Hamburg's port position: Hinterland competition in Central Europe from TEN-T corridor ports

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Content

Abstract

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Abstract: This paper aims at analyzing the hinterland position of the German port of Hamburg in Central Europe. As a first step, we identify Koper and Gdansk ports that could act as potential competitors to the German ports, since they exhibit a dynamic development in container throughput over the last five years. As a next step, we compute the contestable economic potential of the hinterland from Hamburg, and from their possible emerging competitors, respectively, by using simple travel time matrices for different transport modes. Afterwards, we analyze the planned infrastructure improvements based on the EU's TEN-T projects. We show how much the economic potential can be increased due to infrastructure improvements, and how this affects the competitive position in hinterland transport. However, besides the hinterland infrastructure there are other determinants relevant for port competition; inter alia the clustering of logistic activities, efficiency of port operations, and liners connectivity.

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1 | Introduction

Hamburg's hinterland position

Traditionally, Hamburg has a strong hinterland position in the German federal states of Bavaria and Baden-Wurttemberg, as well as in Central and Eastern European countries like Poland or the Czech Republic (Biermann et al. 2015). But its competitive position is increasingly challenged by ports like Koper (SI), or Gdansk (PL) that have experienced strong growth rates between 2010 and 2014. From an economic perspective, those ports might even be preferable if the overall travel time and the corresponding travel costs can be further reduced. Both ports are part of the TEN-T's Baltic-Adriatic corridor that connects them to the Central Europe capitals of Vienna, Bratislava, or Warszawa. Improvements planned along this corridor shall reduce travel time between Warszawa and Klagenfurt by over 3 hours (approx. 25 %) by 2022. Hamburg, in contrast, is part of the Scandinavian-Mediterranean corridor that connects northern Europe and Italy. Due to existing bottlenecks, improvements in the rail connection between Hamburg and Hanover (formerly known as "Y-Achse") are crucial for their competiveness against other European ports in the South German and Central Europe hinterland.

According to the OECD (2014), the main determinants for port competitiveness are maritime connectivity, efficiency of port operations, and hinterland connectivity. While maritime connectivity and efficiency of port operations can be improved in (relatively) short time – though port capacity remains a limiting factor on both –, hinterland connectivity bases on landward infrastructure and can thus be improved only slowly in the long-run. Nevertheless, all three determinants are interdependent, with shipping lines choosing ports that are well equipped and well connected seaward as well as landward. Examples in the literature are rare. Meersman et al. (2008) show that port competition is positively affected by hinterland connections and routing. They compare rail connections from the Netherlands and Belgium, respectively, to the German Ruhrgebiet.

Infrastructure and hinterland

Before improving the infrastructure, the regions to be linked and the best routes to connect these regions have to be identified. From a port's perspective, the contestable hinterland determines the routes that should be reconstructed. Contrariwise, the contestable hinterland could be expanded by improving the hinterland connections. But this expansion only works to a limited degree, since the port will start to compete with other ports that already serve the specific hinterland.

Infrastructure improvements in a port's hinterland are not only a national task, since most of the European ports also serve as hubs for adjacent countries. The German "Ruhrgebiet", for example, is well connected to the ports of Rotterdam and Antwerp, respectively, and goods coming from or going to that region are to a great extent shipped via these ports. The port of Hamburg, for example, is well connected to the Czech Republic and the South of Poland (Teuber et al. 2015). To maintain a high quality of infrastructure in Europe, the EU started the

Trans-European Transport Network (TEN-T) initiative that aims at maintaining the EU's competitiveness by improving transport infrastructure along main routes across Europe. The EU identified nine corridors on which relevant infrastructure such as roads, railways, inland waterways, tunnels, and bridges should be expanded or reconstructed to improve the connectivity. Main European ports are embedded alongside these corridors where a large share of European imports and exports are transferred. Improved infrastructure should have a significant impact on the ports' hinterland connectivity and transport efficiency, since peripheral regions gain disproportionally.

Aim of the paper

This paper analyses the current situation in the German North Sea port of Hamburg compared to the emerging Adriatic Sea port of Koper (SI), as well as to the Baltic Sea port Gdansk (PL). Hamburg has comparatively a strong hinterland position not only in Southern Germany but also in Central and Eastern Europe. But its position is challenged by the aforementioned ports that have experienced high growth rates during the last couple of years. Koper's, and Gdansk's main infrastructure bottleneck maintains the transport flow into the hinterland. A recent study shows that for containerized imports to South Germany the port of Hamburg is still the first best choice, though Koper is much closer in terms of kilometers (Drewry, 2016).

Structure of the paper

The remainder of this paper is organized as follows: The second chapter gives an overview of the importance of hinterland connectivity for port development. In the third chapter, the development of container throughput in the relevant ports is shown. In the fourth chapter, the ports' hinterland is identified, with a focus on the railway network. In chapter 4, we also compute travel time matrices for the ports to identify their contestable hinterland. In chapter 5, we highlight infrastructure projects and improvements and show how reduced travel time can lead to an expansion of the contestable hinterland. Chapter 6 concludes.

