Competition for Connecting Traffic between Europe and Asia among European and Middle Eastern Hubs

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Competition for Connecting Traffic between Europe and Asia among European and Middle Eastern Hubs

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Abstract
The paper presents a methodology to measure hub competition on transfer markets using estimated origin and destination (O&D) traffic data. We study the Europe-Asia market and analyze the competition between the top European hubs and their fast growing competitors from the Middle East.

We observe that most of the analyzed hubs face their top competitors on 70%-80% of their network and serve only less than 5% of their transfer traffic without competition. A substantial share of the total transfer hub traffic (15%-30%), especially in case of smaller hubs, is generated on O&Ds, on which the given hub has a marginal market share of less than 5%. Small hubs are also exposed to more competition than the bigger ones.

The fast growing Middle Eastern hubs rank as one of the strongest competitors to most European hubs in terms of traffic impact, although they rarely rank as top competitors in terms of network exposure. The expansion of the Middle Eastern hubs in recent years increased the competitive pressure on the European hubs and slowed down their growth. However, a large share of the transfer traffic increase through Middle Eastern hubs was a result of market stimulation and growth.

Keywords: Hub competition; air traffic; airline connectivity
1. Introduction

1.1. Motivation

Transfer passenger traffic is one of the key drivers of growth for hubs. It generates a substantial share of traffic of most big airports. Transfer passengers account for more than 30% of the total passenger traffic served at the top hubs airports in Europe. In case of Frankfurt, the share of connecting passengers exceeds 50%. Moreover, the additional traffic from transfer passengers allows hub airports to offer more direct flights that could not be sustained based solely on the local demand. This is particularly the case for the long-haul flights as approx. 60% of all passengers on international flights longer than 5000 km are connecting passengers 1.

Hub connecting traffic has a very competitive nature. Passengers who travel between their origin and destination (O&D) can usually choose from many alternative connections offered by various airlines and hubs that compete on the given O&D. Passengers who choose connections via a given hub can easily switch to alternative connections if carriers that operate other hubs improve their service on a given O&D by e.g. increasing the frequency, improving the temporal coordination of connecting flights or decreasing the price of their connections. Given the importance of hub connecting traffic and its highly competitive nature, it is essential to understand the competitive position of a given hub on the various markets it serves.

The rise of the Middle Eastern carriers in the recent years has significantly changed the competitive landscape for long-haul air travel, in particular between Europe and Asia. Emirates, Qatar Airways and Etihad Airways with their hubs in Dubai, Doha and Abu-Dhabi, as well as Turkish Airlines in Istanbul, build their business models on the transfer long-haul traffic connected via their hubs. As result of their rapid growth and given the competitive nature of connecting traffic, European carriers and hub airports find themselves under increasing competitive pressure. In this study we evaluate the competitive position of top European hubs for the transfer O&D traffic between Europe and Asia vs. Dubai, Doha, Abu-Dhabi and Istanbul and analyze how it evolved in recent years.

1.2. Existing measures of hub competition

A number of studies measure the competitive position of hubs (Allroggen et al., 2015; Bootsma, 1997; Veldhuis, 1997; Burghouwt and de Wit, 2005; Danesi, 2006; Burghouwt, 2007; Burghouwt and Veldhuis, 2006; De Wit et al., 2009; Grosche and Klophaus, 2015; Lee et al., 2014; Malighetti et al., 2008; Paleari et al., 2010; Redondi et al., 2011). Most of them use schedule data and focus on overall hub performance measures such as: number of destinations and frequencies served, average connection times or the number and quality of transfer connections offered by a given hub. In studies that focus on hub connectivity, the quality of transfer connections is typically assessed with schedule related factors such as: number of stops, connection time, circuitry factor, total travel time etc. (see Serydonski et al. (2014) for a discussion on connection building parametrization). Connections that satisfy some predefined minimum quality requirements (e.g. maximum connection time and maximum circuitry factor e.g. (Bootsma, 1997; Danesi, 2006) or maximum perceived travel time e.g. (Veldhuis, 1997; Burghouwt and de Wit, 2005)) are identified and weighted using various functions to form an aggregate connectivity index for a given hub. An overview of existing approaches for measuring hub competitive position is provided in the study of Burghouwt and Redondi (2013).

