Visualizing the network of cruise destinations in the Baltic Sea - A multidimensional scaling approach

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Abstract

This paper takes a cross-table with the call frequencies of more than 80 cruise ships to each of more than 20 cruise ports in the Baltic Sea in 2014 in its cells as its starting point. Correlations and proximities between the different ports are then established. This is visualised using a multidimensional scaling (MDS) technique, and groups of cruise destinations (ports) are developed by using factor analysis, which eases the interpretation of the MDS diagram. While many position studies in marketing and tourism use attitudinal data from surveys as input data for the MDS analyses, this study uses numeric data from secondary data sources as input. The aims and contributions of this study are two-fold: Firstly, it contributes insights into the relative positions of the cruise destinations in the Baltic Sea. Secondly, in doing so, it demonstrates how multidimensional scaling (MDS), in combination with factor analysis, can be used not only for traditional position analyses but also as analytical options in the context of two separate network analysis traditions, namely the IMP (industrial marketing and purchasing) tradition and the SNA (social network analysis) tradition.

Keywords: cruise destinations; correlations; multidimensional scaling; factor analysis.

Introduction

Worldwide, the number of cruise passengers almost doubled from 2004 to 2014. During the same period, cruise tourism in the Baltic Sea more than doubled, measured by the number of passengers handled in total, as well as for key ports such as St. Petersburg and Copenhagen (cf.

Cruise Baltic, 2015a, 2015b). The growth was primarily driven by an increase in the average number of passengers per call, whereas the number of calls per key port increased by a lower rate. In 2014, the top tier of cruise ports in the Baltic Sea by number of cruise calls were St. Petersburg (315), Copenhagen (313), Tallinn (297), Stockholm (263), Helsinki (261), cf. Cruise Baltic (2015a). Among the ports in the Baltic Sea, Copenhagen, Kiel, Rostock and Stockholm have the highest number of turnaround calls.

The number of passengers taking a cruise involving Copenhagen as either a port of call or as a port of disembarkation increased from 254,000 in 2004 to 528,000 in 2014, according to Statistics Denmark. The number of persons embarking can be added to this. Globally, about 21.7 million persons took a cruise in 2014. Correspondingly, about 728,000 persons made a cruise in the Baltic Sea in 2014 (author's own estimate), not including Norway. Ports in the region can choose to measure their position in terms of arriving cruise passengers relative to total number of cruises in the Baltic Sea, or relative to the total number of calls to all ports in the region. The increasing average and maximum ship sizes pose opportunities as well as challenges, especially for minor ports (ports of call). Although ships can anchor outside of some of the ports, utilising tender boats to enter the ports thereby saving costs, this poses a risk for missed calls in case of poor weather conditions. Some ports are responding to this by investing in pier and port expansion, if the required heavy investments are feasible in light of the relatively short cruising season in the Baltic Sea. In the Baltic Sea the number of passengers per ship increased by 93% from 2004 to 2014, while number of calls only increased by 17% (Cruise Baltic, 2015b). Increasing ship sizes (notably the increasing length of the ships) limit the number of ports which cruise ships can enter, thereby limiting diversity in terms of destinations. Thus, there is a risk for the cruise lines that their cruise offers will slip towards commoditisation, with calls to the same large ports, and with increasing price competition as a likely consequence in the high volume part of the market served by large cruise ships. A relatively small luxury segment of the market served by small-medium sized cruise ships remains, though. Each cruise port has its own physical limitations, and whether or not a given cruise ships can enter the port is an important distinction.

The research question is as follows: How can the market position of cruise destinations in the Baltic Sea be analysed and visualised? - It will be discussed how positions can be interpreted, and what options for strategic actions are available for the cruise ports in the context of segmentation, positioning and target marketing. It will also be mentioned how the (combination of) analytical techniques applied in this paper might fertilize (two) different network analysis traditions.

The aims of this study are two-fold: Firstly, it should contribute insights into the relative positions of the cruise destinations in the Baltic Sea. Secondly, in doing so, it will demonstrate how multidimensional scaling (MDS), in combination with factor analysis, can be used not only for traditional position analyses but also as analytical options in the context of two separate network analysis traditions, namely the IMP tradition and the SNA tradition. - The contribution of this study is the fulfilment of these aims.

Literature review and conceptual model

Gamm (1981) define a network as a system or a field comprised of organisations and inter-organisational relationships. Scott, Baggio and Cooper (2008) made an overall distinction between qualitative and quantitative network analyses in the context of tourism. As one of the quantitative techniques, which can be applied for network analysis, Scott et al. (2008) mention the visualisation technique multidimensional scaling (MDS). Each of the variables in a data matrix can be represented in a MDS diagram as object points (dots). Each object point (variable) can be considered a dimension, hence the name “multidimensional scaling”. The graphical visualisation in MDS diagrams is typically illustrated in scatter diagrams of only two dimensions (X and Y), but with multiple object points (brands, destinations), typically up to 20 but sometimes more. Although MDS is a quantitative visualisation technique, the input data can be perceptual assessments such as tourists’ assessments of different dimensions of a destination. Thus, MDS analyses are sometimes referred to as perceptual mapping.

Marcussen (2014) reviewed 64 tourism studies applying the MDS visualisation technique published since the mid 1970’s. Most of these used “soft data” as input, i.e. attitude or perceptions of objects such as destinations, the relative positions of which were then visualised using MDS techniques. Contrary to this most typically used type of “soft input data” in marketing and tourism related MDS studies, Marcussen (2011) used “hard data” as input, namely monthly overnight statistics over 12 years for 33 European destinations, the relative position of which were illustrated in a series of MDS diagrams. Also, one of the very first (and now classical) examples of an MDS analysis, included in Green, P.E., & Tull, D. (1978: 461), used airline distances between pairs of U.S. cities to reconstruct a map of the relative location of these cities. This map was quite similar to the locations of the same cities on an actual map, thereby supporting the validity of MDS as a visualisation technique.