2 | Hinterland Connectivity as a Determinant for Port Competitiveness

Ports competition factors

Maritime connectivity, the quality of port infrastructure, and the hinterland connectivity determine a port's competitive position (Grossmann et al. 2010; Notteboom 2009; OECD 2014). Maritime connectivity refers to the number of vessel calls, vessel size and maximum capacity, liner services, and the number of companies operating in a country's ports. Efficiency of port infrastructure is a measure for promptness and reliability in cargo handling. For example, ports with a high level of automation and excellent port facilities are usually more efficient. Figure 1 shows the results of an evaluation of the maritime connectivity and the quality of port infrastructure, both on a country level.

Figure 1 Quality of port infrastructure and liner shipping connectivity index
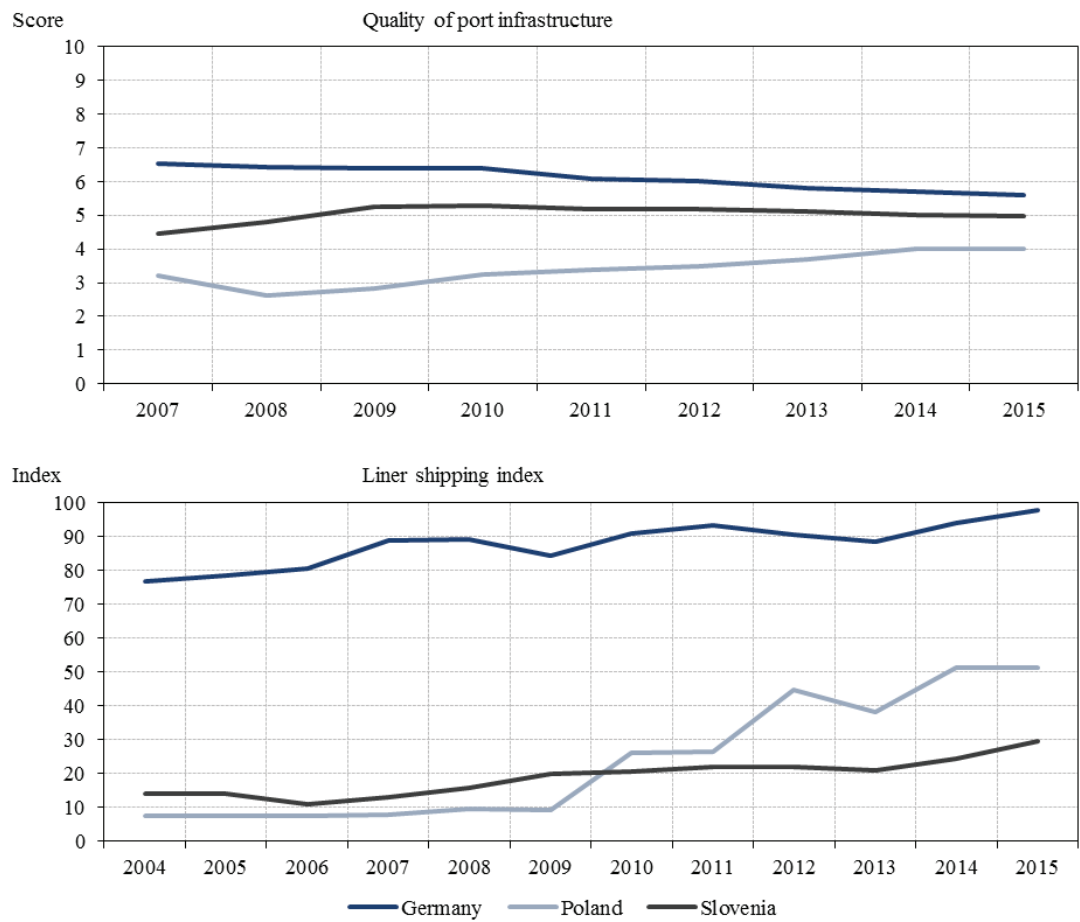
Index: The base value is 100 for China in 2004
Score: Values can vary between 1 (extremely underdeveloped) and 7 (efficient by international standard)

Source: World Bank (2016).

Among the analyzed countries, Germany ranks highest in liner shipping connectivity and quality of port infrastructure. Nevertheless, its quality of port infrastructure declined over the last five years. Poland and Slovenia could improve their position, with Slovenia having a comparatively high port infrastructure. Since Koper is the only Slovenian port, any improvement in Slovenia's maritime connectivity and port infrastructure can be taken as an improvement in the port of Koper.

Hinterland connectivity and competition

Specific parameters at various port locations determine the advantages and disadvantages of these locations, which have affected their development in the past and will also have an effect on their future growth rates. A special characteristic of ports is that their functions and the related business sectors usually cannot be transferred to any arbitrary location (i.e. path dependency). The intensity of the competition which a port faces is related to the geographic distance from other (potential) port locations. Numerous factors relating to the landward site influence the competitive position of a port and, thus, the volume of cargo handled in that port.

A critical site-related factor that is highly significant for the competitiveness of ports and their economic development is the hinterland link by rail, inland waterways, and road/trucks. Seaports are intermodal transport junctions in international and domestic trade, and goods are transported from the port to their final destination by various means of transport. Therefore, to be competitive, a port must be integrated into the local maritime and hinterland transport chain (Carbone and De Martino, 2003; Franc and van der Horst, 2010; Merk and Notteboom, 2015). If ports exhibit at least some gateway traffic, any expansion of a terminal should be accompanied by sufficient hinterland infrastructure (Acciaro and McKinnon, 2013).

