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**ECONOMIC SPILLOVERS BETWEEN RELATED DERIVATIVES MARKETS:**

**THE CASE OF COMMODITY AND FREIGHT MARKETS**

# MANOLIS G. KAVUSSANOS

Athens University of Economics and Business

Department of Accounting and Finance

# 76 Patission St, TK 104 34, Athens, Greece

# Tel: +30 210 8203167, Email: [mkavus@aueb.gr](mailto:mkavus@aueb.gr)

# ILIAS D. VISVIKIS \*

World Maritime University

PO Box 500, SE-201 24, Malmö, Sweden

Tel: +46 (0) 40 35 63 72, Email: [ivisvikis@wmu.se](mailto:ivisvikis@wmu.se)

# DIMITRIS N. DIMITRAKOPOULOS

Athens University of Economics and Business

Department of Accounting and Finance

76 Patission St, TK 104 34, Athens, Greece

Email: [jim@aueb.gr](mailto:jim@aueb.gr)

# 1. Introduction

Cross-market information transmission is a research area that has received a lot of attention from both academia and practitioners alike (see Nazlioglu *et al*., 2013; Wu and Li, 2013; Jung and Maderitsch, 2014; and Reboredo, 2014, among others). Economic shocks in one market can impact other markets with various degrees of severity. In perfectly efficient markets, new information is simultaneously incorporated into the prices of the markets, in such a way that prices adjust to new equilibrium levels without any time delay (Chan, 1991). However, transactions costs, information asymmetries, supply-demand imbalances and other market microstructure issues may create information spillover relationships between markets (see Wahab and Lashgari, 1993; and Fleming, *et al*., 1996, among others). The importance of modelling such relationships is linked with the nature of trading dynamics between markets.

Cross-market linkages and spillover effects broadly fall into three categories. The first constitutes a linkage between spot markets that are fundamentally linked through supply and demand functions (see Yu *et al*., 2007 on spot grain commodities and freight prices; and Haigh and Bryant, 2001 on barge, ocean freight prices and soybeans prices, among others). The second refers to information flows between derivatives markets and their underlying spot markets (see Coppola, 2008 on futures and spot commodity markets; and Kavussanos and Visvikis, 2004 on forward and spot freight markets, among others), and the third one, which, surprisingly enough, has received the least attention, concerns return and volatility spillovers between different derivatives markets (see Chng, 2009 on natural gas, palladium and gasoline Japanese futures markets; Chulia and Torro, 2008 on DJ Euro Stoxx 50 index futures and Euro Bund futures markets; Fung *et al*., 2010 on US and Chinese aluminum and copper futures markets; Kavussanos *et al*., 2010 on freight forwards and commodity futures markets; Ding and Pu, 2012 on US stock, bond and credit derivatives markets; Trujillo-Barrera *et al*., 2012 on US crude oil, ethanol, and corn futures markets; Beckmann and Czudaj, 2014 on US corn, cotton, and wheat futures markets; and Liu *et al*. 2014 on Chinese copper, aluminum, natural rubber and soybean futures, amongst others.

This study investigates the information (spillovers) relationships between freight derivatives markets of the dry bulk sectors of ocean going vessels and the available derivatives of the commodities carried by these vessels, and analyses the magnitude and direction of these spillovers. More than 90% of the world’s commodity trade is transported by ocean going vessels (George, 2013). The international market for freight services possesses some special features that set it apart from other commodity markets, due to its high volatility, cyclical nature, the seasonal influences of the commodities transported, and its non-storable nature, amongst others (see Kavussanos and Visvikis, 2011). The latter characteristic alone differentiates the freight market from all other storable commodities, as the theory of storage and the cost-of-carry no-arbitrage relationships cannot be applied for the pricing of freight derivatives contracts (see Kavussanos and Visvikis, 2004). As such, there is an increasing need for more sources of information that may be utilized by economic agents participating in these markets for the pricing and trading of such commodity contracts. Furthermore, according to Skiadopoulos (2013), commodity futures markets have attracted a lot of attention during the last decade from practitioners, regulators and academics due to: (i) an increase of investments in commodities; (ii) the perception that they are an alternative investment asset class; (iii) the commodity boom, between 2004 and 2008; and (iv) the Dodd-Frank Wall Street Reform and Consumer Protection Act in 2010, for the regulation of margins in commodity futures markets.

The implications of the economic linkages uncovered in this study are important as returns and volatilities are related to the rate of information flow to a market, and changes in them reflect the appearance of new information. Investigating the extent to which (and the magnitude of) commodity derivatives’ (return and volatility) shocks are spilled over to freight derivatives markets and vice versa, are important. The design of investment portfolios, asset pricing and risk management, are some of the important areas of application of the findings (see for example, Reboredo, 2014). Thus, international investors, in order to guarantee sufficiently diversified freight portfolios, have to observe and monitor continuously the changes in market linkages (between commodity futures and freight derivatives) and assess if these changes are transitory or have a more permanent nature (Jung and Maderitsch, 2014). Traders may utilize the revealed linkages to construct profitable trading strategies; that is, take trading positions on the freight derivatives markets according to the direction of the commodity derivatives forward curves or take trading positions on the freight options markets to gain from volatility changes spilled from the commodity derivatives markets. Additionally, hedgers can monitor the freight and commodity derivatives markets to implement risk management through hedging in a more effective manner. The investigation of the topic is also related to seaborne transportation, as commercial decisions in maritime transportation (e.g. chartering of vessels) can be supported by information that may come, ahead from the decision, from the commodity futures markets. This, may in turn, lead to more informed decision-making and to an increase in the efficiency of the freight market (see Goulas and Skiadopoulos, 2012).