According to Gui and Rosso (2011), ‘in a particular region with different ports, each one should find its proper position in the growing cruise business’ (p. 142). This applied to ports in the

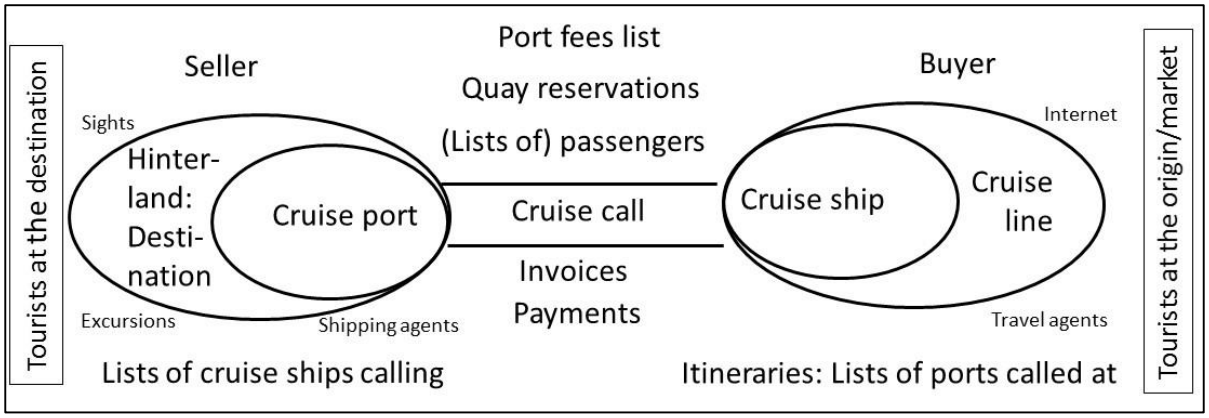
Mediterranean, but it may also hold true for cruise destinations and ports in the Baltic Sea, indeed globally. - Terms such as ‘market share’ and ‘position’ or ‘positioning’ can be used in connection with cruise lines/brands/companies (Rodrigue & Notteboom, 2013), or in connection with ports. In the latter case, the terms often appear in the various *top lists* of certain cruise regions, such as the Adriatic Sea within the Mediterranean (Stojanović, Jugović, & Jugović, 2014), the Baltic Sea (Cruise Baltic, 2014a), or Europe overall (CruiseEurope.com). Cruise Europe (2014) also publishes a Port Handbook, with one version covering the Baltic Sea, including nautical data for each port, with information such as maximum length for ship’s berth.

Klein (2005, p. 18) noted that ‘the key to maximizing the benefits of cruise tourism to BC [British Columbia] is to avoid competition between ports’. And further: ‘Even though ports join together in Cruise BC [see cruisebc.ca for details] for marketing purposes, they still compete for the same cruise ships. Instead, the province should take the lead and help coordinate cruise tourism’ (2005, p. 18). Correspondingly Brooks, McCalla, Palla, and Van der Lugt (2010) described the advantages of cooperation for peripheral ports in Atlantic Canada. In the Baltic Sea, initiatives to coordinate and jointly promote the region in the form of the Cruise Baltic brand have been described by Lemmetyinen (2009) and Lemmetyinen and Go (2010). Within the Baltic Sea, there is a second layer of cooperative networks, e.g. Cruise Denmark, which is an expansion of the original, Cruise Copenhagen. There is also a third layer of cruise networks, namely at the individual cruise destination. According to Corres and Papapchristou (2013), pure turnaround ports are always competitors; however most turnaround ports are a mixture of *turnaround ports* on some cruises, and *ports of call* on other cruises. That is certainly the case in the Baltic Sea.

In addition to port fees, cruise ports compete on facilities, notably berths. With increasing ship lengths, some ports invest in longer quays. Also, ports compete with themselves, since in some ports it is up to the cruise operators whether to anchor outside of the port, or dock inside the port, if the port can accommodate them. Cruise ships are deployed in different parts of the world in different seasons (Rodrigue & Notteboom, 2013). Therefore, on one hand, the different regions of the world are to some extent complementary, but on the other hand, they compete, since the ships can always stay a longer time in one region and a shorter time in another. Probably from the point of view of cruise lines, Rodrigue and Notteboom (2013) argued that *the cruise industry sells itineraries, not destinations*. While this may be true, *regions or networks of destinations sell destinations* and it would be fair to note that individual ports take a special interest in selling their particular port or destination, within the context of the whole network/region.

An interaction model is proposed, concerning the relationship between the port or destination as (organisational) seller, and the cruise line as (organisational) buyer, and is intended to encompass the perspectives of both. At the core of their interaction is *the cruise call*. The relationships between the two parties, with the shipping agent as intermediary, may be of a long-term nature. See Figure 1.

Figure 1. Model of the relation between cruise destination and cruise line: The crucial cruise call



Source: Own development.

The “cruise destination – cruise line interaction model” of Figure 1 is inspired by the Interaction Model of the IMP Group (Industrial Marketing and Purchasing), first presented in Håkansson (1982). A redrawn version of the IMP interaction model can be found in Wilson (1995). The IMP interaction model is one of two core models from within the IMP Group, the other one being the ARA model (actors, resources, activities) of industrial or inter-organisational networks, cf. also Axelsson (2010). Emphasising cooperation in networks, the works by Lemmetyinen (2009) and Lemmetyinen and Go (2010) about the network of Cruise Baltic's destinations can be placed within the research tradition of the IMP Group.