Good logistics for the hinterland areas are a prerequisite for ensuring that no bottlenecks arise, preventing traffic jams and thus keeping the transport time and cost as efficient and low as possible (Grossmann et al., 2007; Notteboom, 2009). To avoid congestion at a port, containers could be transported by trucks to railway or inland waterway nodes, respectively, or to dry ports. The hinterland connectivity of a port depends on the density of inland transport networks, the accessibility of industrial centers, the modal options, as well as capacity and reliability (Acciaro and McKinnon, 2013). Developments and changes in port hinterland have a substantial influence on the efficiency of freight distribution (Rodrigue and Notteboom, 2010). This is particularly important because costs for an additional kilometer in landward transport are usually much higher than for seaward transport (Clark et al., 2004).

Notteboom (2009) describes the containerization as a reason that has facilitated the rise of ports' gateway to the hinterland. Containerization and the development of larger container vessels go hand in hand: In the long-distance route, economies of scale are crucial for cost reduction. Another reason is the liberalization in European rail and development of intermodal corridors. The recent stagnation in container throughput – only 0.4% increase in 2015 (ISL 2016) – and the sharply decreased freight rates lead to more port competition for

loads. As a result the ports cannot longer act as regional monopolies (Cullinane and Wang, 2006).

Hinterland competition with respect to a port's position in the global shipping network

The development of container throughput in a port does not allow one to draw conclusions about future development, since one of the main factors, the economic development of the trading partners, is not taken into account on this aggregated level. Therefore, the development of a port depends on its bilateral traffic flows, its centrality within the network, and the dominance of trading partners, that might make a port more vulnerable (Xu et al., 2015). Furthermore, ports with a high share of transshipment are twice affected if main trading partners face declining cargo volumes. The share and development of hinterland traffic in ports with the same number of containers handled can thus be quite different. Competition in hinterland traffic will therefore mainly arise if ports face the same trading partners in seaborne trade and act as inland gateways for overlapping hinterland regions.

Port strategies and hinterlands functions

Transshipment figures for European container ports indicate that the North Range ports are – except for Antwerp – no real transshipment hubs. They serve as intermediate hubs. Mainline vessels call at these ports and they benefit from liner connectivity. The port of Hamburg has a transshipment incidence of around 30%. This means that Hamburg is heavily dependent on its hinterland connectivity and reliability. The transshipment incidence for Hamburg has been relatively constant between 2004 and 2012. Moreover, the North Range ports are typically inland gateways in the maritime hub-and-spoke systems with hinterland-based and foreland-based port regionalization strategies (Rodrigue and Notteboom, 2010).

By contrast, in the Mediterranean Sea most ports are typically transshipment ports with more than 80% transshipment traffic, for e.g. Gioia Tauro, Taranto, and Malta. The conditions for those hubs are geographical conditions, since those ports in the Mediterranean Sea are situated between markets (e.g. East Asia and Europe). Koper itself has no transshipment activities at all; the port of Koper serves as inland gateway with a hinterland-based regionalization strategy (Rodrigue and Notteboom, 2010).

The port of Gdansk relies on a foreland-based regionalization strategy to get access to major trade routes. Gdansk, but also most of the other ports in the Baltic Sea, receives mainly the connecting feeder services from different hubs as Bremerhaven, Hamburg, and Rotterdam. This strategy provides a higher robustness in the trade network. The practices are a result of the long-distance to the Baltic ports, but also the limited nautical accessibility of the Baltic Sea (Rodrigue and Notteboom, 2010). However, Gdansk is one of those ports in the Baltic Sea aiming for direct calls of deepsea vessels, whereby the competition for direct calls would rise up for Hamburg. Both ports demand the same hinterland markets in Central Europe.

3 | Development of Port Traffic

Current development

The current development in the ports of Gdansk and Koper on the one hand, and Hamburg on the other hand, follows a classical pattern: Dynamically growing ports with growth rates above the market trend are usually in a process where the import and export of general and bulk cargo is decreasing, while the import and export of industrial and consumer products is increasing. Since those higher-value products are typically shipped in containers, the port's container throughput is growing disproportionally (OECD, 2015). Established ports that already experience high container throughput volumes will predominantly increase their volume if the overall trade volume or the rate of containerization is growing, since their potential of gaining market shares is limited.

Container development of the case ports

Table 1 shows the container throughput and the respective growth rates for the years 2005 to 2015. Compared to 2005, all ports increased their container throughput. Especially the port of Gdansk gained importance, with an increase in container handling of nearly 1,500 % between 2005 und 2015. But also Koper experienced high growth rates. Hamburg, however, grew at a much slower path. In 2015, only the port of Koper was able to increase its throughput, decoupling its development from the decelerated trade growth.

