 | & SBLK           |
|                                      |                 |                 | & MCFT           |
|                                      |                 |                 | & GLBS           |
|                                      |                 |                 | & GASS           |
|                                      |                 |                 | & DRYS           |
|                                      |                 |                 | & DCIX           |
|                                      |                 |                 | & MCFT           |
|                                      |                 |                 | & NCLH           |
|                                      |                 |                 | & MCFT           |
|                                      |                 |                 | & GLBS           |
|                                      |                 |                 | & PXS            |
|                                      |                 |                 | & SBLK           |
|                                      |                 |                 | & SHIP           |
|                                      |                 |                 | & EGLE           |

(continued)

Table 3.

Table 3.

| Panel C: Macro variable correlations                                                                                                                                                                                                                                                                                                                                                                                                                                                     |        |        |        |        |        |        |        |        |        |        |       |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | GRUDE  | COMINF | SPREAD | UN     | EMUINF | EURINF | G20INF | IPGEU  | IPGG7  | LCSPR  | CEXR  |
| COMINF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0.934  |        |        |        |        |        |        |        |        |        |       |
| SPREAD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | -0.152 | -0.212 |        |        |        |        |        |        |        |        |       |
| UN                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | -0.144 | -0.204 | 0.375  |        |        |        |        |        |        |        |       |
| EMUINF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0.281  | 0.258  | -0.076 | 0.022  |        |        |        |        |        |        |       |
| EURINF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0.308  | 0.293  | -0.067 | 0.040  | 0.985  |        |        |        |        |        |       |
| G20INF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0.472  | 0.524  | -0.165 | -0.039 | 0.488  | 0.527  |        |        |        |        |       |
| IPGEU                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0.164  | 0.232  | -0.350 | -0.270 | 0.008  | 0.026  | 0.167  |        |        |        |       |
| IPGG7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0.147  | 0.232  | -0.444 | -0.362 | 0.003  | 0.005  | 0.098  | 0.680  |        |        |       |
| LCSPR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | -0.007 | -0.005 | 0.494  | 0.000  | -0.014 | -0.005 | -0.009 | -0.021 | 0.041  |        |       |
| CEXR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | -0.388 | -0.467 | 0.054  | 0.098  | -0.081 | -0.092 | -0.191 | -0.090 | -0.090 | -0.032 |       |
| TEXR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | -0.441 | -0.530 | 0.111  | 0.138  | -0.103 | -0.115 | -0.204 | -0.114 | -0.130 | -0.017 | 0.922 |
| <b>Notes:</b> COMINF is commodity price inflation; SPREAD is the 10yr US T-note minus 3-m Treasury bill; UN the unemployment rate; EMUINF is EMU inflation rate; EURNF is Europe's inflation rate; G20INF is the G20 countries inflation rate; IPGEU is Europe's industrial production; LCSPR is the long credit spread (BAA minus 10-year T-note); CEXR is the USD exchange rate vs. other currencies; TEXR is the US trade-weighted exchange rate. Sample spans from 1/2001 to 12/2019 |        |        |        |        |        |        |        |        |        |        |       |

Before estimating equation (2), it is useful to discuss the importance and expected signs of the risk factors [3]. The impact of exchange rates on the shipping companies' stock returns is mixed. Leggate (1999) reported that exposure to exchange rate risk can have a positive or a negative effect on US-dollar denominated expenditures of shipping companies, depending on the direction of movement in the exchange rate. Grammenos and Arkoulis (2002) found a negative relationship between stock returns of shipping firms and the dollar exchange rate of the domestic currency, while El-Mashry *et al.* (2010) reported negative, positive or no relationships.

The evidence is also varied on the influence of interest rates and credit spreads on the shipping companies' stock returns. The slope of the term structure of interest rates reflects market expectations about the future path of the macroeconomy and, by extension, companies' stock returns. The slope of the credit term structure negatively predicts future stock returns (Han *et al.*, 2017). El-Mashry *et al.* (2010) concluded that stock returns of shipping firms were, generally, negatively impacted by changes in interest rates, which affected their debt-servicing capacity. Similar arguments can be made for changes in credit spreads. For example, Grammenos and Arkoulis (2003) implied that credit spreads negatively influence laid-up tonnage, and thus, indirectly, stock returns. Kavussanos and Tsouknidis (2014) also argued that credit spreads are important determinants for global financing risk(s) given that global shipping is a highly asset-intensive business.

Evidence on the influence of news in crude oil prices on shipping companies' stock returns is again mixed. On one hand, Grammenos and Arkoulis (2002) reported that companies' stock returns were negatively affected by oil price changes, Kavussanos and Marcoulis (2000), Drobetz *et al.* (2010) and El-Mashry *et al.* (2010) on the other, argued that oil prices may be a contributor to stock returns given that oil is the major input for generating cargo service.

