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Comparative Study of Freight Ferry Services in the South Baltic Sea

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Abstract:

Purpose: *The aim of this article is to analyse ferry services in the South Baltic Sea in terms of the availability for the customers (road hauliers and freight forwarders) as well as quality of transport services.*
Design/Methodology/Approach: *The following research methods were used in the study: literature review, desk research and comparative analysis.*
Findings: *A comparative analysis of ferry services in terms of cargo turnover aims to compare the following key elements:sailing time between the ports, number and timing of departures, number of shipping companies and vessels operating the connections, prices and tariffs, and transported volumes. These are crucial quality factors for ferry operator customers.*
Practical Implications: *The article emphasizes that the components of the comparative analysis presented in the article are crucial for road hauliers and freight forwarders. They provide information on transport capacity in the maritime section of road-ferry transport chains.*
Originality/Value: *Literature related to the ferry sector is not extensive, it includes a relatively small number of scientific articles and monographs. The aim of the analysis is to fill the research gap in studies concerning the ferry sector. As there are no current analyses of the ferry line operations in terms of cargo capacity availability on individual lines in the South Baltic Sea.*

Keywords: *South Baltic, ferry shipping, the ferry operation, the quality of ferry services.*

JEL classification: *M21, L99, L83, C38.*

Paper Type: *Research article.*

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1. Introduction

The countries in the Baltic Sea Region trade with neighbouring as well as with the states located relatively close. A strong economic and trade relations have developed between these countries (Laaser and Schrader, 2017).

A steady increase in turnover between countries in the region has been observed before lockdown caused by the pandemic despite previous economic shocks, like crisis in 2009, when exchanges dropped by 25%. A comparable situation occurred in 2020 due to the Covid -19 pandemic.

The key drivers of trade volumes are the economic activities of individual countries. However in recent years, negative factors affecting turnover have been the economic slowdown in the region, inflation, the war in Ukraine, and high fuel prices, which have been reflected in a decline in mutual trade. Another factor was the low exchange rate of the Swedish krona against the euro, which made imports of such products as automotive and electronic appliances from continental Europe less profitable.

Trade between the Baltic Sea Region states is predominantly based on manufactures commodities and semi-finished products. Exports to the Nordic countries are dominated by goods such as machinery and equipment, the automotive, furniture and household products.

A significant share is also represented by the chemical and metallurgical industry products. Another group comprises agricultural goods and foodstuffs. The main products imported from Sweden and Finland to continental European countries comprise wood and products of the forest and paper industry. The others are agricultural commodities and foodstuffs.

Trade relations, the volume of commercial exchange between continental European and Nordic states, as well as the structure of the trade determine the cargo flows in the region and constitute the regional supply chains in Baltic Sea Region. The majority of cargo between Nordic countries and continent are carried by ships.

Since manufactured goods predominate, they are transported in cargo units and naturally suited to ro-ro shipping consisting of ferries and pure ro-ro vessels. It is estimated that ro-paxes and ro-ros carry up to 80 per cent of total internal cargo turnover in this region (Serry, 2014).

Ferry connections constitute key components of land-sea transport chains, as well as important elements of transport systems (Urbanyi-Popiołek, 2021). In the case of intermodal sea-land transports performed by the ro-paxes, the first and last stages of transport are performed by road, while the prime part of transport by sea (Fremont and Franc, 2010, Kotowska *et.al*, 2024).

2. Literature Review and Methodology

Carriage of passengers and cargo by one ship using ro-ro technology for loading and discharging wheeled units and private cars is the prime characteristic of the analysed segment of the maritime transport. Ferry operation is also define as a type of liner shipping where passengers and cargo form one market (Urbanyi-Popiołek, 2021). Ferries operate the regular routes, usually between two ports according to schedules (Urbanyi -Popiołek, 2009; Kotowska, 2014).

Ferry shipping is the prime mode of general cargo transportation within the Baltic Sea Region. Carriage comprises different vehicles, as semitrailers, lorries, trucks and containers on roll-trailers. Ferry shipping form strategic connections in regional supply chains. Ferry links are elements of road – sea transport systems from mainland Europe to Nordic countries (Daduna *et al.,* 2012). Ferry business constitute prime elements of regional transport chains and multimodal transport systems (Paixao Casaca and Marlow, 2009).

