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Competition in Norwegian Air Passenger Transport markets:

Using the Herfindahl-Hirschman Index to compare concentration levels with eight European countries of reference

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Author:	Falko Mueller
Project leader:	Prof. Svein Bråthen

Preface

The Norwegian Ministry of Transport and Communications commissioned this note on the state of competition in Norwegian air transport markets and a comparison with the situation in a selection of other European countries.

Svein Bråthen has been the project leader for this analysis and has been responsible for the quality control. Falko Müller performed the major parts of the analysis, including the sourcing of necessary data, the needed calculations and the writing of this report.

The Client's representative has been Senior Advisor Anne C. Brendemoen, Norwegian Ministry of Transport.

Molde, 15 June 2019

Table of Contents

1. Summary

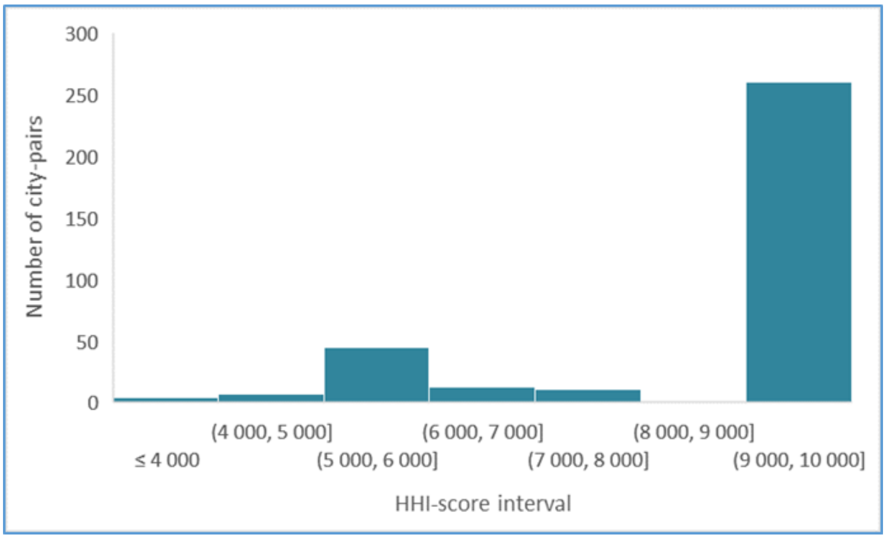
This work aims to assess the degree of competition in the Norwegian air transport market with the help of a comparative analysis that includes eight benchmark countries (Denmark, Finland, Sweden, Spain, Ireland, Italy, Portugal, UK).

In order to proxy the degree of competition, this note evaluates market concentration levels. The analysis of the concentration levels uses the Herfindahl-Hirschman Index (HHI). HHI expresses market concentration by the sum of the squared individual market shares. The fewer firms there are serving a market and the larger the variations in market shares, the higher is the resulting HHI score. The higher the score, the more concentrated a market; hence the lower the level of competition. HHI reaches its maximum of 10,000 for purely monopolistic markets. Normally, regulatory agencies consider markets with HHI scores of more than 2,500 points as highly concentrated and assume suppliers to have 'market power'. The transport market in general and perhaps the air transport market in particular is characterized by an 'Increasing Returns to Scale/Density' cost structure, meaning that larger units and denser networks reduce the unit costs of production on average. This is an underlying force tending to cause a higher concentration compared with more conventional competitive markets with constant returns to scale.

Based on airline flight schedule data, sourced from the 'SRS-Analyser' database, we calculate the HHI index on the city-pair level, restricted to direct flights only. For Norway, a list showing individual HHI scores for all city-pairs operated in the year 2018 is provided in Attachment 3.

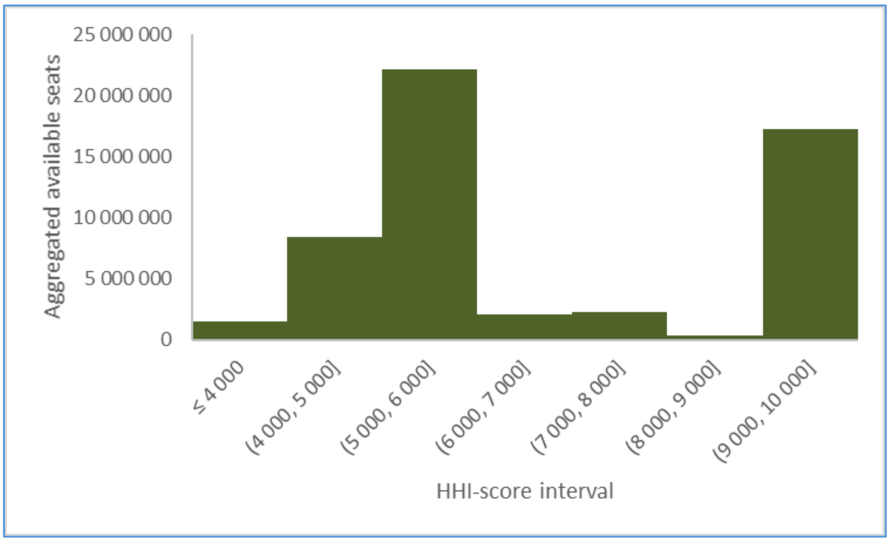
We identify that roughly 75% of all 342 relevant city-pairs served in 2018 are pure monopoly markets. Only 13 city-pairs reach scores of 5,000 or below. In general, a score below 5000 requires at least three airlines to serve the city-pair in parallel. The majority of the routes with HHI scores of or below 5000 points link Norway with European destinations, only three city-pairs are domestic (Bergen - Stavanger, Oslo - Stavanger, Oslo - Trondheim). Figure S1 summarizes this national perspective by mapping the number of city-pairs that fall into a certain HHI interval. In this perspective, the aggregated Norwegian air transport market has to be characterised as highly concentrated.

Figure S1: Number of city-pairs involving at least one Norwegian airport vs. HHI-scores 2018



Further, we weight the city-pair specific HHI scores for 'assumed demand'. That is, we take into account how often traveller are affected by different competitive situations and adjust the respective HHI scores accordingly. In the absence of suitable demand statistics, we use the number of seats offered per city-pair to proxy the underlying demand. Figure S2 summarizes this national perspective by mapping the number of 'available seats' that fall into a certain HHI score interval.

Figure S2: Available seats on city-pairs involving at least one Norwegian airport and HHI-scores 2018



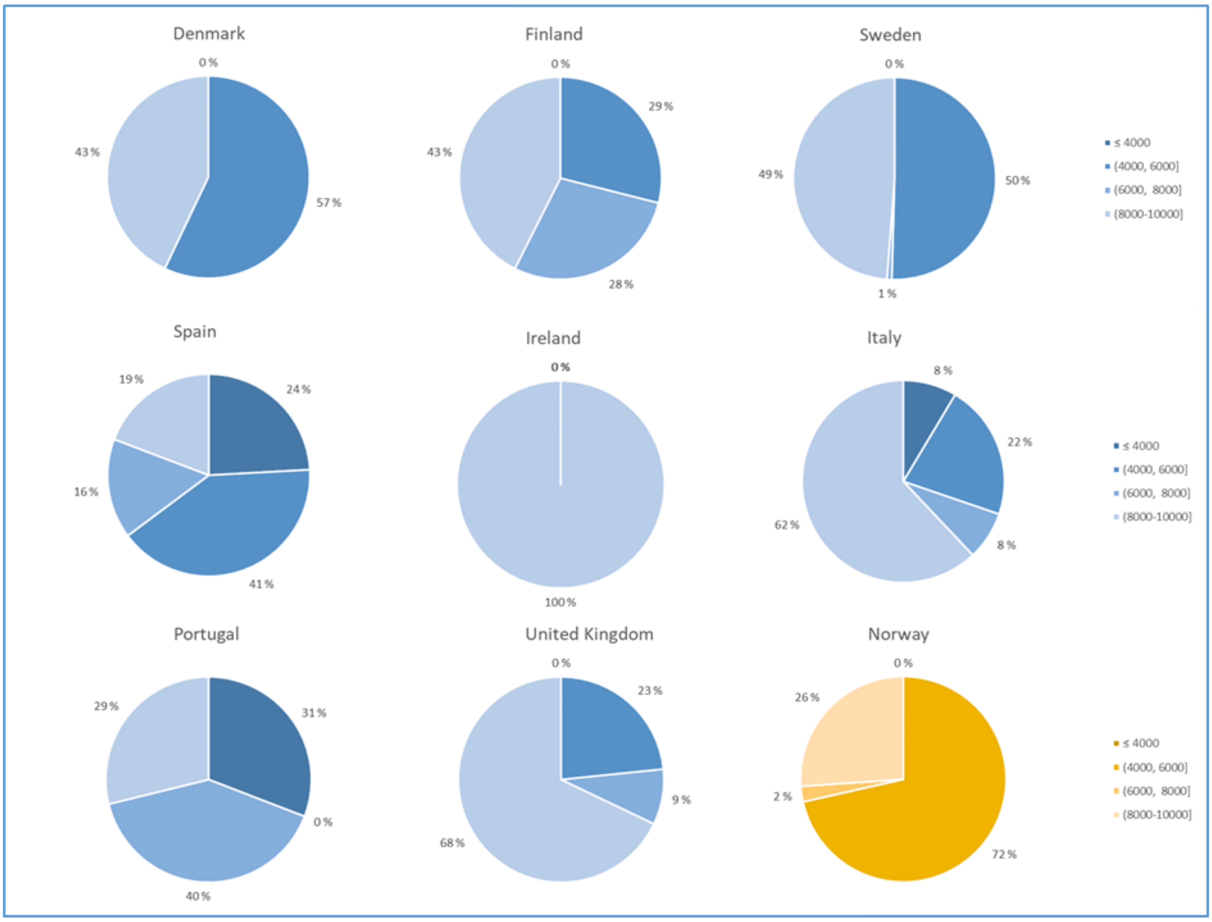
In the light of this perspective, we still find that the Norwegian air transport market has to be labelled as highly concentrated. We notice however, that high demand on a few relatively competitive routes changes the distribution pattern substantially compared to Figure S1. In this weighted perspective, 75% of all domestic seats available are subject to some degree of competition (HHI scores: 4,750 - 9,765). In fact, 71% of all available seats are offered on city-pairs with HHI scores below 6,000.

If we in addition exclude all seats provided on PSO and PSO-related city-pairs from the analysis, we find that only 15% of all domestic seats are purely 'monopoly seats' and hence, 85% of the seat volume is offered on city-pairs that are subject to some degree of competition.

Next, we compare the *distribution* of weighted city-pair specific HHI scores for Norway with those for the markets of Denmark, Finland, Sweden, Spain, Italy, Ireland, Portugal, and the United Kingdom.

Figure S3 visualizes the domestic comparison with the eight benchmark countries. We realize that the share of 'domestic monopoly seats' is in six out of eight benchmark countries higher than in Norway. Only the domestic markets of Spain and Portugal seem to have a 'more favourable' distribution than Norway.

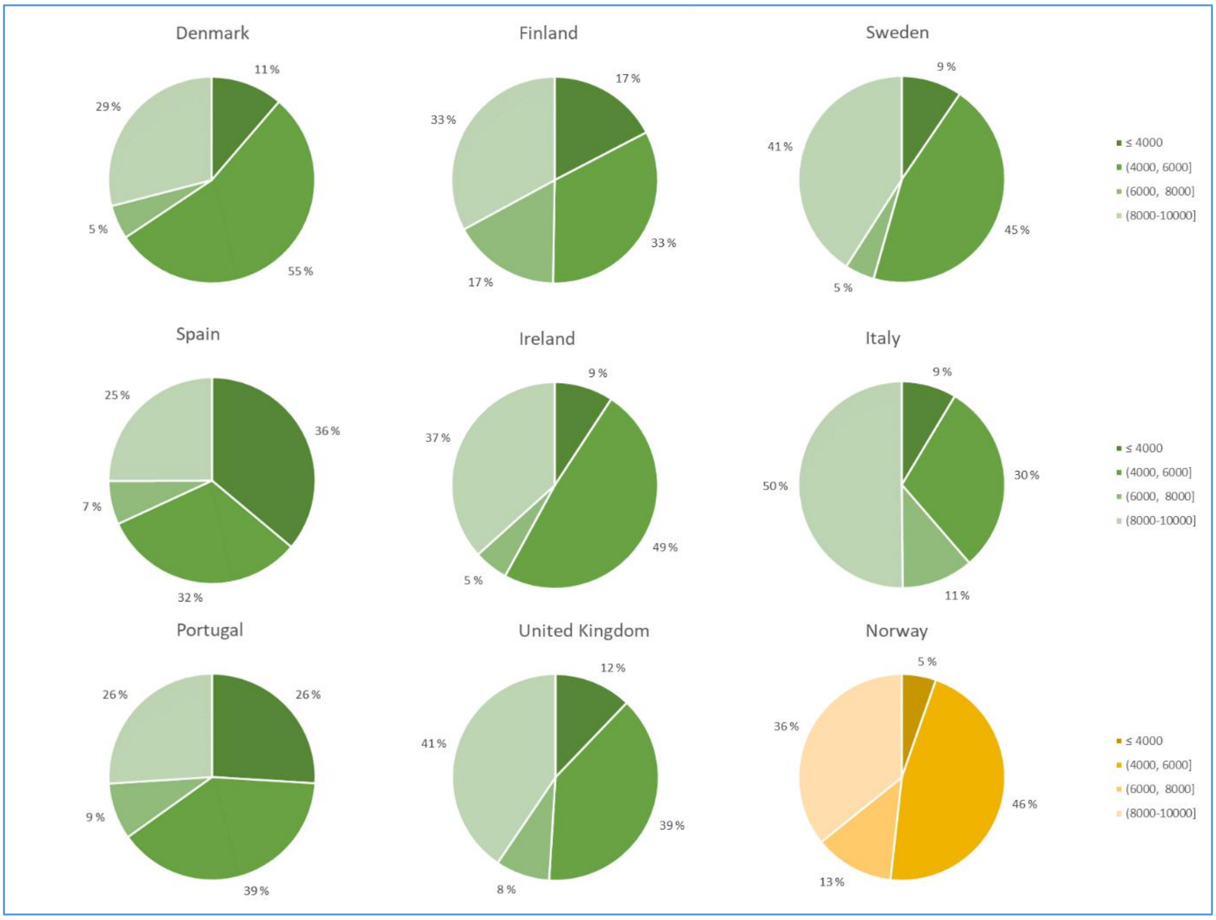
Figure S3: Distribution of 'available seats' in percent per HHI score intervals - domestic city-pairs 2018 - comparison



We conclude that domestic air passenger transport markets are generally highly concentrated. This holds true for Norway as well. However, the concentration level for the Norwegian domestic market is rather low in direct comparison to the benchmark countries.

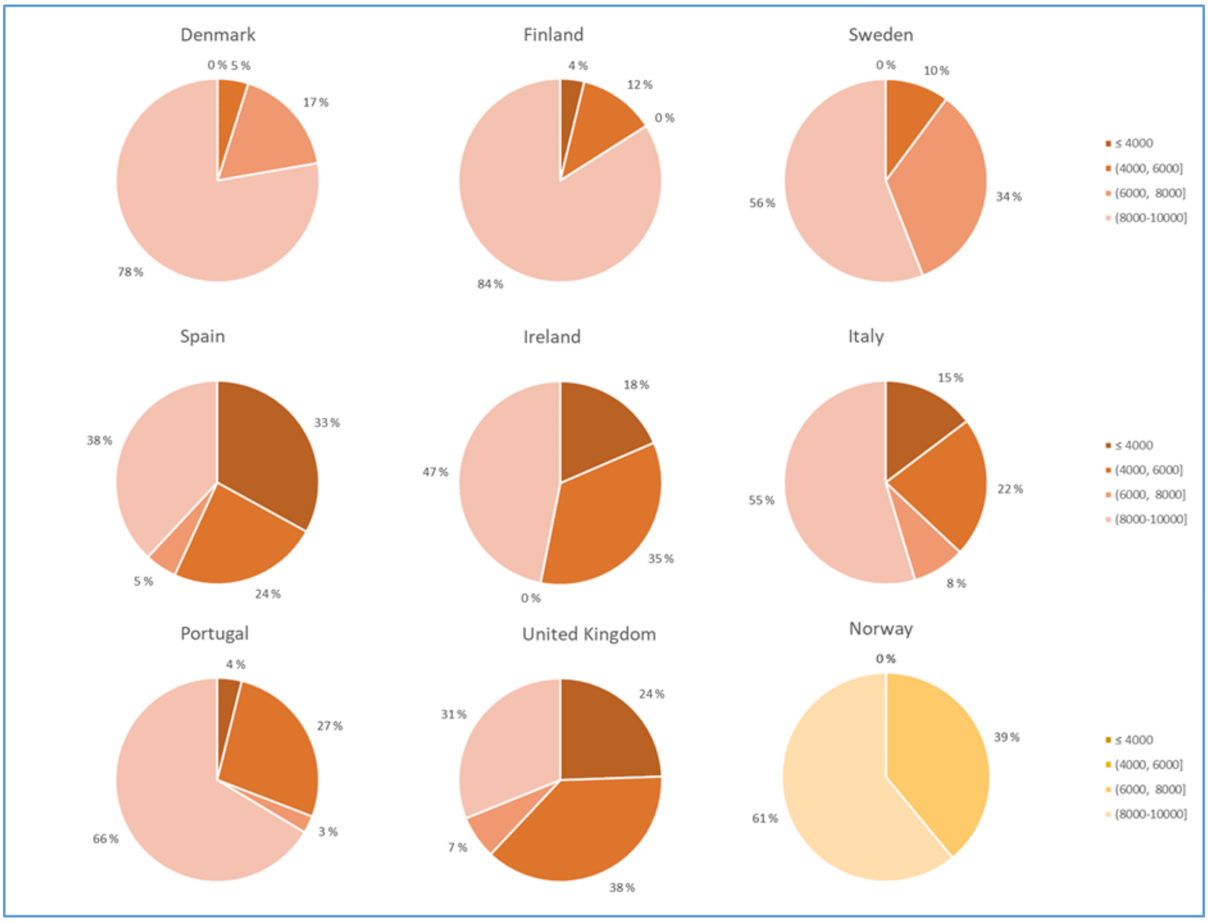
Figure S4 presents the results for the European city-pairs. For Norway, only 5 per cent of all seats are offered on routes with HHI scores below 4,000. Compared with the other countries, this is a relatively low value. On the other hand, Norway has a rather large share of seats that fall into a HHI score range between 4,000 - 6,000 points, indicating around two airlines/route on average. In total, the distributions shown in the figure suggest that Norway is most comparable to Sweden, Ireland, and the UK. Denmark and, most notably, Spain and Portugal seem to have lower levels of concentration on their European city-pair markets.

Figure S4: Distribution of 'available seats' in percent per HHI score intervals - European city-pairs 2018 - comparison



Finally, Figure S5 compares the *distribution* in an intercontinental city-pair context. We see that 39 per cent of Norway's intercontinental city-pair markets fall into the HHI score interval (6 000, 8 000]. However, only 13 such city-pair markets, linking a Norwegian airport with an intercontinental destination, existed in 2018. The share of 39 percent, therefore, relates to only two observations—the city-pair markets DXB-OSL and BKK-OSL. Consequently, the small intercontinental segment has to be characterized as highly concentrated.