Within the IMP Group qualitative methods for researching inter-organisational networks dominate, and few studies in this tradition have made use of quantitative analytical tools such as multidimensional scaling to assist in getting an overview of the structure of given networks, or the positions of the different actors in networks. So, given its largely exclusive emphasis on quantitative methods, this study does not position itself explicitly within the IMP Group research tradition. However, it is argued that multidimensional scaling can be a useful tool in network analyses. – This paper places itself within the series of position analyses in tourism, which applies multidimensional scaling, cf. Marcussen (2014). It contributes to this field by demonstrating that yet another source of data, namely the call lists of the cruise ports, can be used as the basis for

describing the structure of an inter-organisational network, in this case cruise destinations (ports) in the Baltic Sea (Figure 2 and Figure 3). Also it contributes a cruise version of the Interaction Model (Figure 1). - In a recent study, Marušić, Sever, and Ivandić (2012) used cruise itineraries in an analysis of the competitiveness of ports/destinations in the international cruise market, including many aspects of the market, and the position of given cruise destinations or ports in the region.

One could argue that there is a need for a seller-seller interaction model emphasising both cooperation and competition in networks of suppliers (such as cruise destinations), who attempt to attract and serve the same customers (such as cruise ships and cruise lines). In some respects or in certain activities, such as in joint marketing efforts, cooperation is essential, but depending on a number of factors (such as if they tend to be included in the same cruises or not), to some degree the suppliers (cruise destinations) are also competitors.

In one of the books on Social Network Analysis (Knoke & Yang, 2008: 82-85), multidimensional scaling (MDS) is mentioned as an important method for uncovering underlying structures among network actors, and as a method for visualising data structures. In another book on Social Network Analysis (Passmore, 2011), multidimensional scaling is not mentioned, though. Tichy, Tushman & Fombrun (1979) defined some of the concepts of Social Network Analysis for organizations, but did not mention multidimensional scaling either. However, a slightly earlier article by Breiger, Boorman & Arabie (1975) puts multidimensional scaling and other methods in the context of Social Network Analysis (SNA). Goduscheit (2007) made a comparison of Social Network Theory and the IMP tradition. Although separate research traditions, SNA was used by Henneberg, Jiang, Naudé & Ormrod, R. P. (2009) to analyse co-authorships of more than 20 years of conference papers among researchers within the IMP Groups. So, within the IMP Group (mostly using qualitative research methods) there is awareness of the (more quantitative analytical) techniques of SNA. Henneberg et al. (2009) illustrate the use of SNA. One difference between SNA graphs and multidimensional scaling (MDS) graphs is that the former explicitly includes the links between the objects (actors, e.g. cruise ports) while the latter only include the nodes (object points, cruise ports). However, implicitly MDS graphs indicate that certain object points (cruise ports, cruise destinations) are closely linked by automatically placing these close to each other.

According to Baggio, Scott & Cooper (2010: 803) “few works are available which examine a tourism destination from a network point of view and fewer still that use quantitative methods of network science”. Thus, there seems to be a need for studies demonstrating the use of quantitative methods such as multidimensional scaling (MDS) and factor analysis (principal component

analysis, PCA) in the analysis of tourism networks such as the cruise ports of the Baltic Sea. In the past, both MDS and PCA have been used in the context of Social Network Analysis (Freeman, 2011: 32).

In summary:
Firstly: More than 60 tourism studies have been published since 1975 applying multidimensional scaling techniques. The majority of these studies uses surveys to measure the attitudes of tourists towards destinations or other touristic objects, after which the relative positions the destinations are illustrated in one or more MDS diagrams. The term “networks” is rarely used in these studies. – Secondly: Within the IMP Group there is a tradition of empirical research into business-to-business networks, with the interaction model (Håkansson, 1982) and the ARA model (Håkansson, 1987) at the core. The research is mostly European, typically applying qualitative research methods. – Thirdly: In Social Network Analysis (SNA), quantitative research methods are typically applied. Multidimensional scaling is one of several techniques in the toolbox of SNA research tradition. Much of the research in SNA focuses in networks and relations between individuals, whereas within the IMP Group the emphasis is on inter-organisational relations and networks or separate companies and other organisations.

So, in which of these traditions is this paper positioning itself, and to which of the fields will this paper contribute new insights? This paper is part of “1”, namely a tourism paper applying MDS – in combination with other quantitative analytical techniques - in order to get an overview of the structure of the network of cruise destinations in the Baltic Sea. Arguably, the same set of techniques could be applied within the two other research traditions, the IMP Group and SNA. At the same time, although not directly used in this study, since the term “network” is part of the title of this paper it is appropriate to draw attention to and acknowledge the mentioned two traditions of network analysis.

The input data

Itineraries and *lists of cruise ships calling* at individual ports in a region, contain many of the same basic facts, which can be aggregated and analysed with either as the source, or a combination. Lists of *cruise ships calling* at given ports, and *itineraries* for given cruise ships are interconnected. Indeed, one can be reconstructed from the other, at least partly. Also, cross checks between lists of cruise ships calling at different ports can be made, since often previous and following ports are

mentioned in cruise lists. If some ports list calls of cruise ships, which no other ports count as cruise ships, they can be excluded. The definition of cruise ships at some ports may be wider than at others. However, cruise ferries (taking cars aboard) should be excluded. Although call lists for the individual ports at given seas are widely available, in published cruise studies these call lists are rarely utilized as input data, unless for a single port, for example, as supplementary information in connection with a survey at a given port.