For the ports of Gdansk and Koper, there has been a sharp increase in the share of Container handling on all cargo handling. Between 2005 and 2015, this number had grown from 3 % to nearly 30 % in the port of Gdansk and from 14 % to 37 % in the port of Koper. In Hamburg, the number has been stable at around 65 % for the last decade (Handelskammer Hamburg 2015, Port of Gdansk 2016, Port of Koper 2016). Container throughput in the port of Hamburg seems to be quite vulnerable to world container traffic development: When overall trade is growing slowly or even decreasing, Hamburg loses disproportionally (i.e. losing its share by direct and feeder vessels calls). The recent downturn can be seen as a result of China's slowing growth and the EU's sanctions against Russia (Port of Hamburg 2016).

Table 1 Receiving and shipping containers (in 1,000 TEU)

Port	2015	2014	2013	2012	2011	2010	2005	Change 2014-15	Change 2005-15
Gdansk	1,091.2	1,212.0	1,177.3	928.9	678.0	514.6	70.0	-10.0%	1458.5%
Koper	790.7	674.0	600.4	569.0	589.3	476.7	179.7	17.3%	339.9%
Hamburg	8,820.0	9,729.0	9,257.4	8,863.9	9,014.2	7,895.7	8,087.5	-9.3%	9.1%

Source: Port of Hamburg (2016).

Maritime connectivity and trading partners

Of the ten operators with the largest existing container fleet, all call the port of Hamburg and nine out of ten the port of Koper. Gdansk is served by G6 Alliance (inter alia Hapag-Lloyd, NYK Line, OOCL), CMA CGM, Maersk, and, due to the formation of the 2M alliance, by MSC

as well (Port of Gdansk 2016, Port of Hamburg 2016, Port of Koper 2016). The maritime liner connectivity of Hamburg and Koper is thus higher than the connectivity of Gdansk.

One of the three main trading partners for all ports is China. The shortest sea route from the port of Shanghai to the three ports has Koper: Shanghai-Koper approx. 9,800 nautical miles or 27 days at sea; Shanghai-Hamburg approx. 12,300 nm or 34 days at sea; and Shanghai–Gdansk approx. 13,000 nm or 36 days at sea (port.com, 2016). The average maritime transit time from Far East to Koper is about 29 days. There is even one service with a transit time of only 25 days, while average transit time to Rotterdam and Hamburg is 33 days, respectively (Drewry 2016). The transit time is clearly a competitive advantage for the port of Koper. However, the relationships with China are traditionally strong for Hamburg, and to a lesser extent for Gdansk. Koper's main trading partner for the last couple of years has been Egypt.

4 | Contestable Hinterland Markets and Connectivity

Current competitive situation

Ports compete in hinterland traffic if they face the same trading partners in seaborne trade and act as inland gateways for an overlapping hinterland. Since the ports of Gdansk, Hamburg, and Koper are relatively strongly interconnected with China, and all three compete with each other in the Central European hinterland that covers Austria, the Czech Republic, Slovakia, and the southern part of Germany, as well as Poland, Slovenia and parts of Italy (see figure 2), the three ports can be assumed to be direct competitors. The three ports all have a direct link to the Trans-European Transport-Network (TEN-T), connecting Europe in a north-south corridor. The core networks in question are Scandinavian-Mediterranean and Baltic-Adriatic. Moreover, the port of Koper is also part of the so-called Mediterranean core network; Hamburg is a node in the North-Sea-Baltic core network. However, both mentioned network corridors lie in the direction from west to east, so they are not part of the competitive analyses.

Hamburg acts as a gateway to and from Central Europe as well as German regions. Main hinterland regions are the German states of Bavaria, North-Rhine-Westphalia, Lower Saxony, and Baden-Wurttemberg, as well as the Czech Republic. Of all containers handled, about 30 % are shipped to or received from these regions. The port has a high loco quota of about 30 %, i.e. nearly one third of the container cargo demand and supply is generated in the metropolitan area of Hamburg (Port of Hamburg, 2016). In 2012, Koper's hinterland traffic to and from Slovenia amounted to about 29 % of Koper's total hinterland traffic, followed by Austria (around 27 %), Italy, Hungary, and Slovakia (Port of Koper 2013). Except for Austria and Italy, the main cargo shipped to and received from these countries is containerized cargo (Port of Koper 2013). According to the port, it is the most important gateway for Austria's overseas trade (Port of Koper, 2015). Gdansk acts as an inland gateway to the south of Poland, but also to Belarus and Ukraine (Port of Gdansk, 2016).