Figure S5: Distribution of 'available seats' in percent per HHI score intervals - Intercontinental city-pairs 2018 - comparison



Overall, it appears that all Scandinavian countries as well as Portugal have rather concentrated intercontinental markets. Spain and particularly the UK on the other hand, reach HHI scores indicating lower levels of market concentration.

Next, we obtain aggregated HHI scores for the 'average seat' in each segment. That is, we first multiply the seats of a city-pair with the route's individual HHI score. We then aggregate the values for all city-pairs of a segment (domestic, European, intercontinental) and divide the sum by the total number of seats available in the segment. For Norway, this yields the 'average seat HHI scores' as shown in Table S1.

Table S1: HHI-score for 'average seat' 2018 - Norwegian city-pairs

	Segment/City-pairs		
	Domestic	European	Intercontinental
HHI-score	6 377	6 962	9 171

We find that the domestic city-pair market in Norway is on average less concentrated than the European and the intercontinental city-pair market. Note that a 'typical' domestic, high-demand city-pair in Norway is served by SAS and Norwegian more or less in parallel, which drives HHI scores towards 5,000 points. On the opposite end, multiple low-demand city-pairs are typically served by only one airline (e.g. Widerøe), which forces the 'average seat' HHI scores towards 10,000 points. The European and, most notably, the intercontinental city-pair segments score considerably higher, indicating the dominance of monopoly markets.

Finally, we compare the segmented Norwegian 'average seat' concentration levels with those of the benchmark countries. We find that Norway has the second lowest domestic value among the benchmark countries. Only Spain seems to have a less concentrated domestic market. In comparison with the Scandinavian countries, Norway's domestic HHI score is about 1,000 points lower. We further identify a reduction in domestic market concentration over the last decade.

In terms of the 'European segment' as well as the 'Intercontinental segment', the Norwegian 'average seat scores' are in line with the values of the other Scandinavian countries. Particularly in an intercontinental perspective, the markets of Norway, Denmark, and Finland have to be described as highly concentrated. The same counts with reservation for Sweden. The remaining benchmark countries outside of Scandinavia score better.

To conclude, we have compared the concentration levels for Norway with those of the respective markets of Denmark, Finland, Sweden, Spain, Italy, Ireland, Portugal, and the United Kingdom. We find that air passenger transport markets are generally highly concentrated. We further derive that the 'average' concentration level in the Norwegian domestic market is rather low in direct comparison to the benchmark countries - but still high in absolute terms. Moreover, we conclude for Norway that concentration levels in the European and in the intercontinental market segments are comparable to those in other Scandinavia countries.

2. Introduction

The liberalization of the air transport industry some 30 years ago has sparked off intensive research efforts. Several authors have studied resulting changes in air transport networks, such as the development of hub and spoke network structures (e.g. Dennis (1998), Burghouwt and Hakfoort (2001)). Others have focused on the effects of liberalization on air fares (e.g. Goolsbee and Syverson (2008), Brueckner, Lee, and Singer (2013)). A third group of publications deals with the spatial distribution of benefits from competition (e.g. Dobruszkes (2009), Lieshout et al. (2016)). Research addressing the competitive state of national air transport networks is scares, especially in the Scandinavian context.

The main objective of this report is to gain additional insights into the competitive situation in the Norwegian air transport market. This note aims to assess the degree of competition by means of a comparative analysis with eight benchmark countries.

The remainder of this note is organized as follows: First, the methodology is presented. This includes a brief discussion of the data and the limitations of the research approach selected . We further provide a short introduction of how the Herfindahl-Hirschman Index is calculated and how different index values can be interpreted. Chapter 3 starts with a presentation of the Norwegian Air Transport Network (as define in this note), before market concentration levels for Norway are derived and compared with those of the benchmark countries. The note ends with a discussion of the findings and concluding remarks in Chapter 5.

3. Methods

3.1 Data, Research Focus, Limitations

The analysis in this note is based on data sourced from the SRS-Analyser database (SRS). The software RStudio version 1.1.463 is used for statistically analysing the data. Based on airline flight schedules, SRS contains a wide set of air transport information, such as statistics on number of flights and seats provided by airlines within a specific time window for any two airports linked by the airlines. SRS uses 'IATA notations' to identify airlines ('two-letter code') and airports ('three-letter code'). We follow this approach in the main document and match the IATA codes with the respective full airline and airport names in Attachments 1 and 2 of this note.

Statistics in SRS are strictly differentiated for different airline companies. A user can, for example, find separate information for flights operated by airline 'DY' (Norwegian Air Shuttle AS) and by airline 'D8' (Norwegian Air International Ltd.). In our analysis, however, treating the two airlines as independent might show competition where in reality none exists. In the initial data manipulation process for this project, we therefore integrate airlines with their subsidiaries into only one entity. This approach is applied to the subsidiaries of the Norwegian, Lufthansa, KLM, Alitalia, Iberia, and Wizzair airlines.

Further, SRS reports data for direct flights between two airports (city-pair). But since passengers regularly travel between airports that are not connected by direct flights, they have to transfer at some third transfer airport. Due to the rather complex air transport network structure, travellers can often choose between multiple transfer airport alternatives. For example, a traveller planning to fly from Ålesund to New York might transfer at either OSL or AMS or some other transfer airport. The choice of the distinct transfer airport is dependent on a large set of attributes, such as temporal coordination in the network, the traveller's personal preference of service attributes, etc. In order to comprehensively assess the competitive situation for travels between Ålesund and New York, all possible travel paths between the two cities have to be identified and compared. This requires a rather complex modelling exercise, which cannot be conducted within the limits of this project[1]. Therefore, the analysis of the competitive state presented in this note is restricted to direct, non-stop routings between two airports. This implies that the findings in this note might underestimate exiting levels of competition.

Based on the results presented in this note, an interested reader might also be tempted to infer results for a one-stop travel path. Such an approach, however, can lead to incorrect conclusions and should be avoided. For example, even though both direct routes 'KSU-OSL' and 'OSL-LGW' are monopoly routes, an air journey between KSU and LGW will anyway be subject to at least some degree of competition. This is because multiple additional travel paths connecting KSU with LGW are available to the customer. Depending on personal preferences and temporal network coordination, an air traveller could very well also choose to fly KSU-TRD-LGW or KSU-BGO-LGW. These alternatives are operated by airlines other than the KSU-OSL route; hence, journeys between KSU and LGW can be considered to be subject to competition. Additionally, one might see the airports LHR, LTN, and STN as substitute for LGW, which 'complicates' the scenario even further. Similar cases can easily be constructed for domestic city-pairs.

The reporting of non-stop flights in SRS comes with an additional challenge that the reader has to be aware of. So-called 'milk-routes' are split into independent sub-routes in this analysis. For example, in

[1] For a detailed discussion of the underlying issue, the interested reader may consult Lijesen (2004). For a more recent analysis of the European market covering also indirect routings we refer to Lieshout et al. (2016). Finally, we point to an ongoing project at HiMolde that analyses the connectivity of Norwegian airports. Comparing indirect travel with direct travel paths is one key feature of the work.

this analysis, the Widerøe route 'WF 974' (route number), which connects the airports HFT, HVG, and MEH, is treated as the two independent routes HFT-HVG and HVG-MEH. This inflates the flight and seat statistics presented in later Chapters, compared to other openly accessible statistics that might report on 'route number levels'.

Further, SRS reports only supply-side data. Information on demand, e.g. in the form of passenger statistics, is not included and is difficult to obtain, especially for indirect travel paths. The route-specific seats statistics in Attachment 3 might, however, still allow the reader to gauge the size of demand that is affected by the different stages of competition.

In the analysis, we focus on the competition in the passenger air transport market. Flight movements conducted by pure airfreight aircrafts are therefore disregarded. Further, we exclude from the analysis 'flights' that were 'registered' by an official flight number, but were in fact performed by bus or train.

SRS statistics are aggregated based on the observation of individual flights between airports. This means that the database contains, for example, statistics on direct flights between BGO and NRT. However, the database shows that this direct flight was served only four times in 2018. In order to limit the analysis to 'relevant' markets (city-pairs), we discard all direct flights between airports that were served less than 50 times per year by the same airline. We regard this constraint as rather soft, since it implies that we include all city-pairs that were offered on average once a week.

We perform the analysis based on aggregated annual statistics. This includes some degree of uncertainty of which the reader should be aware. First, airlines typically do not set up their route schedules on an annual basis—they operate with separate flight schedules for each so-called IATA-season (winter/summer). If airline 'a' and airline 'b' operate the same route but in different seasons of the same calendar year, the annual aggregation approach applied in this note might indicate competition (within a year), where none existed in reality (within the season). We assess this issue as limited to a few individual cases. The aforementioned constraint of at least 50 flights per year per airline also dampens the issue. Second, if a route is identified as 'competitive' in this report, this statement should be treated with some caution. The interested reader might additionally consult the respective airline's flight schedules. This might reveal that different airlines serve the same route, but on different days and/or different times of the day. In this case, some travellers might not see the different airlines as substitutes; hence, in such cases an assumed inverse relationship between market concentration identified in this note and actual airline ticket pricing does not hold.

3.2 The Herfindahl-Hirschman Index

The Herfindahl–Hirschman Index (HHI) is a popular measure to analyze the concentration of markets. Originally introduced by Albert Hirschman in 1945 and Orris Herfindahl in 1950[2], HHI today is a widely applied metric both in academic research and in public policy action, aiming at the regulation of markets.

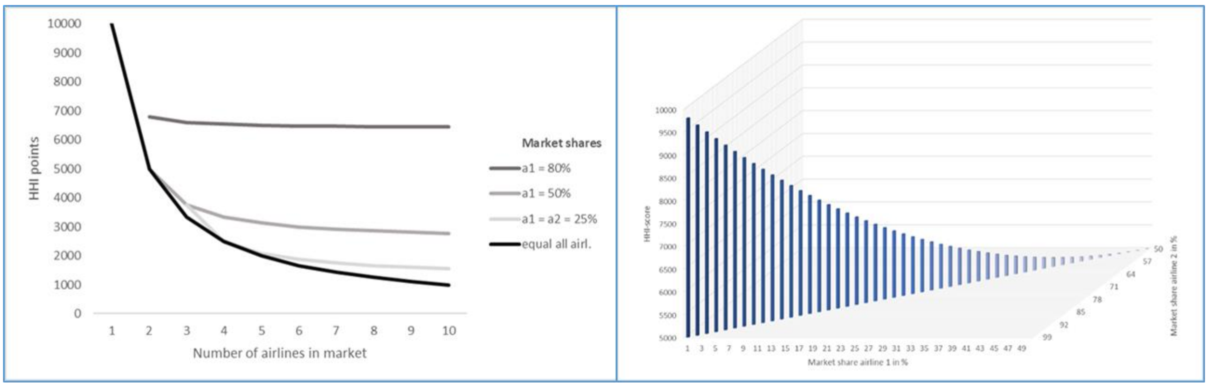
HHI expresses market concentration by the sum of the squared individual market shares. The fewer firms there are serving a market and the larger the variations in market shares are, the higher are the resulting HHI scores.[3] HHI, applied to a market of passenger air transport between airport x_1 and airport x_2, can be expressed by the following equation:

$$HHI_{x_1 x_2} \equiv \sum_{i=1}^{n} \alpha_i^2 \qquad (1)$$

where α_i denotes airline $i's$ market share in the market between x_1 and x_2. Airline i is one operator out of the set of airlines I. The set describes all airlines serving that market ($i \in I$). By design, HHI scores γ can take any value in the following interval: HHI = $\{0 < \gamma \leq 10{,}000\}$. Values at the lower limit indicate so-called atomistic markets (perfect competition) while values at the upper limit represent pure monopoly markets.

Figure 1(a) visualizes HHI scores for some exemplified market settings. On the x-axis, the number of airlines in the market is mapped and on the y-axis, HHI scores are traced. The diverse curves reflect different market structures in terms of market share distribution. The black curve, for example, shows HHI scores for markets where market shares are equally distributed among all existing operators. In a market with three airlines for instant, each airline would hold 33% of the market. Note that this 'equal market share curve' reflects a 'minimum HHI frontier' in regard to the number of airlines in the market - no matter the distribution of the market shares. In other words, no market with two airline can have a HHI score below 5000, no market with three airlines lower than 3333, etc. For air transport markets (route/city-pair level) it is therefore very unlikely to find HHI scores below 2000, since this requires at least 6 airlines to serve the same route.

Figure 1: (a) HHI index – example scores; (b) HHI index - possible scores for two airline market



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[2] For an enlightening discussion of the HHI, its history and its challenges once applied to network industries, the reader might consult Roberts (2014).

[3] For further details, the interested reader might consult standard textbooks on 'Industrial Organization' such as Waldman and Jensen (2013) or Corchón, Marini, and Edward Elgar (2018).

On the contrary, in markets with unevenly distributed market share, the resulting HHI score will always be higher than indicated by the black curve. The grey curves show some such possible scenarios where either the market share of one dominating airline a_1 or of two dominating airlines a_1 and a_2 are fixed. In both cases, the remaining market shares are again evenly distributed among all other participating airlines. Note the importance of the market share of the 'largest' airline for the overall HHI. Note further how relatively 'unimportant' the market share distribution among the remaining airlines is for the HHI scores giving the fact of one dominating airline.

Finally, figure 1(b) shows possible HHI scores for a duopolistic market in regard to the market share distribution among the two airlines. Note that no matter this distribution, HHI scores for a duopoly will never lie below 5,000, hence markets with HHI scores below that threshold require at least one more operator. The reader has to be aware however, that HHI scores above 5,000 do not comparatively describe markets with only one or two airline participating. Depending on specific uneven market share distributions, also markets with many more than two airlines can reach scores above 5,000.

No generally valid definition exists that relates the HHI score to the market power of firms and hence their ability to generate excessive rents. The regulatory framework for mergers and acquisitions in the US and Europe might indirectly be used to set some basic framework. The US Department of Justice (USDOJ), for example, considers markets with HHI scores between 1,500 and 2,500 as moderately and markets with HHI scores of more than 2,500 points as highly concentrated. In the latter case, USDOJ considers transactions (e.g. mergers) that increase HHI by more than 200 points, as market power enhancing (USDOJ 2018). Similarly, the European Commission (EC) assesses transactions once a market has a HHI above 2,000 and changes resulting from mergers would exceed 150 points (European Commission 2004). Following this framework, the majority of all air transport markets (route level) have to be characterized as highly concentrated, from reasons briefly described above. Mergers affecting those markets would most likely always be subject to review by some regulatory agency.

4. Analysis

This chapter starts with a brief introduction to the Norwegian Air Transport System (NATS)[4], based on the most recent annual statistics (2018). In addition, the development of some key numbers over the last decade is presented. Then, a section deals with the market concentration levels in the NATS. Next, the air transport systems of eight benchmark countries are introduced and compared to the NATS. The final part of the chapter compares market concentration levels in Norway with those in the benchmark countries.

4.1 The Norwegian Air Transport System

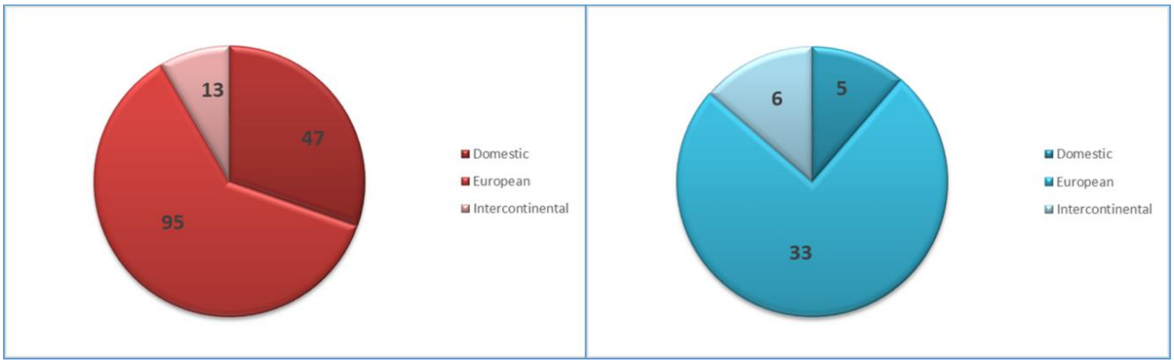
4.1.1 Snapshot 2018

Figure 2 provides an overview of the Norwegian Air Transport System in terms of network size (number of airports) and airlines serving that network.

The left side of the figure shows the number of airports that can be reached by any direct flight originating from an airport within Norway. For 2018, the dataset indicates that the Norwegian domestic network consists of 47 different airports. In addition, 95 different European airports can be reached with a direct flight from Norway (corrected for double-counting). Furthermore, 13 destination airports outside of Europe can be reached without an intermediate stop. In total, the network considered here (as defined by the non-stop constraint) had 155 airports in 2018. The number of city-pair relations (two airports that are connected by a direct flight) is a multiple of this value. In fact, we find that for 2018, 126 different domestic, 203 European, and 13 intercontinental individual city-pairs were served.

Figure 2: Snapshot Norwegian Air Transport System 2018;

(a) Airports connected by direct flight per route type *(b) Airlines by route type*



Note: in (b) in total, 38 Airlines aggregated across all route types; including the helicopter operator 'LTR' (Lufttransport AS)

Table 1 provides some additional insights concerning the distribution of links to airports outside of Norway. We find that 11 Norwegian airports offer at least one direct route to a European destination. For intercontinental destinations, only OSL and BGO provide such services. However, nine domestic airports have direct links to European hub airports other than OSL, which could be used as a transfer point to both European and intercontinental destinations.

[4] Even though this term typically embraces more components than airports and airlines alone, we use this term in this note to address different countries' air transport networks.

Table 1: Snapshot 2018 – Norwegian Airports with non-stop flights to non-Norwegian airports

Routes to	Airports (IATA Codes)
European Airports	"AES" "BGO" "BOO" "EVE" "HAU" "KRS" "OSL" "SVG" "TOS" "TRD" "TRF"
Intercontinental Airports	"BGO" "OSL"
'Hub'-Airports ≠ OSL	"AES" "BGO" "BOO" "HAU" "KRS" "SVG" "TOS" "TRD" "TRF"

Note: European 'Hub-Airports' = $\{AMS,\ ARN,\ CDG,\ CPH,\ FRA,\ HEL,\ LGW,\ LHR,\ MAD,\ MUC\}$*; for airport names, see attachment 2*

The right-hand side of Figure 1 states the statistics for the 'airside' of the market (bound to the network defined above). In 2018, five airlines were offering domestic passenger air transport services.[5] As Table 2 indicates, this count includes the helicopter operator 'Lufttransport AS' (LTR), which operates exclusively on the route 'BOO-VRY', and the airline 'Danish Air Transport AS' (DX), which serves the domestic routes 'OLA-OSL' and 'OSL-SRP'. The remainder of all domestic routes in Norway are operated by only three airlines. On the other hand, 33 airlines serve European destinations (including four domestically operating airlines), while only six airlines offer intercontinental services. Aggregated across all route types and corrected for double-counting, 38 different airlines are operating from/to at least one Norwegian airport.

