Asset Valuation and Market Expectations in Dry Bulk Shipping

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This digest article is based on Professor Nikos Nomikos' presentation to the JPMCC's Research Council on September 30, 2016.

During the JPMCC's Research Council meeting on September 30, 2016, Professor Nikos Nomikos (far left-hand side), Cass Business School, City, University of London (U.K.), presented during the "Emerging Risks and Challenges in Commodity Supply Chains" morning panel. The other participants in the panel were (starting to the right of Professor Nomikos, from left-to-right) Mr. John Schmitter, KEP LLC; Mr. Steffen Hammer, Robert Bosch GmbH (Germany); and Professor Colin Carter, University of California, Davis and Research Council Chair, JPMCC. Professor Carter moderated the panel.

Introduction

The shipping industry plays an important role in the world economy since about 90% of the world trade is carried by sea, according to the International Chamber of Shipping (2017). One of its sectors is the *dry bulk* market that involves the transportation of homogeneous bulk commodities, typically raw materials

such as iron ore, grains, coking and thermal coal, bauxite and alumina, on non-scheduled routes, mainly on a "one ship-one cargo" basis (Alizadeh and Nomikos, 2010). The dry bulk sector is important in its own right, as it represents by far the largest shipping segment in terms of both cargo carrying capacity and quantity transported. Last year, dry bulk vessels carried more than 43% of the world's seaborne trade. It is thus not surprising that dry-bulk freight rates are considered as indicators for world economic activity (Kilian, 2009).

Shipping Demand

Demand for dry bulk shipping services translates into demand for seaborne trade which, in turn, is driven by a few main factors. Undoubtedly, the most important one is the world economy; as Stopford (2009) documents, seaborne trade is highly correlated with world GDP cycles. In addition, seaborne trade is affected by the prevailing conditions in the related commodity trades. Commodity markets affect the demand for shipping in both the short- and long-term. Regarding the former, short-term fluctuations in shipping markets may be caused by the seasonal character of some trades (e.g. in agricultural commodities). On the other hand, long-term fluctuations can be mainly attributed to changes in the economies of the countries that import and export the corresponding commodities. In addition to those factors, which are exogenous to the shipping industry, demand is also affected by the distance over which commodities are transported, known as the "average haul" and measured in tonne-miles.[1] Finally, one must also consider random shocks that perturb the shipping equilibrium and result in the well-known shipping boom-bust cycles or, equivalently, generate the extraordinary volatility that characterizes the industry. These unique and unpredictable shocks in shipping demand may be caused by economic disturbances superimposed on business cycles such as the two oil price shocks in 1973 and 1979 and the recent financial crisis, or political events such as wars, revolutions and strikes (Stopford, 2009).

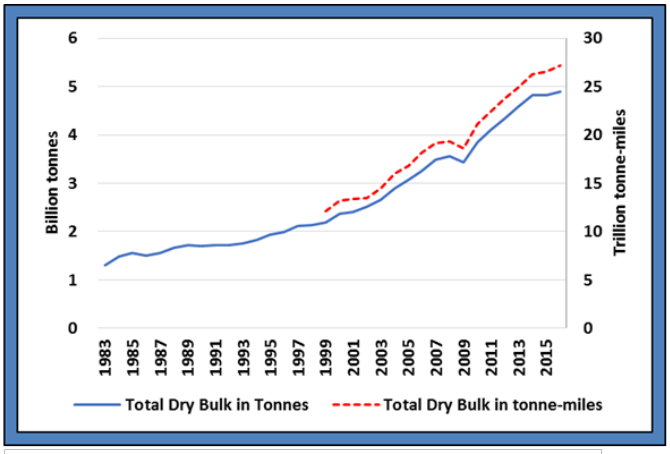
Consequently, demand is considered as rather inelastic and exogenous to the shipping industry. Panel A of Figure 1 presents the evolution of dry bulk seaborne trade from 1983 to 2016. Evidently, the aggregate demand variable follows an upward sloping time trend that results in a significant aggregate increase over the respective years. Specifically, the total increase is equal to 376.6%, corresponding to an annual average compound growth rate of 4.1%. However, as we observe in Panels B and C, commodity-specific and country-specific demand fluctuates significantly around this upward trend. Panel C of Figure 2 illustrates that annual demand changes of around 10% are not an unusual phenomenon in this industry. In conclusion, we can characterize the evolution of dry bulk demand as a mean-reverting process around a positive drift.[2]