This paper takes a cross-table with the call frequencies of more than 80 cruise ships to each of more than 20 cruise ports in the Baltic Sea in 2014 in its cells as its starting point. Proximities (based on correlations) between the different ports are then established by the MDS programme. As a result, this is visualised using a multidimensional scaling (MDS) technique. In a separate analysis groups of cruise destinations (ports) are developed by using factor analysis (with Varimax rotation). The groups identified by the factor analysis is manually superimposed on the MDS diagram, which eases the interpretation of this. The method used in this paper, as far as the underlying data is concerned, is to use and rely on *lists of cruise ships calling* rather than itineraries, to piece together the data required to provide an overview of the network of cruise destinations in the Baltic Sea. But after assembling the basic data, the next question is how to analyse it to illuminate aspects of the position of each cruise destination.

An important issue in connection with an analysis covering a given region (or a network) is how to define the boundaries of what should be included, if the boundaries are not self-evident. In this study, the region of the network has been limited to nine of the ten countries included in Cruise Baltic plus (partly) one port in southern Norway, namely Oslo. Two other ports further west in southern Norway were not included. The activities in the network were limited to cruise calls undertaken by cruise ships which called at *minimum two ports of the nine core countries*. The calls to Oslo by the 81 cruise ships thus identified were included, which accounted for 102 of 256 calls to Oslo (referred to in the following tables and figures as ‘Oslo Baltic’). Basically, the calls of cruises between Oslo and coastal Norway were excluded while those between Oslo and the Baltic were included. - Four ships, which were only listed in the cruise call lists of one port each, were excluded, and calls by car ferries in the north-east of the Baltic Sea were also excluded with reference to the normal definition of cruise ships, which excludes cruise ferries. Cruise ports and their hinterland are tourist destinations, mostly for single day visits, except the *marque port* (iconic port) of St Petersburg, where cruise ships typically stay over at least one night. St Petersburg is not a turnaround port, however, so the term *marque port* is a separate typology.

Results

The set of ports or cruise destinations included in the partial correlation matrix shown in Table 1 are those which have a significant correlation with at least one other port in the basin, which in this study is the Baltic Sea. A total of 18 ports have been chosen from more than 20 ports for which lists of calls were available. Lists of cruise ships calling were available for all major ports and most of the minor ports. Generally, the large and medium sized ports were all included, whereas a few of the smallest ports were left out (since they were marginal in the overall analyses).

Table 1 consists of 18 cruise ports, and correlations with a selection of other cruise ports are shown. Correlations are typically positive, and no significantly negative correlations have been identified. Significant correlations are marked by one star, highly significant correlations are marked by two stars. Positive correlations occur when a pair of ports tend to be visited by the same cruise ships, i.e. if the individual ships call (more frequently) at one port they tend to call (more frequently) at the other.

Figure 2 is a visualisation of the proximities between ports reflected in all of the pairwise correlations. In Figure 2, ports which are highly (positively) correlated tend to be close to each other. A computer program tries to find the best representation of all the object points (mostly ports) in Figure 2 in such a way that stress is minimised, i.e. the best possible visualisation of the relative position of the variables (ports) in the data set. In addition to the 17 selected ports and one reference point, one variable, representing the product of number of calls (in the core geographic area, i.e. excluding Norway) and passenger capacity of each of 81 cruise ships, is included. The graph would be almost identical without the reference point, but the reference point is included to demonstrate that the ports around it are the high volume ports in terms of number of passengers arriving to the ports (departing passengers are not included in the reference point or other parts of the analysis). In Figure 2 (as well as in Figure 3) dimension 1 is the primary dimension, and dimension 2 is the secondary dimension. What the labels of the axes might be is open to interpretation. All the big ports are located in the left side of the horizontal axis (dimension 1).

In order to take the position analysis or network analysis further, Table 2 shows the result of a factor analysis. In the data matrix the ports (for given years) are columns, the rows are each of the cruise ships, and the numbers in the cells are the frequency of calls for the given year (for the given ship to the given port). Factor analysis forms groups of ports or destinations, which are represented by variables (columns) in the data matrix.

Group 1 - *The major capital cities – towards north-east*: This group consists of six ports plus the reference point, and accounts for as much as 74% of the cruise port passengers (and 69% of the cruise calls) in the Baltic Sea, cf. Table 2. Stockholm is the port most typical for this group of ports or destinations, while the port with the largest number of (arriving) passengers in the Baltic Sea is Copenhagen. Departing passengers are not included in this analysis, i.e. no extra counting for turnaround ports.

Group 2 - *Kattegat – towards north*: This group consists of three cruise ports and accounts for 14% of arriving cruise passengers (and a similar percentage of the cruise calls), cf. Table 2. Göteborg (Gotenburg) and Oslo are to the north through Kattegat with Kiel as the embankment (turnaround) port.

Group 3 - *Eastern Baltic destinations Klaipeda, Riga, and Gdynia*: This group accounts for about 6% of cruise port passengers.

Group 4 - *Baltic Islands*, *Visby (Gotland), Rønne (Bornholm), and Mariehamn (Aaland Islands)*: This group accounts for a little over 3%.

Group 5 - could be labelled *The Hanseatic southern Baltic including Gdansk and Lübeck* which accounts for 1%.

This leaves 2% of arriving passengers for *other ports* in the Baltic Sea.

Table 2 also shows the percentage of total variation in the number of cruise calls which is explained by each of the five groups and accumulated: 76% in total.

Figure 3 combines the results of factor analysis from Table 2 with the MDS analysis of Figure 2. The five factors, principal components of Figure 2, are circled or boxed in, in Figure 3. Some ports are positioned fairly closely to each other, since they are fairly highly correlated, even if they are in different groups. These high correlations beyond the groups are indicated in Table 1, e.g. Copenhagen/Malmö-Oslo and Rønne-Klaipeda.