Table 2: Snapshot 2018 – Airlines serving the Norwegian Air Transport System per Route Type

Route type	Airline (IATA Codes)
Domestic	"DX" "DY" "LTR" "SK" "WF"
European	"0B" "2N" "7R" "AF" "AY" "BA" "BM" "BT" "DX" "DY" "ET" "EW" "FI" "FR" "IB" "KL" "LH" "LM" "LO" "OS" "OU" "PC" "PF" "RC" "SK" "SN" "SU" "TK" "TP" "U2" "VY" "W9" "WF""
Intercontinental	"DY" "EK" "PK" "QR" "SK" "TG"

Note: for Airline names, see attachment 3

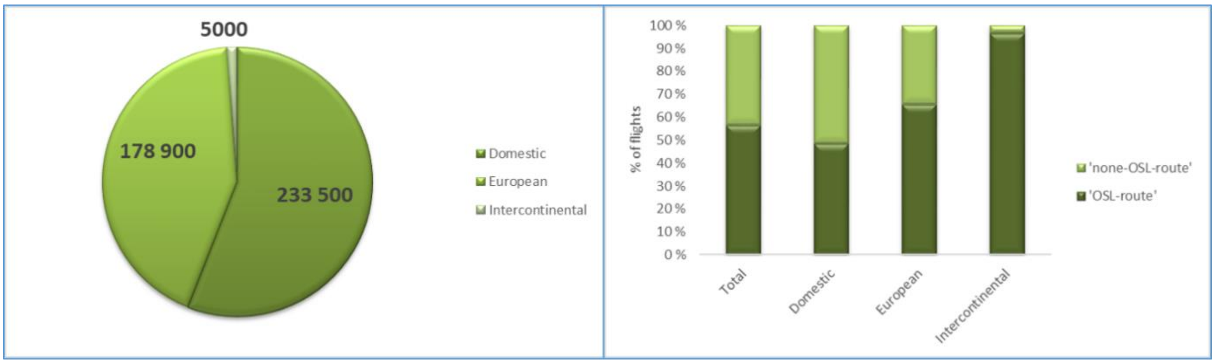
Figure 3 shows the number of flights in the network for 2018 (aggregated to/from), differentiated for route type on the left-hand side and the distribution of flights from/to OSL vs. all remaining airports in Norway on the right.

We find that the domestic segment accounts for more flights[6] than the European segment and that the intercontinental segment is of a marginal size. Converted to daily averages, there are approximately 640 flights between domestic city-pairs, 490 between European, and 14 between intercontinental city-pairs. We further realize that approximately 56% of all flights performed in the network relevant to this analysis either depart or arrive at OSL. The remaining 44% of all flights connect city-pairs that do not include OSL. We assess this distribution as a consequence of the pronounced hub-and-spoke network structure of the NATS.

[5] Services of the airline 'FlyViking AS' are not included since no route was served at least 50 times in 2018.
[6] Note that the 'milk-route issue' introduced in Section 3.1 inflates the domestic flights statistics.

Figure 3: Snapshot Norwegian Air Transport System 2018;

(a) – Number of flights to/from Norway per route type *(b) 'OSL-' vs. 'none-OSL'-routes of total flights per route type*



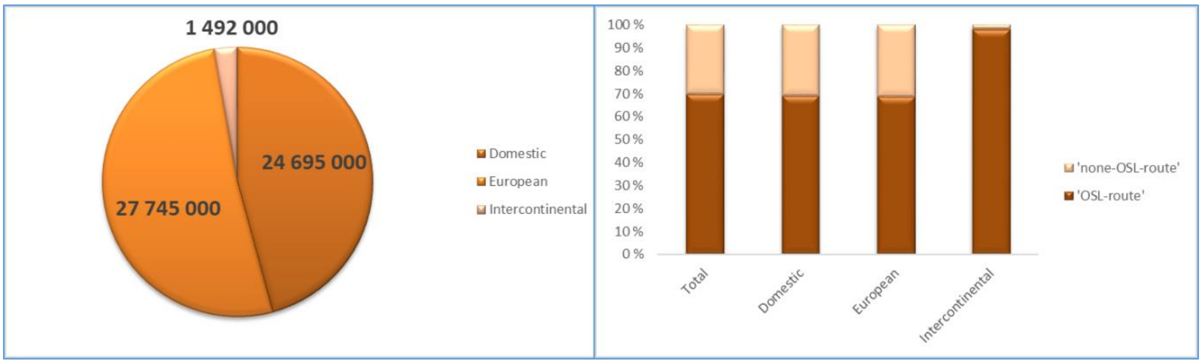
Note: 'City-pair perspective' – inbound and outbound statistics are aggregated; 'OSL-route'= route with 'OSL' as either departure or destination airport

If one focuses on the routes to European destination, the share of OSL routes increases to approximately 65%. For intercontinental routes, the share of OSL routes reaches 96%. In fact, only one intercontinental route not connecting OSL was served in 2018. The database shows 171 flights between the airport of Bergen (BGO) and Steward International Airport (SWF; New York/Newburgh /US) operated by DY.

Figure 4 mirrors the above statistics in the perspective of 'available seats' rather than 'available flights'. We find that, expressed in available seats, the European segment is now larger than the domestic segment. Here, the diverse structure of the aircraft fleet used in the segments takes effect. Where the domestic segment is served by a mixture of small- and medium-sized aircrafts, flights to European destinations are typically served by medium-sized aircrafts. Calculating the seat capacity of 'the average aircraft' using the numbers in Figures 3 and 4, we find capacities of 106/155/298 seats respectively. Additionally, we notice that the share of 'OSL routes' increases across all route types, when expressed in 'available seats'. This effect is most notable in the domestic segment, where the operation of 'low-capacity airplanes' (e.g. Dash-8 series), mainly in remote areas, increases the statistics in favour of the OSL routes.

Figure 4: Snapshot Norwegian Air Transport System 2018;

(a) – Number of seats to/from Norway per route type *(b) 'OSL-' vs. 'none-OSL'-routes of total seats per route type*



Note: 'City-pair perspective' – inbound and outbound statistics are aggregated; 'OSL-route'= route with 'OSL' as either departure or destination airport

In Table 1, we already specified which Norwegian airports have links to 'hub-airports' other than OSL. Referring to the initial discussion of indirect travel paths and their exclusion from this analysis (Section 3.1), we anyhow consider those links as important determinants of market concentration. 'Hub-airports' are not only destinations in their own right, but are used as transfer points to some other destination airport. In this role, links to 'hub-airports' outside Norway enable travellers to bypass OSL and hence competition is created even though the travel path via OSL might superficially appear to have low levels of competition. Therefore, Table 3 outlines additional statistics on the number of flights and 'available seats' for links that connect European 'hub-airports' with Norwegian airports other than OSL. We compare the statistics with the respective numbers for OSL and find that in 2018, approximately 33,000 flights were conducted between European 'hub-airports' and Norwegian airports other than OSL. This accounted for about 4 million seats. At the same time, about 57,000 flights with 9.6 million seats were conducted between OSL and the same set of European 'hub-airports'. Assuming that supply statistics are correlated with underlying demand, we conclude that a noticeable share of travellers 'bypass' the national 'hub-airport' OSL. We further find that smaller aircraft are typically employed on 'non-OSL-hub routes'. Here, the utilization of aircraft models like Embraer 175 on 'hub-feeder routes' (e.g. AMS-AES) drives down the average.

Table 3: Snapshot 2018 – Links to European 'Hub-Airports' – 'OSL-routes' vs. 'Non-OSL-routes'

	Routes linking to European 'Hub'-Airport	
	'OSL-routes'	'Non-OSL-routes'
Flights	57 100	33 200
Seats	9 664 600	4 074 600
Seats/Flights	169	123

Note: European 'Hub-Airports' defined as $\{AMS,\ ARN,\ CDG,\ CPH,\ FRA,\ HEL,\ LGW,\ LHR,\ MAD,\ MUC\}$

To complete the introduction of the Norwegian Air Transport System, we present some disaggregated route-specific statistics. First, Table 4 presents the 'top five' routes (precisely: bi-directional per city-pair) in terms of number of flights conducted and 'available seats' for each route type. In addition, the statistics for the 'median city-pair' per route type are presented to allow for better assessment. These route statistics are aggregated across all airlines that served the city-pair in 2018.

For the domestic segment, we first see that the OSL routes connecting to TRD, BGO, and SVG are the largest links, with good margin. In fact, more than 20 daily frequencies (one-way) are offered between the cities. Further, we realize that 'BGO-SVG' is the only 'top-five' route that does not link OSL, again highlighting the hub-and-spoke structure of the network. Next, we see that an ordinary domestic route ('median city-pair') is substantially smaller, with approximately 1.5 daily flights (one-way) and 130 daily seats.

The top five European routes connect OSL with some other European 'hub-airport'. It can be assumed that a causality exists between the prominence of hub-airports in the list and the rather low direct intercontinental connectivity of OSL. An assumedly substantial share of demand originating in Norway might serve as 'feed' for the networks of Air France/KLM, Finnair and SAS via CPH and ARN. Although labelled 'European routes' here, one can see these hub-links as part of an overall longer intercontinental travel path. The links to ARN and CPH have more than double the volume than the third-largest link to Amsterdam. The 'median European route', here represented by Oslo-Palanga, is about 2.5% of the volume of the largest European routes.

Table 4: Snapshot 2018 - Top-5/Median city-pairs per route type; available flights/seats

	City - pair	Flights	City - pair	Seats
Domestic	OSL - TRD	17 149	OSL - TRD	2 918 363
	BGO - OSL	16 629	BGO - OSL	2 862 363
	OSL - SVG	14 642	OSL - SVG	2 474 585
	OSL - TOS	9 770	OSL - TOS	1 694 165
	BGO - SVG	7 748	BOO - OSL	1 180 779
	:		:	
(median)	BGO - SOG	1 177	OSL - RRS	48 269
European	ARN - OSL	12 841	ARN - OSL	2 261 693
	CPH - OSL	12 456	CPH - OSL	2 248 827
	AMS - OSL	6 060	LHR - OSL	940 660
	LHR - OSL	5 787	AMS - OSL	875 849
	HEL - OSL	4 928	FRA - OSL	736 372
	:			:
(median)	OSL - PLQ	306	OSL - PSA	52 720
Intercontinental	DOH - OSL	918	DXB - OSL	301 822
	BKK - OSL	830	BKK - OSL	280 138
	DXB - OSL	813	DOH - OSL	238 462
	EWR - OSL	724	EWR - OSL	192 496
	JFK - OSL	477	JFK - OSL	145 640
	:		:	
(median)	FLL - OSL	288	FLL - OSL	69 948

In terms of intercontinental links, the values of frequencies and 'available seats' are substantially lower. Aggregated to a metropolitan area level, the link between New York (EWR+JFK) and OSL is the largest one. Individually however, the routes linking OSL to Bangkok (BKK), Doha (DOH), and Dubai (DXB) are superior in terms of volume. The latter two routes might again be considered as transfer points to some other destination airport.

Table 5: Snapshot 2018 - Top-5 city-pairs per route type – 'non-OSL'; available flights/seats

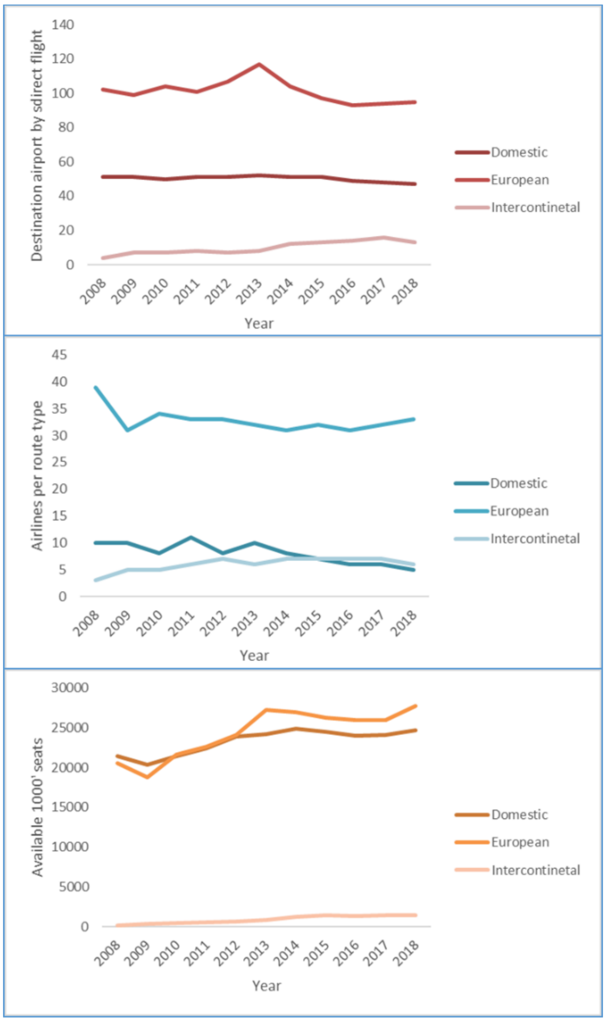
	City - pair	Flights	City - pair	Seats
Domestic	BGO - SVG	7 748	BGO - SVG	1 052 074
	HFT - TOS	4 620	BGO - TRD	628 256
	BGO - TRD	4 507	BOO - TRD	378 638
	BOO - LKN	4 081	BOO - TOS	368 272
	BGO - TRF	3 485	BGO - TRF	281 254
	:			
(median)	BGO - FDE	870	ANX - BOO	35 052
European	BGO - CPH	4 078	BGO - CPH	602 032
	CPH - SVG	3 328	AMS - BGO	430 338
	AMS - SVG	3 229	CPH - SVG	416 442
	AMS - BGO	2 928	AMS - SVG	349 226
	ABZ - SVG	2190	GDN - TRF	314 688
	:		:	
(median)	SSZ - TRF	238	AGP - SVG	38 316
Intercontinental	BGO - SWF	171	BGO - SWF	32 319

Mainly for reasons of comparison, Table 5 visualizes the corresponding 'top-five routes' that do not involve OSL. Apart from 'BGO-SVG', none of the domestic routes are close in size to their counterparts, as shown in Table 4. Further, the four largest European routes connect to the two 'hub-airports' AMS and CPH. Finally, only one intercontinental direct route existed in 2018 that does not address OSL. In general, the largest 'non-OSL links' involve the airports BGO, BOO, SVG and TRD.

4.1.2 Development in the years between 2008 and 2018

This section provides a brief overview of how the Norwegian Air Transport System has evolved since 2008[7]. We focus on three metrics: number of airports in the network, airlines operating in the network, and available seats in the network.

Figure 5: NATS - Evolvement 2008-2018 (per route type);
(a) Airports connected by direct flight
(b) Operating airlines
(c) Available seats



In terms of number of airports accessible by direct link originating in Norway (figure 5(a)), we see a rather stable pattern for the domestic part of the network. The number of European destinations accessible reached its maximum in 2013 and has stabilized in the recent past to around 95 destination airports. The number of direct intercontinental destinations has, on a low level, continuously increased. Expressed in number of total city-pairs served, the network started in 2008 with 321, peaked in 2013 with 410, and declined to 342 city-pairs in 2018.

Concerning the number of airlines serving the segments (figure 5(b)), most notable is the decline in the domestic network, as indicated by the SRS database. The statistic peaked in 2011 with 11 airlines and declined to five in 2018. However, SRS has been somewhat inconsistent with airline names and airline codes over time. The past numbers, therefore, have to be considered somewhat uncertain. In addition, many airlines—such as 'City Airlines' (CF), alleged to have served 'RYG-SVG' in 2011—might have done this with strong ties to one of the dominating airlines in the market, such as SK. The graph alone therefore does not support a general conclusion that market concentration of the domestic market has increased.

Finally, part (c) of Figure 5 shows the substantial growth in supply since 2009 for all route types. This growth, however, at least in part, relates to corrections following a massive decline in the financial crisis period. Furthermore, we observe the European segment overtaking the domestic one in 2013.

[7] No data availability for years prior 2008.

4.2 Norway - Level of market concentration

Applying formula (1) to all markets (city-pairs) involving at least one Norwegian airport, we derive HHI scores for each market. Attachment 3 provides a comprehensive overview of the market concentrations for all markets served in 2018 as well as their development in the most recent past. In addition, the tables show 2018 statistics on available seats and flights.

We find that roughly 75% of all the 342 relevant city-pairs are pure monopoly markets. If we follow the systematization of USDOJ (2018) and European Commission (2004), literally all city-pair markets have to be termed as 'highly concentrated'. Only 13 city-pairs reach scores of 5,000 or below (which in general requires at least three airlines). Out of those 13 city-pairs, only three are domestic (BGO-SVG, OSL-SVG, OSL-TRD). The remaining 'below-5,000' city-pairs are all European markets. The least concentrated market is the European city-pair Paris Charles de Gaulle - Oslo (CDG-OSL) with an HHI score of 3,471. Figure 6 summarizes this national perspective by mapping the number of city-pairs that fall into a certain HHI interval.

Figure 6: Number of city-pairs involving at least one Norwegian airport vs. HHI-scores 2018

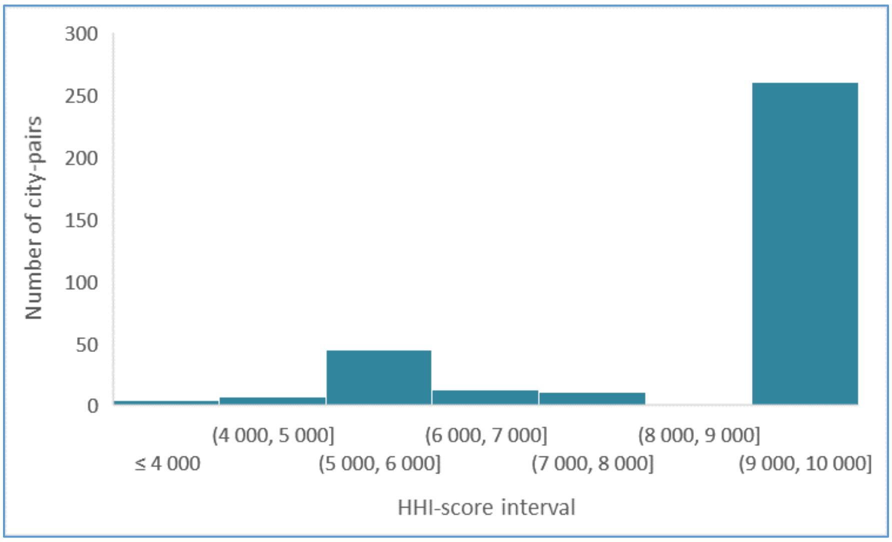


Figure 7 provides a more differentiated picture in terms of individual route types. The distributions for 126 domestic, 203 European, and 13 intercontinental city-pairs (markets) are shown.