Shipping Supply

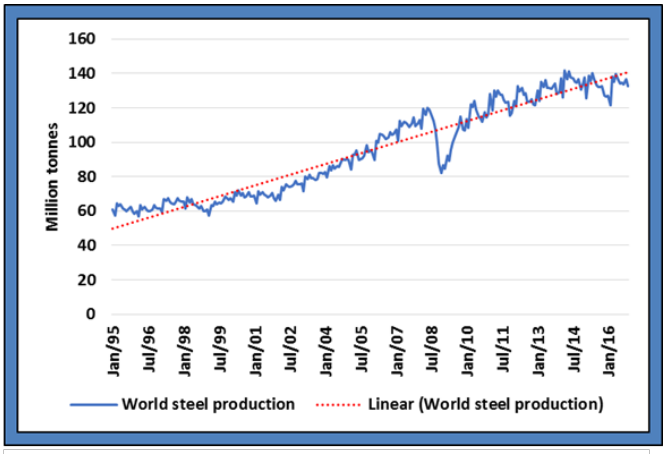
The supply component of the shipping mechanism corresponds to the cargo carrying capacity of the dry bulk fleet. Depending on the size of the vessel, the dry bulk fleet can be subdivided into four main sectors, which researchers and industry participants treat as different markets; that is, the Capesize, Panamax, Handymax, and Handysize sectors. At the largest end of the range, Capesize carriers have a cargo carrying capacity that exceeds 100,000 dwt and carry primarily iron ore and coal.[3] Panamax carriers (60,000-80,000 dwt) serve mainly the coal, grain, bauxite and the larger minor bulk trades. At

the lower end of the range are the Handymax (40,000-59,000 dwt) and Handysize (20,000-39,000 dwt) carriers. These ships serve as versatile workhorses in trades where parcel size and port restrictions require smaller vessels. Usually, they carry minor bulks and smaller quantities of major bulks. As of December 2016, the Capesize, Panamax, Handymax, and Handysize dry bulk sectors consisted of 1,651, 2,450, 3,445, and 3,316 vessels, respectively. Equivalently, the total cargo carrying capacity amounted to approximately 793 million dwt (or 10,862 vessels).

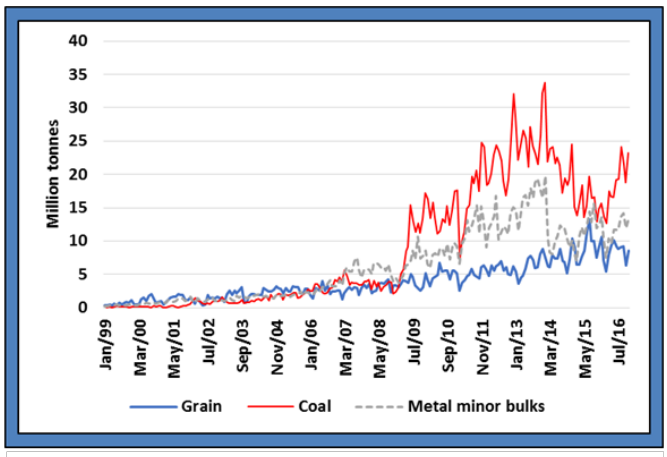
Figure 1
Demand for Dry Bulk Shipping Services



Panel A: Total dry bulk seaborne trade, from 1983 to 2016.