The measures of hub performance developed in the referenced studies are useful in practical applications such as benchmarking airports (or airlines) or comparing various schedule scenarios. However, most of these measures do not consider which O&Ds are served by which hubs and consequently on which O&Ds hubs directly compete with each other.

To our knowledge, the only measures that focus on the O&D hub competition were proposed by Redondi et al. (2011) and Grosche and Klophaus (2015). Redondi et al. (2011) generated transfer connections between a large set of origins and destinations and calculated the corresponding travel times. Connections significantly slower (e.g. 20%) than the fastest available flight alternative on the given O&D were disqualified as not competitive. Based on the set of qualified, competitive

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1Source: Amadeus Traffic Analytics, 2014
connections the authors identified the O&D served by analyzed hubs and (among other measures) calculated what portion of O&Ds served by a given hub can also be served by its top competitors. They found that the networks of the biggest hubs (world-wide as well as for the selected long-haul markets between Europe, Asia and North America) strongly overlap. According to the study, most big hubs face their top competitor on approx. 75%-85% of their O&Ds. Grosche and Klophaus (2015) used a similar approach but implemented a more complex algorithm to build and identify attractive connections. They focused on the competition between European and Middle Eastern hubs for the long haul traffic from or to the EU states. Both studies found that hubs compete mainly with other hubs located in the same region. In neither of these studies the Middle Eastern hubs ranked as the top competitors of the European hubs.

The referenced works provide a number of additional measures to benchmark hubs on overlapping O&Ds (e.g. average frequency, connection time or routing factor) or on the total market (number of O&Ds, connections, and connected seats). From the practical perspective, these methodologies can be of use for benchmarking purposes, as they allow to identify the key strategic advantages of the analyzed hubs. However, both studies consider all O&Ds served by a given hub as equally relevant, ignoring its potential in terms of addressable passenger demand. As a result, hubs that connect many not necessarily attractive O&Ds are favored over hubs that focus on less, but more important O&Ds.

1.3. Aim, contribution and outline of the study

This paper introduces a methodology for measuring competition between transfer hubs on long-haul markets. In contrast to previous studies that mainly used schedule data, our approach uses estimated traffic data (Amadeus Traffic Analytics). This allows us to better assess the actual competitive position of hubs at the level of individual O&Ds as well as at the overall hub network on a given market.

In this study we focus on the traffic between Europe and Asia and analyze competition between the top European and Middle Eastern hubs. In order to assess the overall competitive environment of the studied hubs, we analyze their total transfer traffic volumes on Europe-Asia as well as their market shares at O&D level. For each hub we calculate its average O&D market share on the entire Europe-Asia market as well as the percentage of its transfer traffic served on O&Ds on which the hub has a dominant (high market share, low competition) or marginal (low market share, strong competition) position.

To evaluate the hub’s network exposure to top competition, we calculate what portion of a given hub’s transfer traffic is served on O&Ds offered also by nonstop flights as well as by other transfer hubs. We identify which other hubs compete for the largest portion of the given hub’s network and determine the top competitors in terms of network exposure. In order to evaluate the strength of competition, we simulate a service quality increase for each competitor of a selected hub and evaluate the corresponding shifts of market shares on all overlapping O&Ds. We calculate the resulting change of hub’s passenger traffic and identify the top competitors of the hub in terms of traffic impact.

We focus on the competitive position of the top European hubs. We calculate their network exposure to competition from the fast growing Middle Eastern hubs as well as the strength of competition in terms of traffic impact and analyze how the competitive position of these hubs evolved in the past several years (2009-2014).

In the next section we briefly introduce the data used in the study. We also explain the methodological approach and the detailed setup of the analysis. In section 3 we provide the results for the top European and Middle Eastern hubs on analyzed Europe-Asia market. In the final section we summarize the key findings of this study, discuss its limitations and highlight points for future research.