Figure 2: Port Hinterland and Ten-T core network
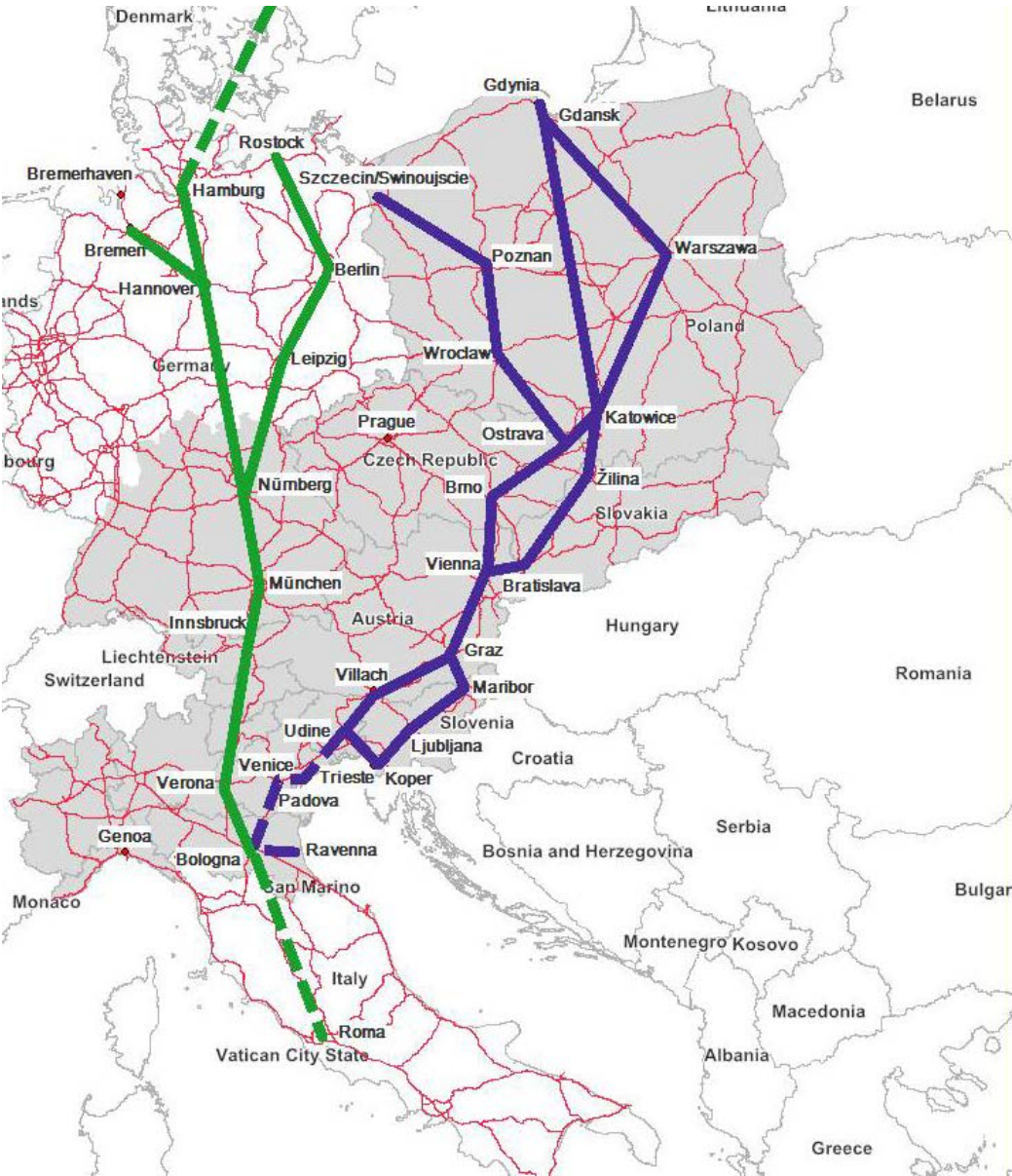
green line: Scandinavian-Mediterranean corridor; purple line: Baltic-Adriatic corridor
Source: HWWI (2016).

Railway Connections

Compared to other North Range ports, Hamburg has a high share of rail transport in hinterland traffic (45 %) with more than 1,100 rail services per week. All terminals offer at least daily services to the main logistic terminals in Austria, Slovakia, and the Czech Republic; Budapest is served daily, while Polish inland terminals are served at least 6 times a week. German logistic hubs are served most frequently, some of them more than twice per day. Currently, the port of Koper offers rail services to Austria, Hungary, Slovakia, the Czech Republic, Poland, and Germany, with at least one connection to each of these countries starting at the port of Koper 5 times a week. The Port of Gdansk has a network of rail connections with

all geographical directions. The port's railway network is connected with Poznan and Wroclaw, as well as with Szczecin. However, currently the port of Gdansk operates daily (21 times a week) almost all goods with its railway hub in Kutno, where goods are redistributed via Brzeg-Dolny/Wroclaw (5 times a week), Gliwice (5 times a week), and via Frankfurt/Oder (6 times a week) to Germany. From Kutno there is also a 3 to 5 times weekly services rail connection to Brest in Belarus (Teuber et al., 2015).

Travelling time

Vanoutrive (2012) modeled the linkages between port competitiveness and population density within the hinterland regions. We have chosen a similar approach, represented by Evangelinos, Hesse, Püsche and Gröschko (2012), to research the extent to which the three ports of Gdansk, Hamburg, and Hamburg can reach a certain market potential. The attractiveness of a port location increases with its market potential which is simply measured by achievable gross domestic product (Biermann et al. 2015, Schürmann and Talaat 2000).