Panel B: World steel production, from 1/1995 to 11/2016.



Panel C: China's coal, grain, and metal minor bulk imports, from 1/1999 to 11/2016.

Panel A illustrates the evolution of total dry bulk seaborne trade measured in both tonnes and tonne-miles at an annual frequency. Panel B shows the monthly world steel production measured in million tonnes. Finally, Panel C shows the evolution of China's coal, grain, and metal minor bulk imports measured in million tonnes at a monthly frequency.

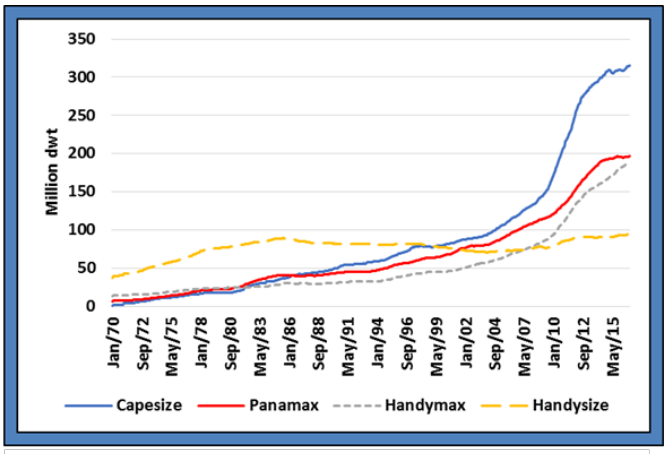
Source: Clarksons.

The dry bulk industry consists of a large number of ship owning corporations that essentially act as price-takers. Therefore, from an economic point of view, dry bulk shipping is considered as a highly competitive industry. Panel A of Figure 2 illustrates the evolution of fleet capacity (measured in dwt) for each of the four sectors while Panel B depicts the development of the aggregate dry bulk fleet. The evolution of the sector-specific and aggregate supply variables is very similar to those of demand; since 1983, total growth in the aggregate dry bulk supply is 450.6% which is equivalent to 4.7% average annual increase (Panel B of Figure 2).

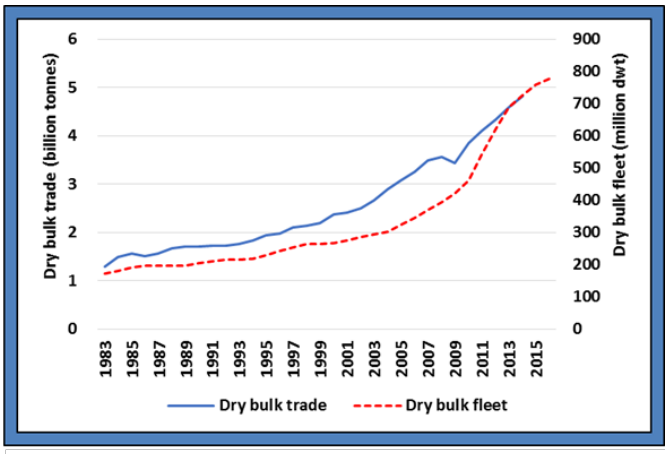
In contrast to demand, shipping supply is determined by the investment decisions of market agents and therefore, is endogenous to the dry bulk industry; it can be increased through the ordering of newbuilding vessels, and decreased through the demolition of existing ones. Thus, supply is highly elastic in the long run. To quantify this inherent feature of the shipping industry, consider the following stylized fact: during the market peak of 2007, the order book was approximately 70% of the corresponding fleet.[4] Thus, by 2016 the net increase in the size of the fleet, that is after accounting for scrapping activity, was more than 100%, compared to its 2007 level (Panel B of Figure 2).