Unanticipated US and global inflation rates are also expected to exert a negative impact on international trade and investment. Global inflation (proxied by the global commodity price index, G20 or Europe's inflation rates) is viewed as a proxy for worldwide investor uncertainty regarding expectations on global economic activity, which would adversely impact global shipping companies' profits. Kavussanos *et al.* (2002a, 2002b) stated that the negative consequences of unexpected inflation can be mitigated by hedging (in stock prices). Grammenos and Arkoulis (2002), however, failed to establish a significant empirical relationship.

Finally, other macro risk factors are the unexpected changes in global industrial production, as measured by the G7 and Europe's industrial production indices all of which reflect the global economic/business cycle. Isserlis (1998) and Drobetz *et al.* (2012) reported that movements in world economic cycles and freight rates followed similar patterns. Stopford (2009) found that business cycles in advanced economies reflected cycles in sea trade and, consequently, the relationship between global industrial production and international shipping stock returns is expected to be positive. Grammenos and Arkoulis (2002), however, found a negative relationship between these magnitudes.

### 3.3 Empirical results from multi-factor models

Table 4 contains the results for the benchmark multi-factor model, with the US factors mentioned above and the extended model with the global factors, which surfaced as mostly statistically significant in preliminary runs of a model, which contained all variables [4]. The GMM approach to estimate the benchmark model uses the Newey-West heteroscedasticity-consistent correction and the estimated J-statistics, which are the most common diagnostics to evaluate the suitability of the model, which were above zero and their probabilities near zero. In addition, in each regression, related variables were used, for example, for the crude oil the Brent and WTI we used, in turn, but the final model specification was the one reported in the table (the NYSE-listed companies in Panel A and the NASDAQ-listed companies in Panel B).