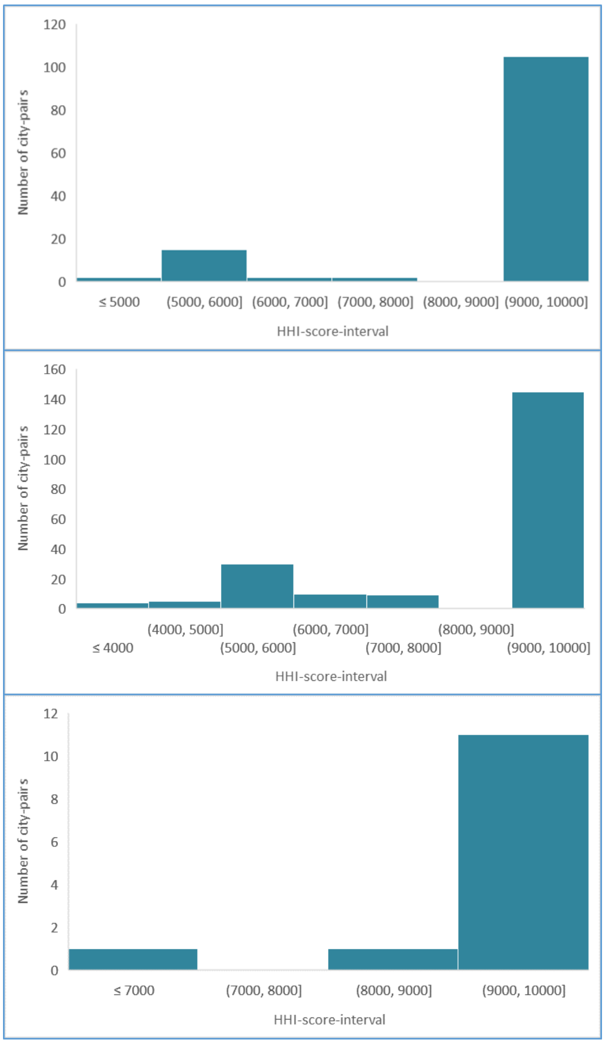
For the domestic market (Figure 7(a)), we find that 83% of all city-pairs are purely monopoly city-pairs. That is to say, only 22 of the 126 domestic city-pairs achieve scores below 10,000 points. At first glance, this suggests a very low level of competition in the domestic network. Recall however, the definition of 'city-pair' applied in this note and the rather weak constraint of 50 flights per year to qualify as a city-pair for this analysis. Therefore, the 126 domestic city-pairs considered here might go beyond what a 'common traveller' would deem a valid set of city-pairs for her/his travel needs[8] and hence the value of 83% monopoly city-pairs might sketch an overly negative picture. This will be further discussed on pages 22 and 23.

The lowest domestic HHI scores are achieved for the city-pairs BGO-SVG (4,750) and OSL-TRD (4,975), where the three airlines DY, SK, and WF were present in 2018 (market shares: 27%/63%/10%;

[8] For example, KSU-MOL and MJF-MQN are considered as valid city-pairs in this analysis. This 'wide' definition was necessary to ensure comparability with the domestic networks of the eight benchmark countries.

50%/49%/0.5%). The remaining city-pairs with scores below 10,000 points mostly link OSL with the regional airports or regional airports with each other. Both SK and DY typically serve those markets in parallel. A more even distribution of market shares between the two operators results in scores closer to 5,000, whereas uneven market share distribution gives scores closer to 10,000.

Figure 7: Number of city-pairs involving at least one Norwegian airport and their HHI-scores in 2018 (per route type)
(a) Domestic city-pairs
(b) European city-pairs
(c) Intercontinental city-pairs



We note that HHI scores below 5,000 are generally rather scarce in the domestic market, even though three airlines exist in parallel. This contradiction is due to WF concentrating its operations on city-pairs between medium and smaller sized airports. Services between those airports often require aircrafts not operated by DY and SK. Therefore, WF's operations only rarely compete with services of DY and SK.

We recognize that 67 of the analysed 126 domestic city-pairs are directly operated under Public Service Obligations (PSO) (e.g. OSY-TRD) or are indirectly related to such PSO-operations, e.g. were PSO-airlines decided to operate a link which does not fall under the 'official' PSO-regime (e.g. OSY-RVK). Such city-pairs are by design purely monopoly city-pairs. If we exclude these city-pairs from the analysis and focus on city-pairs where demand is high enough to attract at least one commercially operating airline[9], we identify 'only' ca. 60% of the city-pairs to be monopoly city-pairs. This value might still seem high, but recall the aforementioned notion on the definition of city-pairs in this document.

For the European city-pairs, we identify 145 out of 203 markets as purely monopoly markets. The share of approximately 71% monopoly markets is therefore slightly lower than in the domestic case (including PSO routes), but higher if PSO routes are excluded. The European markets with the lowest market concentration are CDG-OSL (3,471), HAM-OSL (3,694) and ARN-BGO (3,706). If, however, we assume that the airports LHR, LGW, and STN serve the same metropolitan area, we can aggregate all services connecting OSL with one of the airports. In this case, the services of BA+SK (LHR), DY (LGW), and FR (STN) can be seen as substitutes and the resulting HHI score for the city-pair 'Greater London Area - OSL' is 2,691, making it the least concentrated market in the analysis. Considering TRF as substitute for OSL, in addition, the score declines even further to 2,537 (owing to the resulting more

[9] Note that such city-pairs might still be dependent on the existence of 'nearby' PSO-routes to be commercially viable (e.g. SKN-TOS).

even distribution of market shares). A similar approach is possible for the metropolitan areas of Berlin and Paris (but with less dramatic impact on the HHI scores).

For the intercontinental segment, we find that 11 out of 13 city-pairs are monopoly markets. Only BBK-OSL (6,770) and DXB-OSL (8,903) are subject to some degree of competition. However, we note that EWR-OSL and JFL-OSL link Oslo to the same metropolitan area. If we aggregate all services (DY+SK) from Oslo to the 'Greater New York Area', the resulting HHI score for 'New York-Oslo' would be 5,100, indicating some degree of competition on the city-pair.

So far, the distribution of HHI scores was compared based on city-pair count. That implies that all city-pairs were weighted equally. In reality, however, some routes might be more important to society than others; hence the distribution of HHI scores might change if corrected for 'route-importance'. In the absence of a consistent demand dataset, we proxy 'route importance' by statistic on available seats in 2018. Figure 8 presents the resulting distributions.

For the domestic network, we now find that 25% of the 'available seats' are provided on purely monopoly city-pairs (including all PSO seats). That is, 75% of all domestic seats analysed here, are subject to some degree of competition (HHI scores: 4,750 - 9,765). In fact, 71% of all 'seats available' are offered on city-pairs with HHI scores below 6,000. The weightage for 'route-importance' yields thereby results different from the analysis based on city-pair count. Weighted for 'seats available', the domestic network appears to show substantially lower levels of concentration.

If we now in addition exclude all seats provided on PSO and PSO-related city-pairs from the analysis, we find that only 15% of all domestic seats are purely 'monopoly seats' and hence, 85% of the seat volume is offered on city-pairs that are subject to some degree of competition.

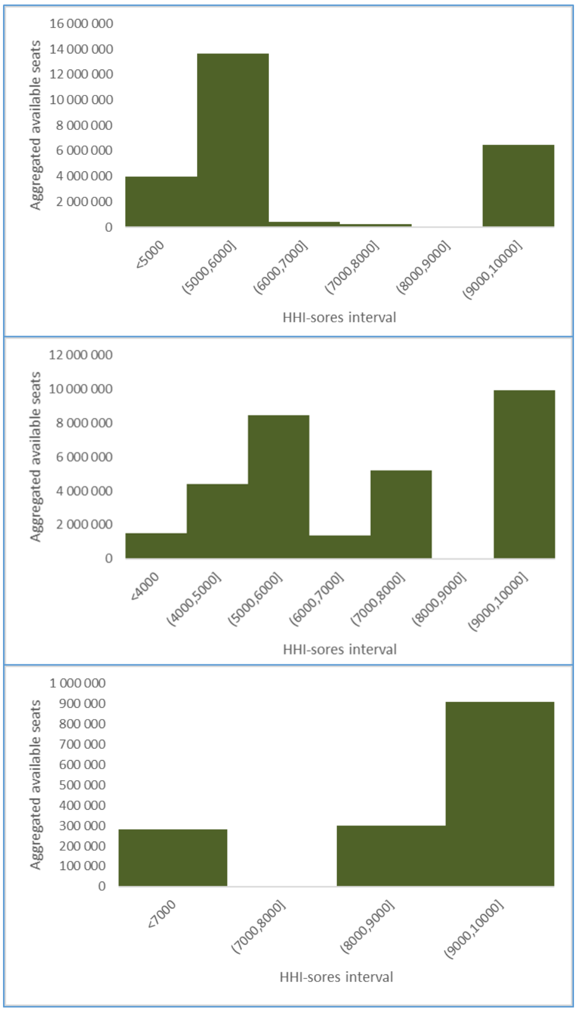
We see a similar change—even though on a smaller scale—for the European city-pairs. Once corrected for volume, only 33% of the available seats stem from monopoly routes. However, HHI scores of around 5,000 still indicate a highly concentrated market.

Figure 8: Available seats on city-pairs involving at least one Norwegian airport and their HHI-scores in 2018 (per route type)

(a) Domestic city-pairs

(b) European city-pairs

(c) Intercontinental city-pairs

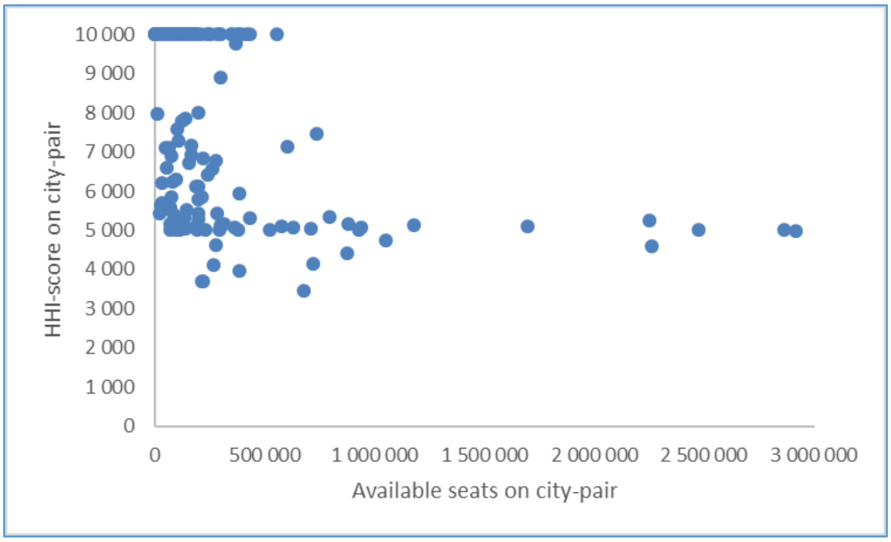


The differences between Figures 7 and 8 are partly related to the aspect that the 'larger' a route already is, the more attractive it is for additional airlines to join the market. Hence, larger routes will tend to have lower HHI scores (all else equal). Moreover, lower market concentration should lead to lower ticket prices, which again fosters demand growth on such routes.

Figure 9 maps the 'available seats' statistic of all 342 city-pairs against their respective HHI scores. We see that city-pairs with slightly more than 500,000 seats per year (corresponds to approximately 3.5 round-trips with Boeing 737–800 per day) are generally subject to some degree of competition. We identify LGW-OSL, OSL-SFX, AMS-BGO and CPH-SVG as the 'largest' monopoly city-pairs in the dataset[10].

On the other hand, supposedly 'thin' city-pairs can be operated by more than one airline at the same time. We find BGO-BLL (HHI 7,966, seats 14,100), BGO-HAM (HHI 5,440, seats 20,600) and FNC-OSL (HHI 5,645, seats 25,800) as the 'thinnest' non-monopoly city-pairs. Volumes on such city-pairs are rather low, resulting in on average less than one round-trip per day, even with small size aircraft. In this context, one can question whether travellers in fact see different airlines as substitutes and hence might benefit from the alleged degree of competition.

Figure 9: Available seats on city-pairs involving at least one Norwegian airport vs. HHI-scores 2018



In terms of consistency over time, we analyse the 342 city-pairs existing in 2018, concerning changes in their HHI scores in 2018 compared to those in 2010. No clear-cut tendency can be identified. We find that 38 city-pairs have become more concentrated with an increase of on average 1,800 points. At the same time, HHI scores of 50 other city-pairs declined by on average 2,300 points. No changes in scores occurred to 145 city-pairs, which were, and still are, monopoly markets. In addition, 109 city-pairs were served in 2018 that had not been operated in 2010[11]. The HHI scores of todays 'top-10' routes in terms of 'available seats' appear to be rather stable over time.

[10] LGW-OSL and OSL-SFX can in a 'metropolitan perspective' be described as competitive city-pairs.

[11] We disregard city-pairs that had been operated in the past, but not in 2018.

4.3 Comparison with other countries

This section sets out to compare the concentration levels in the Norwegian Air Transport System with the competitive situation in a sample of eight other countries. We have chosen Denmark, Sweden, and Finland to compare in the Nordic context. In addition, we look at Ireland, Italy, Portugal, Spain, and the United Kingdom, which we believe have some common characteristics in terms of 'peripheral' location in Europe.

The reader should anyway respect that individual features of a country/Air Transport Systems (e.g. locational aspects and overall population size) might significantly affect the results of the analysis. Ireland and the United Kingdom, for example, due to their favourable location, will likely attract strong demand for travel on the North-Atlantic routes; hence, it should have lower market concentration on those routes. The same counts for routes connecting the countries with the rest of Europe, since air travel on those routes faces lower competition by other modes of transportation. Spain and Italy, as popular holiday destinations on the other hand, will attract high volumes of travellers and hence airports of those countries should be attractive for airlines to connect to.

Furthermore, the reader has to be aware of the interrelation between the location of a country and the route-type categorization used in this note. Due to their closeness to the African continent for example, Spain and Italy will naturally have a relatively 'high' number of intercontinental routes. Measured in flight distance, some of the links might be more comparable with Norwegian EU routes. Some of the Nordic countries might on the opposite have fewer intercontinental routes, due to their unfavourable 'topological' position for intercontinental flight in the network.

4.3.1 Structure of the Air Transport Systems

In order to facilitate the interpretation of the HHI scores in different countries, we provide two informative tables for the reader.

Table 6: Comparison network properties based on 2018 statistics - expressed in percent of Norwegian value

	NO	DN	FI	SE	ES	IT	IR	PT	UK
	Abs. Count	In percent of reference value from Norway							
# of Airports:									
Dom. (total)	47	19	36	64	79	<u>83</u>	6	40	126
Dom. with direct link to Europ.	11	55	<u>109</u>	155	282	291	55	55	318
Europ. with direct link to Dom.	95	132	<u>94</u>	137	209	186	148	137	264
Dom. with direct link to Intercon.	2	<u>100</u>	50	150	600	800	150	200	700
Intercon. with direct link to Dom.	13	285	215	<u>162</u>	677	662	215	346	1 154
# of Airlines on _ city-pairs:									
Dom.	5	<u>120</u>	60	180	220	240	20	160	280
Europ.	33	133	82	136	212	218	<u>91</u>	139	215
Intercon.	6	333	83	250	900	983	267	350	1 267
# of _ citypairs served:									
Dom.	126	10	17	41	138	<u>133</u>	2	26	148
Europ.	203	92	52	116	639	564	<u>109</u>	141	710
Intercont	13	292	215	<u>169</u>	1 169	1 315	277	446	2 123

Note: '<u>XXX</u>' = lowest deviation from Norwegian statistics / most comparable to Norwegian case (all else equal)

First, Table 6 presents some key *network properties* of the different Air Transport Systems. The statistics are provided in absolute values for Norway (NO) but are expressed in percentage of the respective Norwegian value for all other countries. Referring to the first statistics, the number of domestic Airports in 2018 ('# of Airports: Dom. (total)'), which means that only the United Kingdom had more active airports (26% more) in their domestic system than Norway. All other countries have considerable fewer airports in their domestic network.

We next compare how the domestic airports are connected to Europe. In an 'outbound' perspective, we find that only Denmark, Ireland, and Portugal have fewer domestic airports that have direct links to Europe than Norway. This finding, however, has to be interpreted relative to the total number of domestic airports in the countries' networks.

Assessed from the 'inbound' view, we see that almost all other countries link to more European destinations. Only Finland connects to approximately the same number of European destinations. The number of airlines serving that segment correlates with the link statistics.

In terms of intercontinental links, we find Norway to be a distinct case. First, we see that Norway has 'centralized' its intercontinental operations as have Denmark, Finland, Sweden, and Ireland. However, in terms of number of intercontinental destinations served, Norway trails in the group with a large margin. The second 'weakest' integrated country is Sweden (162% of Norwegian value), whereas the highest value is reached by the UK.

Concerning the number of airlines operating different route types, we find that Norway in general has fewer airlines involved than most benchmark countries. Once corrected for the number of domestic airports, Norway is clearly trailing the group for all route types. From a domestic perspective, Norway is most comparable to Denmark in terms of number of airlines operating in the domestic network. We realized, however, that the Danish domestic network is of considerably smaller size. If we focus on countries that have a more comparable quantity of domestic airports, such as Italy and the UK, we find that they have considerably more airlines operating their network.

We finally assess the network's degree of integration, as proxied by the number of city-pairs served. We see that Norway has a relatively high number of domestic city-pairs when compared to the benchmark group. Only Spain and Italy have notably more domestic city-pairs. If we set the statistics in relation to the absolute number of domestic airports in the network, Norway turns out to have a relatively low degree of domestic network integration. We calculate the theoretically maximum number of city-pairs in the networks ($n * (n-1)/2$; where $'n'$ denotes the number of airports in the network). The resulting value for a 'fully integrated network' for Norway is 1,081 city-pairs. Hence, 126 operated city-pairs reflect approximately 12% of the maximum possible value. We relate this value to a pronounced 'hub-and-spoke' network structure. In terms of integration with the European and Intercontinental network, we find that Norway is weaker integrated than most of the benchmark countries, most notably in the intercontinental context.

Table 7 addresses some supply side statistics in more detail and allows a comparison in relation to the countries' population sizes. The numbers for the benchmark countries are expressed in percentage of the Norwegian reference value again.

The statistics indicate that supply in the Norwegian domestic network is rather strong compared to the other countries. Only the considerably higher populated countries of Spain, Italy and the UK show bigger absolute supply numbers, but fail to reach the level of Norway in a per capita perspective. In the European perspective, we find again that Norway is trailing the field in absolute numbers. Once corrected for national population however, the numbers indicate also for this segment a rather high supply in Norway. Only Denmark and Ireland achieve higher per capita supply values. For the intercontinental segment, we find in absolute numbers and from a per-capita perspective that Norway has the lowest supply numbers of all countries in the sample.