Another interesting feature is that the delivery of a newbuilding order requires a time-to-build that can vary from 18 months upwards and depends on the prevailing market conditions (Kalouptsidi, 2014). Hence, in the short-term, shipping supply can be inelastic and supply adjusts sluggishly to changes in demand (Greenwood and Hanson, 2015). Consequently, as Panels B and C of Figure 2 demonstrate, while the levels of aggregate shipping supply and demand exhibit a high degree of co-movement, their respective growth rates are less correlated, the correlation coefficients being 0.96 and 0.26, respectively. The implications of this feature are very important both in terms of shipping lease rates (net earnings)[5] and vessel prices.

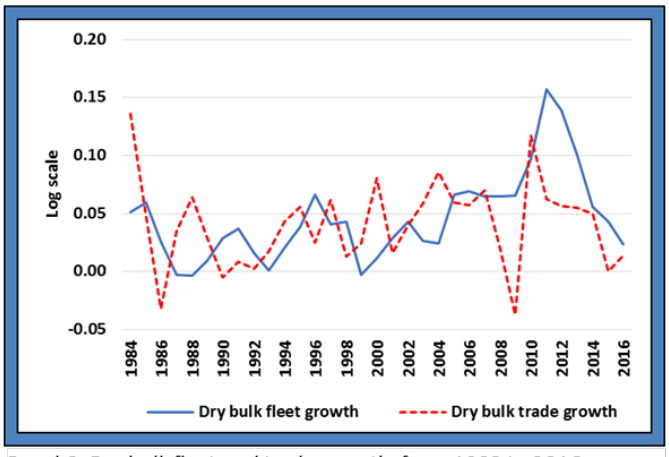
Figure 2
Dry Bulk Shipping Supply and Correlation with Demand



Panel A: Dry bulk fleet development, from 1/1970 to 12/2016.



Panel B: Dry bulk fleet and trade development, from 1983 to 2016.



Panel C: Dry bulk fleet and trade growth, from 1983 to 2016.

Panel A illustrates the fleet development for each dry bulk sector (measured in million dwt) at a monthly frequency. Panel B provides a comparison between the total dry bulk fleet development (measured in million dwt) and the evolution of the total dry bulk trade (measured in billion tonnes). Finally, Panel C compares the evolutions of total dry bulk fleet and total dry bulk trade growth. The data corresponding to Panels B and C are measured annually.

Source: Clarksons.

Shipping Earnings, Vessel Prices, and Market Conditions

From a shipping investor's perspective, changes in net earnings directly affect asset values, i.e. vessel prices. Specifically, random shocks in demand perturb the short-run shipping equilibrium and, consequently, the prevailing net earnings; this can be thought of as a first-order effect. In turn, an increase in current net earnings has an indirect effect on future net earnings through the current investment decisions of market agents. Due to the time-to-build constraint though, changes in supply will not be realized immediately but in future periods which can be thought of as a second-order effect. This fact, in conjunction with the mean-reverting (around an upward trend, as illustrated above)

character of the exogenous demand result in extremely volatile shipping cash flows. Consequently, shipping net earnings are not exogenously, but partially endogenously determined by the investment decisions of market participants.

Therefore, one should expect net earnings to be positively and negatively related to shipping demand and supply, respectively. Indeed, Nomikos and Moutzouris (2015) proxy shipping demand through the aggregate dry bulk seaborne trade and estimate a significant positive relationship between net earnings growth and shipping demand growth across all dry bulk sectors (with correlations ranging from 0.49 to 0.63). Furthermore, they show that net earnings growth is negatively related to the spread between supply and demand growth rates (the respective correlation coefficients range from -0.79 to -0.87). In the following, we incorporate findings from Nomikos and Moutzouris (2015) for the Capesize sector; results in the other three sectors are both quantitatively and qualitatively similar.