2. Data and methodology

2.1. Data and scope market

The study uses Amadeus Traffic Analytics data. This commercial industry data source provides an estimation of the total O&D traffic for any origin and destination city-pair worldwide, split by departure, arrival and connecting airports and operating carriers.
We analyze the long-haul traffic between Europe (28 EU member countries plus Switzerland, Norway and Iceland) and Asia (South and Eastern part of the continent – see figure 1) in June and July 2009-2014. We further focus our study on the top EU hubs (FRA: Frankfurt, AMS: Amsterdam, CDG: Paris Charles De-Gaulle, LHR: London Heathrow, HEL: Helsinki, MUC: Munich and ZRH: Zurich) and their key competitors from the Middles East and Turkey (DXB: Dubai, DOH: Doha, AUH: Abu-Dhabi and IST: Istanbul).

2.2. Hub competition at O&D level

We analyze competition on the O&D level (defined as directional origin and destination city-pair). We consider that two (or more) hubs compete if they serve the same O&D. In figure 2 HUB1 and HUB2 compete on the O&D ORG-DST2 but not on ORG-DST1 or ORG-DST3.

In the case of multi-segment connections we assign the traffic to the hub that serves the longest part of the entire trip. For example, a three-segment connection from Tokyo via Frankfurt and Zurich to Barcelona (TYO-FRA-ZRH-BCN) is assigned to Frankfurt since this hub serves the longest part of the trip (the distance of the part-connection TYO-FRA-ZRH is greater than the distance of FRA-ZRH-BCN).

2.3. O&D relevance and result aggregation

Hubs serve a large number of transfer O&Ds. Obviously, not all O&Ds are equally relevant. There are many factors that may influence the strategic relevance of particular O&Ds for a given hub at a given point in time but generally, the most important O&Ds are those, on which the hub serves most passengers. In this study we assume that the O&D relevance is proportional to the number of passengers served by a given hub in the analyzed period of time. We analyze hub competition on each O&D and aggregate the results for the complete analyzed hub network by weighting each O&D with the number of passengers served on this O&D by the given hub. In figure 3, HUB1 serves 5% of its total transfer traffic volume without competition. It faces one competitor (HUB2) on 70% of its network and two competitors (HUB3 and HUB4) on the remaining 25%.
2.4. Measures of competition

2.4.1. O&D market share

The traffic share captured by each hub reflects their competitive position on each O&D. It is therefore a straightforward measure of competition. A high O&D market share of a given hub implies that the hub serves this O&D with limited competition. Similarly, a low O&D market share indicates that the hub faces a strong competition.

For each hub we calculate its market share per O&D and aggregate the results proportionally to the O&D passenger volume served by this hub. We calculate the hub’s (weighted) average O&D market share and analyze what share of the hub’s transfer traffic volume is served on O&Ds where the hub has a dominant position (market share close to one) or plays only a marginal role (market share close to 0).

2.4.2. Minimum service level and network exposure to competition

For each of the analyzed hubs, we aim to identify which other hubs compete for the largest share of its transfer network. In this analysis it is important to consider only the relevant competitors. A hub that offers poor connections and only accidentally attracts individual passengers on a given O&D can hardly be considered a significant competitor of a hub that serves this O&D with several attractive connections per day and that regularly attracts hundreds of passengers.

In order to identify relevant competitors per O&D, we compare the number of passengers served by the analyzed hub (\(\text{hub}_0\)) and by other hubs that serve the given O&D. We consider that a different hub (\(\text{hub}_i\)) is a relevant competitor of \(\text{hub}_0\) on the O&D only if \(\text{hub}_i\) serves at least \(p\%\) of the passenger volume served by \(\text{hub}_0\). We use 5\% as the base setting of this study. Additionally, we provide the sensitivity analysis for \(p\) set to 1\% and 20\%.

Consider the example in figure 4. One O&D is served by six hubs. The number of passengers served by each hub is 500, 600, 350, 45, 4 and 1 respectively. We analyze competition from the perspective of HUB1. If the parameter \(p\) is set to 5\% then only hubs that serve more than 25 passengers (HUB2, HUB3 and HUB4) will be considered as relevant competitors of HUB1. If \(p\) is set to higher value (e.g. 20\%) then the minimum level of service (traffic volume) that qualifies other hubs as relevant competitors increases.

2.4.3. Impact of competition on hub’s passenger traffic

In the final analysis we focus on the strength of competition between hubs and measure the impact of competition on hubs’ transfer passenger traffic. To measure this impact, we simulate a
service quality increase for each competitor of a selected hub and evaluate the resulting shifts of market shares and passenger flows on all impacted O&Ds served by this hub.