Table 1. Correlations between cruise ports in the Baltic Sea

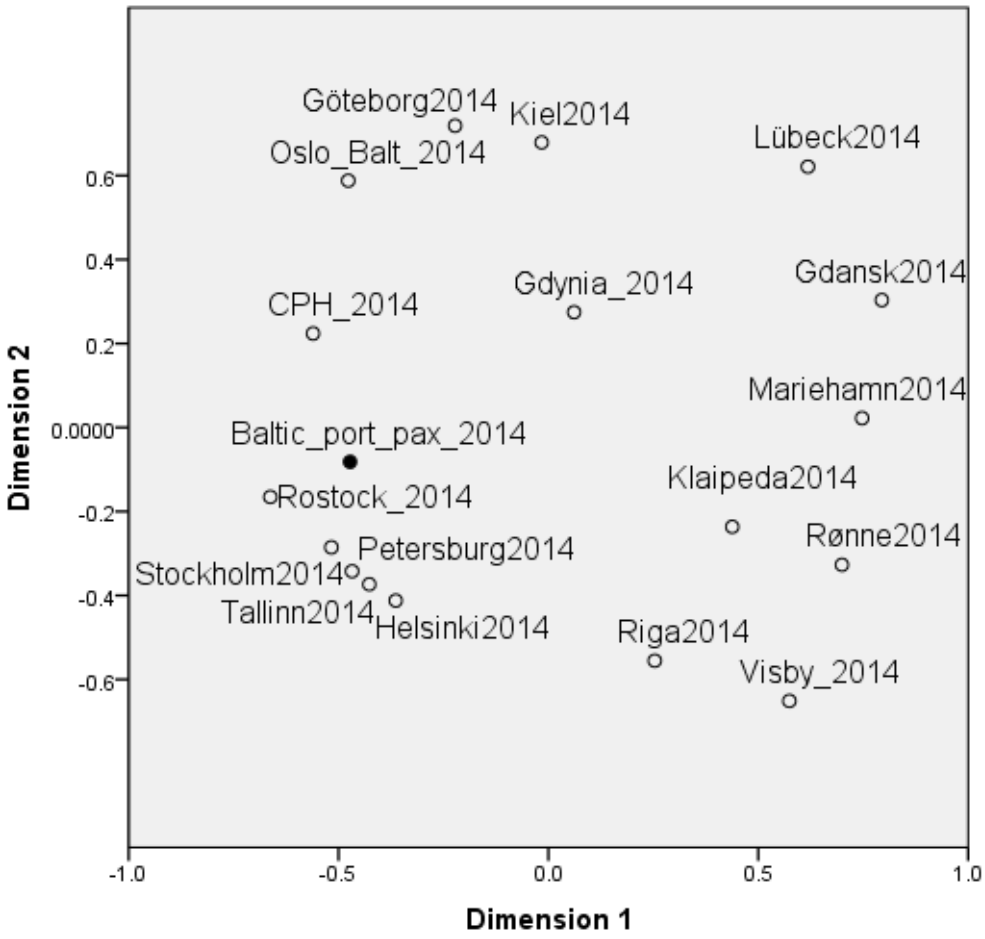
	Stockholm2014	Tallinn2014	Petersburg2014	Helsinki2014	Rostock_2014	Baltic_port_pax	CPH_2014	Göteborg2014	Kiel2014	Oslo_Balt_2014	Klaipeda2014	Riga2014	Gdynia_2014	Rønne2014	Visby_2014	Mariehamn2014	Gdansk2014	Lübeck2014
Stockholm2014	1	.920**	.868**	.825**	.763**	.790**	.530**	-,026	-,074	,171	,013	,086	,114	-,021	,004	-,014	-,085	-,147
Tallinn2014	.920**	1	.839**	.858**	.748**	.721**	.497**	-,067	-,108	,134	,136	,171	,071	-,003	,029	,057	-,015	-,105
Petersburg2014	.868**	.839**	1	.824**	.722**	.856**	.533**	,055	,054	,172	-,014	,077	.259*	-,080	-,081	-,117	.338**	-,216
Helsinki2014	.825**	.858**	.824**	1	.531**	.720**	.386**	,057	,054	,098	,123	,187	.251*	-,064	,010	-,010	-,057	-,184
Rostock_2014	.763**	.748**	.722**	.531**	1	.714**	.574**	,046	-,131	,184	-,060	-,087	,146	-,151	-,170	-,075	-,117	-,108
Baltic_port_pax	.790**	.721**	.856**	.720**	.714**	1	.679**	.299**	.286**	.383**	-,027	,057	.452**	,024	-,034	-,141	-.258*	-,181
CPH_2014	.530**	.497**	.533**	.386**	.574**	.679**	1	.442**	.285**	.570**	-,161	-,105	,168	-,154	,006	-,111	-,101	-,104
Göteborg2014	-,026	-,067	,055	,057	,046	.299**	.442**	1	.733**	.631**	-,102	-,113	.261*	-,083	-,072	-,083	-,093	-,077
Kiel2014	-,074	-,108	,054	,054	-,131	.286**	.285**	.733**	1	.423**	,100	,116	.459**	,123	-,065	-,012	-,085	-,082
Oslo_Balt_2014	,171	,134	,172	,098	,184	.383**	.570**	.631**	.423**	1	-,189	-,063	,026	-,175	-,111	-,057	-,152	-,081
Klaipeda2014	,013	,136	-,014	,123	-,060	-,027	-,161	-,102	,100	-,189	1	.741**	.230*	.353**	-,022	.221*	.221*	,100
Riga2014	,086	,171	,077	,187	-,087	,057	-,105	-,113	,116	-,063	.741**	1	.233*	.252*	-,002	,087	,099	-,053
Gdynia_2014	,114	,071	.259*	.251*	,146	.452**	,168	.261*	.459**	,026	.230*	.233*	1	,155	-,080	-,005	-,179	-,073
Rønne2014	-,021	-,003	-,080	-,064	-,151	,024	-,154	-,083	,123	-,175	.353**	.252*	,155	1	.528**	.443**	,167	,160
Visby_2014	,004	,029	-,081	,010	-,170	-,034	,006	-,072	-,065	-,111	-,022	-,002	-,080	.528**	1	.265*	.245*	,073
Mariehamn2014	-,014	,057	-,117	-,010	-,075	-,141	-,111	-,083	-,012	-,057	.221*	,087	-,005	.443**	.265*	1	.330**	,214
Gdansk2014	-,085	-,015	.338**	-,057	-,117	-.258*	-,101	-,093	-,085	-,152	.221*	,099	-,179	,167	.245*	.330**	1	.409**
Lübeck2014	-,147	-,105	-,216	-,184	-,108	-,181	-,104	-,077	-,082	-,081	,100	-,053	-,073	,160	,073	,214	.409**	1