For illustrational purposes, consider a discrete-time, dynamic environment where annual net earnings are determined through the previously analyzed supply and demand mechanism. Assume further that due to an unexpected demand shock, current net earnings are significantly high. Therefore, the owner of a vessel can immediately exploit the prosperous market conditions. In anticipation of this increased short-term cash flow, current vessel prices increase compared to their previous level; this substantial price increase is a positive first-order effect of the increased net earnings.[6] The strong, positive relationship between current net earnings and vessel prices is depicted in Panel A of Figure 3.

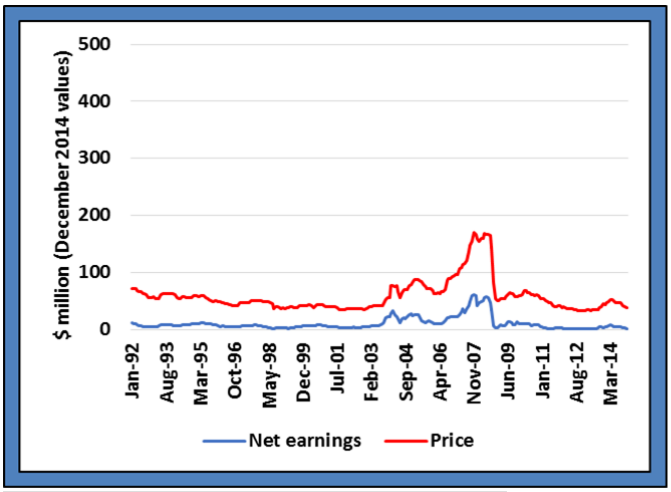
Furthermore, in analogy to commodity markets literature, due to the time-to-build required for the delivery of a newbuilding order, this first-order effect can be interpreted as a “convenience yield”, which is reflected in the ratio of the price of a 5-year second-hand (SH) vessel to the price of newbuilding (NB) vessel. In particular, as we observe in Panel C of Figure 3, this ratio increases with net earnings. Noticeably, during market upturns (downturns) the ratio is significantly higher (lower) than one; that is, 5-year old vessels are more (less) expensive than newbuilding ones. This result becomes even more interesting if we consider that the latter have significantly longer economic lives compared to the former.

In addition, high current net earnings result in increased current net investment. As Kalouptsidi (2014) argues, entry into dry bulk shipping markets is free, subject to an entry cost and time-to-build delays. Panel D of Figure 3 demonstrates that current net earnings and current scaled net investment are significantly positively correlated. Accordingly, increased net investment results in increased future fleet capacity, which *ceteris paribus* leads to decreased future net earnings. Notice that this decrease can be highly exacerbated due to the mean-reverting character of demand. Nomikos and Moutzouris (2015) justify this argument formally by performing predictive ordinary least squares regressions of future net earnings growth on current net investment; as one would expect, their results suggest that current net investment negatively predicts future net earnings growth.

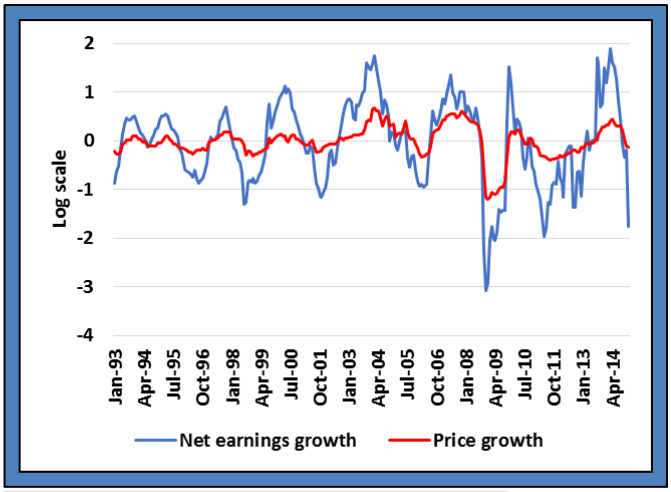
Consequently, market participants at time *t* anticipate this mechanism and value second-hand vessels as if they expect future net earnings to be lower compared to the prevailing ones. Hence, current net earnings - through current investment - have a negative second-order effect to current second-hand prices. Therefore, in market upturns the growth rate of net earnings is significantly higher compared to

that of prices (Panel B of Figure 3). On the other hand, during market downturns current net earnings decrease substantially more than vessel prices as investors anticipate that future net earnings will be higher in the future. Specifically, low net earnings result in lower (even negative) current net investment, which in conjunction with an expected increase in future demand, results in expectations of higher future net earnings. In this case, current net earnings have a negative first-order effect to current prices but a positive second-order one.