**Table 4.**  
Multi-factor model  
estimates of US and  
global risk factors

| Firm                         | Macro risk factors |         |          |          |          |         |          |          |          |        |
|------------------------------|--------------------|---------|----------|----------|----------|---------|----------|----------|----------|--------|
|                              | constant           | COMINF  | LCSRP    | EMR      | TEXR     | USINF   | USIPG    | LIBOR    | EUIPG    | J-stat |
| Panel A: NYSE-listed stocks  |                    |         |          |          |          |         |          |          |          |        |
| ASC                          | 0.345              | 0.424** | 4.357    | -0.618   | -0.037   | 1.534** | 1.123    | -0.345   | -1.589   | 0.445  |
| BIP                          | 0.656              | 0.032   | 7.244    | 0.489*   | -0.289   | -0.671  | 1.456    | -0.807   | 0.823    | 0.945  |
| BPL                          | 2.165*             | -0.083  | -5.231   | -0.467   | 3.078    | 2.443*  | 0.735    | -1.034** | 0.078    | 0.523  |
| CCL                          | 1.734*             | 0.334   | 6.007    | 0.131    | 0.347    | 2.197   | 1.365    | -0.323** | 0.002    | 0.332  |
| CKH                          | -0.567             | -0.176  | -5.457   | 0.907*   | 0.182    | 0.878   | -0.225   | 0.245    | -0.954   | 0.291  |
| CMRE                         | 0.478              | 0.104   | -6.113   | -0.360   | -0.167   | 4.445*  | 2.356    | -0.334   | 2.271    | 0.226  |
| DAC                          | -2.061**           | 0.334   | 4.223    | 0.865*   | 0.035    | -5.667  | 1.078    | -0.234   | 3.500**  | 0.033  |
| DHT                          | -2.567             | -0.445  | -6.491   | -0.245   | -0.222   | 4.567*  | -4.042   | 0.243    | 1.256    | 0.789  |
| DLNG                         | 3.987              | 0.867   | 7.497    | -0.238   | 1.313    | 5.667   | 3.298    | -4.189** | -3.211   | 0.607  |
| DSX                          | -1.587             | -0.534  | -6.156   | -0.123   | -0.601   | 6.334** | -1.287   | 0.787    | -0.876   | 0.656  |
| EURN                         | -1.467             | -0.012  | -7.808** | 1.156*   | -0.686   | 5.456   | -2.572   | 0.445    | 0.078    | 0.045  |
| FRO                          | -1.767             | 0.434   | 6.156    | 0.234    | -0.567   | -6.497* | -0.468   | 0.787    | 1.856    | 0.032  |
| GLOP                         | 1.089              | -0.123  | 6.198    | 0.267    | 0.589    | 1.445   | 7.412**  | -0.561   | 1.066    | 0.244  |
| GSL                          | 2.389              | 2.312   | 3.078    | -0.956   | 2.223    | 6.516   | 2.798    | -2.432   | 2.776    | 0.023  |
| HII                          | 1.113**            | 0.078   | 3.323**  | 0.239    | 1.245    | -0.332  | 2.173    | -0.332   | 1.967    | 0.022  |
| HMLP                         | 0.734              | 0.630** | -0.423   | -0.712   | 2.321    | 3.245** | 0.512    | 0.443    | 0.332    | 0.565  |
| HOS                          | -2.451**           | 0.571   | 3.897    | 2.034*   | 0.817*   | 3.223   | 0.254    | 0.332    | 0.056    | 0.352  |
| INSW                         | -3.867             | -1.234  | -1.108   | 1.876**  | 1.445    | -5.112  | -2.287   | 4.556    | 1.232    | 0.598  |
| KEN                          | -1.234             | 0.223   | 1.387    | 2.208*   | 1.443    | 1.332** | 3.087*   | 1.445    | -0.679   | 0.923  |
| KEX                          | 0.345              | 0.322   | 2.091    | 0.934*   | 0.140    | 1.276   | 1.065    | 0.134    | 1.171    | 0.667  |
| KNOP                         | 1.334              | 0.173   | 3.134    | -0.366   | -0.744   | 3.591   | 1.045    | 0.254    | 0.767    | 0.951  |
| LPG                          | -2.187             | -0.143  | -3.176   | 1.234*   | -0.265   | 4.334   | -3.387   | 1.223    | -0.335   | 0.932  |
| MATX                         | 0.834              | -0.023  | -1.275   | 1.248*   | 0.034    | 1.089   | -0.398   | -0.887*  | 0.378    | 0.019  |
| MPX                          | 2.332*             | 0.623   | 2.122    | 0.254    | -0.478   | 3.334   | 2.512    | -0.093** | 0.774    | 0.018  |
| NAT                          | 0.029              | 0.191   | 3.078    | -0.119   | -0.397   | -3.578  | 0.712    | 0.006    | 0.721    | 0.012  |
| NM                           | -2.334             | 2.223   | 2.787**  | 2.898*   | 3.334    | 3.678   | 2.154    | -0.445   | 2.556    | 0.034  |
| NMM                          | 0.422              | -0.323  | -3.226   | 0.402**  | -1.734   | -0.123  | -3.423   | -1.443   | 1.074    | 0.834  |
| NNA                          | -1.598             | -0.234  | -1.123   | -0.975** | -0.345   | -4.321  | -4.778   | 0.889    | -0.849   | 0.045  |
| NVGS                         | -0.645             | -1.834  | -3.200   | 0.332    | -1.223   | 3.234   | -4.034   | 1.388    | 0.445    | 0.067  |
| OSG                          | -0.213             | 1.334** | -2.508   | 0.389    | -4.334   | -4.456  | 4.775    | 1.556    | 2.434    | 0.299  |
| RCL                          | 2.778*             | 0.145   | -3.187** | 0.323    | -0.287   | -2.665  | 1.112    | -1.443*  | -1.334   | 0.934  |
| SALT                         | -3.332             | -2.189  | 1.775    | 2.812*   | 0.334    | 4.332   | -3.176   | 0.309    | -1.331** | 0.841  |
| SB                           | -0.945             | 1.332*  | 3.667    | 0.898**  | 2.445    | -4.132  | 4.486    | -0.221   | 2.657    | 0.531  |
| SFL                          | 0.132              | -0.012  | -1.308*  | 1.346*   | -0.445   | 2.109   | 0.267    | 0.398    | 0.014    | 1.078  |
| SSW                          | -0.123             | -0.456  | 0.065    | 1.187*   | 0.066    | 3.223   | 1.108    | 0.007    | 2.387    | 1.012  |
| TDW                          | -2.878*            | 0.487   | 3.697*   | 1.727*   | -0.162   | 3.445   | 2.467    | 0.712    | -0.334   | 1.055  |
| TGP                          | -0.376             | -0.801  | 4.176    | 0.712*   | 0.497    | 4.554*  | 2.837    | 0.123*   | -0.567   | 1.092  |
| TK                           | -0.276             | -0.023  | 4.067    | 1.234*   | -0.223   | 2.332*  | 1.710    | -0.189   | 0.221    | 0.348  |
| TNK                          | -2.345             | -0.701  | -5.445** | 1.423*   | -0.034   | 4.534   | -3.403   | 1.423*   | -2.765   | 1.008  |
| TNP                          | -1.023             | -0.402  | -3.056   | 0.145    | 0.245    | 1.342   | -1.167   | 0.434    | -0.112   | 1.006  |
| TOP                          | -1.023             | 0.311   | 4.002    | 0.839*   | 1.287**  | 5.445** | 2.187    | -0.589   | 0.321    | 1.100  |
| Panel B: NADAQ-listed stocks |                    |         |          |          |          |         |          |          |          |        |
| CPLP                         | -4.223             | 0.365** | 2.571    | 1.467*   | 1.342**  | 3.534   | 4.280*   | 0.845    | -1.121   | 0.989  |
| DCIX                         | 7.089              | -1.889  | 5.331    | 2.089*   | -4.234   | 3.221   | -4.335   | -1.089   | -2.077   | 0.011  |
| DRYS                         | -5.778*            | -0.124  | -4.334*  | 0.687*   | -2.334** | 2.145   | -2.211   | 2.089    | 1.956    | 0.011  |
| EGLE                         | -6.887*            | 0.278   | -5.008   | 0.334    | 1.897    | 3.089** | -5.011   | 1.664*   | 1.523    | 0.070  |
| ESEA                         | -4.689*            | -0.089  | -1.587   | 0.404**  | 0.423    | -4.789* | -2.445** | 0.978    | -0.771   | 0.012  |
| GASS                         | -1.675             | 0.297** | 5.332**  | 1.213*   | -0.323   | 5.008*  | -0.245   | 0.042    | -0.267   | 0.013  |
| GLBS                         | -5.234             | -0.523  | 5.998    | 1.297**  | -0.912   | -3.335  | 5.656    | 1.109    | 1.978    | 0.012  |

