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Explaining price differences between physical and derivative freight contracts

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ABSTRACT

Physical time-charters (TC) and Forward Freight Agreements (FFAs) represent two hedging approaches that differ in terms of risks and physical access to transportation. We investigate the determinants of the time-varying TC-FFA freight rate differential in the dry bulk market. We find that TC and FFA prices are co-integrated but TC rates are generally priced higher than FFAs. The differential is explained by the level and slope of the term structure, a measure of economic condition and default risk as well as vessel specifications and contractual terms. Finally, the TC-FFA differential is related to default risk premium and the potential convenience yield.

1. Introduction

Agents and participants in the international shipping market have developed and utilised different types of contracts and tools to control freight market risk. These include long-term period timecharter contracts, contracts of affreightments and, more recently, freight derivative contracts such as forward freight agreements (FFA) and freight options.[1] The main difference between physical and financial contracts relates to flexibility and access to transportation. Physical contracts such as time charters ensure access to a transportation service and a vessel, but they are not flexible because the underlying vessel cannot be changed, their termination could be costly, and they are bilateral contracts that are subject to default or counterparty risk. FFA contracts are flexible in terms of trading and have virtually no default risk when they are cleared, but they do not provide access to a vessel or transportation service. Nevertheless, both period and FFA contracts are used for managing spot freight rate exposure by shipowners and charterers.

A large body of the literature has been devoted to investigating different aspects of the FFA and physical market including Kavussanos and Visvikis (2004a,b), Kavussanos et al. (2004a,b), Batchelor et al. (2007), Alizadeh (2013), among others (see Section 2). For instance, Kavussanos et al. (2004a) investigate the unbiasedness of FFA prices in relation to determination of future spot rates and conclude that forward freight rates are unbiased predictors of spot freight rates. Other studies such as Kavussanos and Visvikis (2004a and 2010) and Alizadeh et al. (2015) focus on evaluating hedging performance and the interaction between FFA and spot

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[1] The forward freight agreement (FFA) contracts were developed and evolved over time to enable agents involved in international shipping to manage risks that arise from fluctuations in freight rates (see Kavussanos and Visvikis, 2004 and Alizadeh and Nomikos, 2009) and vessel prices (Alizadeh and Nomikos, 2012). A FFA is defined as a cash-settled contract between two counterparties to settle a freight rate for a specified quantity of cargo or hire rate for a type of vessel in one (or a basket) of the major shipping routes in the dry bulk, tanker and container shipping sectors for a specified future time period. The underlying asset of the FFA contracts can be any of the routes (or basket of routes) that constitute the freight indices produced mainly by the Baltic Exchange or by other providers of freight market information (see Kavussanos and Visvikis, 2006 and Alizadeh and Nomikos, 2009, for a full description of FFAs and their applications for hedging).

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rates. They use different hedging techniques including constant and time-varying hedge ratios when hedging spot freight market exposure with FFAs. The general finding here is that the hedging performance of FFAs is substantially worse than for other commodity and financial markets, a fact which is typically attributed to the non-storable nature of spot freight rates and the corresponding lack of a cost-of-carry relationship between spot and forward prices.

These early studies (Kavussanos and Visvikis, 2004a,b; Kavussanos et al., 2004a) were undertaken at a point in the dry bulk FFA market development where the most active contracts were related to individual routes such that the hedging of spot exposure was indeed the *modus operandi*. Within the past decade, such contracts have effectively ceased trading, with liquidity now focused on longer FFA contracts (quarters or calendar years) settled on a global weighted average spot rate per vessel size, the Baltic TC averages (Adland and Jia, 2017). The hedging of freight market exposure using such FFA contracts is, by definition, more akin to using physical TCs, where owners and operators lock in time-charter-equivalent earnings per vessel for a prolonged period of time.

In this study, we therefore examine, for the first time, the statistical relationship between physical TC and FFAs. While both alternatives lock in a fixed freight rate for a defined period, the two approaches carry very different types of risks. Firstly, a time-charter (TC) is a physical contract that gives the charterer commercial control over a vessel and access to a transportation service, while a FFA contract is a purely financial cash-settled contract for the difference between a Baltic Index and the agreed contract rates. If secure access to transportation has value (a “convenience yield”) then we would expect that TCs are, on average, priced higher than FFA contracts for the same ship size and period. We would also expect that this differential is positively related to the state of the freight market, because secure access to transportation will have a lower value (convenience) during periods of oversupply of ships and low freight rates. This is a general concept for the forward pricing function in commodity markets, where the underlying asset is storable and the marginal convenience yield is a decreasing function of stocks held (Brennan, 1958).