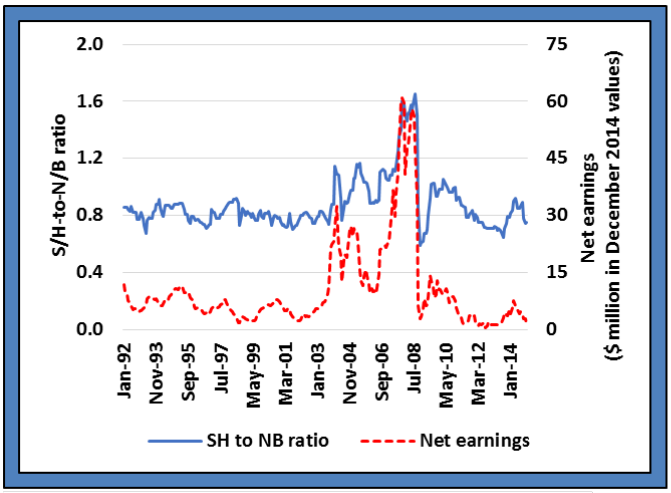
Figure 3
Net Earnings, Vessel Prices, and Investment



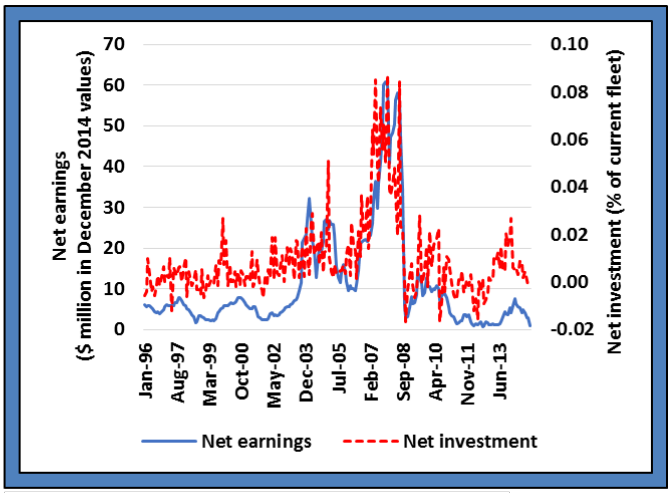
Panel A: Net earnings and vessel prices.



Panel B: Net earnings and price growth.



Panel C: Net earnings, second-hand, and newbuilding prices.



Panel D: Net earnings and net investment.

Figure 3 summarizes findings from Nomikos and Moutzouris (2015) related to the Capesize dry bulk sector for the period January 1992 to December 2014. Panels A and B depict the relation between real annual net earnings and real 5-year vessel prices and their respective growth rates. Panel C depicts the relation between the ratio of 5-year old to newbuilding vessel prices and current net earnings. Panel D illustrates the relation between net earnings and net investment. All variables are in monthly frequency.