The realized traffic is the result of passenger choices throughout the given booking period so it reflects all service quality factors that influence passenger itinerary selection such as price, frequency, schedule convenience (e.g. travel time, number of stops, connecting time, detour, departure and arrival times), airline preferences, loyalty programs, marketing campaigns and many more). Hence, the estimated, realized passenger traffic \( (Pax_i) \) can be used as a measure of the overall utility \( (U_i) \) of service offered by hubs on each O&D in the analyzed period.

Following the assumptions made in passenger itinerary choice modeling (see e.g. Coldren et al. (2003) and Garrow (2010)) we express the traffic share \( (S_i) \) captured by a given hub as the ratio between the overall utility of all itineraries offered by this hub and the total utility offered on the given O&D. The absolute number of passengers captured by a given hub can be then expressed as the respective utility share multiplied by the total passenger traffic \( (TotalPax) \) on the given O&D in the analyzed period.

\[
Pax_i = \frac{U_i}{\sum U_i} \ast TotalPax
\]  

(1)

If one of the hubs increased the utility of its service on this O&D by a given factor \( (k) \) this would result in a shift of market shares. Assuming no demand stimulation \( (TotalPax \text{ does not change}) \) and the same proportional impact on all other hubs competing on the O&D\(^2\), the expected change of traffic volume after the utility change between the base scenario (0) and the simulated scenario (1) can be calculated as:

\[
\Delta Pax_i = Pax_{i,1} - Pax_{i,0} = \left( \frac{U_{i,1}}{\sum_i U_{i,1}} - \frac{U_{i,0}}{\sum_i U_{i,0}} \right) \ast TotalPax
\]  

(2)

where:

\[
U_{i,1} = (1 + k_i) \ast U_{i,0}
\]

The change of traffic volume on the given O&D is positive for the hub that increased its utility \( (k_i > 0) \) and negative for all other hubs \( (k_i = 0) \).

Consider again the example in figure 4. The O&D is served by six hubs with 500, 600, 350, 45, 4 and 1 passengers respectively. The traffic volumes are used as the base utility \( (U_0) \) to calculate the market shares in the base scenario. Now, assume HUB2 increased its utility by 10%. The market shares would shift as shown in table 1. HUB2 would gain almost 35 passengers and all other hubs would lose passengers proportionally to their initial traffic share.

<table>
<thead>
<tr>
<th>Hub</th>
<th>Pax_{0}=U_0</th>
<th>U share (S_0)</th>
<th>( \Delta U )</th>
<th>U_1</th>
<th>U share (S_1)</th>
<th>Pax_{1}</th>
<th>( \Delta Pax )</th>
</tr>
</thead>
<tbody>
<tr>
<td>HUB1</td>
<td>500</td>
<td>33.33%</td>
<td></td>
<td>500</td>
<td>32.05%</td>
<td>480.77</td>
<td>-19.23</td>
</tr>
<tr>
<td>HUB2</td>
<td>600</td>
<td>40.00%</td>
<td>10%</td>
<td>660</td>
<td>42.31%</td>
<td>634.62</td>
<td>34.62</td>
</tr>
<tr>
<td>HUB3</td>
<td>350</td>
<td>23.33%</td>
<td></td>
<td>350</td>
<td>22.44%</td>
<td>336.54</td>
<td>-13.46</td>
</tr>
<tr>
<td>HUB4</td>
<td>45</td>
<td>3.00%</td>
<td></td>
<td>45</td>
<td>2.88%</td>
<td>43.27</td>
<td>-1.73</td>
</tr>
<tr>
<td>HUB5</td>
<td>4</td>
<td>0.27%</td>
<td></td>
<td>4</td>
<td>0.26%</td>
<td>3.85</td>
<td>-0.15</td>
</tr>
<tr>
<td>HUB6</td>
<td>1</td>
<td>0.07%</td>
<td></td>
<td>1</td>
<td>0.06%</td>
<td>0.96</td>
<td>-0.04</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1500</td>
<td>100%</td>
<td></td>
<td>1560</td>
<td>100%</td>
<td>1500</td>
<td>0</td>
</tr>
</tbody>
</table>