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Source: Own analysis based on frequency counts of calls per cruise port per cruise ship in 2014, based on call lists from the individual cruise ports.

Figure 2. Visualisation of the position of the cruise ports, based on call frequencies by 81 cruise ships in 2014, MDS diagram



Note: This is an illustration of the correlations in Table 1.

Normalised Raw Stress = 0.05. Dispersion Accounted For (D.A.F.) = 1-0.05 = 0.95.

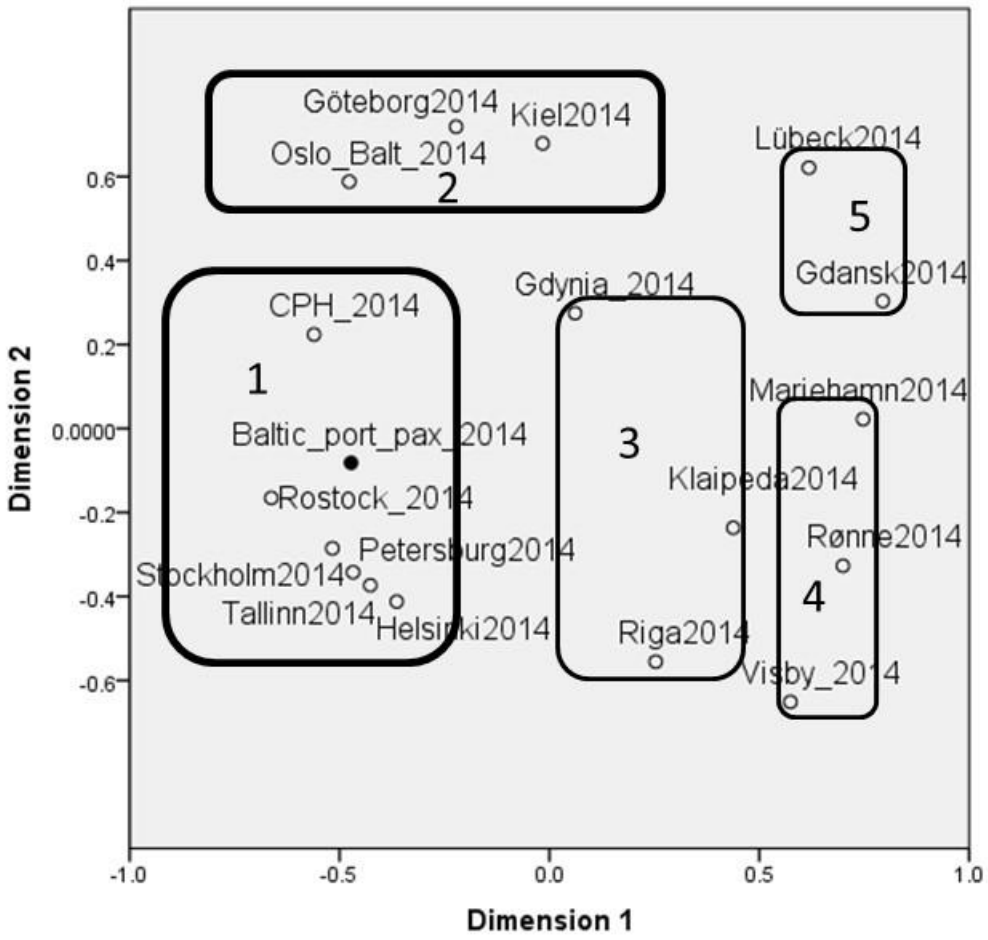
Table 2. Result of factor analysis – five factors (components, groups)

