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# Economic spillovers between related derivatives markets: The case of commodity and freight markets

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ABSTRACT

Extant literature investigates volatility spillovers between spot markets of the same asset class or between derivatives and their underlying spot markets. This paper investigates economic spillovers between the freight and commodity derivatives markets. The economic relationship tested links the derivative price of the commodity transported with the derivative price on the freight rate. High frequency data on commodities are synchronised with freight data and freight rates of different vessels are matched with portfolios (baskets) of commodities that these vessels carry. The 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, agricultural commodity futures informationally lead the freight markets. The results can help improve the understanding of the information transmission mechanisms between freight and commodity markets.



## 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 et al., 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

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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 aluminium 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, aluminium, 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.[2] 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 utilised by economic agents participating in these markets for the pricing and trading of such commodity contracts.[3] 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 utilise 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, globalisation 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.[4] This economic link further contributes to the pricing of freight derivatives, which are not so precisely priced

[2] The major ones are dry bulk, wet (liquid) bulk, general cargo, and liquid gas. Cargo carrying/ocean shipping has distinct segments (see Kavussanos 2010, among others). This study in its analysis concentrates in the dry bulk segment. Specifically, it focuses on the Capesize, Panamax and Supramax sectors, as they are the major and most prominent sub-sectors of dry bulk, and most importantly, for the freight rates of which and the commodities carried, freight and commodity derivatives prices are available.

[3] For instance, Prokopczuk (2011) employs alternative affine continuous-time models of the spot price dynamics in order to derive closed-form valuations for freight futures contracts.

[4] Kavussanos and Visvikis (2004), show that freight derivatives markets are broadly unbiased and that the freight derivatives market informationally leads the underlying (physical) spot market for freight rates. As such, freight derivatives can be utilised as price discovery vehicles for spot freight markets. Participants can have a better assessment of risk management, chartering and budget planning decisions by utilising the information available in the freight derivatives market as a price discovery vehicle. Wheat, corn, soybean and coal futures, which correspond to the underlying commodities transported in the shipping routes of the dry bulk freight derivatives contracts, for which data are available, are also shown in the literature to fulfill their price discovery role in relation to their underlying spot markets; see for instance, McKenzie and Holt (2002) for US corn futures and Yang and Leatham (1999) for US wheat commodity futures markets, among others.