(continued)

Table 4.

| Firm | Macro risk factors |          |         |         |        |         |          |         |          |        |
|------|--------------------|----------|---------|---------|--------|---------|----------|---------|----------|--------|
|      | constant           | COMINF   | LCSPR   | EMR     | TEXR   | USINF   | USIPG    | LIBOR   | EUIPG    | J-stat |
| GLNG | 0.208              | 0.156    | -6.121* | 0.407** | 0.354  | -1.967  | 3.645**  | -0.132  | -0.324   | 0.067  |
| GNK  | -4.334             | 0.278    | -1.408  | 0.235   | 0.824  | 6.556** | 1.345    | 2.334   | -4.231   | 0.745  |
| GOGL | -1.334             | 0.435**  | 5.234   | 0.822*  | 0.254  | 5.667*  | 0.345    | 0.185   | 0.412    | 0.055  |
| MBUU | -1.443             | 0.068    | -2.078  | 1.601*  | -0.056 | -5.776* | -3.223** | 0.476   | -2.007** | 0.077  |
| MCFT | 4.987*             | -0.443** | -5.434* | -0.612* | -2.334 | 2.245   | 1.254    | -2.445* | 0.987    | 0.100  |
| NCLH | -0.324             | -0.387** | 5.445   | 1.323*  | 0.012  | 0.886   | 0.132    | -0.452  | -0.756   | 0.002  |
| OMEX | -3.077**           | -0.411   | -2.656  | 0.987*  | -0.497 | -1.732  | -0.987   | 1.332** | 0.143    | 0.002  |
| PANL | -3.908             | 0.756    | -3.443  | 0.507** | -0.987 | 0.453   | 5.871**  | 1.967** | 2.554**  | 0.045  |
| PXS  | -3.501             | -1.234   | -4.332  | 0.513** | -0.276 | 3.334   | -5.461   | 1.387   | -3.223   | 0.001  |
| SBLK | -3.667             | 0.036    | 4.776   | 0.235** | 0.065  | 2.341   | 5.889    | 0.607   | -0.287   | 0.001  |
| SHIP | -5.779*            | 0.807    | 5.008** | 0.513** | 1.412  | 2.276   | 6.008**  | 1.297   | 1.387    | 0.069  |
| TOPS | -6.007*            | 0.047    | 6.008*  | 0.712*  | -1.167 | -3.997  | 2.109    | 0.087   | -3.228** | 0.088  |

**Notes:** Global commodity inflation (COMINF); US long credit spread (LCSPR); NYSE excess market returns (EMR); Trade-weighted US dollar exchange rate (TEXR); US inflation (USINF); US industrial production growth (USIPG); the London Interbank Offered Rate (LIBOR); European industrial production growth (EUIPG); J-stat is the GMM J-statistic; \*, \*\* refer to 5% and 10% levels of significance, respectively

The following observations can be made on the NYSE-listed companies' results. First, there were no consistent signs of a particular factor across all companies. Second, all factors appear to have been useful in some companies but not in others and their signs agree with our expectations. Third, the least significant factor seems to have been the USIPG and the most significant factors, in terms of appearing most often, were the stocks' betas, US inflation and the long credit spread. The latter factor's coefficients are almost always negative and mostly statistically insignificant, which indicates that increases in credit spreads depress stock returns. Fourth, the fact that the companies' betas are mostly statistically insignificant suggests that other risk factors may be more important at play. Further, the finding that the (unexpected) exchange rate's coefficients are mostly statistically insignificant hint that companies did in fact engage in foreign exchange hedging.