The stronger the competitor is, i.e. higher passenger and utility share, the stronger the impact of such utility increase on the traffic of other hubs. For example, HUB1 would lose almost 20 pax

\(^2\)These simplifying assumptions are never perfectly valid for an actual market change. In this paper however, we use the utility increase simulations mainly as means to quantify the strength of existing competition so the bias is more limited than e.g. in forecasts and evaluations of future schedule scenarios.
if HUB2 increased its utility on this O&D by 10% but HUB1 would be hardly impacted by an analogical utility increase (10%) of HUB5. The proposed approach takes into account not only the strength of competition but also the O&D relevance. Hubs that serve many passengers on the O&D from the above example (e.g. HUB1, HUB3) would lose more passengers (in absolute terms) than hubs for which this O&D is less relevant (e.g. HUB5, HUB6). The simulation of the utility increase is repeated for each of the given hub’s competitors. The corresponding traffic changes are calculated for all impacted O&Ds and summed up for all O&D served by the given hub. The total resulting decrease of passenger volume for the analyzed hub is then used as the aggregate measure of competition and used to determine the strongest competitors of the given hub. It is worth to point out, that although conceptually this approach is based on an evaluation of a simulated market change, it aims to evaluate the strength of the existing competition in the analyzed period.

3. Results

We present results for the top EU hubs and their selected competitors from Middle East, incl. Istanbul on the studied Europe-Asia market. The result section is divided into five subsections. First, we analyze the estimated total hub transfer traffic and the distribution of traffic shares at O&D level to evaluate the overall competitive environment of the analyzed hubs in June and July 2014. Next, we study what portion of the selected hubs’ transfer traffic is served on O&D also offered with nonstop flights. In the further two subsections, we identify the top competitors of the analyzed hubs; first by network exposure and second by traffic impact. Finally we analyze the traffic growth of the analyzed hubs between 2009 and 2014 and discuss the change of the competitive position of the EU hubs vs. their fast growing competitors from the Middle East.

3.1. Overall competitive position and distribution of O&D market shares

Figure 5 shows the estimated number of transfer passengers served per hub on the analyzed market in June and July 2014. DXB is the market leader with almost 700 thousand pax and almost twice the traffic volume of Doha which ranks second. FRA, the biggest EU hub on this market ranks third, ahead of the third Middle Eastern hub: AUH. AMS, CDG and IST follow with roughly 250 thousand pax each and the four other analyzed European hubs HEL, LHR, MUC and ZRH with 160-100 thousand pax. Other EU hubs attract less traffic on the analyzed market and are not further analyzed in this study.

![Figure 5: Estimated number of hub transfer O&D passengers served between Europe and Asia in June and July 2014.](image)

We analyze the competitive environment of each hub in more detail. For each of the analyzed hubs we calculate its traffic share per O&D and aggregate the results on all O&Ds proportionally to the passenger volume served by this hub. We also calculate the (weighted) average O&D market share on all O&Ds the hub serves between Europe and Asia. Finally, we define several intervals of O&D market share: 0%-5%, 5%-20%, 20%-50%, 50%-80%, 80%-95% and 95%-100% and analyze what share of the given hub’s traffic falls into which interval of O&D market share. In general,
a low market share of the hub implies a stronger competition. Hence, the distribution of O&D market shares reflects the overall competitive environment of the given hub.

The average O&D market share of the analyzed hubs in 2014 ranges from 12% (ZRH) to 33% (DXB), see figure 6. Bigger hubs (in terms of traffic volume on Europe-Asia) see a higher average O&D market share than smaller hubs; compare e.g. DXB (33%) with DOH and AUH (22%) or FRA, AMS, CDG, IST (28%-29%) with ZRH and MUC (12%-19%). Higher market share implies less competition, so according to this analysis the smaller hubs face stronger competition than bigger hubs.

Figure 6: Average O&D market share per hub and percentage of hub transfer traffic served per given interval of O&D market share.

