



Determining optimal transit charges: the Kiel Canal in Germany

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ABSTRACT

The Kiel Canal in Germany connects ports on the Baltic Sea with the rest of the world and is the most-used artificial waterway in the world. Despite this fact, it generates a balance sheet loss. Revenues, which are mainly generated by the transit charge, do not cover its operating expenses. This situation raises the question how the current charging system could be redesigned to make the canal generate a balance sheet profit.

In this paper, we focus solely on the canal's revenue. Because the canal is a monopoly that allows, in principle, for perfect price discrimination, we contrast the current charging system with an optimal charging system based on the willingness-to-pay (WTP) approach. We devise a general approach to calculate optimal transit charges and apply it in a case study that includes four ship types on three routes. The findings of the case study indicate that, in principle, much higher revenues could be generated if the transit charges were based not only on ship size but also on fuel prices and a ship's departure and destination ports, as these affect a ship's costs in terms of fuel costs and required sailing time.

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1. Introduction

Maritime transportation of goods is a costly business. Major determinants of the costs are fuel consumption and the time it takes a ship to sail from one port to another. Ships operating between ports of the Baltic Sea and the rest of the world, for example, have the choice of alternative passageways to leave or enter the Baltic Sea. They can use the Kiel Canal passageway, the most-used artificial waterway in the world¹ and, according to Knowles (2006a), one of the world's strategic ship canals, or one of the two natural passageways around Denmark: through the Great Belt passageway or through the Øresund passageway. Sailing through the Kiel Canal saves, on average, 250 nautical miles² and, depending on the type of ship, up to several hours.³ Fig. 1 shows the three alternative passageways for four ports in the region.⁴

The Kiel Canal is used by roughly the same number of ships as the Panama Canal and Suez Canal⁵ taken together, but handles sig-

nificantly less cargo tonnage. 43,378 ships transporting 99.78 million tonnes of cargo passed the Kiel Canal in 2007 (WSD Nord, 2011b).⁶ In comparison, during the same year, 14,721 ships transporting 208.2 million tonnes of cargo passed through the Panama Canal (Panama Canal Authority, 2009), and 20,384 ships transporting 848.2 million tonnes of cargo passed through the Suez Canal.⁷

Despite the large amount of ship traffic the Kiel Canal handles, it nevertheless generates a balance sheet loss. Its revenues, which are mainly generated by the transit charge (charged by the Waterways and Shipping Authority North (WSD Nord)), do not cover its operating expenses. The transit charge is determined by the gross tonnage (gt) of a ship and includes up to four components, such as a transit toll, a pilotage due, a pilotage fee, and a helmsmen fee.⁸ The last two components (pilotage fee and helmsmen fee) are passed on to the pilots and helmsmen for providing their services.⁹ The pilotage due is used by the WSD Nord to maintain the pilotage

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¹ <http://www.kiel-canal.org/english.htm>.

² Footnote 1.

³ For example, a 1400 TEU container ship on the route Helsinki–Rotterdam would save about 8.5 h if the Kiel Canal were used instead of the Great Belt passageway.

⁴ We define route as the connection between ports, and passageways as the alternative ways on that route.

⁵ The Panama Canal links the Pacific Ocean with the Caribbean. The Suez Canal links the Mediterranean with the Red Sea/Indian Ocean. Both canals provide the opportunity to significantly shorten the distance of shipping routes (Knowles, 2006a).

⁶ This includes 39,239 cargo (bulker, tanker, etc.) and 4139 non-cargo ships (fishing ships, service ships, etc.), but excludes 14,865 small boats (sailing boats etc.).

⁷ <http://www.suezcanal.gov.e.g/TRstat.aspx?reportId=3>.

⁸ The German terms distinguish between fees that are regulated by public law and fees that are regulated by private law. The transit toll (Befahrensabgabe) and the pilotage due (Lotsenabgabe) are regulated by public law, whereas the pilotage fee (Lotsengeld) and the helmsmen fee (Kanalsteuergeld) are regulated by private law. We follow the official English translation of the WSD Nord to emphasize that differences in terms exist.

⁹ Pilots and helmsmen are not employed by the WSD Nord. Pilots work freelance in accordance with §21 Seelotsgesetz (SeeLG, 2010) and helmsmen are organized in a registered association (<http://www.kanalsteuer.de/index.html>).