Fifth, the global commodity inflation factor's (COMINF) coefficients surface as both positive and negative and occasionally as statistically significant. This finding connotes that these companies might have used inflation as hedges for their stock returns but the empirical literature is not conclusive on the sigh of unanticipated inflation against stock returns (see, for example, Chen *et al.*, 1986). Sixth, LIBOR did not always emerge as statistically significant which means that these shipping companies may not have used it frequently as a means of financing for their activities. At the peak of the shipping frenzy, during the global financial crisis, margins were unreasonably low and most global loans were extended at LIBOR plus 80 basis points. Afterward, shipping loans were commanding much higher margins. It appears that the global shipping industry has been able to cope with these much higher margins, and thus it is expected to cope with some small interest rate increases in the years to come.

Finally, Europe's industrial production factor's coefficients were not found significant for these shipping companies, which is surprising given that they reflect the global business cycle. This finding agrees with the inconclusive results in the literature. For example, Poon and Taylor (1991) found a negative relationship between stock returns and industrial production in the UK and Chen and Jordan (1993) reported no association between the two magnitudes.

As regard the results for the NASDAQ-listed companies, shown in Panel B, we observe that almost always the stocks' betas are statistically significant while the remaining risk

factors appeared to be occasionally significant. Thus, it may be inferred that these companies' exposures emanate mostly from the general US market's movements and to a lesser extent from other factors (and, perhaps, from their own financial factors). This can be partly rationalized by the fact that these companies had their initial public offerings in the US market and have greater exposure to the US market. Overall, it can be deduced that some of these US and global macro risk factors surfaced as statistically significant for most of the companies investigated and appear to exhibit a consistent pattern in the way in which they affected shipping stocks. These findings are also in line with the hypothesized signs of each of the variables (factors) discussed above.

What about using the Fama-French factors in exploring the companies' stock returns? Regarding the NYSE-listed stocks, the excess market returns (EMR) surfaced as significant and with the correct sign, more often than the other factors. Also, SMB and HML were typically insignificant but the RMW factor appeared more often significant. A similar picture is evident also for the NASDAQ-listed companies. Thus, it may be inferred that these factors are not important for these shipping companies, besides the market [5].

Finally, given that the sample period contains a serious financial crisis, which became global in nature, a dummy variable was created to capture the effect of the crisis years (2007–2009). In all regressions, the dummy variable did not surface as statistically significant but was mostly negative and, at times, large in size, suggesting that it did have an adverse economic impact on the shipping companies' stock returns (but not in a statistical sense) [6].

#### *3.4 Empirical results from panel models*

We have estimated several variants of (unbalanced) panel models but report only the most statistically significant ones (fixed effects) in [Table 5](#). Looking at the results for the NYSE-listed companies in Panel A, we observe that regardless of the approach used, OLS or GMM, the relevant market, the US unemployment rate, the US inflation rate and the US industrial production growth factors emerged as statistically significant, while the world commodity inflation, the credit spread, Europe's industrial production growth and the trade-weighted exchange rate did not. In addition, the G20 countries' inflation rate appears to be significant in the GMM approach and with the appropriate sign. At the bottom of the panel, some diagnostic statistics are reported, namely, the adjusted R-squared, J-statistic and a test for the redundancy of the fixed effects. In all cases, their values did not point to issues or worries about the appropriateness of the models.

Panel B of the table contains the results for the NASDAQ-listed companies. Contrary to the other shipping companies' results, we see that the US industrial production growth and the trade-weighted exchange rate did not emerge as significant. Further, in this set of companies, Libor was statistically significant in both panel approaches. As with the NYSE-listed companies, the models' diagnostics corroborate their suitability. Thus, it may be concluded that these US exchange-listed companies abide mostly by domestic fundamentals and to some extent to global factors such as Libor and G20 inflation rate. This conclusion agrees with the multi-factor models' results. This is a surprising result given the global nature of these companies' business. Further, it is possible that these companies' stock returns are affected by their financials such as operating and financial leverage, dividend payout ratio and the like but these are not examined in this paper (for those, see [Grammenos and Marcoulis, 1996](#)). The above findings, in general, are in line with those of the extant literature ([Drobetz et al., 2010](#); [Grammenos and Arkoulis, 2002](#); [Westgaard et al., 2007](#)).