Destination, port	1	2	3	4	5
Stockholm2014	,960	-,028	,010	,022	-,027
Tallinn2014	,956	-,077	,097	,031	,066
Petersburg2014	,911	,058	,049	-,034	-,271
Helsinki2014	,853	,015	,192	,025	-,099
Rostock_2014	,838	,030	-,111	-,163	,009
Baltic_port_pax	,837	,373	,057	,045	-,242
CPH_2014	,611	,554	-,218	-,061	,042
Göteborg2014	-,009	,909	-,058	-,050	-,038
Kiel2014	-,091	,841	,261	,093	-,165
Oslo_Balt_2014	,194	,751	-,205	-,163	,082
Klaipeda2014	,022	-,073	,886	,078	,227
Riga2014	,070	-,055	,863	,026	,027
Gdynia_2014	,148	,385	,478	,131	-,376
Visby_2014	,000	-,068	-,174	,839	,072
Rønne2014	-,058	-,011	,293	,834	,046
Mariehamn2014	-,008	-,024	,127	,549	,422
Gdansk2014	-,082	-,069	,136	,173	,807
Lübeck2014	-,119	,001	,008	,068	,702
Explained, %	29,2	15,1	11,9	10,2	9,5
Explained, acc.	29,2	44,4	56,2	66,4	75,9
Percent of calls	69,2	13,5	7,6	5,1	2,4
% of calls, accum.	69,2	82,7	90,3	95,4	97,8
Percent of pax	74,2	14,1	6,1	3,2	0,7
% of pax, accum.	74,2	88,3	94,3	97,6	98,3

Note: Extraction Method: Principal Component Analysis. Varimax.

Rotation converged in 6 iterations.

Figure 3. Visualisation of the position of the cruise ports, MDS diagram 2, with indication of five groups of cruise destinations from the factor analysis



Note: This is a combination of Table 1 and Table 2.

For the network of cruise destinations in the basin, in this case the Baltic Sea, the more cruise ships and cruise passengers – and preferably those willing to spend money – that can be attracted, the better for all parties within the basin. For the individual ports, the cruise calls to their port is of prior interest. Therefore, how these can be secured will be discussed in the next section.

Discussion

Ports can be divided into different categories such as ports of embarkation (home ports, turnaround ports), ports of call, and hybrid ports (all-purpose ports, mixture), cf. Marti (1990). From a cruise line's point of view as well as from a general destination perspective, segmentation typically concerns those on the cruise, the tourists. However, from a port point of view, cf. Figure 1*, the ships* and their operators can be considered the customers that may need to be segmented. Marti (1990, p. 159) quotes Ward for suggesting classifying cruise ships according to sheer size. An additional segmentation criterion for cruise ships can be price per person per day.

The position analyses of MDS – in combination with factor analysis - can be used in the context of the "segmentation, targeting and positioning" model of mainstream marketing. Furthermore, MDS – in combination with other analytical tools - could be useful within two different network analysis traditions: Firstly, within "industrial networks" of the IMP Group with its inter-organisational buyer-seller "interaction model" and its "ARA-model". And secondly, within Social Network Analysis (SNA), where MDS could get a revival when combined with other useful tools, for example correlations analysis and factor analysis.

According to Kotler (1984), there is a six-step procedure, or model, which may be quite applicable for cruise ports/destinations, when they wish to attract cruise lines and their ships. Kotler's six-step procedure for market segmentation (steps 1 and 2), market targeting (steps 3 and 4) and market positioning (steps 5 and 6) are as follows: 1. Identify bases for segmenting the market; 2. Develop profiles of resulting segments; 3. Develop measures of segment attractiveness
4. Select the target segment(s); 5. Develop positioning for each target segment; 6. Develop marketing mix for each target segment. - Since cruise ports (e.g. ports of call) generate more revenue from fees from ships' passengers which 'go alongside' in one of the port's berths, a basic segmentation basis is ships over, at or under the maximum length (and depth and width). There is a high correlation between the different indicators for size of cruise ships. GRT (tonnage, Gross Registered Tonnes) has the highest correlation with number of passengers, but for some ports the

length of the ship, shorter or longer than the berth, is more crucial. In the Baltic Sea, at least 81 cruise ships called at more than one port, not including any Norwegian ports, and not including any combined cruise car ferries. A general model for segmenting cruise ships from the point of view of cruise ports (cruise destinations) is suggested in Table 3.

Table 3. A segmentation model for ports (suppliers), to segment cruise ships (customers)

	A. Cruise ships, which can fit within the limits of *our port*	B. Cruise ships beyond the limits of *our port*
1. Current cruise ships, visit *our port* this year	Our core current business: Fight to keep	Lucky strike: Keep serving as best we can
2. Past cruise ships, still active in the basin	Ships essential to our growth: Try to win these back	"We are still here for you, and you can anchor cheaply"
3. Cruise ships in the basin, but have never visited *our port*	Ships important to our growth: Offer test call at a discount e.g.	Promotion of our port via high level cooperative network only

Source: Own development.

Additional or remaining segments consist of cruise ships, which we know will sail in our basin next year, divided by size as 4A and 4B. And finally, 5A (and 5B) are ships which have previously visited our port (in port or by anchor) but which have 'sailed away' to other basins. If they come back we should make sure that they return to our port. Those scrapped we can ignore. Segments 4A to 5B are omitted in Table 3 for simplicity.

'Our' current ships are 1A and 1B. Although ships are short enough to berth, not all of them necessarily dock in the port. Segment 1A consists of those ships which can dock in the cruise port in question. The segments can be described from the point of view of given cruise ports. For example, 67% Two thirds of the cruise ships sailing in the Baltic Sea in 2014 were less than 240 metres, i.e. short enough to pass through the Kiel Canal, but they accounted for just 51% of the calls, and for just 24% of the cruise port passengers. As the average size of the cruise ships at all ports increases, obviously ports with limited berth length experience increasing difficulties in accommodating the ships in the port. Anchoring outside of the port is an option at many ports of call; however, experience and numbers show that ports do not attract many cruise ships beyond the physical restrictions of the port. For minor ports, for example in the Baltic Sea, one positioning strategy in their target segments is to be a contrast, something very different from the metropolitan ports. How to go through the six- step procedure, and how finally to establish the marketing mix,

which may include joint efforts for a network of ports at either sea basin, national or local destination level, is for each port to decide and implement.
Segments 2A and 2B consist of ships, which have previously visited our port or anchored outside of our port. Segment 2A is particularly interesting for our port, since they would be paying the full port fees and it key staff of the ships and their cruise lines are familiar with our port. – Generally it would be easier and thereby more cost effective to persuade cruise lines with ships in segment 2A and 2B to come back to our port than it would be to make cruise lines with ships in segment 3A and 3B try our port and associated destination for the first time. – The optimal marketing mix of the port to target each of the segments would be different from segment to segment.