Musso, Casaca and Lynce describe ferry services as a segment of short sea shipping market (Musso *et al.,* 2010). Moreover ferry shipping is also considered as alternative for land transportation in concept of green corridors (Castels *et al.,* 2012; Chen *et al.,* 2014). The growth of the ferry turnover as an alternative for road haulage is primarily aimed at discerning social benefits resulting from lower external costs generated in maritime transport, lower number of accidents and reduced congestion (Kotowska, 2015). The ferry services connect the continental Europe transport system with Scandinavian roads. This maritime transport enables efficient and effective carriage of goods transported in lorries and semitrailer across the Baltic Sea (Urbanyi-Popiołek, 2023).

The concept of carriage of valuable goods, as automotive, electronic appliances, machinery, construction equipment, medical equipment, textiles, furniture, household appliance and medicines as well as food and agriculture commodities, wood and paper products, steel and semi-finished products is based on house to house formula.

Such commodities generally are loaded into trucks or semi-trailers at seller`s premises or his warehouse and unloaded at receiver`s place (Urbanyi-Popiołek, 2023). These cargoes are transported in the region in road-sea transport chains, where ferry services constitute the maritime links.

The ferry services link the continental Europe transport system with Scandinavian roads. This maritime transport enables efficient and effective carriage of goods transported in lorries and trucks via Baltic Sea (Urbanyi-Popiołek, 2020). In accordance with the scope of the article, the prime function of ferry shipping is its “floating bridge” function and it is considered as essential links in European supply chains.

The prime objective of this article is to analyse ferry services in the South Baltic Sea in terms of the availability for the customers (road hauliers and freight forwarders) as well as quality of transport services. The aim of the analysis is to fill the research gap in studies concerning the ferry sector. As there are no current analyses of the ferry line operations in terms of cargo capacity availability on individual lines in the South Baltic Sea.

In order to achieve the objective, the following research questions have been formulated:

RQ1: What is the ferry route network structure in the southern Baltic Sea?
RQ2: What factors are important to ferry customers?

The following research methods were used in the study: literature review, desk research and comparative analysis. Desk research were based on the original data collected from the ShipPax Information, a publisher of ferry reports and provider of consulting services for the ferry and ro-ro shipping segments. The data is also based on ferry companies reports as well as operators` websites.

A comparative analysis of ferry services in terms of cargo turnover aims to compare the following key elements:

- sailing time between the ports,
- number and timing of departures,
- number of shipping companies and vessels (including types, capacity etc.) operating the connections,
- prices and tariffs,
- transported volumes.

In the authors` opinion the components of the comparative analysis presented are crucial for road hauliers and freight forwarders. They provide information on transport capacity in the maritime section of road-ferry transport chains.

Transit time is an important quality factor, as the appropriate sailing time is important in terms of regulations concerning drivers` working hours. Regulation EC 561/2006 imposes a mandatory11-hour daily rest period on drivers. Time spent on a ferry during sailing counts as this pause. Ferry departure and arrival times are also important for planning transport and delivery times.

Prices are an important factor in choosing a route and ferry operator, as they constitute the major component of total transport costs. Customers have contracts with operators under which they benefit from individually agreed rates, often lower than the available official tariffs.

3. Overview of Ferry Cargo Transport in the Baltic Sea Region

It is estimated that at the beginning of 2025, there were 1,469 ro-pax vessels active in global ferry shipping, with a total capacity of 16,775 million GT and of 989,000 line metres.

The European ferry freight transport market is dominated by a few players. The Grimaldi Group, which owns Finnlines and Minoan Lines, among others, has been the leader in the ferry segment for years. The group controls over 9% of the global capacity represented by ro-pax ferries – a total of over 88,000 metres of cargo space.

This is twice as much as Grandi Navi Veloci (GNV), which ranks third. Stena Line remains in second place (77,600 metres). Other carriers include Attica Group, DFDS Seaways, Balearia, Onorato Armatori Group (with Moby), Brittany Ferries, TT-Line and P&O Ferries. It is estimated that these carriers control over 50% of the total cargo capacity of ro-pax ferries.

The Baltic ferry shipping is concentrated, 15 carriers operate on international Baltic routes and prime domestic connections in Denmark, Sweden and Finland. The number of operators has remained stable for years. A few players dominate the market: Stena Line, DFDS Seaways, Tallink Group, TT-Line and Finnlines. Other significant carriers are Viking Line, Molslinien, Scandlines, as well as the Polish operators active in the southern Baltic Sea - Unity Line and Polferries.

The network of the ferry lines included 60 services (some are parallel). According to Shippax data, in the beginning of January 2025, the number of active ferries totalled around 120 vessels.