#### *3.5 Robustness tests*

Some robustness tests are performed to ensure that the above results remain valid to alternate specifications and factors. First, the benchmark multi-factor model was run with both the US

**Table 5.**  
Panel estimation  
results

| <i>Factor</i>                           | <i>OLS coefficient (stand. error)</i> | <i>GMM coefficient (stand. error)</i> |
|-----------------------------------------|---------------------------------------|---------------------------------------|
| <i>Panel A: NYSE-listed companies</i>   |                                       |                                       |
| constant                                | −0.323* (0.120)                       | −0.333* (0.120)                       |
| cominf                                  | 0.018 (0.012)                         | 0.054 (0.035)                         |
| nyse                                    | 0.530* (0.029)                        | 0.540* (0.029)                        |
| lcspr                                   | 0.484 (0.345)                         | 0.230 (0.135)                         |
| usun                                    | 2.545* (0.802)                        | 2.416* (0.794)                        |
| usinf                                   | 2.244* (0.487)                        | 2.118* (0.490)                        |
| usipg                                   | 0.473* (0.203)                        | 0.522* (0.203)                        |
| euipg                                   | 0.188 (0.115)                         | —                                     |
| texr                                    | 0.068 (0.088)                         | 0.070 (0.068)                         |
| G20inf                                  | —                                     | −2.212* (0.822)                       |
| Fixed effects                           | Yes                                   | Yes                                   |
| Adj- $R^2$                              | 0.061                                 | 0.062                                 |
| J-statistic                             |                                       | 1.078                                 |
| F-stat (prob)                           | 8.416 (0.000)                         |                                       |
| Redundant fixed                         |                                       |                                       |
| Effects F-test (prob)                   | 1.319 (0.024)                         |                                       |
| <i>Panel B: NASDAQ-listed companies</i> |                                       |                                       |
| constant                                | −2.763* (0.480)                       | −2.443* (0.420)                       |
| cominf                                  | 0.075 (0.062)                         | 0.088 (0.075)                         |
| nasdaq                                  | 0.350* (0.065)                        | 0.371* (0.067)                        |
| usinf                                   | 2.264* (0.987)                        | 2.070* (1.011)                        |
| usipg                                   | 0.413 (0.332)                         | 0.372 (0.283)                         |
| libor                                   | 0.548* (0.215)                        | 0.549* (0.213)                        |
| texr                                    | −0.068 (0.088)                        | −0.071 (0.067)                        |
| G20inf                                  | —                                     | −1.612 (0.982)                        |
| Fixed effects                           | Yes                                   | Yes                                   |
| Adj- $R^2$                              | 0.040                                 | 0.039                                 |
| DW                                      | 2.094                                 | —                                     |
| J-statistic                             |                                       | 0.378                                 |
| F-stat (prob)                           | 4.781 (0.000)                         | —                                     |
| Redundant fixed                         |                                       |                                       |
| Effects F-test (prob)                   | 2.431 (0.004)                         | —                                     |

**Notes:** \* denotes statistical significance at the 5% level; G20inf is the inflation rate of the G20 countries; see Table 4 for additional variable definitions

standard equity market index, S&P500 and the world equity index, MSCI, in place of the NYSE and NASDAQ. The estimated betas of the NYSE-listed companies with the S&P500 index were almost always lower than those using the relevant index, while the NASDAQ-listed companies' betas were mostly above the ones with the relevant market. Thus, in the first case, the standard market proxy underestimated betas while in the second case it overestimated them. Finally, when using the MSCI index and contrary to the results with the NYSE and NASDAQ indices, we see much lower beta values for all companies, as well as negative betas for some companies at both stock exchanges[7]. These results, in general, imply that these companies are not influenced much by a world benchmark index even though their operations are global. Thus, using the US equity indices proved to be a correct choice for the market proxy.

Second, the Clarksea index's coefficients were always statistically insignificant in both sets of companies, and thus not reported. This is consistent with previous work by [Drobetz et al. \(2016\)](#). Regarding other variables as substitutes for the original ones, we alternated a number of them such as spreads (short and medium-term ones), industrial production

growth rates (EMU's and Europe's) and crude oil variables (Brent and WTI) in all models but did not emerge as significant.

Finally, we estimated a random-effects panel specification and performed a [Hausman \(1978\)](#) specification test to ensure that our choice of a fixed-effects model was the correct one versus the random-effects one. The results pointed to the rejection of the null hypothesis of "random effects are preferred" in all cases, as the probability values were less than 0.05.

#### 4. Conclusions

This study examined the impact of the US and global macroeconomic risk factors on all NYSE- and NASDAQ-listed shipping companies' stock returns from January 2001 to December 2019. The main results are summarized as follows. First, the multi-factor models showed that some of the US and global macro risk factors surfaced as significant for most of the companies and appeared to exhibit a consistent pattern in the way they affected their stocks. Second, from the results of panel analyzes we observed that domestic magnitudes such as the relevant market were significant for the NYSE-listed companies and for the NASDAQ-listed ones, LIBOR and the G20 inflation rate was also significant. Thus, it may be concluded that these US exchange-listed companies abided mostly by domestic fundamentals and to some extent to selected global factors, which is a surprising result given the global nature of these companies' business.