Furthermore, agricultural commodities are regarded as financial assets, and as such, globalization and increased world market integration have accelerated the “*financialization of commodities*” (Nazlioglu, *et al*., 2013). Due to the cross-border trade of commodities around the world, commodity markets are linked with operations in seaborne transportation markets. Therefore, policy makers and regulators analyse the dynamics of return and volatility transmissions between commodities and shipping markets in order to guide them into better decisions. In terms of policy implications, as significant spillover effects have been found to exist between market channels, policy changes in commodity markets should have an impact on shipping markets (see also, Jung and Maderitsch, 2014). Sound policy measures then should be based on a clear comprehension of the transmission mechanisms between commodity and shipping markets.

This paper contributes to the literature in a number of ways: First, it investigates how the derivatives market of the commodity transported is linked to the freight derivatives market of the vessel transporting it. Following that, and since it has been found in the literature that the derivatives markets under investigation informationally lead their corresponding underlying spot (physical) markets, the main findings here should apply in the spot (physical) freight and commodity markets as well. This economic link further contributes to the pricing of freight derivatives, which are not so precisely priced given the non-storable nature of their underlying “*commodity*”; namely the freight service (see Kavussanos and Visvikis, 2004). To the best of our knowledge, this is the first study to empirically examine cross-market return and volatility information spillovers between the major segments of dry bulk freight derivatives and the corresponding derivatives markets for the products that are carried by the vessels operating in these segments. Thus, all major sub-segments of the dry bulk sector (Capesize, Panamax and Supramax vessels) for which there are freight derivatives prices are investigated. This facilitates comparisons of the results between the segments. Additionally, since different types of freight contracts (route-specific and time-charter contracts – see section 3 for more details) are involved it enables comparisons between the different freight contracts[[1]](#footnote-1). The empirical investigation of various types of commodities transported under different types of freight contracts reveal that in most cases new information appears first in the returns and volatilities of the commodities futures markets, before it is spilled over into the freight derivatives markets. Thus, commodity futures informationally lead the freight markets. Consideration of the different commodities and their link with corresponding freight derivatives enables the comparison of effects between commodities.

Second, by utilizing a data set large enough to include the global financial crisis, the paper investigates the possibility of significant structural changes on the spillover patterns between the examined variables, which may arise under such adverse market conditions. Investigating and incorporating the influence of such structural breaks in an information spillover framework is important to investors and traders engaging in these derivatives markets, as derivatives contracts can serve the role of “*break discovery*” to the underlying spot markets. Lien and Yang (2010) argue that the breaks in futures markets always take place before those in the physical markets. Therefore, locating structural breaks in derivatives markets can serve as an indication that such breaks will occur later in the spot markets.

Third, due to different time zones some markets may be more liquid than others, and as such, are able to incorporate global information faster than other markets. Since the US commodity futures markets open at a different time than the time of the announcement of freight derivatives prices in the UK, it is possible that non-synchronicity may influence the results[[2]](#footnote-2). Most of the studies in the literature (especially the sectoral ones), do not emphasize enough this market microstructure effect, and as such, do not utilize “*time-matched*” data. In order to ensure that the spillover inferences are not biased due to non-synchronous trading among the markets, a “*time-matched*” high frequency data set is created, in which the prices of all commodity futures contracts are retrieved in the US, on a daily basis, at the exact publication time of the freight derivatives prices in London, and thus, overcoming the possibility of non-synchronicity in the data. Furthermore, to account for the different commodities transported by the vessels of the underlying freight derivatives baskets and routes, synthetic equally weighted commodity futures baskets are also constructed. Having secured that the results are free from non-synchronicity issues, they can be used from researchers to make further efficient econometric inferences.

Fourth, this paper investigates and reveals that commodity and freight derivatives markets are interrelated, standing in a long-run equilibrium (cointegration) relationship between them, even after allowing for structural breaks. The existence of a cointegrating relationship, therefore, binding the two derivatives markets together, can help improve the understanding of the information transmission mechanisms between freight and commodity derivatives markets (and consequently between their underlying spot markets) and assist market participants into more effective trading, investment and hedging decisions.

The remainder of this paper is structured as follows. The next section presents the economic framework and methodology used. Section three analyses the data and outlines some preliminary results. Section four presents the return and volatility spillover results. Section five measures the economic significance of the main spillover results. The sixth section provides a critical discussion of the results. Finally, section seven concludes the paper.

1. The only exception is the study by Kavussanos *et al*. (2010), which investigates the Panamax market only. [↑](#footnote-ref-1)
2. On any given day, the Baltic Exchange freight derivatives prices are announced at 17:30 London time, while Chicago Mercantile Exchange (CME) closing futures prices are published at 19:15 London time (13:15 in Chicago). [↑](#footnote-ref-2)