Table 1. *Summary of basic data on selected ferry operators.*

Carrier	Number of ro-pax vessels			Cargo capacity – line metre		
	2023	2024	2025	2023	2024	2025
Stena Line	18	15	14	45 686	40 276	38 776
DFDS Seaways	8	7	5	20 801	18 908	16 056
Tallink Group	9	10	8	16 930	16 990	14 373
Viking Line	5	5	5	5 435	5 435	5 435
TT-Line	9	9	9	25 250	25 250	25 250
Scandlines	7	7	7	6 235	6 235	6 235
Finnlines	8	8	9	30 274	31 259	36 459

Source: *Own elaboration based on Shippax Market 23, Shippax Information, Halmstad 2023, Shippax Market 24, Shippax Information, Halmstad 2024, Shippax Market 25, Shippax Information, Halmstad 2025.*

Over the past three years, shipowners from the Baltic Sea region have invested heavily in tonnage. In 2022, seven new vessels entered service, including two introduced by DFDS (Aura Seaways and Luna Seaways), two by Stena Line (Stena Estelle and Stena

Baltica – rebuilt) and one each by TT-Line (Nils Holgersson), Tallink (MyStar) and Viking Line (Viking Glory). The following year, another three new ro-pax vessels were put into service for Stena Line (Stena Ebba), TT-Line (Peter Pan) and Finnlines (Finnsirius), and last year two more for Finnlines (Finncanopus) and Polferries (Varsovia). With these actions, Stena Line, Finnlines, DFDS Seaways and TT-Line completed their investment projects in the Baltic Sea.

Ferry business in the Baltic Sea Region includes three prime ferry markets:

- West Baltic - comprises lines from Denmark to Sweden, Norway and Germany, services from Sweden to Norway and Germany and Germany – Norway connection, the west market accounts to 60% of freight traffic,
- East Baltic - covers services from Sweden to Finland and Estonia, from Estonia to Finland, the east market accounts to 18% of freight turnover,
- South Baltic/ Central Baltic - comprises lines between Sweden and Poland, Sweden and Latvia and Lithuania and the connections between Germany and Lithuania, Latvia and Finland, the central market constitutes 22% of freight.

These markets differ in terms of the demand for transport services and the functions the ferry lines perform. In west and south Baltic cargo turnover dominates. Both markets accounts for 82% of ferry loads in region. Most services are cargo oriented routes.

4. Comparative Analysis and Discussion

The South Baltic region includes ferry routes connecting Sweden with Germany, Denmark, Poland, as well as with Lithuania. In all, there are 7 shipping companies that operate in the selected area. The number of point - to - point connections amounts to a total of 16.

The study excludes two lines between Germany and Denmark Puttgarden – Rodby and Rostock – Gedser. These connections transport cargo from western Germany, the Netherlands, Belgium to Scandinavia and constitute the main maritime links in the western transport corridor.

Furthermore, the former service is located more in the western part of the Baltic Sea and the latter on the border with the studied area. The transit time of both lines is short (45 minutes and 2 hours respectively) and the lines offer a high number of departures (up to 40 crossing daily and 10 departures daily respectively) and are therefore incomparable with others in the surveyed area.

The research also excludes the Gdansk–Nynashamn and Kiel – Gothenburg routes, as their transit time is not comparable to other connections (it takes 18 and 14 hours respectively). Moreover, those services are less important for freight transport than other destinations.

The selected links are presented in the Table 2. Parallel services are active on most of the routes analysed and are treated together. The highest concentration of ferry services in the South Baltic Sea is located between the ports of Świnoujście and Trelleborg and Ystad. Shipowners operate four services between terminals in these locations.

Świnoujście – Ystad route is operated by Unity Line and Polferries. The ro- pax vessels owned by Unity are Polonia, Skania and Galileusz. The cargo line of the former amounts to 2,200 metres. She also transport railway cars. Ro-pax Skania is characterised by a similar load capacity (load line 2,170 metres).

The latter one is smaller with load capacity of 1,830 metres. Vessels are classified in the medium-sized segment in terms of carrying capacity. Unity Line ro-paxes run from 2 to 3 times a day. The daily capacity with 3 departures amounts to 375 trucks from each port (750 in round trips). The freight comprising base rate and two charges (Bunker – Environmental Surcharge and ETS emission surcharge) amounts to 585 euro per unit.