Secondly, there are multiple potential sources of cash flow differences (basis risks) due, for instance, to a) different vessel specifications between the physical vessel and the standard Baltic type vessel underlying FFA contracts, b) different trading patterns of the physical ship, c) higher default risk for a single charterer in a TC than the clearing houses standing behind FFA contracts and d) timing differences in the start and end-dates of the contracts, particularly when TC contracts have embedded extension options. These sources of risk are likely to be time-varying and dependent on market conditions and the financial standing of the charterer.

Our paper has three primary objectives. Firstly, we want to assess whether there is a (potentially time varying) differential between TC rates and corresponding FFA prices. We assess this relationship by comparing the standardized fixed-duration TC rates as supplied by shipbrokers and the FFA prices for an equivalent duration. Secondly, we want to assess whether such differential is caused by known differences in risks and cash flows (e.g. different vessel specifications). Thirdly, we want to evaluate whether the differential is dependent on freight market conditions such that it can be interpreted as a convenience yield in the physical forward market. For the latter two research questions, we evaluate the differential between realized individual TC fixtures in the dry bulk market and the FFA price for the corresponding period.

Addressing the above questions are important for several reasons. First, from a theoretical point of view, a better understanding of the FFA and time-charter markets and their interaction can be used to specify better models and produce more accurate forecasts for these variables. Second, from a practical point of view, improved knowledge of the relationship and differences between time-charter rates and FFAs can help ship-owners, operators and charterers to assess freight trading tactics, formulate better hedging strategies and enhance the efficiency of their risk management process. For instance, market participants can use the information on the difference between FFA and TC contracts to determine the value of period contracts (e.g. time-charter or contract of affreightment) using FFA curves. Third, shipowners, operators and charterers can use the results to assess whether apparent arbitrage opportunities between the physical and “paper” forward freight markets are real or simply a result of time-varying risk premia or physical basis risks. Fourth, our research is closely related to the important question of default risk in physical time-charters. Adland and Jia (2008) show conceptually that default risk is strongly related to freight market conditions and contract duration, with longer contracts fixed during strong markets at greater risk. By comparing TC rates with “risk free” FFA prices we are able to uncover a similar risk profile, supporting earlier results in the literature. Finally, the results reveal important information regarding the adjustment of hedge ratios according to vessel and contract specific factors when FFAs are used to hedging a vessel’s earnings.

The remainder of this paper is structured as follows: Section 2 reviews the relevant literature, Section 3 describes our data and methodology, Section 4 contains our empirical results and Section 5 discusses the implications of our findings. Section 6 summarises the findings and concludes with suggestions for future research.

2. Literature review

The maritime economic literature typically treats pricing in the freight derivatives and physical forward markets separately, even though the dynamics of spot freight rates is the main driver of both markets. Studies on freight derivatives focus on three main issues: the hedging efficiency of the contracts (Thuong and Visscher, 1990; Haralambides, 1992; Kavussanos and Nomikos, 2000a,b; Kavussanos and Visvikis, 2010; Goulas and Skiadopoulos, 2012), price discovery and the unbiasedness of forward prices in relation to realized spot rates (e.g. Kavussanos and Nomikos, 1999; Kavussanos and Nomikos, 2003, Kavussanos and Visvikis, 2004a) and causality viz-a-viz spot freight rates (see, Kavussanos et al, 2004a,b; Kavussanos and Visvikis, 2004b; Alizadeh et al., 2014). Performed on both the defunct BIFFEX freight futures and the FFA market, these empirical studies broadly conclude that freight derivatives have overall poor hedging efficiency, even when allowing for time-varying hedge ratios, and represent unbiased forecasts only in the short run (1–2 months out).

A related branch of the literature focuses on the modelling of spot freight markets using stochastic models. Examples are the logarithmic mean reverting process proposed by Tvedt (1997), the stochastic partial equilibrium models of Tvedt (2003) and Adland