Overall, Europe-Asia is a highly competitive market. The portion of hub transfer traffic served on O&Ds where one hub has a dominant position (market share close to one) is very low. Most of the analyzed hubs serve only less than 5% of their traffic on O&Ds where they capture almost all the traffic (95% to 100%). Most of the analyzed hubs serve more than half of their transfer traffic on O&Ds with a market share below 20%. A substantial portion of the hubs’ total traffic (up to 20% in the case of the biggest hubs and more than 25% in the case of smaller hubs) is served on O&Ds with a market share below 5%. This is an important observation. It means that a lot of hubs, especially smaller ones, heavily rely on traffic generated on O&Ds on which they have only marginal market share.

3.2. Network exposure to nonstop competition

Hubs compete for O&D traffic not only with other transfer hubs but also with nonstop services. In figure 7 we present the percentage of hub transfer traffic served on O&Ds on which nonstop flights were available in the analyzed period. To provide more detail we differentiate O&Ds depending on the average daily frequency of nonstop flights (less than one, one to two, two to four, more than four flights per day).

Figure 7: Network exposure to nonstop competition. Percentage of hub transfer traffic served on O&Ds also offered with nonstop services.
The biggest EU hubs, as well as IST are much less exposed to competition of nonstop services than the smaller hubs EU hubs (HEL and ZRH) and the three Middle Eastern hubs. DXB, DOH and AUH compete with nonstop flights for 26%-29% of their transfer traffic, whereas FRA, CDG, AMS, LHR, MUC and IST only for 13%-17%. A substantial share of the transfer traffic of the Middle Eastern hubs (up to 10%) is generated on O&Ds served with two or more nonstop flights per day, compared to approx. 5% in case of the biggest EU hubs and IST.

These figures may be interpreted in terms of exposure to competition but (especially in case of bigger hubs) they also show the ability of hubs to capture traffic from much more attractive nonstop services. From this other perspective, the Middle Eastern hubs show a much higher performance than the top EU hubs.

3.3. Top competitors by network exposure

We calculate what share of analyzed hub networks are exposed to competition of other hubs and identify their top competitors by network exposure. As discussed in section 2.4.2, we aim to consider only relevant competition on each O&D. Only hubs that serve at least p% of the passenger volume of a given focus hub are considered as its competitors on a given O&D. We identify all relevant competitors on all O&Ds served by a given focus hub and aggregate the results for the entire hub transfer network between Europe-Asia proportionally to the passenger volume served by this hub on each O&D.

We set the competition relevance parameter p to 5% in the base analysis and identify the top five competitors for each analyzed hub, see figure 8. The percentages represent the share of the focus hub’s traffic exposed to competition of the given other hub. For example, FRA competes with CDG on 65% of its network, with IST and AMS on 58%, with DXB on 51% and with MUC on 50%.

Figure 8: Top competing hubs by network exposure. Percentage of hub transfer traffic exposed to competition of other hubs. Base parameter setting (p=5%).

The top competitors of most analyzed hubs (in terms of network exposure) are the biggest hubs located in the same region. The top competitor of most EU hubs is in most cases FRA, followed by CDG, AMS, or IST. Each of the three Middle Eastern hubs competes primarily with the other two, then with IST, FRA and CDG or AMS.

This analysis confirms our observations that Europe-Asia is a highly competitive market. Most of the analyzed hubs face their top competitor on 60%-80% of their network and at least three top competitors on more than 50%. The network overlap with the top competitor is comparable for the biggest EU hubs and their Middle Eastern competitors but the EU hubs compete for a high share of their network (e.g. 50%) with more competitors than the Middle Eastern hubs. The network exposure to competition is highest in the case of small European hubs. An extreme case is ZRH that competes with FRA for more than 95% of its network and with other four hubs (IST, CDG, AMS, and MUC) for more than 80%. These observations are in line with the analysis of O&D market share discussed in the previous section.

We repeat the analysis using different settings of the parameter p (1% and 20%) to analyze the sensitivity of results, see figure 9. Obviously, if only stronger competition is considered relevant
(higher p), then the share of traffic exposed to relevant competition of other hubs is lower. In our study, the ranking of top competitors is quite stable and looks similar for all three analyzed settings of p – compare figures 8 and 9. This might be different in practical applications, especially if the analysis would focus on a smaller market (e.g. country or sub-region level instead of a big Asia-Europe market analyzed in this study) or on a detailed trend evolution (e.g. on weekly or on monthly level). In such cases accidental bookings for unattractive connections on voluminous O&Ds may bias the results for the analyzed market. It is therefore recommended to consider a minimal competition relevance level.