Table 7: Comparison of Supply statistics based on 2018 statistics - expressed in percent of Norwegian value

	NO	DN	FI	SE	ES	IT	IR	PT	UK
	Abs. Count	In percent of reference value from Norway							
population size	5 258 000	109	<u>104</u>	190	888	1 152	91	196	1 255
# of flights on _ city-pairs:									
Total	417 000	68	45	82	341	262	62	<u>86</u>	438
Domestic	233 000	13	18	46	156	105	1	25	<u>128</u>
European	179 000	134	<u>74</u>	126	535	420	129	150	708
Intercontinental	5 000	318	294	221	2 051	1 906	521	663	5 213
# of seats on _ city-pairs:									
Total	53 937 000	79	51	<u>90</u>	453	339	81	<u>109</u>	577
Domestic	24 695 000	12	19	47	201	158	1	27	<u>121</u>
European	27 750 000	128	69	<u>122</u>	610	436	134	160	747
Intercontinental	1 492 000	279	263	<u>203</u>	1 696	1 526	440	512	4 970
# of seats on 'Top-5' _ city-pairs									
Dom.	2 226 051	23	27	48	<u>104</u>	76	4	39	47
Europ.	1 412 680	122	82	125	121	<u>99</u>	112	94	146
Intercon.	231 771	<u>141</u>	148	146	406	397	237	188	1 084

Note: '<u>XXX</u>' = lowest deviation from Norwegian statistics / most comparable to Norwegian case (all else equal)

Finally, we compare the aggregated volume of supply provided by the 'top-five' city-pairs for all countries in the sample. We see that the five largest Norwegian domestic routes by far outperform most of the other countries. Only Spain reaches comparable values, fostered by strong supply on the domestic routes between Madrid, Barcelona, and the Baleares. In terms of 'top-five' European routes, we see that the values across the countries are more homogenous than for the domestic routes. For the intercontinental routes, we find that the 'largest' Norwegian city-pairs are of considerably lower size than the 'top-five' routes of the other countries.

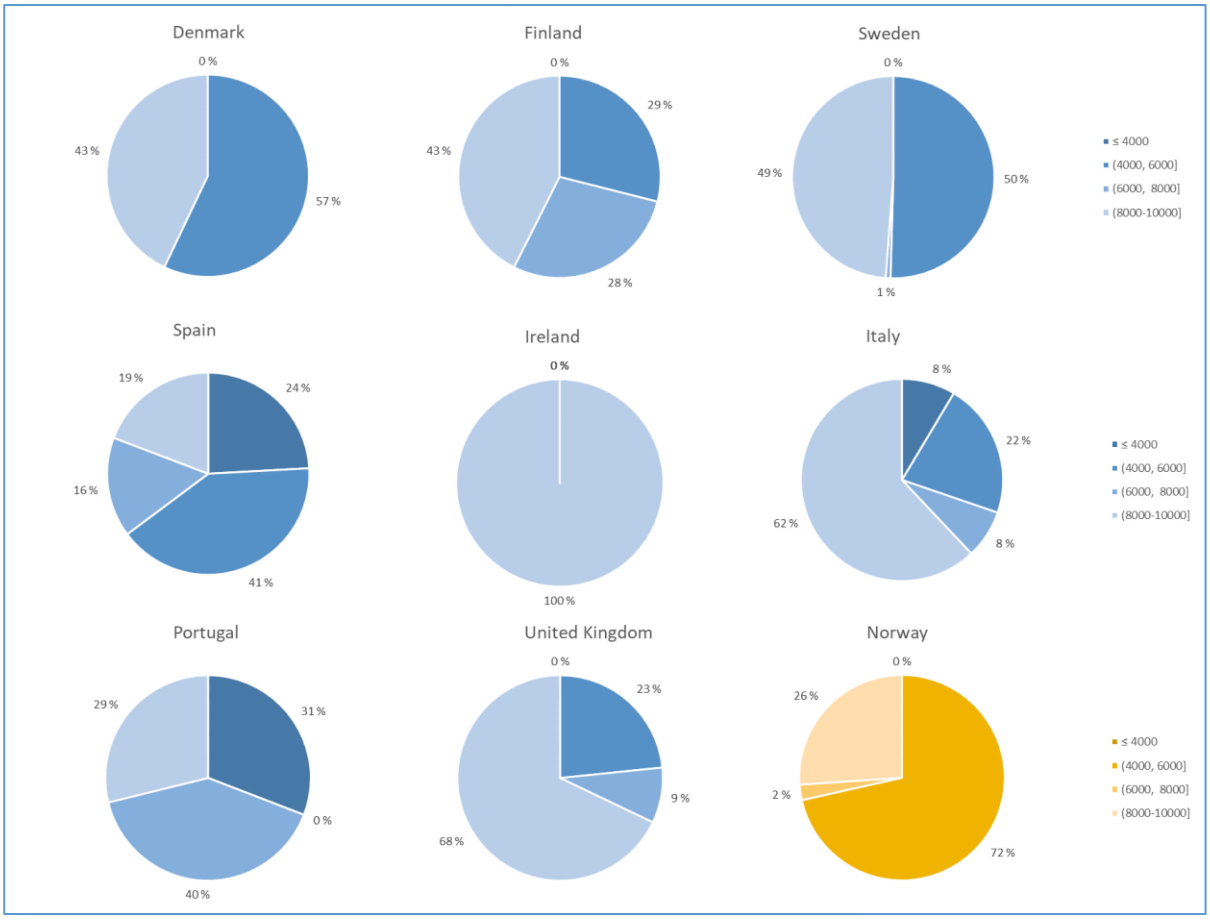
To summarize this section on the comparison of network properties and supply statistics among the sample countries, we notice the following key aspects. The Norwegian domestic network consists of a comparably higher number of airports. The level of supply in the domestic network can be considered high, especially if the overall population size is considered. The number of airlines operating this domestic network is low relative to the number of airports. The network integration (in terms of number of destinations) to Europe is lower than in most other countries. In addition, services to European destinations are concentrated in relatively few Norwegian airports. Once corrected for population size, aggregated supply statistics on European city-pairs appears to be rather high. The intercontinental segment is less pronounced in Norway compared to the benchmark countries. Overall, the number of airlines operating in all three segments seem low, compared to the other countries in the sample.

4.3.2 Level of market concentration

In order to compare the concentration levels in different countries, we run separate analyses with respect to domestic, European and intercontinental routes/city-pairs. In each category, we assign the yearly seat statistic of each individual route to one out of four groups. If a city-pair has a HHI score below 4,000, all seats available on this city-pair are assigned to Group 1 in the pie-charts below. A city-pair's seats are assigned to Group 2 if it's HHI score is between 4,000 and 6,000 (Group 3 6,000–8,000; Group 4 above 8,000). We thereby aggregate all 'available seats' of a country into the four groups. We then finally visualizes market concentration as the shares of all 'available seats in a country' that fall into each of the four groups. By this approach, information on the market concentration of each route as well as their 'overall importance' are taken into account. We regard this method to be superior to a crude aggregation of statistics on a national level, where a set of monopoly routes operated by different airlines might well trigger the HHI to indicate competition where in reality none exists.

Figure 10 presents the results for the domestic market. We see that for Norway, the share of seats on routes with HHI scores below 4,000 is zero, simply because no such routes existed in 2018. Comparing with the other countries, we see that only Italy, Spain, and Portugal have routes with this relatively low degree of market concentration. The latter two countries in fact have a considerably large share of their overall domestic seats in such markets.

Figure 10: Distribution of 'available seats' in percent per HHI score intervals - domestic city-pairs 2018 - comparison



If we focus on the group with the second lowest market concentration group ($4{,}000 \leq \gamma < 6{,}000$), we see that approximately 75% of all seats in Norway fall in this category. This share is larger in none of the other countries. In fact, even if we add in the ‘below - 4000 shares’ of Italy, Spain and Portugal, the Norwegian domestic air transport system still appears to have comparably lower levels of concentration. Recall however that HHI scores around 5000 point to a market where only two airlines have substantial market shares.

On the opposite end, we see that approximately 26% of all available seats in the Norwegian domestic system are supplied on routes with one dominating airline. Compared to the other countries, this share looks relatively small.

In order to present the situation detached from any artificially set bounds of the grouping, we calculate the HHI score of the ‘average seat’ for the domestic market. We first multiply the seats of a city-pair with the route’s individual HHI score. We then aggregate the values for all routes and divide by the total number of seats in the domestic network. Table 8 provides the resulting HHI scores for the ‘average seat’ in the domestic market of each country.

Table 8: HHI-score for ‘average domestic seat’ 2018

	NO	DN	FI	SE	ES	IT	IR	PT	UK
HHI-score	6 377	7 327	7 784	7 372	5 744	7 998	10 000	6 490	8 635

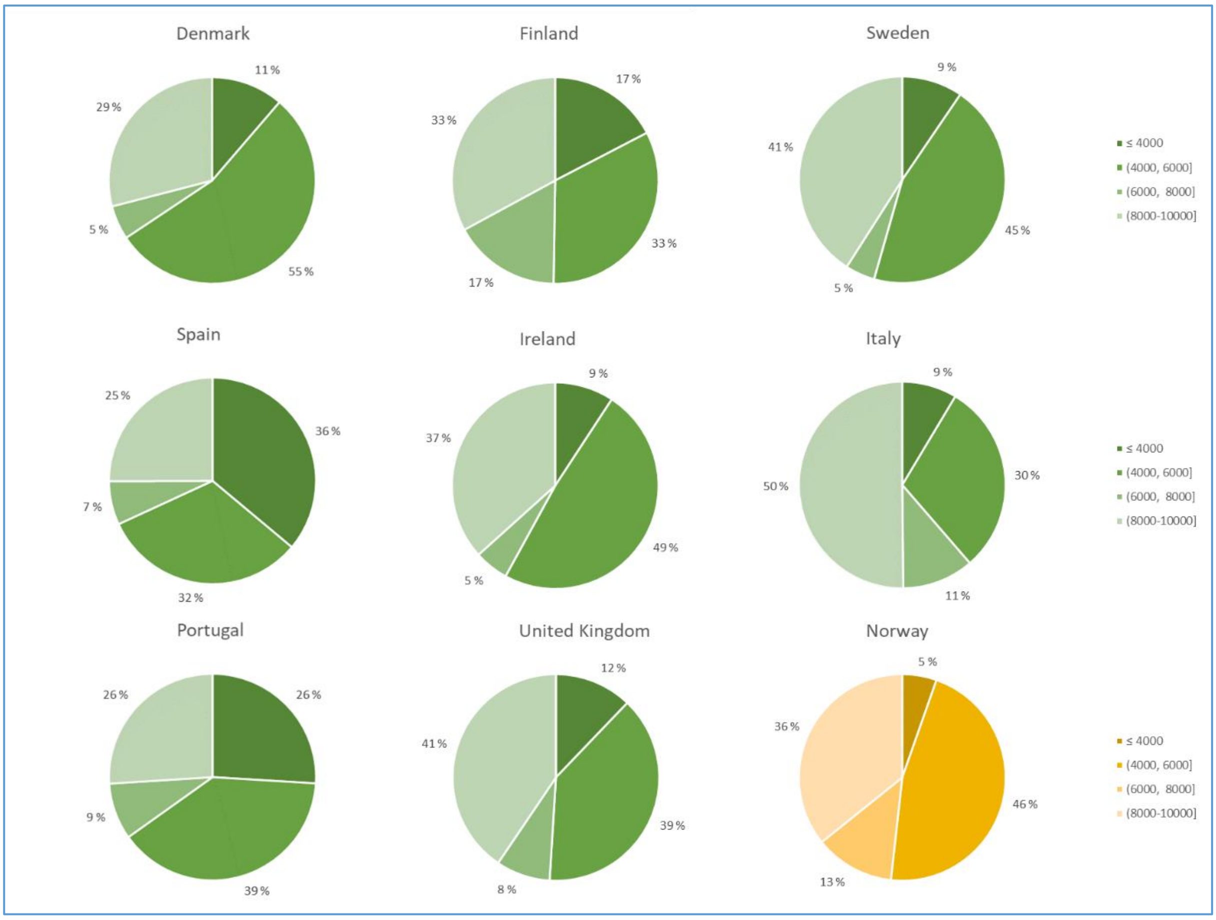
We find that Norway has the second lowest value in the table. Only Spain seems to have a less concentrated domestic market. In comparison with the Scandinavian countries, Norway’s HHI score is about 1,000 points lower. Note again that all the scores have been derived from individual route statistics. For Sweden, this implies that routes from ARN and BMA are considered independent. If, however, the airports ARN and BMA are treated as substitutes, multiple city-pair duplications are created. From this perspective, ‘Braathens Regional Aviation’, almost exclusively operating out of BMA, becomes a direct competitor for SK and DY, operating out of ARN, on multiple high-volume routes. The domestic HHI score of Sweden would decrease substantially.

For Norway, the score of 6,377 reflects the duplications of large parts of the network (SK + DY), a minor amount of ‘larger’ monopoly routes (e.g. BDU-OSL, KSU-OSL) and a large quantity of ‘small’ monopoly routes (WF). If we calculate an aggregated reference score across all city-pairs in the sample—irrespective of the country—we get a value of 7,101. Even thus still highly concentrated, the Norwegian domestic market seems to ‘outperform’ most of the benchmark countries.

We calculate the HHI-score for the year 2008 and find a respective value for Norway of 7 050 points. This indicats a reduction in market concentration over the last decade.

Figure 11 presents the results for the European city-pairs. We find for Norway that only 5 per cent of all seats are offered on routes with HHI scores below 4,000. Compared with the other countries, this is a relatively low value. On the other hand, Norway has a rather large share of seats that fall into Group 2. In total, the distributions shown in the figure suggest that Norway is most comparable to Sweden, Ireland, and the UK. Denmark and, most notably, Spain and Portugal seem to have less concentration on their European city-pairs.

Figure 11: Distribution of 'available seats' in percent per HHI score intervals - European city-pairs 2018 - comparison



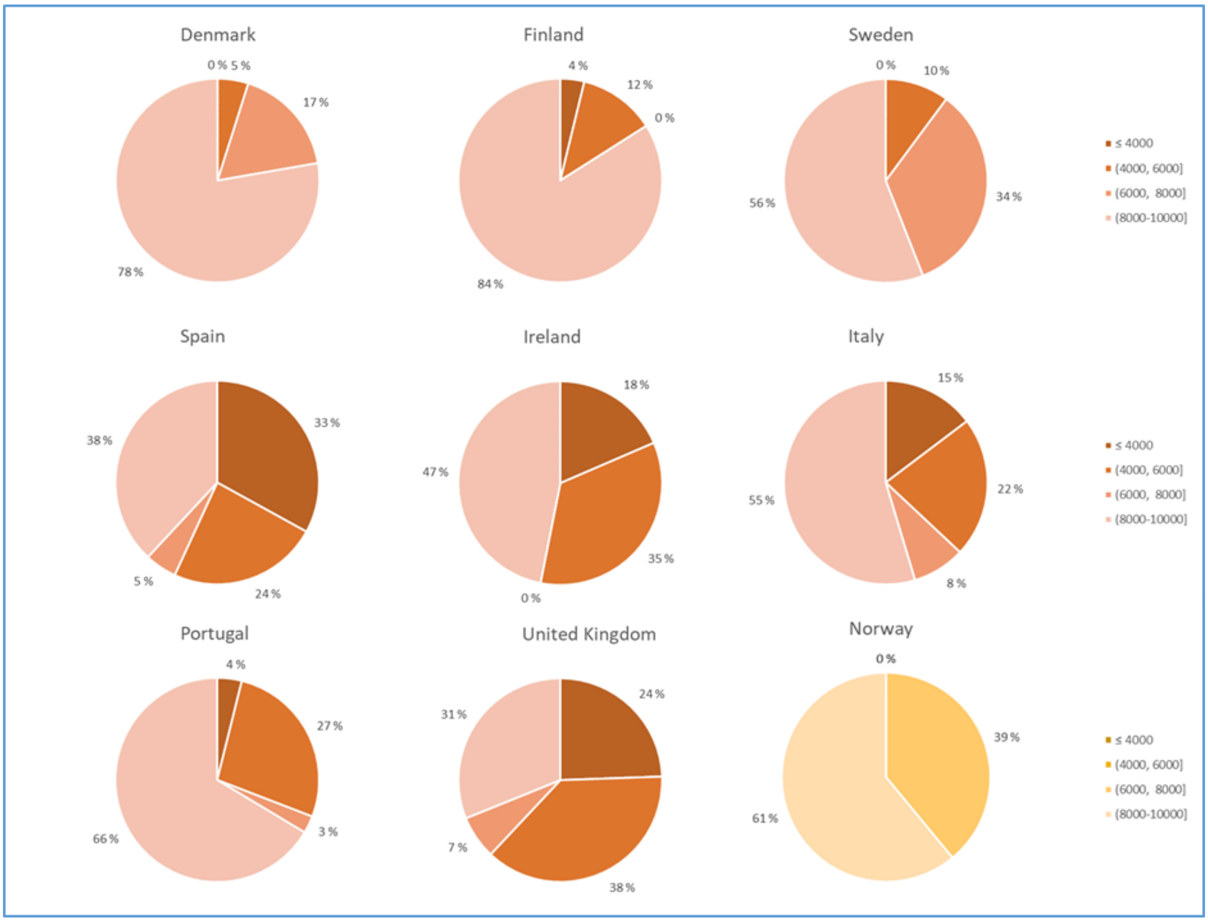
The findings presented in Table 9 confirm these results. We see that in the 'average seat perspective', Norway scores approximately at the level of Sweden and the UK. The Scandinavian neighbours of Denmark and Finland reach lower scores. The top countries, Spain and Portugal, score substantially lower than Norway. Compared to the domestic scores, we find European city-pair markets to be slightly less concentrated in general. Only Norway shows the opposite pattern with a lower score on domestic rather than on European city-pairs. If we derive a 'European average score', we find 6,775 points as the reference value. Norway's respective value for the year 2008 was 6 933 points; hence no major improvement in the last decade can be identified.

Table 9: HHI-score for 'average European seat' 2018

	NO	DN	FI	SE	ES	IT	IR	PT	UK
HHI-score	6 962	6 402	6 587	6 998	5 750	7 585	6 879	5 963	7 031

Finally, we turn towards the intercontinental city-pairs. Figure 12 gives the distributions, and we see that 39 per cent of Norway's intercontinental city-pairs fall into the interval (6 000, 8 000]. Recall, however, that only 13 intercontinental city-pairs existed in 2018. The share in Group 3, therefore, relates to only two observations—the city-pairs DXB-OSL and BKK-OSL.

Figure 12: Distribution of 'available seats' in percent per HHI score intervals - Intercontinental city-pairs 2018 - comparison



Overall, it appears that all Scandinavian countries as well as Portugal have rather concentrated intercontinental markets, while Spain and the UK, in particular, reach HHI scores indicating lower levels of market concentration.

Table 10 shows that Norway, Denmark, and Finland have highly concentrated markets from the 'average seats perspective'. The same counts with reservation for Sweden. The remaining benchmark countries score better. The 'average score' across all city-pairs in 2018 is 6,872—this is substantially lower than the Norwegian value (9171). Here the comparably low market concentration on some high-volume city-pairs (e.g. JFK-LHR: 3 800,000 seats, HHI score 2995; LAX-LHR: 2,016,000 seats, HHI score 2443) strongly affects the average value. The historic Norwegian score for the year 2008 was 10 000 points owing to only three monopoly routes in the database.

