Transportation Research Part E 101 (2017) 155–175

Contents lists available at ScienceDirect

Transportation Research Part E

journal homepage: www.elsevier.com/locate/tre

Alliance formation in a cooperative container shipping game: Performance of a real options investment approach

Philipp Rau *, Stefan Spinler

WHU - Otto Beisheim School of Management, Kuehne Foundation Endowed Chair in Logistics Management, Burgplatz 2, 56179 Vallendar, Germany

ARTICLE INFO

Article history:
Received 7 July 2016
Received in revised form 7 February 2017
Accepted 20 February 2017

Keywords:
Maritime logistics
Real options
Container shipping investment
Strategic investment
Cooperative game theory

ABSTRACT

This paper develops an integrated alliance formation and investment simulation model within container shipping. In light of low profitability and frequent alliance changes, the optimal choice of investment approach is addressed. This is achieved by comparing the performance of three investment approaches: real options analysis, and individual and collective discounted cash flow. It turns out that the real options trigger performs best, especially under conditions of high competitive intensity and freight rate volatility. A sensitivity analysis concludes that competitive intensity, alliance complexity cost, and freight rate volatility lead to alliance instability and that shorter lead times increase industry concentration.

1. Introduction

In their attempt to safeguard profitability in a market characterized by overcapacity and eroding margins, container shipping industry participants have increasingly sought to establish cooperation in the form of strategic alliances. This process culminated in the potential control of 71.8 percent of global shipping capacity by three large alliances (P3, G6, and CKYHE), until the Chinese Ministry of Commerce stepped into prohibit the formation of the P3 alliance (between Maersk, MSC, and CMA-CGM). The P3 alliance alone would have had a global market share of about 37 percent (MOFCOM, 2014; Alphaliner, 2014a).

From a regulatory and, even more so, an investment perspective, economic agents and policymakers in the shipping industry should ask a number of questions: How stable is the current alliance structure? When, and for which reasons, is it appropriate to seek new partners? How should investment be evaluated in light of a dynamic coalition structure? To what extent should and can we collaborate on capacity investments?

Economic agents in the container shipping industry are operating in a challenging market environment. They face market cycles (Stopford, 2010), supply-demand imbalances (Rau and Spinler, 2016; Syriopoulos, 2010), high capital intensity of investments, and market concentration (Alphaliner, 2014c). This is in contrast to bulk shipping, which can be characterized by perfect competition (Pirrong, 1992).

One explanation for non-optimal investment timing and sizing is shortcomings in investment evaluation methods (Bendall, 2010). The Discounted Cash Flow (DCF) methodology is seen as the primary tool for ocean freight capacity investment (Evans, 1984; Gardner et al., 1984), even though it fails to take into account uncertainty and managerial flexibility (Bendall, 2010). One possible alternative is Real Options Analysis (ROA) (Bendall, 2010; Rau and Spinler, 2016).

* Corresponding author.
E-mail addresses: philipp.rau@whu.edu (P. Rau), stefan.spinler@whu.edu (S. Spinler).

http://dx.doi.org/10.1016/j.tre.2017.02.005
1366-5545/

Since the earliest days of sea trade, carriers have formed conferences and alliances. The Calcutta Conference of 1875 and other conferences on the most important trade routes established agreements between a number of shipping companies and fixed transportation services on a specific route with joint pricing. More recently, conferences have come under legal scrutiny for antitrust reasons and were banned with the Ocean Shipping Reform Act of 1998 (Sjostrom, 2010; Thanopoulou et al., 1999).

In the 1990s, the shipping industry went through a paradigm shift as the first strategic alliances - Grand Alliance and Global Alliance - were established (Midoro and Pitto, 2000). In the past 20 years, however, alliance formation has been very unstable; various studies show that up to 80 percent of alliances fail (Song and Panayides, 2002). The period between 2011 and 2015 saw several changes to the alliances in container shipping. Fig. 1 shows that in 2011, there were three major alliances, namely CKYH (11.3 percent market share), Grand Alliance (9.2 percent), and The New World Alliance (8.5 percent). This has changed frequently over time and thus far in 2016, the alliance structure has remained unchanged despite the merger of COSCO and CSCL. CMA-CGM's 2016 acquisition of NOL (APL) will, however, lead to further changes since the European Commission's approval of the merger is conditional on NOL (APL) leaving the G6 alliance (Shingleton, 2016).