A first implication of this mechanism is that shipping net earnings are substantially more volatile than vessel prices. This is in line with Greenwood and Hanson (2015) who argue that investors recognize, up to a certain degree, the mean-reverting character of net earnings. This in turn results in a more conservative and less naïve valuation of vessels, compared to the case of perfect extrapolation in which investors assume that current earnings will also prevail in the future. Second, earnings yields are strongly positively related with net earnings and vessel prices. Since in financial and real estate markets valuation ratios are used as indicators of fundamental value of the generated cash flow relative to corresponding price of the asset (Campbell and Shiller, 1988), we can argue that in shipping, during market peaks (troughs) vessels are undervalued (overvalued) compared to their respective generated cash flows (Panel A of Figure 3). Finally, a third and most important implication of this mechanism is that high shipping earning yields strongly reflect market expectations about deteriorating future market conditions (i.e. net earnings growth). Equivalently, we can argue that vessel prices mainly move due to investors' expectations about future market conditions.

Endnotes

1 Tonne-miles are defined as the product of the tonnage of shipped cargo times the transportation distance (Stopford, 2009).

2 The assumption of a simple mean-reverting process for demand has also been proposed by Kalouptsidi (2014) and Greenwood and Hanson (2015).

3 dwt stands for deadweight tonnage and measures the cargo carrying capacity of a vessel. Minor bulks refer to commodities that are transported in smaller parcels such as forest products, bauxite and alumina, fertilizers, cement, petroleum coke, and nickel ore.

4 The order book measures the number of vessels under construction or awaiting construction (Papapostolou *et al.*, 2014).

5 Net earnings are defined as the operating profit for the owner of the vessel and is calculated as freight income minus operating costs.

6 Technically, this is an implication of the fact that net earnings for period $t \to t+1$ are $\mathcal{F}_t$-measurable.

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Author Biography

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Nikos Nomikos is Professor of Shipping Risk Management at Cass Business School. He commenced his career at the Baltic Exchange as Senior Market Analyst where he was responsible for the development of the shipping indices that are currently used in the market as pricing benchmarks. For the last 10 years he has been with the Faculty of Finance at Cass Business School, where he is also the Director of the M.Sc. course in Shipping, Trade and Finance, a leading postgraduate program that attracts high calibre graduates from around the world. His area of expertise is Ship Finance and Risk Management. As such, he particularly enjoys lecturing on the topics of shipping economics, ship finance and shipping risk management as well as quantitative finance and risk management in financial and commodity markets.

Dr. Nomikos has collaborated with a number of companies both as consultant as well as educator in executive training programs. Some of the companies include AP Moeller Maersk, the Baltic Exchange, Boston Consulting Group, Clarksons, Far East Trading/Sinochem, Korean Banking Institute, Overseas Shipholding Group and TBS Shipping Services. He also holds visiting faculty positions in Copenhagen Business School, University of Geneva and International Hellenic University where he lectures on topics such as Insurance and Risk Management, Shipping Trading and Finance and Energy and Power Markets Trading & Risk Management. He was appointed as "The Wilmar Professor in International Commodity Business" for 2013 at the Singapore Management University. He is also a regular speaker in a number of practitioner seminars and symposia such as the *Financial Times* Investment Series Seminars, London Biennial Meetings, The Freight Derivatives Annual Seminars and Energy Risk Europe.

Dr. Nomikos has published his research in numerous academic and practitioners journals. He has published more than 40 papers in international academic journals such as *Review of Finance, Energy Economics, Energy Policy, Transportation Research, Journal of Banking and Finance, Applied Mathematical Finance, Journal of Futures Markets, Journal of Derivatives,* and *Logistics and Transportation Review*. He has also published numerous book chapters and has co-authored the book, Shipping Derivatives and Risk Management, which is considered the leading reference book in the area of shipping risk management. His views about commodity and shipping markets have also been profiled in a number of newspapers and other media such as *International Herald Tribune, NY Times, Financial Times, Lloyd's List, Tradewinds, Bloomberg, CNBC News,* and *Daily Telegraph*.

Professor Nomikos holds a B.Sc. in Economics from Athens University of Economics and Business, an M.Sc. in Shipping, Trade & Finance (Distinction) from Cass Business School and a Ph.D. in Finance from Cass Business School. In addition, he is a Member of the Institute of Chartered Shipbrokers.

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