Table 10: HHI-score for 'average intercontinental seat' 2018

	NO	DN	FI	SE	ES	IT	IR	PT	UK
HHI-score	9 171	9 149	9 252	8 559	6 467	7 589	7 628	8 380	6 201

One interesting implication comes to mind. We earlier found that all Scandinavian countries are better 'integrated' in the intercontinental network than Norway. We derived this conclusion based on a count of the city-pairs served, flights offered, and seats available. Table 10, however, indicates that the 'average market concentration' on intercontinental city-pairs to/from Scandinavia is almost equally high, irrespective of the specific Scandinavian country. The implication is that travellers starting their air journey for example from Denmark might have a larger choice set in terms of where they can fly to without an intermediate stop. Nevertheless, once they have decided on a specific intercontinental destination, they are likely to face a monopoly provider anyway. The pure number of destinations an airport/country is linked to might allow to proxy the level of network integration, directness of travel and, to some degree, generalized travel costs. Nevertheless, it seems to be a rather weak indicator for the level of market concentration.

5. Discussion and Summary

5.1 Overall market concentration and size of market

In the overall picture, the analysis presented above yields that air transport markets in general are rather highly concentrated. Only very few individual routes in 2018 reached scores within a range so that USDOJ (2018) or the European Commission (2004) would define the respective market as 'moderately concentrated'. In fact, only eight out of 5,600 city-pairs considered in this analysis have HHI scores below 2,500.[12] Most of them are European city-pairs linking population centres in central Europe with holiday destinations in Spain. Additional 431 city-pairs score below 5,000 points. The remaining some 5,160 city-pair in this analysis have market concentrations above 5,000. The 'average' HHI score in the sample (route-based and across all city-pairs) is 8,608, while the 'median' score is 10,000. Once weighted by the number of 'available seats', the HHI score of the 'average' route is 8,658. Based on this finding, we conclude that even if not desirable from a customer perspective, highly concentrated air transport markets display the norm rather than being an exception. It is, therefore, natural to expect that the Norwegian Air Transport System would be characterized by high levels of market concentration as well.

The existence of a correlation between the level of market concentration in a specific market and its respective level of demand is widely assumed in the academic literature. The direction of this correlation, however, is open to debate. Proponents of the 'entry affection effect' of market growth argue that the higher the demand on a specific route, the more profit would a potential monopolist reap. Consequently, the incentive for additional airlines to join the market increases and the market concentration decreases. Oliveira and Oliveira (2018), for example, empirically determine this negative association between demand and market concentration for the Brazilian Air Transport market. Opponents of this view claim that the economics of traffic density in air transport networks in general favours dominant airlines and that market growth will even further foster their competitive advantage. Consequently, market concentration is positively correlated to market size.

To assess the relationship, we estimate the Pearson's correlation coefficient between HHI scores and the number of available seats (as proxy for demand) on the route level across all observations in the dataset. The resulting correlation coefficient has a value of -0.44 and is significant. The results suggest a weak to moderate negative correlation, meaning that HHI scores are likely to drop as routes grow.

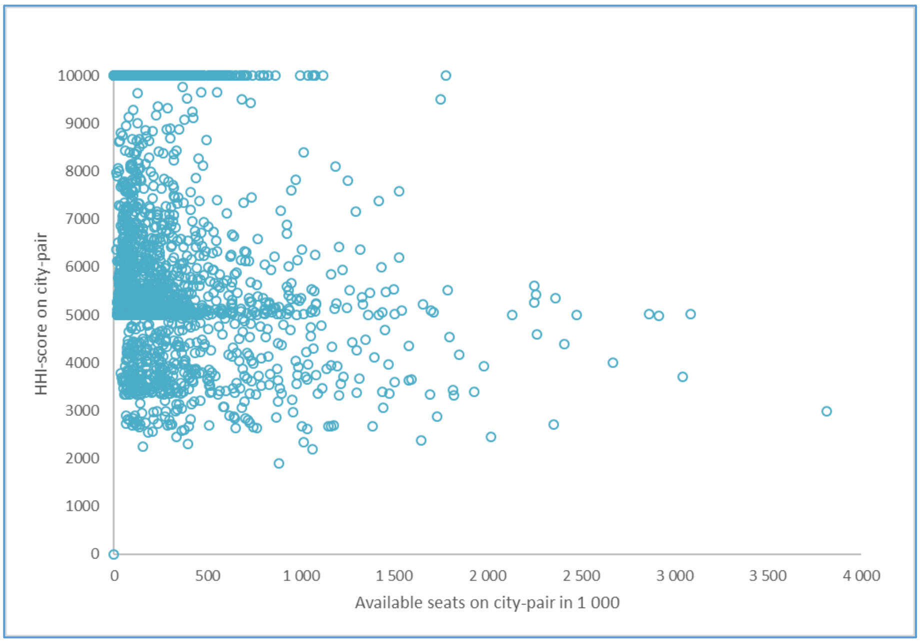
[12] For further details concerning these routes, see Attachment 4.

Figure 13 investigates the same assumption and plots all 5,600 city-pairs' HHI scores against their seating statistics. No clear, strong relationship can visually be identified. The dataset contains both multiple 'small' routes subject to competition and a few 'large' city-pairs that are monopoly routes. If it is possible to derive a general conclusion from the chart at all it is that the likelihood of a city-pair being a monopoly market declines dramatically once the available seat statistics become larger than 1,000,000.

On the other hand, the graph visualizes that high capacity numbers are not necessarily mandatory to achieve relatively lower levels of market concentration. Several reasons might motivate airlines to operate in low-demand markets in parallel with their competitors[13].

First, an airline's network might be structured in a way that one hub-airport requires intensive 'feed' (short-haul routes). If, in addition, the airline can yield a monopoly rent on some high-volume routes originating at that hub (e.g. long-haul routes), the airline might be willing to enter 'low-profit feeder' routes. In such a case, the airline does not compete 'over' the specific feeder route, but their entire network structure.

Figure 13: Available seats on city-pairs entire dataset vs. HHI-scores 2018



Second, temporal coordination in networks might cause airlines to operate on routes that, seen in isolation, only cover costs. If an airline, for example, serves domestic morning and evening waves (e.g. to/from OSL), which are supposedly high-profit routes, it might be willing to utilize its aircraft in 'small' competitive markets between the two peak periods. As long as revenue of those operations is larger than the costs of parking the aircraft between the domestic waves, airlines will have an incentive to engage in such markets.

[13] Note that our analysis aggregates on the city-pair level and we allow rather 'small' routes to enter the analysis. This might lead to a situation where an airline 'a_1' serves a specific city-pair only once every Monday and an airline 'a_2' serves the same city-pair once every Thursday. The graph would then show this city-pair as a 'small' city-pair with HHI scores around 5 000. To test for the impact of such 'low' volume routes on our results, we deleted all city-pairs from the analysis that have not been served at least once a day. The resulting correlation coefficient as well as the implications from Figure 13 did not change substaintially.

As of today, only eight city-pairs exceed the aforementioned capacity threshold of 1,000,000 seats per year in Norway. Six of them are domestic routes while the other two link to European destination. They are all already subject to some degree of competition (HHI-scores typically around 5,000), as are all Norwegian city-pairs showing seats statistics above 500,000 (in total 22 city-pairs).

However, we note that 289 city-pairs in the overall sample reach HHI scores below 4,000 (requiring at least three airlines with considerable market shares) and that the average seat-statistic on those city-pairs is around 480,000. If we disregard all presumably 'holiday city-pairs', the seat statistics increases to 550,000. In this respect, Norwegian high-demand city-pairs seem large enough to attract additional airlines.

Nevertheless, we also find some convincing arguments as to why potential market entry on those routes is less likely. We notice the specific hub-and-spoke nature of the Norwegian Air Transport network, with OSL as the central, national hub-airport and, inter alia, TRD, BOO and TOS as secondary, 'regional sub-hubs'. The latter once serve among other as transfer points for air journeys between a large set of rather small airports and for example OSL (e.g. RET-BOO-OSL). This, however, implies that a substantial amount of demand is 'generated on' routes connecting OSL with the 'regional sub-hubs'. In addition, some demand between rather large Norwegian cities (e.g. Bodø-Ålesund) is due to the existing network structure channelled through OSL. As a consequence of both aspects, we can assume that traffic (seat statistics) on some of the 'largest' Norwegian routes (e.g. BOO-OSL) is much higher than the real underlying demand for travel between the cities of Bodø and Oslo.

This is relevant in our context because a potential newcomer that establishes isolated services between the airports BOO and OSL will most likely be an attractive supplier for the demand fraction that wants to travel between Bodø and Oslo (origin-destination context). Passengers that use BOO and/or OSL as a transfer point, on the other hand, are likely to prefer travelling the entire journey with some established airline that offers services 'out of one hand', meaning transfers within the same airline/alliance. In order to attract such customers and reach the same network coverage, a potential newcomer would have to file cooperation agreements with established airlines (e.g. codeshare agreements) or 'duplicate' large parts of the network with own services. Whether or not total 'network demand' is high enough to facilitate an additional network duplicate seems uncertain. These prospects might deter potential newcomers.

Another interpretation of this aspect is as follows. We earlier referred to 289 city-pairs with HHI-values below 4,000 and an average capacity of 480,000 seats. If a substantial share of those routes serve 'real', direct origin-destination demand and hence are not part of a longer, indirect travel path, then the 480,000-seat threshold cannot be applied to the Norwegian setting. Substantially larger volumes might be necessary to attract an additional airline into individual Norwegian city-pairs without engaging the entire network.

In short, the data used in this analysis reveals that air transport markets are highly concentrated across all countries investigated. The correlation between market size and level of market concentration in our dataset is weakly to moderately negative. Based on this relationship and the distinct network structure in Norway, we do not find overwhelming reason for additional airlines to enter the Norwegian network structure on a large scale.

5.2 The Domestic perspective

In a distinct domestic perspective, the lowest concentrated domestic route in the sample is IBZ-MAD with a HHI score of 2,679. In contrast, the least concentrated domestic route in Norway scores 4,750. This makes BGO-SVG the 38th least concentrated domestic route in the sample (sample size 775). Since some additional high-volume routes in Norway have relatively low HHI scores, the Norwegian domestic market achieves lower HHI scores than most of the benchmark countries (once weighted for the number of seats offered). Here the wide scale network duplication of DY and SK lowers the score, while a large amount of low-volume and monopoly city-pairs tends to increase the score (mainly WF routes). Over the last decade, growth of DY has led to a more even distribution of market shares, causing the HHI-score to decrease. In comparison with the benchmark countries, the Norwegian domestic market can be described as relatively moderate, but still as highly concentrated (- expressed in absolute HHI values).

It seems worth spending a few additional words on the network structure and competition in this domestic context. As initially discussed, the analysis is limited to direct routes. We briefly elaborated on the potential competition between alternative indirect travel paths. We further claimed that Norwegian domestic network is in large parts organized in a stringent hub and spoke fashion and that this contributes to the making of some of the OSL routes to high-volume city-pairs. Direct links between so-called spoke cities, however, represent attractive alternatives for traveller that otherwise would be 'forced' to transfer at OSL. Operators of such direct routes can be considered to compete with the established hub and spoke airlines in an origin-destination-context.

Therefore, we argue that new or strengthened spoke-spoke routes, even in case of 'monopoly routes', can contribute to the reduction of overall market concentration in Norway. Instead of trying to motivate an additional airline to enter the established hub- and spoke structure, one might want to evaluate this alternative approach. One of many challenges facing this potential tactic is the presumably low demand on spoke-spoke city-pairs vs. the need to provide acceptable frequency levels. Proceeding this idea would require to motivate airlines operating new, relatively small aircraft, such as Embraer E 190, to enter the network. Alternatively, aircraft types like the ones used in PSO contracts could be employed on such spoke-spoke routes. We underline that these views have to be supported by future research in order to add substance.

A somewhat related question to this aspect and the discussion in section 5.1 is how a potential market newcomer would integrate its new domestic routes with the already existing network. Having in mind the relatively 'low' market concentration in the Norwegian domestic network (compared to the benchmark countries), it appears somewhat uncertain whether or not a newcomer would at the outset take the risk to operate and compete on domestic routes independent of its existing network. This leaves WF as the only 'established' airline that could enter the competition based on their already existing infrastructure within the domestic network. All other potential entrants would have to enter the market from the 'outside', most likely linked with some already established Norwegian–Europe city-pair(s). Recent studies on how airline networks typically grow are unfortunately not available. It is, therefore, hardly possible to assess the likelihood of the different scenarios. Further, it is highly uncertain how the eventual process of market entry would proceed in a network perspective.

To summarize this section, we identify the Norwegian domestic network to be highly concentrated. Compared to the benchmarking countries, however, market concentration appears rather moderate. Set in isolation, this finding does not argue in favour of additional airlines imminently engaging in the Norwegian domestic network in a large scale. We propose to see competition in terms of the coexistence of direct and indirect travel paths.

5.3 The European/Intercontinental perspective

Focusing on European city-pairs first, we find that the aggregated Norwegian-European market is slightly more concentrated than its domestic counterpart. This is in contrast to the relationship in all other benchmark countries. Moreover, it opposes the suspicion expressed at times that the international segment in general has outperformed the domestic segment in terms of the degree of competition. The results of our analysis do not support this claim.

We discovered that nine out of the ten Norwegian city-pairs with the lowest HHI scores are European city-pairs. Traveller on these specific routes may substantially benefit from competition. Irrespective of this finding, the aggregated Norwegian domestic market is still characterized by lower levels of concentration once adjusted for travel behaviour (as proxied by seats available). This means that the 'average' traveller on a European route faces more concentrated markets than the 'average' traveller in the domestic network.

The perception of European city-pair markets as being less concentrated than domestic city-pairs might be related to the difference in the number of airlines operating in both segments or to the sheer number of destinations served. The analysis reveals that most European city-pairs are served by only one airline and hence are monopoly markets. The allegedly higher degree of competition in the European market is thus related to competition between different destinations but not necessarily to competition between airlines. Whether this type of competition translates into relatively lower prices for customers might be questionable.

Taking the overall network structure and the necessity of indirect travel paths into perspective again, adding an interesting facet to the discussion. Even though some European city-pairs have relatively low levels of concentration, not all travellers are able to benefit directly from it. That is, travellers starting their journey at Norwegian domestic spoke airports without direct EU-links have to transfer at least once within Norway. Such passengers will often try to travel the entire path on board the same airline to avoid disutility cause by transfers between different airlines[14]. This means that a large number of travellers might not consider other operators as viable alternatives, a circumstance that domestic airlines can potentially capitalize on. On the other hand, travellers starting/ending their trip at OSL, for example, can directly benefit from the situation.

From the intercontinental perspective, we find Norwegian city-pair markets to be highly concentrated, which is in line with the results of most of the benchmark countries. Due to the low number of existing intercontinental city-pairs for Norway, a detailed discussion of the market concentration levels is obsolete. We believe that the future should be about strengthening (i.e. increase demand on) existing links and extending the intercontinental network (number of direct links to/from Norway), rather than trying to increase competition on existing routes. As of today, volumes of on average 115,000 seats (13 city-pairs) seem too low to realistically expect substantial competition on the route level. New links are needed to generate 'feed' into the intercontinental routes, either by 'diverting' Norwegian transfer passengers back from other European hub-airports or by attracting foreign citizens on intercontinental journeys to transfer in Norway. Both scenarios come with considerable challenges that are beyond the scope of this note to describe. An alternative approach that could be considered in the medium run is to stimulate the establishment of new intercontinental routes linking Norwegian spoke cities directly with intercontinental destinations, utilizing modern narrow-body aircrafts. Such links then might also have indirect effects on the market concentration in the domestic network.

[14] For example, baggage claim and re-check in, financial risk of missing connection etc.

5.4 Summary

In summary, we have conducted an analysis of the concentration levels in Norwegian Air Transport markets using the Herfindahl-Hirschman Index as the measure. We calculate the index on the city-pair level and aggregate for the Domestic, European, and Intercontinental segments. We have compared the resulting concentration levels for Norway with those of the respective markets of Denmark, Finland, Sweden, Spain, Italy, Ireland, Portugal, and the United Kingdom. We found that air passenger transport markets are generally highly concentrated. We further derive that the 'average' concentration level in the Norwegian domestic market is rather low in direct comparison to the benchmark countries. Moreover, we conclude that concentration levels in the European and in the intercontinental markets show a more diverse picture.