Figure 9: Top competing hubs by network exposure. Percentage of hub transfer traffic exposed to competition of other hubs. Results sensitivity depending on the parameter settings (p=1% vs. p=20%).

3.4. Top competitors by traffic impact

The key focus of the network exposure analysis discussed in the previous section was whether a competing hub serves the same O&Ds as the analyzed focus hub or not. We defined a minimum service level using the parameter p to consider only relevant competition but we did not further analyze its strength. In this section we address this issue and calculate what share of transfer passenger traffic the analyzed hubs lose to their competitors. We simulate an increase of 10% in the quality of service (utility) offered by a given competing hub, analyze the shifts of market share and evaluate the impact on passenger traffic of a selected focus hub. Please refer to the section 2.4.3 for the details of the methodological setup.

We present the top five competitors for each analyzed hub, see figure 10. For most of the analyzed hubs, a simulated 10% increase of their top competitor’s service utility leads to a decrease of the hub’s transfer passenger volume by 0.7% to 1.6%. The top competitors of the Middle Eastern hubs are the other two hubs from this region, followed by IST, FRA or BKK (Bangkok). The competition of DXB from the perspective of AUH and DOH is stronger than the competition of DOH or AUH from the perspective of DXB. If DXB increased its utility by 10% the other Middle Eastern hubs would lose 1.3%-1.6% of their transfer traffic. If DOH or AUH increased their utility by 10%, DXB would lose only 0.7%-0.6% of its transfer traffic. This obviously reflects the size disproportion (in terms of passengers served between Europe and Asia) of those hubs, see figure 5. Similar relationship can be observed e.g. for FRA and MUC.

The strongest competitors of most European hubs are FRA and DXB, followed by AMS, CDG and IST. DXB counts as one of the top three competitors of all analyzed EU hubs and it is the top competitor of FRA and LHR. Note that none of the Middle Eastern hubs appeared as the top competitor of the EU hubs in terms of network exposure (compare previous section). This means that the European hubs compete with the Middle Eastern hubs on less markets than with other European hubs, but the competition of the Middle Eastern hubs (in particular DXB) is relatively stronger and has a higher impact on their traffic volumes.

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[3] An increase by a different factor leads to very similar results. For example, if we simulate an increase of 5% instead of 10%, then the resulting traffic impact is approx. 50% lower for each hub.
3.5. Evolution of the competitive position of the EU hubs vs. their Middle Eastern competitors in years 2009-2014

The competitive position of the analyzed hubs changed significantly over the past six years. The Middle Eastern hubs grew rapidly between 2009 and 2014 and roughly doubled (DXB, DOH) or even tripled (AUH, IST) their transfer traffic volume on the analyzed market, while the top EU hubs either stagnated (FRA, AMS, LHR, MUC) or grew with a moderate past (CDG, HEL, ZRH) over the same period - see figure 11. The rapid growth of the Middle Eastern hubs incl. Istanbul in the recent years resulted in an increased competitive pressure on the analyzed EU hubs. Below we analyze how the competition between the EU hubs and their selected competitors (DXB, DOH, AUH and IST) evolved from 2009 to 2014 in terms of network exposure and traffic impact.

The network exposure (measured using the base setting of p=5 %) of the analyzed EU hubs to competition of DXB, DOH, AUH and IST increased by 20 to 30 percentage points over the last six years – see figure 12. For example, in 2009 FRA competed with DXB on roughly 30% of its (weighted) O&Ds, while in 2014 this share already exceeded 50%. A similar evolution can be observed for all analyzed EU hubs. The highest increase in case of network overlap was observed in case of AUH (e.g. FRA’s network overlap with AUH increased from 10% in 2009 to almost 40% in 2014). The network exposure of the EU hubs to competition of DXB, DOH, AUH and IST was (in most cases) highest for IST and lowest for AUH, throughout the whole analyzed period between 2009 and 2014. In 2014, the top EU hubs compete with IST on at least 60% of their (weighted) transfer network. The network overlap of the EU hubs with DXB exceeds or at least approximates...
50%, similar with DOH. The overlap with AUH ranges between 30% and 40% in case of FRA, AMS, CDG, HEL and MUC and exceeds 50% in case of LHR and ZRH.