The literature on shipping provides a comprehensive account of (1) how the characteristics of the shipping industry have favored alliance formation (Sjostrom, 2010; Panayides and Wiedmer, 2011); (2) the general motivation and drivers for entering an alliance (Glaister and Buckley, 1996; Lu et al., 2006; Agarwal, 2007); (3) the necessity of collaboration in the shipping industry (Sjostrom, 1989; Zhao, 2007); and (4) the possibility of addressing challenges in investment decisions with real options methods (Rau and Spinler, 2016; Bendall, 2010). The performance of investment approaches in a cooperative market setting has - to our best knowledge - neither been evaluated with a theoretical model, nor empirically tested.

This is necessary because the changing nature of coalition structures in the shipping market adds another layer of complexity to investment decisions. Hence the objectives of this study are: (1) to create a dynamic model of coalition formation in container shipping using the coalition structure value concept; (2) to integrate the choice of investment approach, i.e. real options trigger, individual DCF, and collective DCF approach; (3) to test the hypothesis that a real options trigger investment approach performs best, especially for high competitive intensity and freight rate volatility; and (4) to quantify the impact of competitive intensity, lead time, alliance complexity cost, and freight rate volatility on average industry capacity, cash flow to economic agents, alliance stability, and industry concentration.

First, this study presents a normative model for dynamic alliance composition in shipping. Previous research applies core theory to explain why collusion is necessary (Sjostrom, 1989; Zhao, 2007), to study stability (Yang et al., 2011), or assess whether a stable core is possible (Song and Panayides, 2002). We take this one step further by applying the coalition

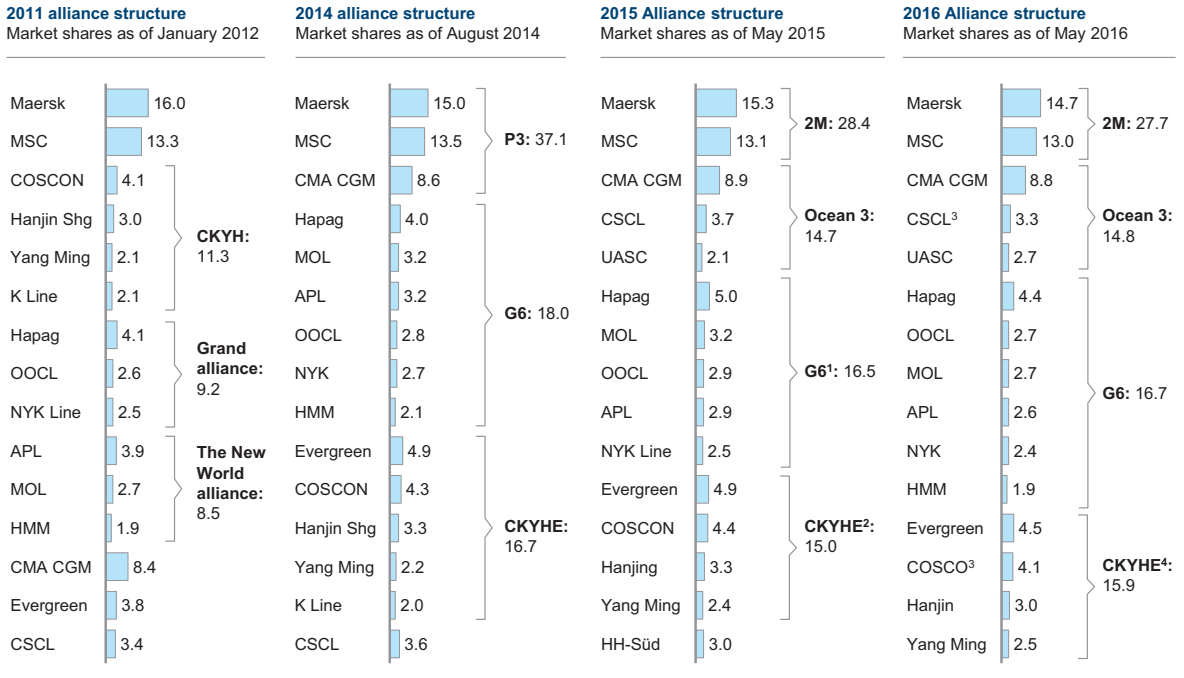

Fig. 1. Analysis of alliance changes in the past 5 years.