6. Attachments

Attachment 1:

Airlines; IATA – codes and names

0B	Blue Air Aviation SA	LO	LOT - Polish Airlines
2L	Helvetic Airways	LS	Jet2.com Limited
2N	NextJet AB	LTR	Lufttransport AS
2Q	Avitrans Nordic AB	LX	SWISS
2W	Moldavia Airlines	M3	North Flying A/S
4U	Germanwings	NB	Skypower Express
5N	Smartavia	NWG	AirWing
5W	Astraeus Ltd.	NY	Air Iceland Connect
6F	Primera Air Nordic	OK	Czech Airlines a.s., CSA
6S	Saudi Gulf Airlines	OS	Austrian
7R	RusLine	OU	Croatia Airlines
8N	Regional Air Services	OV	SalamAir
A3	Aegean Airlines	OZ	Asiana Airlines
AB	airberlin	PC	Pegasus Hava Tasimaciligi A.S.
AC	Air Canada	PF	Primera Air Scandinavia A/S
AF	Air France	PK	Pakistan International Airlines
AY	Finnair	Q9	Kuwait National Airways t/a Wataniya Airways
BA	British Airways	QI	Cimber Air A.S.
BD	Cambodia Bayon Airlines Limited	QR	Qatar Airways
BE	FlyBE	R3	Joint Stock Company Aircompany Yakutia
BM	flybmi	R6	DOT LT
BT	Air Baltic	RC	Atlantic Airways Faroe Islands
C0	One Caribbean Ltd	S4	SATA International Servicios Et. Trans Aereos, S.A
CF	City Airlines	S7	S7 Airlines
CO	Cobalt	SK	Scandinavian Airlines System
D8	Norwegian Air International Ltd	SM	AIR CAIRO
DC	Braathens Regional Airways AB	SN	Brussels Airlines N.V.
DE	Condor Flugdienst	SU	Aeroflot
DX	Danish Air Transport A/S	T3	Eastern Airways
DY	Norwegian Air Shuttle A.S	TB	TUI fly
EB	Wamos Air S.A.	TG	Thai Airways International
EK	Emirates	TK	Turkish Airlines
ET	Ethiopian Airlines	TP	TAP Portugal
EW	Eurowings	U2	easyJet
FI	Icelandair	UA	United Airlines
FR	Ryanair	US	US Airways
H9	Himalaya Airlines	UU	Air Austral
HS	Heli Securite Helicopter Airline	VF	FlyViking AS
I2	Iberia Express	VY	Vueling Airlines
IB	Iberia	W2	FlexFlight ApS
IZ	Arkia - Israeli Airlines Ltd	W6	Wizz Air
J7	Denim Air ACMI B.V.	W9	Wizz Air UK Limited
JP	Adria Airways	WF	Wideroe'S Flyveselskap A/S
JU	Air Serbia	WU	Jetways Airlines Limited
JZ	Jubba Airways		
KF	Air Belgium SA		
KL	KLM Royal Dutch Airlines		
L5	Atlantique Air		
LF	Corporate Flight Management, Inc		
LH	Lufthansa		
LM	Loganair Limited		

Note: Airlines operating to/from Norway in period 2008 – 2018; source: SRS-database

Attachment 2 / page 1:

Airports; IATA – codes and names

AAL	Aalborg, DK	CDG	Paris-De Gaulle, FR	HOV	Orsta/Volda, NO
AAR	Aarhus, DK	CFU	Kerkyra, GR	HRG	Hurghada, EG
ABZ	Aberdeen, SC, GB	CGN	Cologne-Bonn, DE	HVG	Honningsvag, NO
ACE	Lanzarote, ES	CHQ	Chania, Crete, GR	IAH	Houston-Intercontinental, TX, US
ADB	Izmir, TR	CIA	Rome-Ciampino, IT	IBZ	Ibiza, ES
ADD	Addis Ababa, ET	CMF	Chambery, FR	ICN	Seoul, KR
AER	Sochi, SF, RU	CPH	Copenhagen, DK	IEV	Kiev-Metro, UA
AES	Alesund, NO	CRL	Brussels, BE	INN	Innsbruck, AT
AGA	Agadir, MA	CTA	Catania, IT	INV	Inverness, SC, GB
AGP	Malaga, ES	DBV	Dubrovnik, HR	ISB	Islamabad, PK
AHO	Alghero, IT	DLM	Dalaman, TR	IST	Istanbul, TR
AJA	Ajaccio, Corsica, FR	DME	Moscow-Domodedovo, CF, RU	JFK	New York-JFK, NY, US
ALC	Alicante, ES	DOH	Doha, QA	JSI	Skiathos, GR
ALF	Alta, NO	DTM	Dortmund, DE	JTR	Santorini, GR
AMS	Amsterdam, NL	DUB	Dublin, IE	KBP	Kiev, UA
ANX	Andenes, NO	DUS	Duesseldorf, DE	KBV	Krabi, TH
ARN	Stockholm-Arlanda, SE	DXB	Dubai, AE	KEF	Reykjavik, IS
ATH	Athens, GR	EBJ	Esbjerg, DK	KGS	Kos, GR
AYT	Antalya, TR	EDI	Edinburgh, SC, GB	KKN	Kirkenes, NO
BCN	Barcelona, ES	EFL	Kefalonia, GR	KOI	Kirkwall, Orkney Is., SC, GB
BDU	Bardufoss, NO	EIN	Eindhoven, NL	KRK	Krakow, PL
BEG	Belgrade, RS	EMA	East Midlands, EN, GB	KRN	Kiruna, SE
BER	Berlin, DE	EVE	Evenes, NO	KRS	Kristiansand, NO
BGO	Bergen, NO	EWR	Newark, NJ, US	KSD	Karlstad, SE
BGY	Milan-Orio Serio, IT	FAE	Faroe Islands, DK	KSU	Kristiansund, NO
BHX	Birmingham, EN, GB	FAO	Faro, PT	KTT	Kittila, FI
BIA	Bastia, Corsica, FR	FCO	Rome-Da Vinci, IT	KTW	Katowice, PL
BIO	Bilbao, ES	FDE	Forde, NO	KUN	Kaunas, LT
BIQ	Biarritz, FR	FLL	Fort Lauderdale, FL, US	KWI	Kuwait, KW
BJF	Batsfjord, NO	FLR	Florence, IT	LAS	Las Vegas, NV, US
BKK	Bangkok, TH	FMM	Memmingen, DE	LAX	Los Angeles, CA, US
BLE	Borlange, SE	FNC	Madeira, PT	LCA	Larnaca, CY
BLL	Billund, DK	FRA	Frankfurt, DE	LCJ	Lodz, PL
BLQ	Bologna, IT	FRO	Floro, NO	LCY	London, EN, GB
BMA	Stockholm-Bromma, SE	FUE	Fuerteventura, ES	LED	St. Petersburg, NF, RU
BNN	Bronnoysund, NO	GDN	Gdansk, PL	LGW	London-Gatwick, EN, GB
BOD	Bordeaux, FR	GLA	Glasgow, SC, GB	LHE	Lahore, PK
BOJ	Burgas, BG	GNB	Grenoble, FR	LHR	London-Heathrow, EN, GB
BOO	Bodo, NO	GOT	Goteborg, SE	LIS	Lisbon, PT
BOS	Boston, MA, US	GRO	Gerona, ES	LJU	Ljubljana, SI
BRE	Bremen, DE	GVA	Geneva, CH	LKL	Lakselv, NO
BRS	Bristol, EN, GB	GZP	Gazipasa, TR	LKN	Leknes, NO
BRU	Brussels, BE	HAA	Hasvik, NO	LLA	Lulea, SE
BTS	Bratislava, SK	HAM	Hamburg, DE	LPA	Gran Canaria, ES
BUD	Budapest, HU	HAU	Haugesund, NO	LPI	Linkoping, SE
BVA	Paris, FR	HEL	Helsinki, FI	LPL	Liverpool, EN, GB
BVG	Berlevag, NO	HER	Irakleion, GR	LRH	La Rochelle, FR
BZG	Bydgoszcz, PL	HFT	Hammerfest, NO	LSI	Shetland Islands-Sum, SC, GB
BZR	Beziers, FR	HHN	Hahn, DE	LTN	London-Luton, EN, GB
CAG	Cagliari, IT	CDG	Paris-De Gaulle, FR	LUZ	Lublin, PL

Note: Airports linked by non-stop flight with Norwegian airport in period 2008 – 2018

Attachment 2 / page 2:

Airports; IATA – codes and names

LYR	Longyearbyen, NO	RAK	Marrakech, MA	TSF	Venice-Treviso, IT
LYS	Lyon, FR	RET	Rost, NO	TXL	Berlin-Tegel, DE
MAD	Madrid, ES	REU	Reus, ES	TZL	Tuzla, BA
MAH	Menorca, ES	RHO	Rhodes, GR	TZX	Trabzon, TR
MAN	Manchester, EN, GB	RIX	Riga, LV	VAR	Varna, BG
MCO	Orlando, FL, US	RJK	Rijeka, HR	VAW	Vardoe, NO
MEH	Mehamn, NO	RKV	Reykjavik-City, IS	VBY	Visby, SE
MIA	Miami, FL, US	RNN	Bornholm, DK	VCE	Venice, IT
MJF	Mosjoen, NO	RRS	Roros, NO	VDB	Fagernes, NO
MJV	Murcia, ES	RVK	Roervik, NO	VDS	Vadso, NO
MLA	Malta, MT	RYG	Rygge, NO	VIE	Vienna, AT
MMK	Murmansk, NF, RU	RZE	Rzeszow, PL	VKO	Moscow-Vnukovo, CF, RU
MOL	Molde, NO	SAW	Sabiha Gokcen, TR	VLC	Valencia, ES
MQN	Mo I Rana, NO	SDN	Sandane, NO	VNO	Vilnius, LT
MRS	Marseille, FR	SJJ	Sarajevo, BA	VRN	Verona, IT
MUC	Munich, DE	SJU	San Juan, PR, US	VRY	Vaeroy, NO
MXP	Milan-Malpensa, IT	SKE	Skien, NO	VXO	Vaxjo, SE
NAP	Naples, IT	SKG	Thessaloniki, GR	WAW	Warsaw, PL
NCE	Nice, FR	SKN	Stokmarknes, NO	WMI	Nowy Dwor Mazowiecki, PL
NCL	Newcastle, EN, GB	SKP	Skopje, MK	WRO	Wroclaw, PL
NRN	Nordrhein-Westfale, DE	SOF	Sofia, BG	XCR	Chalons Sur Marne, FR
NRT	Tokyo-Narita, JP	SOG	Sogndal, NO	YYZ	Toronto, ON, CA
NTB	Notodden, NO	SOJ	Sorkjosen, NO	ZAD	Zadar, HR
NVK	Narvik, NO	SPC	Santa Cruz La Palma, ES	ZAG	Zagreb, HR
NYO	Nykoping, SE	SPU	Split, HR	ZRH	Zurich, CH
OAK	Oakland, CA, US	SRP	Stord, NO		
OLA	Orland, NO	SSH	Sharm el-Sheikh, EG		
OLB	Olbia, IT	SSJ	Sandnessjoen, NO		
ORY	Paris-Orly, FR	STN	London-Stansted, EN, GB		
OSD	Ostersund, SE	SVG	Stavanger, NO		
OSL	Oslo, NO	SVJ	Svolvaer, NO		
OSY	Namsos, NO	SVO	Moscow-Sheremetyevo, CF, RU		
OTP	Bucharest, RO	SVQ	Sevilla, ES		
OUL	Oulu, FI	SWF	New York, NY, US		
PDL	Ponta Delgada, PT	SXF	Berlin-Schoenefeld, DE		
PFO	Paphos, CY	SZG	Salzburg, AT		
PHL	Philadelphia, PA, US	SZY	Szymany, PL		
PIK	Glasgow-Prestwick, SC, GB	SZZ	Szczecin, PL		
PLQ	Palanga, LT	TFS	Tenerife-Reinasofia, ES		
PMF	Parma, IT	THN	Trollhattan, SE		
PMI	Palma de Mallorca, ES	TIA	Tirana, AL		
PMO	Palermo, IT	TIV	Tivat, ME		
POZ	Poznan, PL	TLL	Tallinn, EE		
PRG	Prague, CZ	TLN	Toulon/Hyeres, FR		
PRN	Pristina, RS	TLV	Tel Aviv-Yafo, IL		
PSA	Pisa, IT	TMP	Tampere, FI		
PSR	Pescara, IT	TOS	Tromso, NO		
PUY	Pula, HR	TPS	Trapani, IT		
PVD	Providence, RI, US	TRD	Trondheim, NO		
PVK	Preveza/Lefkas, GR	TRF	Sandefjord, NO		

Note: Airports linked by non-stop flight with Norwegian airport in period 2008 – 2018

Attachment 3 / page 1

Citypair	HHI-score Year 2010	2011	2012	2013	2014	2015	2016	2017	2018	Flights 2018	1000' Seats 2018
AAL_OSL	7 181	9 370	4 741	6 088	4 686	8 717	8 750	5 019	5 160	1 434	69.6
AAR_OSL	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	6 893	1 114	74.1
ABZ_BGO	7 357	8 137	10 000	10 000	10 000	10 000	10 000	10 000	10 000	1 110	86.6
ABZ_OSL				10 000	5 557	6 134	5 460	5 496	5 551	886	60.0
ABZ_SVG	3 807	3 744	3 707	3 700	4 082	5 030	5 010	5 195	5 073	2 190	187.8
ACE_OSL	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	56	10.5
AES_ALC			10 000	10 000	10 000	10 000	10 000	10 000	10 000	76	14.1
AES_AMS				10 000	10 000	10 000	10 000	10 000	10 000	1 162	105.0
AES_BGO	10 000	8 726	6 025	6 828	7 349	6 553	6 724	6 711	6 423	2 579	238.7
AES_FRO								10 000	10 000	71	2.8
AES_GDN				10 000	10 000	10 000	10 000	10 000	10 000	570	126.8
AES_KSU								10 000	10 000	259	10.1
AES_KUN								10 000	10 000	208	46.0
AES_OSL	5 059	5 024	5 117	5 110	5 075	5 037	5 022	5 013	5 013	5 799	926.3
AES_TRD	10 000	8 332	5 470	9 033	10 000	10 000	10 000	8 359	7 579	1 238	104.3
AGP_BGO	10 000	10 000	10 000	5 897	10 000	10 000	10 000	10 000	10 000	272	50.6
AGP_HAU	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	124	23.4
AGP_OSL	5 639	5 407	5 300	5 392	5 629	5 691	5 879	6 066	5 934	2 117	386.0
AGP_SVG	10 000	10 000	6 026	5 429	10 000	10 000	10 000	6 348	10 000	204	37.9
AGP_TRD	10 000	10 000	10 000	5 003	10 000	10 000	10 000	10 000	10 000	152	28.3
AGP_TRF	10 000	10 000	5 072	5 014	5 004	5 038	5 021	5 320	5 408	460	86.4
ALC_BGO	5 866	6 111	6 228	5 899	5 808	6 614	6 758	6 305	6 307	540	98.5
ALC_BOO									10 000	70	12.4
ALC_HAU	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	132	24.9
ALC_KRS	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	76	10.7
ALC_OSL	5 024	5 308	5 054	5 067	5 163	5 104	5 292	5 240	5 320	2 386	434.0
ALC_SVG	5 337	5 597	5 406	5 497	6 281	6 159	5 947	6 392	6 234	442	79.0
ALC_TOS				10 000	10 000	10 000	10 000	10 000	10 000	62	11.5
ALC_TRD	5 001	5 124	5 159	5 612	5 584	6 487	6 898	6 821	7 101	276	50.1
ALC_TRF	10 000	6 261	5 060	5 000	5 037	5 479	5 024	5 853	5 319	710	133.4
ALF_HFT	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	103	4.0
ALF_KKN	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	579	22.8
ALF_LKL	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	158	6.4
ALF_OSL	5 010	5 001	5 008	5 001	5 176	5 456	5 045	5 014	5 442	1 619	284.5
ALF_SOJ				10 000	10 000	10 000	10 000	10 000	10 000	249	9.7
ALF_TOS	5 022	3 449	3 397	3 782	3 714	3 420	3 368	3 072	5 028	2 940	190.5
ALF_VDS	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	660	25.7
AMS_BGO	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	2 928	430.3
AMS_KRS	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	1 731	159.8
AMS_OSL	4 785	5 156	5 301	5 247	5 154	4 738	4 543	4 399	4 409	6 060	875.8
AMS_SVG	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	3 229	349.2
AMS_TRD	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	1 791	172.5
AMS_TRF	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	1 414	132.6
ANX_BOO	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	892	35.1
ANX_EVE	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	474	19.8
ANX_SKN	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	76	3.0
ANX_SVJ								10 000	10 000	756	29.5
ANX_TOS	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	1 271	49.8
ARN_BGO	4 014	2 747	3 738	4 178	3 816	3 609	3 581	3 709	3 707	1 370	220.1
ARN_BOO									10 000	60	7.3
ARN_OSL	5 292	5 120	5 233	5 133	5 142	5 289	5 361	4 843	4 592	12 841	2261.7
ARN_SVG		10 000	5 029	10 000	10 000	10 000	10 000	10 000	10 000	353	33.8
ARN_TOS				10 000	10 000	10 000	10 000	10 000	10 000	314	49.0
ARN_TRD	10 000	8 110	10 000	10 000	10 000	10 000	10 000	10 000	10 000	1 129	102.2
ATH_OSL		10 000	10 000	10 000	5 015	5 391	3 734	6 361	5 016	406	71.2
AYT_BGO	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	80	14.9
AYT_OSL	10 000	10 000	10 000	7 777	10 000	10 000	10 000	10 000	10 000	378	70.4
BCN_BGO	10 000	10 000	10 000	5 639	5 264	5 173	5 405	10 000	10 000	124	23.1
BCN_OSL	5 509	5 295	5 123	4 240	4 234	4 636	4 820	4 987	5 078	2 012	361.1
BCN_SVG			10 000	10 000	10 000	5 122	5 035	10 000	10 000	124	23.1

	HHI-score Year										
Citypair	2010	2011	2012	2013	2014	2015	2016	2017	2018	Flights 2018	1000' Seats 2018
BCN_TRD						10 000	10 000	10 000	10 000	124	23.1
BDU_BOO		10 000	10 000					10 000	10 000	116	4.5
BDU_OSL	8 796	9 402	10 000	10 000	10 000	10 000	10 000	10 000	10 000	1 890	351.5
BEG_OSL	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	290	54.0
BGO_BLL	10 000	10 000	5 082	10 000	10 000	10 000	10 000	10 000	7 966	229	14.1
BGO_BOO	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	905	83.3
BGO_BUD								10 000	10 000	172	31.0
BGO_CDG									10 000	430	61.5
BGO_CHQ	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	54	10.0
BGO_CPH	7 306	6 909	7 066	7 253	7 206	6 731	6 359	7 000	7 130	4 078	602.0
BGO_DBV	10 000	10 000		10 000	10 000	10 000	10 000	10 000	10 000	52	9.7
BGO_FAE			10 000	10 000	10 000	10 000	10 000	10 000	10 000	264	34.4
BGO_FCO	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	124	23.1
BGO_FDE	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	870	33.9
BGO_FRO	10 000	10 000	5 360	10 000	10 000	10 000	10 000	10 000	10 000	2 640	103.2
BGO_GDN	10 000	10 000	10 000	10 000	10 000	10 000	10 000	7 460	10 000	636	119.8
BGO_GLA								10 000	10 000	64	3.2
BGO_GOT	10 000	6 619	10 000					10 000	10 000	108	8.4
BGO_HAM	10 000	10 000	10 000	10 000					5 440	170	20.6
BGO_HEL									10 000	460	52.4
BGO_HOV			10 000	10 000	10 000	10 000	10 000	10 000	10 000	371	14.5
BGO_INV									10 000	184	8.6
BGO_KEF	10 000	10 000	10 000	10 000	5 015	5 021	5 003	5 005	5 579	414	69.9
BGO_KRK	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	268	49.8
BGO_KRS	5 753	7 918	6 186	6 842	10 000	10 000	10 000	10 000	10 000	3 126	239.2
BGO_KSU	6 798	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	1 959	109.7
BGO_KTW				10 000	10 000	10 000	10 000	10 000	10 000	208	47.8
BGO_KUN								10 000	10 000	208	37.4
BGO_LGW	7 073	7 224	10 000	6 413	7 851	10 000	10 000	10 000	10 000	1 348	250.7
BGO_LPA	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	186	34.6
BGO_LPL									10 000	80	9.0
BGO_LSI	10 000	10 000	10 000	10 000				10 000	10 000	50	1.7
BGO_MAD									10 000	124	23.1
BGO_MAN			10 000	10 000	10 000	10 000	10 000	10 000	10 000	138	21.2
BGO_MOL	5 005	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	1 875	93.9
BGO_MUC									10 000	118	13.5
BGO_NCE	10 000	10 000	10 000	5 940	10 000	10 000	10 000	10 000	10 000	140	26.0
BGO_ORY	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	124	23.1
BGO_OSL	5 000	5 000	5 000	5 003	5 008	5 001	5 006	5 018	5 024	16 629	2862.4
BGO_PRG	10 000	10 000			10 000	10 000	10 000	10 000	10 000	254	47.2
BGO_RIX	10 000	10 000	10 000	5 416	5 873	10 000	10 000	10 000	10 000	244	43.9
BGO_SOG	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	1 177	45.9
BGO_SVG	4 780	4 974	5 386	5 135	4 910	4 865	4 754	4 724	4 750	7 748	1052.1
BGO_SWF								10 000	10 000	171	32.3
BGO_SXF	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	310	57.7
BGO_SZZ						10 000	10 000	10 000	10 000	208	37.4
BGO_TOS	6 321	10 000	10 000	10 000	10 000	10 000	10 000	10 000	6 704	1 485	153.8
BGO_TRD	5 717	5 057	5 264	5 327	5 646	5 542	5 454	5 390	5 065	4 507	628.3
BGO_TRF	10 000	10 000	5 044	5 000	5 029	6 442	10 000	10 000	10 000	3 485	281.3
BGO_WAW	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	210	37.8
BGY_TRF	10 000	10 000	10 000	10 000				10 000	10 000	270	51.0
BIA_OSL									10 000	50	9.3
BJF_BVG	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	554	21.6
BJF_MEH	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	307	12.0
BJF_VAW	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	806	31.4
BJF_VDS	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	561	21.9
BKK_OSL	10 000	10 000	10 000	6 841	6 032	6 332	6 518	6 669	6 770	830	280.1
BLL_OSL	5 018	5 001	3 923	4 281	4 373	4 332	4 234	4 219	4 131	2 758	265.3
BLL_SVG	10 000	10 000	10 000	10 000	10 000	10 000	10 000		10 000	63	1.9
BNN_BOO			10 000	10 000	10 000	10 000	10 000	10 000	10 000	1 240	59.4