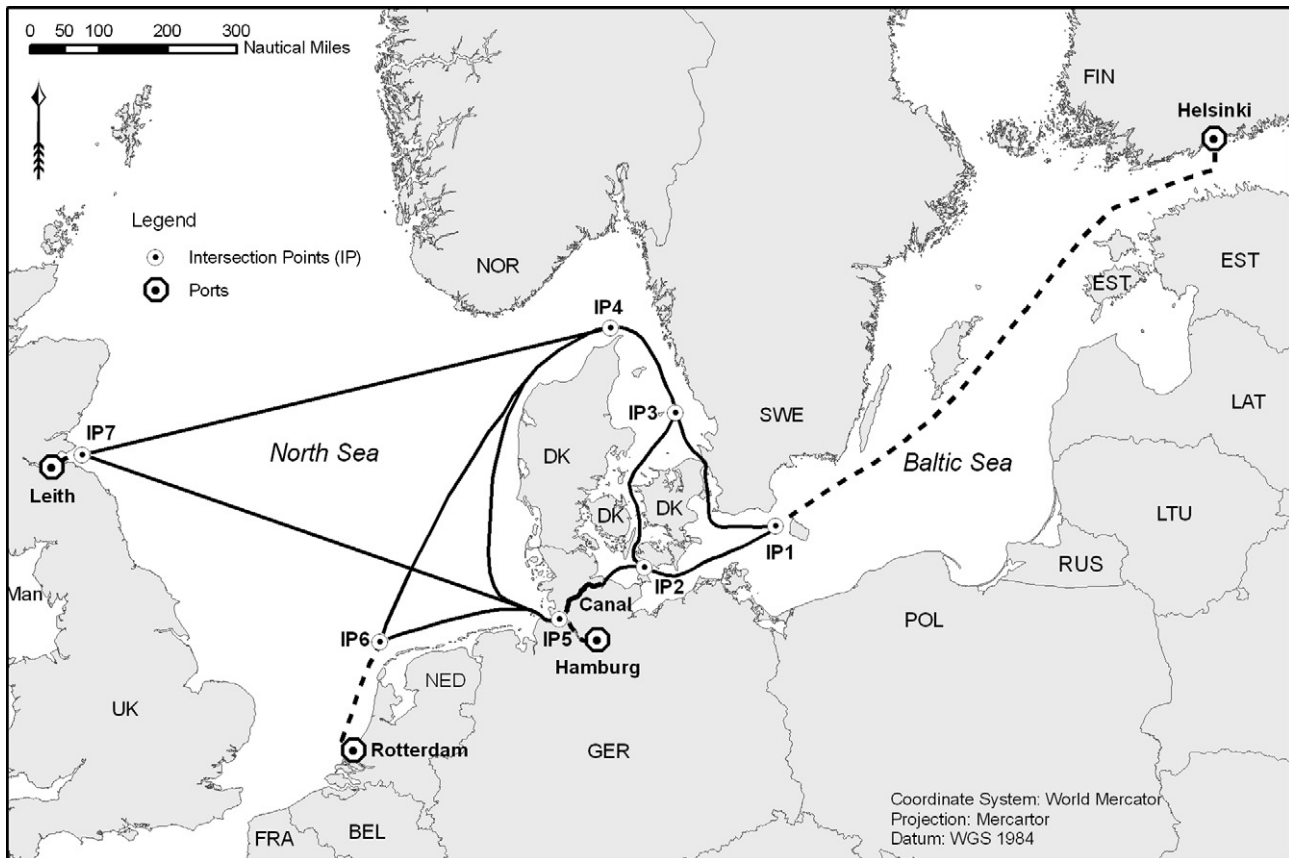


Fig. 1. Shipping routes and alternative passageways. Source: Own presentation based on ESRI Base Map; Shipping routes are based on Kerbaol and Hajduch (2009) and Helcom (2011).

facilities.¹⁰ The WSD Nord relies mainly on the transit toll to cover expenses such as investments in extensions, operating and maintenance costs, and administrative costs.¹¹ Revenues in the period 2005–2010 covered only between 14% and 30% of expenses (WSD Nord, 2011a). The difference was covered by funds provided by the federal government. This loss and the current discussion on further widening and deepening of the Kiel Canal raise the question whether the current transit charges collected by the WSD Nord are too low and could be raised.

The Kiel Canal is a monopoly that allows, in principle, for perfect price discrimination. Under perfect price discrimination, a monopolist charges according to the willingness-to-pay (WTP) of each customer (Besanko and Braeutigam, 2005). WTP is the maximum price the customer is willing to pay for a good, i.e., the customer is just indifferent between buying the good at his/her WTP and not buying the good at all. We define the WTP as the optimal price. Applied to the Kiel Canal, optimal pricing under perfect price discrimination implies charges that amount to the total cost savings a ship operator realizes when choosing the route via the Kiel Canal instead of the one around Denmark. These cost savings result mainly from reduced sailing time and reduced consumption of bunker fuel.

The first paper analyzing this topic with the theory of price discrimination was by Hutchinson (1912), who considered the Panama Canal. He investigated the US government's action to exclude coastwise shipping from paying charges and offset the

decrease in revenue by increasing the charges for international shipping. His results indicate that the resulting loss would not be offset by such a policy. Despite Hutchinson's early analysis, the literature related to this field of research remains limited. Most of the literature studies the competitiveness of certain shipping routes from an operator's point of view (Notteboom, 2012; Lasserre and Pelletier, 2011; Schøyen and Bråthen, 2011; Liu and Kronbak, 2010; Somanathan et al., 2007, 2009). Liu and Kronbak (2010), for example, study the economic potential of the Northern Sea Route (NSR) as an alternative transit route to the Suez Canal route. Their results indicate that the ice-breaking fee is one of the main factors influencing the competitiveness of the NSR.

Two studies exist that look at the Kiel Canal. Baird (2006) analyzes transport-distance-associated costs for established and potential alternative hub locations to find the optimal hub location for northern Europe. Thereby, he includes the current Kiel Canal transit charge into his cost calculations. He finds that using established hub locations, including Rotterdam and Hamburg, to serve the Baltic Sea region via feeder shipping routed through the Kiel Canal, is more costly than using the alternative hub location Orkney, located in the north of Scotland, to serve the Baltic Sea region via feeder shipping routed around Denmark.

Böhme and Sichelschmidt (1997) analyze the factors that cause the Kiel Canal's balance sheet loss in order to determine how to decrease the loss. They find that the main way to leverage the loss is to reduce costs rather than to increase revenue. We build upon their results but also challenge them by analyzing the revenue part of the profit equation in more depth.

We contribute to the existing literature by taking the point of view of the canal authority to determine the optimal canal transit charges under perfect price discrimination. Charging

¹⁰ In accordance with Seelotsgesetz § 6 (SeeLG, 2010).

¹¹ In accordance with Seeaufgabengesetz §13 (SeeAufgG, 2008). Note that the WSD Nord collects additional revenues in the form of fines, grants, refundings, and other fees, but that these additional revenues are of minor importance.

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