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Relevance of the Northern Sea Route (NSR) for bulk shipping

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ABSTRACT

Some scholars consider that today's market conditions are in favor of the Northern Sea Route (NSR) rather than the Suez Canal Route (SCR). However, the number of bulk carriers using the NSR remains extremely limited, despite higher fuel prices since 2009 and subsequent significant fuel savings. In 2013, there were 53 transits via the Arctic, out of which 27 by oil tankers and 6 by bulk carriers. In this article we show that this result might be attributable to a factor, which is not considered in most studies: the spot freight rate to fuel ratio which governs ship owners' decisions regarding the sailing speed. Due to a low ratio since 2011, the speed of vessels on the SCR is at its lowest level, and potential NSR fuel savings are too limited to provide a viable alternative. We further argue that, contrary to most studies, internalizing NSR environmental benefits marginally improves the attractiveness of the NSR.

1. Introduction

The Northeast Passage of the Arctic Circle (NSR) is the maritime route along the Russian coastline. Due to the progressive decline in Arctic sea-ice extent over last 50 years, especially in summer (Stroeve et al., 2012; Comiso, 2012), this route is now subject to much attention (Lasserre, 2014). Indeed, this passage provides a direct link between Asia and Europe, offering up to 40% distance savings compared to the Suez Canal Route or SCR (Furuichi and Otsuka, 2013). If distance is shorter, sailing conditions and ice thickness along the Russian coastline vary greatly, which limits the viability of such an option all year long. Operational challenges in these waters remain severe (Erikstad and Ehlers, 2012). This includes political factors (Russian territorial waters), environmental concerns (possible oil spills), operational conditions (harsh environment, distance to nearest base etc.), ice navigation (possibility of drifting ice), contractual issues (increased probability of delays) and the length of the season that is sufficiently ice free.

These elements largely explain why, in 2013, only 53 NSR transits were recorded (ANSR 2013). Out of these, 27 transits were by oil tankers, representing a negligible number when considering the 15,917 fixtures (transits) of oil tankers in 2013 reported by Clarkson (2014). The same applies for bulk carriers which are the focus of this paper, with 6 transits in 2013. Despite the fact that bulk carriers are those for which one could expect that Arctic transits is the most profitable, the topic has been little explored compared to container shipping which requires a high degree of operational regularity (Erikstad and Ehlers, 2012). This paper contributes to the existing literature by investigating the impact of market conditions on the NSR

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competitiveness for bulk shipping. In particular, we incorporate economic factors through the spot freight rate to fuel ratio, which is a criteria used by ship owners when selecting the optimal sailing speed maximizing profit (Adland, 2013). The decision-support model developed is for a ship-owner which is comparing, for various speeds and at the operational level, the profits that can be expected from sailing through the NSR instead of through the SCR. For simplification, we assumed a comparison for a transit occurring in September when, even if still present (Erikstad and Ehlers, 2012), operational challenges are less prevalent. The model is then extended considering a potential environmental policy to limit CO_2 emissions, for which the NSR may also present a significant benefit.

The present article is organized as follows. Section 2 is a literature review on the relevance of the NSR. Section 3 introduces a model to assess the NSR competitiveness compared to that of the SCR. Section 4 presents assumptions retained for the application; while Section 5 discusses the main findings. Finally, Section 6 provides some conclusions.

2. Literature review

A recent survey by Lasserre (2014) reports that 26 models on the relevancy of the NSR, were published between 1991 and 2013. Lasserre (2014) underlines the difficulty of defining credible parameters to build up a model that could assess the profitability of Arctic shipping, and therefore of comparing the various studies. Amongst these parameters, fuel costs are the largest single cost factor. In 17 models, the fuel consumption rate is considered the same in the Arctic and in the SCR and all models consider that the same type of fuel, usually IFO380, is used on the NSR and SCR. Lasserre (2014) argues that this assumption might not be well-suited for very cold temperatures. The speed chosen for comparison widely differs depending on the model. For year-round navigation, the average speed varies from 7 to 15 kts. The capital cost premiums for ice-class ships depends on the class and range for 17 models between +1% and +120%. Eight models assume the same cost structure for crew while 7 mentioned the need for well-trained crew. Insurance premiums are also subject to a wide range of estimates. Three models assume no insurance premiums while others 50%–75%–100% risk premiums.