The formula for measuring this market potential is:

$$accessibility_i = \sum_j market\ size_j * Z_j\ , with \left[\begin{array}{c} Z_j = 1, if\ TD_{ij} \leq TD_{max} \\ Z_j = 0, if\ TD_{ij} > TD_{max} \end{array} \right]$$

where TD_{max} is the travel distance limit. The model for evaluating the hinterland access of the ports takes into account three transport modes: intermodal freight transport, freight truck transport, and rail freight transport. The model assumption for intermodal freight transport includes switching time between transportation modes, for example rail freight and freight truck transport. The scenarios on the truck travel times respects rest periods in accordance with driving rules and regulations, such as traffic and border controls. The scenarios for rail freight transport include assumptions on stopovers at train stations to be overtaken by fast trains, indirect connections via backup lines, driving rules and regulations (Biermann et al. 2015). However, the calculation neglects the transportation and environmental costs, and also does not consider that rail freight transport loads are much higher (average 2,000 t) than the loads for truck transport (average load 14 t.) (Teuber et al. 2015; Holtermann et al. 2015). Furthermore, it neglects the different (volume) load capacities of the network systems. The model includes means of potential transportation to all NUTS 3 regions in the EU28 as well as to the European Free Trade Area (EFTA) members Norway and Switzerland.

Figure 3 shows the results for the calculation. The absolute difference of the GDP results from different travel speeds and efficiency of the transportation modes. The mode 'intermodal transport' achieves the highest potentially achievable GDP, followed by 'trucking', and 'rail transport'. Among the ports, Koper reaches the highest GDP; the port has an absolute comparative advantage amongst the ports. Between around 10 and 12 hours, Hamburg has relatively a comparative advantage in the transport mode intermodal (truck, rail, inland waterways), where it reaches the highest GDP. Another comparative advantage lies with rail transport, where Hamburg reaches the highest GDP of all three ports; nevertheless, the GDP

that can be reached is limited with rail transport, compared to intermodal or truck transport (see figure 3).

Main destinations and travelling advantages

In the case of Koper, its hypothetical travelling advantages are the northern Italian NUTS regions as well as Austria, Switzerland, and the South of Germany. All these regions have some of the highest gross domestic products in Europe. Id est the port of Koper has the highest geographical centrality. Table 2 presents travel time results for selected NUTS3 regions in the main receiving and shipping regions of goods. The port of Hamburg's advantage is that the city of Hamburg has the highest GDP of the selected NUTS3 regions (see Table 3), however Hamburg's disadvantage is its relatively isolated geographical location in Europe and North-West Germany. This argument is more evident for the port of Gdansk. The port of Gdansk is the best choice to serve the Polish regions of Warszawa, Poznan, and Wroclaw, but these regions have a comparatively low GDP. Nevertheless, via its railway nodes, the port catches up after approximately 24 hours. The port of Koper reaches the highest GDP, which is due to the fact that the Italian regions of Lombardy (Bergamo, Milano) and Emilia-Romagna (Bologna) are adjacent. Those Italian regions are among the European regions with the highest income. Since they will not be served by northern European seaports, there is no competition between Koper, Hamburg, and Gdansk with respect to these regions.

Figure 3 Within 48 hours achievable gross domestic product for rail, intermodal (truck, rail, inland waterways), and truck transport
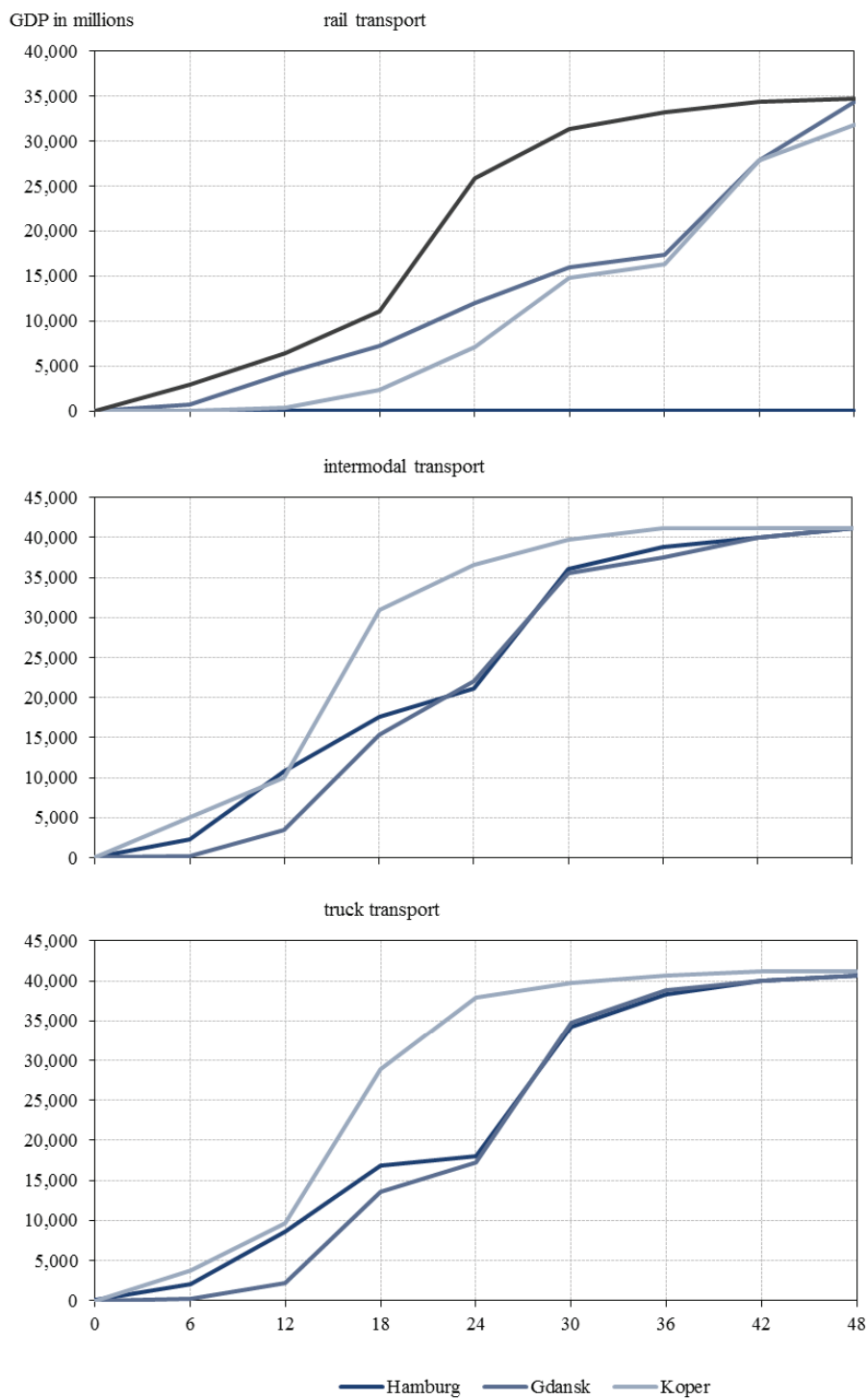
Sources: Office for Spatial Research, Spatial Planning, and Geoinformation (2012, 2015); Eurostat (2016).