Table 2. *Summary of basic data on selected ferry operators.*

Market	Service	Operator	No. of ferries	No. of cargo units in 2024
Germany - Sweden	Travemunde -Trelleborg	TT-Line	2-3	209 000
	Travemunde - Malmoe	Finnlines	3	No data available
	Rostock - Trelleborg	TT-Line	3	307 000
	Rostock - Trelleborg	Stena Line	2	
Poland - Sweden	Świnoujście - Ystad	Unity Line	3	193 000
	Świnoujście - Ystad	Polferries	2	
	Świnoujście - Trelleborg	Unity Line	3	238 000
	Świnoujście - Trelleborg	TT-Line	2	
	Świnoujście - Malmoe	Finnlines	1	27 000
	Gdynia - Karlskrona	Stena Line	3	190 000
Lithuania -Sweden	Kłaipeda - Karlshamn	DFDS Seaways	2	No data available
	Klaipeda - Karlshamn	TT-LIne	1-2	No data available

Source: *Own elaboration based on Shippax Market 23, Shippax Information, Halmstad 2023, Shippax Market 24, Shippax Information, Halmstad 2024, Shippax Market 25, Shippax Information, Halmstad 2025.*

Polferries operate two medium-sized vessels on the same link – Masovia and Varsovia with 2 crossings from each port. The ferries line metre amounts to 2,620 and 2,875 respectively with capacity of 330 units daily in one direction and 660 lorries in round trips. Freight covering the same components as in the Unity Line is approximately 622 euro per truck. The transit time on the Świnoujście–Ystad route is similar for both services. The day crossing takes around 7 hours, and the night one takes approximately 7.5 hours.

The Świnoujście–Trelleborg route is also served by two operators. Unity line operates 3 medium size ro-paxes – Epsilon (2,860 line metres), Copernicus (1,830 metres of line) and Gryf (1,880). The company offers up to 3 crossings daily. The capacity per day amount to 398 units one way and 796 lorries in round trips. The transit time is similar to Ystad service. The operator charges the same freight rates as on its other service.

TT-Line offers 2 sailings per day and the link is operated by various ferries on a rotational basis detailed below. The crossing time rage from 6 till 7 hours and the freight rate charged all- in amounts to 300 euro. With 2 sailings, the daily capacity ranges from 300 to 360 trucks depending on the ferry size in one direction (600-720 round trips).

The Świnoujście–Malmö route is operated by Finnlines with a single vessel, the Finntrader, which has a capacity of 3,050 line metres and can carry up to 165 lorries at a time. The transit time amounts to 9 hours.

The next is Rostock – Trelleborg path. The route is managed by two companies TT-Line and Stena Line.

TT-Line offers from 2 departures (Sunday and Monday) to 4 sailings (Tuesday, Wednesday, Thursday) per day. On other days, there are usually 3 departures from each port. Transit time is 7-8 hours. The shipowner operates the following ro-pax vessels: Nils Holgersson, Peter Pan, Tinker Bell, Nils Dacke, Robin Hood, Tom Sawyer, Huckleberry Finn and Marco Polo. TT-Line ro-paxes are ferries with a large and medium cargo capacity.

The first two can accommodate 300 freight units on decks with a length of 4,000 metres. Tinker Bell has a capacity of 3,670 line metre for 230 trucks. The other ships have loading lines between 2,400 and 1,800 metres. Therefore, the shipowner's vessels can be classified as large and medium-sized ro-pax vessels.

When analysing the schedules, the connection is operated by all vessels, with at least one departure per day being carried out by the three largest ro-pax vessels mentioned above. For example, with four departures per day, the available cargo capacity ranges from 780 to 850 lorries, which can be transported from Rostock to Trelleborg. The same number of units can be transported on the return trip.

Stena Line operates the Rostock–Trelleborg route with two vessels of similar capacity. These are Skane and Mecklenburg-Vorpommern. Both ferries, with a cargo capacity of over 3,200 m, belong to the group of large vessels, which allows them to carry over 200 lorries at a time. The carrier offers three departures a day during the week and two on Sundays, with a transit time of 6-7 hours. The daily (weekday) transport capacity is over 600 vehicles in one direction and over 1,200 freight units in both directions. Moreover, the shipowner's vessels can transport railway waggons.

The next corridor includes connections from Travemunde to Malmö and Trelleborg, operated by Finnlines and TT-Line respectively. TT-Line on Travemunde – Trelleborg operates the same ferries, since the operator, as mentioned, runs the ro-paxes on a rotational model.