The significance of the findings pertains to global investors and shipping companies' managers alike. Given the differential sensitivities of the shipping companies to various risk factors (and the global business cycle, in general), it is possible to include them as a separate asset class in a global portfolio. Managers of shipping companies would also benefit from these findings so they could better understand the exposures of their companies to changing global and domestic macro conditions and successfully navigate their companies through business cycles. Finally and practically-speaking, the findings emphasize the potential diversification benefits from the shipping industry as investors and portfolio managers could hedge their exposures and optimize their portfolio allocations.

A suggestion for future research would be the assessment of the effects of the COVID-19 pandemic on these companies' stock returns to see the extent of the, presumably negative, impact and infer if global non-economic events are capable of affecting globally-operating firms.

#### Notes

1. Data for these factors are obtained from the Kenneth French's online data library.
2. The full results are available upon request from the author.
3. Although not reported (but are available upon request), the correlations among the factors, US and global alike, were very low (the highest correlation of 0.245 was observed between the European inflation and crude oil changes).
4. We performed a stepwise regression with all variables to determine the ones that always emerged as statistically significant.
5. In all cases, the momentum factor did not appear to be significant.
6. The results are not reported but are available upon request. At the suggestion of a referee, we also tested the dotcom bubble and September 11, 2001 attacks using dummy variables but did not find any noteworthy statistical significance.
7. NYSE-listed: *CMRE*, *FRO*, *INSW*, *KNOP*, *NAT* and NASDAQ-listed: *CPLP*, *DCIX*, *ESEA*, *PXS*, *SHIP* and *TOPS*.

---

## References

- Alexandridis, G., Kavussanos, M.G., Kim, C.Y., Tsouknidis, D.A. and Visvikis, I.D. (2018), "A survey of shipping finance research: setting the future research agenda", *Transportation Research Part E: Logistics and Transportation Review*, Vol. 115, pp. 164-212.
- Carhart, M.M. (1997), "On persistence in mutual fund performance", *The Journal of Finance*, Vol. 52 No. 1, pp. 57-82.
- Chen, S. and Jordan, B.D. (1993), "Some empirical tests in the arbitrage pricing theory: macrovariables vs. derived factors", *Journal of Banking and Finance*, Vol. 17 No. 1, pp. 65-89.
- Chen, N., Roll, R. and Ross, S. (1986), "Economic forces and the stock market", *The Journal of Business*, Vol. 59 No. 3, pp. 383-403.
- Drobetz, W., Schilling, D. and Tegtmeier, L. (2010), "Common risk factors in the returns of shipping stocks", *Maritime Policy and Management*, Vol. 37 No. 2, pp. 93-120.
- Drobetz, W., Menzel, C. and Schröder, H. (2016), "Systematic risk behavior in cyclical industries: the case of shipping", *Transportation Research Part E: Logistics and Transportation Review*, Vol. 88, pp. 129-145.
- Drobetz, W., Richter, T. and Wambach, M. (2012), "Dynamics of time varying volatility in the dry bulk and tanker freight markets", *Applied Financial Economics*, Vol. 22 No. 16, pp. 1367-1384.
- El-Mashry, A.A., Olugbode, M. and Pointon, J. (2010), "The exposure of shipping firms' stock returns to financial risks and oil prices: a global perspective", *Maritime Policy and Management*, Vol. 37 No. 5, pp. 453-473.
- Fama, E. and French, K. (1993), "The cross-section of expected stock returns", *The Journal of Finance*, Vol. 47 No. 2, pp. 427-465.
- Fama, E. and French, K. (2015), "A five-factor asset pricing model", *Journal of Financial Economics*, Vol. 116 No. 1, pp. 1-22.
- Ferson, W.E. and Harvey, C.R. (1994), "Sources of risk and expected returns in global equity markets", *Journal of Banking and Finance*, Vol. 18 No. 4, pp. 775-803.
- Grammenos, C.T. and Arkoulis, A.G. (2002), "Macroeconomic factors and international shipping stock returns", *International Journal of Maritime Economics*, Vol. 4 No. 1, pp. 81-99.
- Grammenos, C.T. and Arkoulis, A.G. (2003), "Determinants of spreads on new high yield bonds of shipping companies", *Transportation Research Part E: Logistics and Transportation Review*, Vol. 39 No. 6, pp. 459-471.
- Grammenos, C.T. and Marcoulis, S.N. (1996), "A cross-section analysis of stock returns: the case of shipping firms", *Maritime Policy and Management*, Vol. 23 No. 1, pp. 67-80.
- Han, B., Avaniidhar, S. and Zhou, Y. (2017), "The term structure of credit spreads, firm fundamentals, and expected stock returns", *Journal of Financial Economics*, Vol. 124 No. 1, pp. 147-171.
- Hansen, L.P. (1982), "Large sample properties of generalized method of moments estimators", *Econometrica*, Vol. 50 No. 4, pp. 1029-1054.
- Hausman, J.A. (1978), "Specification tests in econometrics", *Econometrica*, Vol. 46 No. 6, pp. 1251-1271.
- Isserlis, L. (1998), "Tramp shipping, cargoes and freights", *Journal of the Royal Statistical Society*, Vol. 101 No. 1, pp. 53-146.
- Kavussanos, M.G. and Marcoulis, S.N. (2000), "The stock market perception of industry risk through the utilisation of a general multifactor model", *International Journal of Transportation Economics*, Vol. 27, pp. 77-98.
- Kavussanos, M.G. and Tsouknidis, D.A. (2014), "The determinants of credit spreads changes in global shipping bonds", *Transportation Research Part E: Logistics and Transportation Review*, Vol. 70, pp. 55-75.
- Kavussanos, M.G., Juell-Skielse, A. and Forrest, M. (2002a), "International comparison of market risks across shipping-related industries", *Maritime Policy and Management*, Vol. 30 No. 2, pp. 107-122.