Table 2 Receiving and shipping regions of goods by travel time in h

	rail			intermodal			truck		
	Hamburg	Koper	Gdansk	Hamburg	Koper	Gdansk	Hamburg	Koper	Gdansk
Basel	15,7	10,1	25,0	8,2	8,8	14,7	10,8	10,0	17,6
Bratislava	21,7	8,3	22,2	11,6	6,2	11,5	12,9	7,4	12,6
Emilia-Romagna (Bologna)	22,9	4,2	29,8	13,0	3,7	19,4	16,4	4,0	20,6
Graz	23,3	6,0	24,2	11,4	3,3	14,4	13,3	3,6	14,9
Lombardy (Bergamo)	21,1	5,5	30,2	11,7	4,5	18,1	14,4	4,8	19,9
Lombardey(Milano)	20,6	5,7	30,0	11,8	5,1	18,2	14,2	5,4	19,7
München	16,5	9,4	24,0	8,0	5,8	13,1	10,1	7,1	14,1
Nürnberg	12,5	13,6	19,7	6,1	7,8	11,5	8,1	9,1	12,5
Poznan	12,2	21,8	8,5	7,2	13,1	4,5	7,4	13,9	5,3
Prag	13,7	14,6	17,8	7,9	8,2	10,2	8,9	9,4	11,5
Stuttgart	12,5	14,8	21,1	6,8	8,7	13,2	8,9	10,0	14,7
Warszawa	20,5	21,3	11,9	11,0	13,9	5,2	12,1	15,4	6,0
Wroclaw	13,6	16,8	12,3	8,1	11,0	6,5	9,1	12,5	7,2

Sources: Office for Spatial Research, Spatial Planning, and Geoinformation (2012, 2015); Eurostat (2016).

Table 3 Gross domestic product in million Euro in 2013 in selected regions

Region	NUTS-code	GDP in million Euro
Basel	CH031	23,242
Bratislava	SK010	20,729
Emilia-Romagna (Bologna)	ITH55	37,265
Gdansk	PL634	4,088
Graz	AT221	18,228
Hamburg	DE600	99,869
Koper	SI044	1,923
Lombardy (Bergamo)	ITC46	33,029
Lombardy (Milano)	ITC4C	156,121
München	DE212	94,687
Nürnberg	DE254	24,892
Poznan	PL415	11,304
Prag	CZ010	38,689
Stuttgart	DE111	45,386
Warszawa	PL127	52,017
Wroclaw	PL518	5,832

Sources: Eurostat (2016).

5 | Hinterland Infrastructure Development

An improved hinterland infrastructure of the ports of Koper and Gdansk could have a significant impact on the ports' hinterland connectivity and transport efficiency in competition with the port of Hamburg, since, according to the plans, peripheral regions gain disproportionally.

Infrastructural improvements can be divided into two categories: 1) improvements planned alongside the Trans-European Transport-Network (TEN-T) and 2) improvements planned within the port areas by the port authorities.

1) Improvements planned alongside TEN-T

Beside the freight terminals in the port area, for Hamburg the switching yard station of Maschen in the port's hinterland is crucial for the transport to any location south of the metropolitan area. Maschen is one of the biggest switching yard stations in the world; nearly 3,000 wagons are handled per day. From Maschen, a double-track line leads to Hanover, where goods coming from the ports of Bremen und Hamburg, respectively, are further distributed. Only part of the line is already equipped with a 3rd track. One of the main projects along the ScanMed-corridor that affects Germany is the improvement and extension of that railway track. Since the double-track line is used by freight as well as passenger traffic, delays arise that could be ceased by separating traffic flows. Since there are several protests along the new track, construction will not be completed before 2025.