	HHI-score										
	Year									Flights	1000' Seats
Citypair	2010	2011	2012	2013	2014	2015	2016	2017	2018	2018	2018
BNN_OSL	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	315	13.2
BNN_SSJ	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	419	17.5
BNN_TRD	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	2 113	99.9
BOD_OSL	10 000							10 000	10 000	118	22.0
BOJ_OSL	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	144	26.8
BOO_EVE	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	1 418	59.3
BOO_LKN	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	4 081	159.2
BOO_LPA						10 000	10 000	10 000	10 000	56	10.5
BOO_MJF	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	1 220	47.6
BOO_MQN	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	2 065	80.5
BOO_OSL	5 117	5 056	5 126	5 168	5 142	5 273	5 227	5 219	5 127	7 041	1180.8
BOO_RET	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	613	23.9
BOO_SKN	10 000	10 000	10 000	10 000	10 000	10 000	10 000	8 261	10 000	3 239	126.3
BOO_SSJ	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	1 251	51.0
BOO_SVJ	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	3 416	133.2
BOO_TOS	5 806	5 666	5 011	7 302	9 283	9 530	9 586	8 426	9 765	2 853	368.3
BOO_TRD	6 393	5 992	5 332	7 729	9 729	9 723	9 709	9 603	10 000	2 882	378.6
BOO_VRY	10 000	10 000	10 000	5 359	10 000	10 000	10 000	10 000	10 000	1 252	18.8
BRU_OSL	5 026	5 037	5 003	5 003	5 013	5 018	5 000	5 062	5 018	2 580	376.8
BUD_OSL	10 000	10 000	10 000	7 315	10 000	10 000	10 000	10 000	10 000	1 006	187.7
BUD_SVG									10 000	168	30.5
BVG_HFT	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	555	21.6
BVG_MEH	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	253	9.9
BVG_VDS				10 000	10 000	10 000	10 000	10 000	10 000	254	9.9
CDG_OSL	5 045	5 027	5 023	5 033	5 087	5 085	5 110	5 001	3 471	4 031	675.9
CHQ_OSL	10 000	10 000	10 000	10 000	5 484	6 024	10 000	10 000	10 000	238	44.3
CPH_HAU		10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	98	7.6
CPH_KRS	10 000	7 408	10 000	10 000	10 000	10 000	10 000	10 000	10 000	1 620	126.4
CPH_OSL	5 449	5 546	5 630	5 379	5 436	5 396	5 593	5 390	5 250	12 456	2248.8
CPH_SVG	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	3 328	416.4
CPH_TOS									10 000	124	21.4
CPH_TRD	10 000	5 998	5 439	5 706	5 365	5 104	5 089	7 754	10 000	1 617	147.4
CPH_TRF	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	1 584	123.6
DBV_OSL	10 000	10 000	6 841	7 055	7 022	10 000	10 000	10 000	7 096	346	63.2
DBV_TRD	10 000			10 000	10 000	10 000	10 000	10 000	10 000	64	11.9
DOH_OSL		10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	918	238.5
DUB_OSL	5 000	5 001	5 067	5 014	5 089	5 101	5 057	5 009	5 061	1 040	182.1
DUS_OSL	3 877	3 436	4 186	5 098	10 000	10 000	10 000	10 000	10 000	996	144.1
DXB_OSL	10 000	10 000	10 000	10 000	5 712	8 566	10 000	10 000	8 903	813	301.8
EBJ_SVG				10 000		10 000	10 000	10 000	10 000	701	22.0
EDI_OSL	10 000	10 000	10 000	10 000	7 490	7 631	7 435	7 483	7 852	768	141.3
EVE_LPA						10 000	10 000	10 000	10 000	56	10.5
EVE_OSL	5 341	5 225	5 201	5 200	5 366	5 273	5 237	5 253	5 343	4 554	796.5
EVE_TOS	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	1 266	53.2
EVE_TRD	10 000	10 000	10 000	7 411	8 278	8 262	8 001	10 000	10 000	742	59.4
EWR_OSL	10 000	5 003	4 502	5 094	5 113	5 750	7 053	10 000	10 000	724	192.5
FAO_OSL	10 000	10 000	10 000	5 482	10 000	10 000	10 000	10 000	10 000	348	64.8
FCO_OSL	6 117	6 026	5 370	5 223	5 236	5 840	5 837	5 673	6 833	1 190	217.4
FDE_FRO			10 000	10 000	10 000	10 000	10 000	10 000	10 000	256	10.0
FDE_OSL	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	2 940	114.7
FLL_OSL					10 000	10 000	10 000	10 000	10 000	228	69.9
FNC_OSL				10 000				10 000	5 645	146	25.8
FRA_OSL	5 128	5 137	5 182	5 667	5 854	5 970	7 228	7 389	7 461	4 296	736.4
FRA_TOS									10 000	70	9.7
FRO_HOV			10 000	10 000	10 000	10 000	10 000	10 000	10 000	292	11.4
FRO_OSL	10 000	10 000	5 523	10 000	10 000	10 000	10 000	10 000	10 000	1 865	74.6
FRO_SOG								10 000	10 000	440	17.2
GDN_HAU			10 000	10 000	10 000	10 000	10 000	10 000	10 000	486	87.5
GDN_KRS				10 000	10 000	10 000	10 000	10 000	10 000	208	37.4
GDN_OSL	5 102	5 004	5 199	5 160	5 266	5 381	5 391	5 476	6 132	1 108	197.1

	HHI-score Year									Flights	1000' Seats
Citypair	2010	2011	2012	2013	2014	2015	2016	2017	2018	2018	2018
GVA_OSL	10 000	10 000	10 000	6 906	4 833	6 818	10 000	7 068	5 838	434	77.6
GZP_OSL			10 000	10 000	10 000	10 000	10 000	10 000	10 000	190	33.2
HAA_HFT	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	861	33.6
HAA_TOS	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	863	33.7
HAM_OSL	5 573	5 797	5 763	4 527	4 933	3 048	3 364	2 842	3 694	1 344	212.5
HAM_TRF									10 000	124	23.4
HAU_OSL	5 097	5 029	5 051	5 146	5 143	5 066	5 055	5 042	5 046	4 430	711.2
HEL_OSL	3 663	3 602	3 389	3 523	3 543	3 729	3 932	3 794	4 143	4 928	722.6
HEL_TOS					10 000	10 000			10 000	66	7.5
HFT_HVG	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	1 361	53.1
HFT_MEH	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	253	9.9
HFT_SOJ	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	254	9.9
HFT_TOS	10 000	10 000	10 000	10 000	10 000	10 000	10 000	7 536	10 000	4 620	180.2
HFT_VDS				10 000	10 000	10 000	10 000	10 000	10 000	506	19.7
HOV_OSL	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	3 179	124.0
HOV_SDN		10 000							10 000	299	11.7
HOV_SOG	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	605	23.6
HVG_MEH	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	858	33.5
ISB_OSL	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	50	17.6
IST_OSL	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	1 460	292.1
JFK_OSL				10 000	10 000	10 000	10 000	10 000	10 000	477	145.6
KEF_OSL	5 651	5 084	4 594	4 140	4 037	3 945	4 003	4 000	3 961	2 159	382.2
KKN_OSL	5 193	5 393	5 923	5 986	6 040	5 893	5 203	5 141	5 124	1 859	301.9
KKN_TOS	10 000	6 844	5 162	5 202	5 111	5 002	6 474	10 000	10 000	1 201	52.8
KKN_VAW	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	560	21.8
KKN_VDS	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	1 715	66.9
KRK_OSL	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	858	159.6
KRK_SVG	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	206	38.3
KRK_TRD				10 000	10 000	10 000	10 000	10 000	10 000	310	57.7
KRK_TRF	10 000						10 000	10 000	10 000	790	147.3
KRS_OSL	5 145	5 221	5 302	5 274	5 335	5 260	5 261	5 249	5 165	5 319	881.2
KRS_STN									10 000	158	12.3
KRS_SVG	5 143	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	426	25.8
KRS_TRD			10 000	10 000	10 000	10 000	10 000	10 000	7 284	1 236	104.8
KSU_MOL		10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	287	14.4
KSU_OSL	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	2 359	298.5
KSU_SVG	5 238	10 000	10 000	10 000	5 895	10 000	10 000	10 000	10 000	266	13.3
KSU_TRD		10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	403	16.7
KTW_SVG			10 000	10 000	10 000	10 000	10 000	10 000	10 000	240	52.9
KTW_TRF	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	684	134.9
KUN_SVG								10 000	10 000	296	53.3
LAX_OSL						10 000	10 000	10 000	10 000	232	72.3
LCA_OSL	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	154	28.7
LED_OSL	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	94	4.7
LGW_OSL	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	2 980	554.6
LGW_SVG	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	886	164.8
LGW_TOS	10 000			10 000	10 000	10 000	10 000	10 000	10 000	144	26.8
LGW_TRD	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	496	92.3
LHR_OSL	5 080	5 073	5 033	5 004	5 010	5 000	5 007	5 031	5 088	5 787	940.7
LHR_SVG	10 000	6 266	5 030	5 000	5 000	5 032	5 009	5 420	10 000	1 080	165.9
LIS_OSL	10 000	10 000	10 000	7 801	7 499	7 608	7 246	7 220	7 152	872	164.4
LKL_TOS	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	1 807	77.7
LKN_OSL								10 000	10 000	275	10.7
LKN_RET	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	374	14.6
LKN_SKN								10 000	10 000	241	9.4
LKN_TOS								10 000	10 000	608	23.7
LPA_OSL	5 187	5 410	5 485	5 632	5 865	5 594	5 440	5 518	5 838	1 159	213.6
LPA_TOS						10 000	10 000	10 000	10 000	56	10.4
LPA_TRD		10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	104	19.3
LPA_TRF			10 000	10 000	10 000	10 000	10 000	5 422	10 000	151	28.1

Citypair	HHI-score Year 2010	2011	2012	2013	2014	2015	2016	2017	2018	Flights 2018	1000' Seats 2018
LUZ_TRF				10 000	10 000	10 000	10 000	10 000	10 000	228	46.6
LYR_OSL	10 000	10 000	10 000	5 394	5 046	5 011	5 002	5 012	5 045	775	138.8
LYR_TOS	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	447	80.3
MAD_OSL					10 000	10 000	7 978	8 533	7 804	668	123.4
MAN_OSL	10 000	7 915	5 038	5 064	5 158	5 351	5 371	5 717	6 124	1 104	186.7
MAN_SVG				10 000	10 000	10 000	10 000	10 000	10 000	196	36.5
MAN_TRF							10 000	10 000	10 000	432	81.6
MCO_OSL					10 000	10 000	10 000	10 000	10 000	124	38.3
MEH_VDS	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	551	21.5
MIA_OSL							10 000	10 000	10 000	138	36.6
MJF_OSL								10 000	10 000	170	6.6
MJF_TRD	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	1 847	72.0
MJV_OSL	10 000	10 000		10 000	10 000	10 000	10 000	10 000	10 000	124	23.1
MLA_OSL	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	86	16.0
MOL_OSL	5 038	5 070	5 040	5 042	5 051	5 028	4 949	5 063	5 093	3 578	576.9
MQN_OSL							10 000	10 000	10 000	408	15.9
MQN_TRD	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	2 241	87.4
MUC_OSL	7 018	5 321	5 214	5 186	4 868	4 989	5 266	5 425	5 022	3 066	524.7
MXP_OSL	5 008	5 491	5 180	5 004	5 070	5 081	5 325	5 520	5 513	842	146.0
NCE_OSL	5 335	5 336	5 095	5 188	5 475	5 638	6 129	6 763	6 572	1 446	261.2
NCE_TRD	10 000	10 000		10 000	10 000	10 000	10 000	10 000	10 000	62	11.5
NCL_SVG	5 002	5 291	5 689	5 978	5 248	10 000	10 000	10 000	10 000	526	20.4
OAK_OSL					10 000	10 000	10 000	10 000	10 000	124	37.9
OLA_OSL	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	1 040	47.8
OLB_OSL	10 000	10 000					10 000	10 000	10 000	132	24.6
ORY_OSL	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	100	18.6
OSL_OSY									10 000	409	16.0
OSL_OTP								10 000	10 000	238	35.3
OSL_PLQ	10 000	10 000	6 426	10 000	10 000	10 000	10 000	10 000	10 000	306	56.9
OSL_PMI	10 000	10 000	5 744	5 931	6 283	10 000	7 460	6 292	6 920	920	166.7
OSL_PRG	5 153	5 009	7 373	5 967	7 805	8 294	10 000	10 000	7 991	1 080	198.6
OSL_PRN						10 000	10 000	10 000	10 000	216	40.2
OSL_PSA	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	6 604	290	52.7
OSL_PUY	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	6 207	194	33.9
OSL_RAK	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	154	28.7
OSL_RIX	6 465	6 151	5 995	6 141	5 731	5 308	5 154	5 239	5 027	2 557	293.3
OSL_RRS	10 000	10 000	6 943	5 402	10 000	10 000	10 000	10 000	10 000	1 212	48.3
OSL_SAW						10 000	10 000	10 000	10 000	543	100.7
OSL_SDN	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	936	36.5
OSL_SJJ				10 000		10 000	10 000	10 000	10 000	70	13.0
OSL_SKN								10 000	10 000	122	4.8
OSL_SOG	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	1 964	76.6
OSL_SPU	10 000	6 999	5 543	5 306	5 029	5 129	5 259	5 000	5 009	612	110.8
OSL_SRP	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	1 350	63.9
OSL_SSJ		10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	265	10.7
OSL_STN							10 000	10 000	10 000	2 004	378.8
OSL_SVG	5 014	5 051	5 060	5 044	5 016	5 025	5 015	5 003	5 000	14 642	2474.6
OSL_SVJ								10 000	10 000	266	10.4
OSL_SVO	10 000	5 528	6 427	10 000	10 000	10 000	10 000	10 000	10 000	1 455	208.1
OSL_SXF	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	2 096	389.9
OSL_SZG	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	64	11.9
OSL_SZZ	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	206	38.3
OSL_TFS	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	274	51.0
OSL_TLL	5 194	5 218	5 464	5 053	5 016	4 373	3 114	4 347	5 270	1 616	200.4
OSL_TOS	5 217	5 210	5 402	5 445	5 288	5 235	5 261	5 240	5 089	9 770	1694.2
OSL_TRD	5 000	5 022	5 017	5 007	5 002	5 006	5 001	4 985	4 975	17 149	2918.4
OSL_TXL	10 000	10 000	10 000	7 545	6 260	10 000	10 000	10 000	5 221	746	120.5
OSL_VCE		10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	222	41.3
OSL_VIE	6 074	6 150	7 390	6 986	6 432	5 990	5 686	5 812	5 426	1 454	199.8
OSL_VNO	10 000	10 000	10 000	10 000	10 000	7 565	3 758	5 696	5 777	1 058	199.0

	HHI-score										
	Year									Flights	1000' Seats
Citypair	2010	2011	2012	2013	2014	2015	2016	2017	2018	2018	2018
OSL_VRN								10 000	10 000	112	20.8
OSL_WAW	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	4 639	1 898	279.5
OSL_ZAG								10 000	10 000	154	15.4
OSL_ZRH	6 028	6 030	5 949	5 866	5 555	5 218	5 076	5 001	5 000	1 626	229.9
OSY_RVK	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	1 065	41.5
OSY_TRD	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	1 260	49.1
OTP_TRF				10 000	10 000	10 000	10 000	10 000	10 000	242	49.0
OUL_TOS								10 000	10 000	104	4.9
PMI_TRF			5 000	5 005	5 694			10 000	10 000	124	23.1
POZ_TRF	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	5 072	486	88.7
RET_SVJ									10 000	237	9.2
RIX_SVG		10 000	10 000	10 000	10 000	7 663	10 000	10 000	10 000	156	11.9
RIX_TRD	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	312	58.0
RIX_TRF	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	438	78.8
RVK_TRD	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	1 271	49.6
SDN_SOG	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	1 115	43.5
SKN_SVJ		10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	247	9.6
SKN_TOS	10 000	10 000	10 000	10 000	10 000	10 000	10 000	7 316	10 000	1 477	57.6
SKP_TRF						10 000	10 000	10 000	10 000	210	37.8
SOJ_TOS	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	1 223	47.7
SPU_TRD								10 000	10 000	74	13.8
SSJ_TRD	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	1 553	63.9
STN_TRF	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	372	70.3
SVG_SXF	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	254	47.2
SVG_SZZ				10 000	10 000	10 000	10 000	10 000	10 000	208	37.4
SVG_TRD	5 335	6 410	10 000	10 000	10 000	10 000	10 000	10 000	10 000	1 793	189.7
SVG_TRF	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	2 082	161.2
SZZ_TRF				10 000	10 000	10 000	10 000	10 000	10 000	238	45.3
TLL_TRD		10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	240	19.5
TOS_TRD		10 000	10 000	5 842	4 757	5 482	5 534	6 100	5 701	330	32.5
TOS_VDS	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	1 270	49.5
TRD_TRF	10 000	10 000	5 019	5 024	5 000	8 571	10 000	10 000	10 000	1 996	174.8
TRF_VNO			10 000	10 000	10 000	10 000	10 000	10 000	10 000	466	107.2
TRF_WAW	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	602	137.8
TRF_WMI			10 000	10 000			10 000	10 000	10 000	648	120.8
TRF_WRO	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	5 006	526	96.8
VAW_VDS	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	862	33.6

Note: table contains only city-pairs that were served in 2018; city-pair-dyads in alphabetic structure - e.g. 'Oslo-Molde' shown as 'MOL_OSL';

Attachment 4

Table 11: City-pairs with 'moderately concentrated markets' in 2018

City-pair	HHI-score	'Available seats'	'Route-type'
MUC-PMI	1895	884 970	Europe
FRA-PMI	2194	1 064 482	Europe
CGN-LPA	2247	155 950	Europe
DUS-LPA	2298	394 543	Europe
JFK-MXP	2342	1 015 633	Intercont.
DUS-PMI	2386	1 642 925	Europe
DUS-TFS	2442	335 841	Europe
LAX-LHR	2444	2 016 500	Intercont.

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