The number of sailing amounts to 4 daily and the transit time is about 9 hours depending on departure. With four departures per day, the available cargo capacity ranges from 780 to 850 lorries and is comparable to Rostock – Trelleborg. The freight all in amounts to average 320 euro

Table 3. *Summary of key elements of comparative analyses.*

Operator	**Service**	**Daily capacity round**	**No. of daly departures**	**Transit time**	**Freight**
TT-Line	Travemunde - Trelleborg	1,560-1,900	3 - 4	9	320
Finnlines	Travemunde - Malmoe	1,200	3	9	No data available
TT-Line	Rostock - Trelleborg	1,560-1,900	3 - 4	7-8	272
Stena Line	Rostock - Trelleborg	1,200	2 - 3	6-7	386-410
Unity Line	Świnoujście - Ystad	750	2 - 3	7 – 7,5	585
Polferries	Świnoujście - Ystad	660	2	7 – 7,5	622
Unity Line	Świnoujście - Trelleborg	796	3	7 – 7,5	585
TT-Line	Świnoujście - Trelleborg	600-720	1 - 2	6 -7	300
Finnlines	Świnoujście - Malmoe	165	1	9	No data available
Stena Line	Gdynia - Karlskrona	1,040	2 - 3	10	560-680
DFDS Seaways	Kłaipeda - Karlshamn	760	2	14-16	No data available
TT-LIne	Klaipeda - Karlshamn	200	1	15	470

Source: *Own elaboration.*

The former connection Finnlines` Travemunde – Malmoe offers up to 3 departures a day with crossings time about 9 hours. Three ferries are in service – Finnpartner (3,050 line metre), Finnfellow (3,090 line metre) and Finnswan (4,215) which can accommodate up to 600 lorries in one direction and 1,200 in round trips daily. The freight is not available.

The eastern corridor in the studied area comprises three lines. The first is the Gdynia–Karlskrona connection. Stena Line offers 3 crossings daily with transit time around 10 hours. The carrier operates two sister ro-paxes Stena Ebba and Stena Estelle, both with a capacity of 3,600 load line (large ro-pax segment) and Stena Spirit with a line of 2,214 metres (medium sized vessel).

With 3 departures per day, the daily available cargo capacity is 520 trucks in one direction and 1,040 in round sailings. The freight rate depends on the day of the week and whether it is a day or night departure. The rate all-in ranges from 560 to 680 euro per lorry.

The two parallel services connect Klaipeda with Karlshamn. DFDS Seways operates two ro-paxes Luna Seaways (4,500 line metres) and Regina Seaways (2,500 line metres) and offers 2 sailings daily. This allows for the transport of up to 380 lorries per day in one direction and 760 units in round trips. The other TT-Line offers one departure per day, the daily capacity amount to 200 trucks. The transit time is approximately 12-14 hours. The rate all - in amounts to 470 euro.

4.1 Volume of Transported Units

The route between the Polish port of Świnoujście and the Swedish ports of Trelleborg, Ystad and Malmö has the highest turnover, with two connections to the former of these ports dominating in terms of the number of transported units. The Rostock–Trelleborg ferry line, operated by two operators, has the largest volume of lorries transported.

The services from Rostock and Świnoujście to southern Sweden carry cargo not only from Germany and Poland, but also from central and southern Europe, e.g. Austria, the Czech Republic, Slovakia, Hungary and the Balkan countries. These lines are therefore competitive with each other. The Gdynia–Karlskrona route is also a key service, notably for freight forwarders from Poland, Slovakia, Hungary, and Romania.

4.2 Number and Timing of Departures

For ferry customers, important factors when choosing a route are the number of departures on the service, departure times and the transit time. Evening sailings and the availability of night crossings are crucial. Carriers on most of the services surveyed offer two or three departures per day with night sailings.

The routes with the highest demand for services offer a greater number of departures, e.g., from Rostock and Travemünde to Trelleborg, with up to four departures. Ferry operators from Polish ports, on the other hand, offer up to three departures on the peak days of the week.

4.3 Transit Time

Transit time depends on the distance between ports and the speed of ships. On shorter routes (Świnoujście, Rostock–Trelleborg), the transit time is similar (6–7 hours), although night crossings are slightly longer. For longer services, this time exceeds 10 hours. The duration of the journey, particularly overnight sailings, is important for hauliers due to the mandatory rest pause for drivers.

4.4 Freight

There is a visible difference between the freight charges levied by individual ferry operators. The highest charges are quoted by Unity Line, Polferries and Stena Line. However, the rates have been calculated on the basis of available tariffs. In practice, freight forwarders have signed agreements with operators, where individual rates are set. However, this information is confidential.

5. Conclusions

Based on the comparative analysis, one can conclude that the services offered by ferry operators in the South Baltic Sea are similar. Most lines offer at least two crossings daily, including night ones. Departure hours are adjusted o customer requirements. The differences can be found in the size of the ferries in operation. Most vessels owned by TT-Line and Stena Line are classified as large-scale ro-paxes, with load line over 3,000 metres. The other operators operate medium-sized vessels. This means that during peak seasons, one can observe a lack of available capacity.

The ferry market in the South Baltic Sea is extremely competitive. Most operators adapt their transport services to customer requirements.

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