Furthermore, there are several smaller projects within the metropolitan area that are planned by local authorities within the TEN-T network.

Along the Baltic-Adriatic corridor, all countries plan substantial improvements in the rail sector. By 2025, travel time between Warszawa and Klagenfurt (Austria) should be less than 9 hours, a reduction by more than 25 %. One important project is the new Koralm railway line that connects Graz (Austria) and Klagenfurt. The construction of the Koralm Tunnel (33 km) and the Semmering Base Tunnel (27 km) shall reduce travel time between Vienna and Graz, and Vienna and Klagenfurt, respectively, by about 1 hour. Further improvements in tracks or multimodal platforms are planned between Warszawa and Katowice, Wroclaw and Szczecin, Katowice-Ostrava-Brno-Vienna, Katowice-Zilina-Bratislava-Vienna, and Graz-Maribor-Pragersko.

2) Improvements planned by the port authority (port area)

The most crucial infrastructure improvement for Hamburg is the deepening of the river Elbe. Alongside the planned deepening, there will also be a widening of the fairway that allows big vessels to meet when entering and leaving the port, respectively. To face growing throughput, the existing Eurogate terminal will be extended to the west. There are several infrastructure projects as the Kattwyk bridge that will help to increase the efficiency of the port. However, over the coming years the Hamburg Port Authority (HPA) will develop the port into a "smart" port. Smart in this context means the exchange of information to increase the quality and the

efficiency of the port as an important link in the supply chain. This will further reduce travelling time between Hamburg and its destinations. Two projects are under development: smartPORT logistics and smartPORT energy. The first project shall develop traffic and trade flow solutions in the Port of Hamburg. This increases the efficiency and considers both economic and ecological aspects. The latter project aims to promote eco-friendly mobility (Hamburg Port Authority 2016).

Besides investment in Koper's port facilities and the deepening of basins to increase seaward port accessibility, there are plans for building a second railway track and a dry port in the inland of Slovenia to relieve the port of Koper and the existing single line that reaches capacity. The dry port shall be located at Divača, about 50 km from the port of Koper (OECD 2015).

The port of Gdansk formulated different aspects to develop the port in their Port of Gdansk Strategy 2027 (Port of Gdansk 2013). Gdansk's port authority will increase the depth of its berths, the port entrance of the Kaszubski Canal, and the ship turning point. This shall help to boost the throughput capacity by allowing ships with a draft up to 15 m to enter the port. Furthermore, it improves the efficiency as well as navigation safety. The port authority plans further infrastructure improvements within the port area. These improvements shall address the rail and road infrastructure to increase efficiency of the traffic and the volume capacity of trade flows, which is important for the supply chain.

6 | Conclusion

The port of Hamburg is in direct competition not only with the North Range ports, but also with the ports of Gdansk und Koper. They serve as receiving and shipping regions for Central and Eastern Europe, i.e. Austria, Switzerland, the Czech Republic, Slovakia, Southern Germany, and Poland. A functioning hinterland transport network is a precondition for port growth.

Ports' Access to industrial districts and markets ensure its development. The hinterland accessibility is relative in time, since the situation of the geography of places changes (slowly) over time with the instabilities in trade flows and change of growth opportunities (Rodrigue et al. 2013). Moreover, ports are the outcome of long-lasting capital accumulation in assets that takes place over years, partly over centuries, and that shapes operations and further investments. Logistics settles and operates where logistics is already concentrated. This is simply the effect of economies of scale and scope. The smaller the (local) port economy, the less likely it is to be directly linked. There may not be enough load volume to rationalize a direct service between two ports. This is evidently for the ports of Koper and Gdansk.

These arguments result in path dependency of port locations, infrastructure investments, supply-chains, and businesses. The high rank in maritime connectivity the port of Koper, and – to a lesser extent – the port of Gdansk exhibit is therefore diminished by their lower hinterland connectivity and port efficiency. But, as the results demonstrate, the potential for the port of Koper is enormous, since the market potential within the contestable hinterland is

higher and infrastructure improvements will strengthen its further position. As the ports of Gdansk, Hamburg, and Koper are directly linked to the Trans-European Transport-Network (TEN-T) that connects European regions along a north-south corridor, they will profit from any infrastructure improvement. Namely, the corridors are the Scandinavian-Mediterranean and the Baltic-Adriatic corridor.

Another aspect that might explain path dependency on the one hand and disruptive developments on the other hand is the formation of strategic alliances of container shipping lines. As mentioned above, the port of Gdansk is meanwhile served by the 2M alliance (Maersk and MSC). Container lines might stick to a familiar port, but new alliances force them to call other/new ports. This development might slowly change the system of "sticky" port places.

To sum up, the selection of a port with respect to its hinterland connectivity depends on a mix of costs, transit time and reliability, i.e. frequency of services. The recent study performed by Drewry (2016) underlines the above arguments that the port of Hamburg is still the best choice for customers intending to import to South Germany, though in terms of kilometers, Koper is much nearer: Hamburg still offers comparably more frequent and less cost intensive services than the Adriatic ports.

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