Conclusion

The practical implications are first summarized: Correlations between ports within the Baltic Sea are generally positive. It is argued that this indicates a degree of complementarity between ports with significantly positive correlations, since they tend to be included in the same cruise itineraries. The geographic location of ports as one sailing night apart is one of the reasons for ports to be included in the same cruises. Other reasons are to provide diversity between different categories of ports in given cruises, with their combined variety of attractiveness. In general, the more cruise ships which are deployed in the basin, in this study the Baltic Sea, the better for all ports in the basin. However, to some extent ports within the same basin are substitutes. Segmentation of the cruise ships and their operators is one way of dealing with the competitive market situation, in which ports/destinations in the cruise market operate, in spite of co-operation as well among port with regard to promotional activities. A segmentation model was suggested and tested using actual data, which indicated that the size (of the ships) which cruise ship ports seem to be able to attract is historically of great importance. Also, positioning of the port in the minds of the cruise operators and cruise guests as something unique and different from other ports/destinations is important. - Using one of the ports as an example, it is found via regression analysis that cruise calls of the given port are determined, among other factors, by the calls at the given port the previous year, and the cruise calls to a comparable port located within a night’s sailing distance from the given port. Therefore, it is obviously important to keep the customer (the cruise line and its ship) and the customer’s customer (the tourist) happy, so that the latter recommends the former to include the port in its itineraries in future years. The itineraries are of course important, although this analysis used a different source of data.

In positioning studies or in a network analysis, be it interorganisational relations or networks within the IMP Group tradition or within the Social Network Analysis tradition, MDS may come in as a handy tool to illustrate the relative positions of the different actors. In this study cruise ports or cruise destinations are the actors, the relative position of whom is illustrated in a first MDS diagram. Furthermore, factor analysis is a useful supplement to MDS analysis, since the principal components of the factor analysis may graphically be overlaid by the object points in a second MDS diagram. In this case, cliques or groups of cruise destinations within the overall network are illustrated in a second MDS diagram in which the different groups identified in factor analysis are encircled. Both MDS and exploratory factor analysis are descriptive techniques, which are not applicable for hypothesis testing or for testing the significance of association between variables (object points in the MDS diagram). However, deeper insight into the degree to which cruise ports/destinations overlap can be gained by making cross-tabulations (and chi square tests) between pairs of ports, to investigate, for example, how many of the cruise ships active in a given basin call a both port A and B, A not B, B not A, or neither. Chi square tests, correlation analyses or regression analysis, for example, can supplement descriptive techniques such as MDS and exploratory factor analysis. With a slight elaboration of the set of data used in this study, which originates from call lists of the ports, in principle the shares of each port measured in a variety of different ways (share of passengers, cruises, calls, cruise lines or groups, ship sizes or other segments), can be calculated/estimated as part of the position or network analysis.

The contributions of this study, in all modesty, fall into three areas:
Firstly, traditional positioning studies utilizing MDS is placed in the context of the “segmentation, targeting, and targeting” model or procedure of mainstream marketing. MDS is supplemented by another descriptive technique, namely factor analysis, and the resulting groups (factors, principal components) of variables can be used to visualize these by encircling object points (variables) in the MDS diagram. The combination of MDS and factor analysis of this paper is parallel to the earlier study by Marcussen (2011), but apart from that the combination of the two techniques is rarely found in published studies. – A segmentation model specifically for cruise destinations with tentative guidelines as to how each segment (here groups of cruise ships) can be handled is proposed.
Secondly, in the context of one network analysis tradition, namely that of industrial or inter-organisational relations and networks of the IMP Groups, a cruise-version (cruise port – cruise line) of the interaction model of the IMP Group (Håkansson, 1982) is developed. It is argued that perhaps a seller-seller or seller-buyer-seller interaction or network model should be developed which could help to understand to what extent suppliers in the same network, such as cruise ports

in the same basin, compliment or substitute each other, i.e. if they are competitors or complimentary suppliers to the same customers, in this case cruise lines with their cruise ships. MDS is hardly ever used in analyses within the IMP Groups, were there is an emphasis on qualitative research methods. Since networks are often studied within the IMP Groups, arguably MDS analyses could help in getting an overview of the structure of certain networks. Although information and data of a network are often qualitative, they can be coded into numbers and registered in a datamatrix, with the actors as coloumns (variables), which can then be illustrated as object points in a MDS diagram, and perhaps grouped with the help of factor analysis.

Thirdly, although there is an awareness of MDS within another network analysis tradition, namely Social Network Analysis (SNA), for several decades other visualization tool than MDS has been used. SNA tends to use quantitative techniques with an explicit focus on the links between the actors. It is argued, that MDS is in for a revival in Social Network Analysis, possibly in combination with factor analysis, which is useful for identifying groups within the overall network, as illustrated in this case of the network of cruise destinations in the Baltic Sea.

In summary, the contributions of this study are these: Firstly, it contributes insights into the relative positions of the cruise destinations in the Baltic Sea. Secondly, in doing so, it demonstrates how multidimensional scaling (MDS), in combination with factor analysis, can be used not only for traditional position analyses but also as analytical options in the context of two separate network analysis traditions, namely the IMP tradition and the SNA tradition.

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