Out of the 7 bulk shipping Arctic models identified by Lasserre (2014), 3 of them conclude that Arctic routes are profitable and 4 that they are not (Table 1). These cost models are a combination of shipping professional presentations (Paterson, 2011; Falck, 2012), reports (Mulherin et al., 1996; Kamesaki et al., 1999; Kitagawa, 2001) and academic studies (Schøyen and Brathen, 2011; Cho, 2012). Many reasons exist to conclude on the unfeasibility of the NSR bulk shipping. According to Mulherin et al. (1996), the fact that ships in use on the NSR had approximately 25% of the carrying capacity of cargo vessels using the traditional warm-water trade routes is a main factor. The distance advantage enjoyed by the NSR is thus eliminated when larger ships cannot be used. According to Paterson (2011), summer fog remains a huge factor in navigation and requires properly trained people. Kamesaki et al. (1999) and Kitagawa (2001) conclusions are similar and state that the majority of the problems with NSR shipping lies squarely with Russia, with obstacles running from legal issues to questions of taxations and tariffs, and in particular, prohibitive icebreakers tariffs.

Conversely, three more recent studies are in favor of the NSR. Cho (2012) comparison for a 320,000 dwt oil tanker sailing from Kirkeness or Murmansk to Pusan at 16 kts concludes to 36% cost and CO_2 emitted savings, results which are however mostly based on distance savings. Schøyen and Brathen (2011) provide a more comprehensive analysis to compare the cost of deploying Handymax or Capesize vessels between Norway and Eastern Asia with three sailing alternatives: the NSR, the SCR, or the Cape of Good Hope route. Authors conclude that the NSR is economically viable in terms of costs and GHG emissions, when a Handymax vessel sails at a speed of 14.5 kts on the SCR, which corresponds to 11.5 kts on the NSR to reach the same transit time. Falck (2012) from Tschudi Shipping Company AS comparing the sailing from Kirkeness to Yokohama for a 40,000 dwt vessel concludes to 22 days savings at sea or 839,000 USD cost savings, even when accounting for 200,000 USD NSR fees.

This literature review stresses that operational challenges as well as economic considerations such as taxation and tariff, speed or fuel prices are key factors to assess the viability of the NSR. However, for bulk shipping in particular, no study explores how changing market conditions and the introduction of a policy on CO_2 emissions may influence the final results. The next section provides a model that helps taking such elements into consideration.

3. The model

As stated, a crucial component when assessing the NSR viability is the fuel cost differential with SCR. In most papers, the speed and therefore, the corresponding fuel consumptions are given. In this paper, the comparison is done for various SCR and NSR equivalent speeds using an extension of Adland (2013) model to determine first the range of speed that should be considered on the SCR and later, on the NSR. The optimal speed to be decided by a ship-owner is the one that maximizes the short term daily profits with two assumptions considered in this paper, depending on whether a future environmental policy on CO_2 emissions is implemented ($\alpha = 1$) or not ($\alpha = 0$).

The daily profit π from operating a vessel on the SCR (Adland, 2013) is a function of the spot rate R (USD per ton of cargo transported), the cargo size W (tons), the distance to travel D (nautical miles), the speed V (knots), the operating costs of the vessel (USD/day), the SCR and NSR Transit Fee (USD/day), the fuel price P_b (USD per ton of fuel), and the daily fuel consumption F (tons of fuel per day). When a ship-owner considers the environmental impact (CO_2) of its decision on V^*, the emission