- Kavussanos, M.G., Marcoulis, S.N. and Arkoulis, A.G. (2002b), "Macroeconomic factors and international industry returns", *Applied Financial Economics*, Vol. 12 No. 12, pp. 923-931.
- Leggate, H.K. (1999), "Norwegian shipping: measuring foreign exchange risk", *Maritime Policy and Management*, Vol. 26 No. 1, pp. 81-91.
- Lintner, J. (1965), "The valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets", *Review of Economics and Statistics*, Vol. 47 No. 1, pp. 13-37.
- Poon, S. and Taylor, S.J. (1991), "Macroeconomic factors and the UK stock market", *Journal of Business Finance and Accounting*, Vol. 18 No. 5, pp. 619-636.
- Poulakidas, A. and Joutz, F. (2009), "Exploring the link between oil prices and tanker rates", *Maritime Policy and Management*, Vol. 36 No. 3, pp. 215-233.
- Sharpe, W.F. (1964), "Capital asset prices: a theory of market equilibrium under conditions of risk", *Journal of Finance*, Vol. 19 No. 3, pp. 425-442.
- Stopford, M. (2009), *Maritime Economics*, 3rd ed., Routledge, London.
- Westgaard, S., Frydenberg, S., Jensen, E.F. and Mitter, K.W. (2007), "Economic and financial risk factors and tanker shipping stock returns", *Norwegian University of Science and Technology*, Unpublished manuscript.
- Westgaard, S., Osmundsen, P., Stenslet, D. and Ringheim, J.K. (2017), "Modeling superior predictors for crude oil prices", *Journal of Energy Markets*, Vol. 10 No. 2, pp. 77-99.

### Further reading

- Kavussanos, M.G. and Marcoulis, S.N. (1997), "Risk and return of US Water transportation stocks over time and over bull and bear market conditions", *Maritime Policy and Management*, Vol. 24 No. 2, pp. 145-158.
- Kavussanos, M.G. and Marcoulis, S.N. (2004), "Cross-Industry comparisons of the behaviour of stock returns in shipping, transportation and other industries", *Research in Transportation Economics*, Vol. 12, pp. 107-142.

### About the author

Nikiforos T. Laopodis is a Finance Professor at the School of Business and Economics' Finance Department at The American College of Greece. Previously, he was teaching at the Finance Department of Fairfield University's Dolan School of Business. Dr Laopodis is widely published in the areas of finance and economics on topics such as investments, monetary and fiscal policies and financial econometrics and in highly respected journals such as *The Financial Review*, *the Journal of International Money and Finance*, *the Journal of International Financial Markets*, *Institutions and Money* and *the Journal of Financial Stability*, etc. Since 1995, he has been and continues to be, an active and regular participant in the Eastern Finance Association, Financial Management Association (US and Int'l) and recently in the European Financial Management Association. Finally, he has published a textbook in investments in 2013, titled *Understanding Investments: Theories and Strategies*, the 2nd edition of which is now out. Dr Laopodis currently teaches investments, financial econometrics and financial markets and institutions. Nikiforos T. Laopodis can be contacted at: [nlaopodis@acg.edu](mailto:nlaopodis@acg.edu)

---

For instructions on how to order reprints of this article, please visit our website:  
[www.emeraldgroupublishing.com/licensing/reprints.htm](http://www.emeraldgroupublishing.com/licensing/reprints.htm)  
 Or contact us for further details: [permissions@emeraldinsight.com](mailto:permissions@emeraldinsight.com)