![Figure 12: Percentage of transfer traffic of the top EU hubs exposed to competition of the Middles Eastern hubs and Istanbul. Evolution in years 2009-2014.](image)

Obviously, the competition from Middle East not only increased in terms of network overlap but also intensified in terms of its strength. As in the previous analyzes, we quantify the strength of competition in each analyzed period (June and July in each year from 2009 to 2014) by analyzing shifts of O&D market shares and the corresponding traffic impact resulting from a simulated increase of utility of connections served by a given competitor by 10%. Results are given in figure 13. The strength of competition from DXB, DOH, AUH and IST increased considerably for all analyzed EU hubs between 2009 and 2014. For example, in 2009 a 10% utility increase of DXB’s connections would lead to a decrease of FRA’s transfer traffic by 0.5%, in 2014 it was already almost 0.75%, so 50% stronger than in 2009. For some other EU hubs, the strength of competition with DXB, DOH, AUH or IST even doubled (e.g. HEL vs. DXB, CDG vs. DOH, FRA vs. AUH, AMS vs. IST, ...). DXB is the strongest Middle Eastern competitor of the EU hubs, followed by either by IST or DOH and finally AUH.

![Figure 13: Expected traffic decrease (%) of the European hubs as a result of a simulated increase of the overall service quality of their selected competitors by 10%. Evolution in years 2009-2014.](image)
The proposed approach based on a simulated increase of a selected competitor’s utility by a given factor aims to quantify the strength of hub competition in a given point in time for a given network. It does not reflect the expected future market change (determined by carrier network expansion to certain new destinations, increased frequency on selected routes, timetable repositioning of certain flights within the hub wave structure, demand growth and stimulation and many other factors) so that the results in figures 11 and 13 cannot be directly compared. The expansion of the Middle Eastern hubs incl. IST clearly slowed down the possible growth of the EU hubs but the EU hubs managed to keep their transfer traffic volumes at a comparable level between 2009 and 2014. This means that a very large share of the traffic increase in DXB, DOH, AUH and IST was a result of market stimulation and growth. Only a part of this increased traffic was directly captured from the European hubs. Similar observations were made also by Grimme (2011) who analyzed the competition between European and Middle Eastern hubs for traffic between Asia and Germany using the traffic data from the German statistical office.

3.6. Summary and future research

In this paper we introduced a methodology to measure hub competition on long-haul transfer markets using origin and destination (O&D) traffic data. We studied the competitive position of European hubs vs. their competitors from the Middle East on the Europe-Asia market in June and July 2014 and analyzed how it evolved over the past six years. The study was based on the Amadeus Traffic Analytics data, an industry source of estimated O&D traffic data.

We found that Europe-Asia is a highly competitive market. Most of the analyzed hubs serve more than half of their transfer traffic on O&Ds, on which they have less than 20% market share. A considerable portion of their traffic (15%-20% in case of the biggest European hubs and up to 30% in case of the medium ones) is generated on O&Ds on which the given hub has only a marginal market share. Only less than 5% of the transfer traffic of the analyzed hubs is served without competition. European and Middle Eastern hubs face a similar level of competition. One remarkable exception is the network overlap with nonstop services. The Middle Eastern hubs attract over 25% of their transfer passengers on O&D city pairs connected also with nonstop flights, compared to approx. 15% in case of most of the biggest European hubs.

The top competitors in terms of network exposure are, in most cases, the biggest hubs located in the same region, e.g. Frankfurt, Paris CDG, Amsterdam and Istanbul for the European hubs, Dubai, Doha, Abu-Dhabi and Istanbul for the Middle Eastern hubs. Most hubs face their top competitor on 65%-80% of their network. The top competitors in terms of network exposure are not necessarily the strongest competitors in terms of the impact of competition on hubs’ passenger volume. The European hubs lose more passengers to Middle Eastern hubs (in particular Dubai) than to most other European hubs, even though the Middle Eastern hubs rarely rank as the top competitors of European hubs in terms of network exposure.

The rapid growth of the Middle Eastern hubs in recent years increased the competitive pressure on the European hubs. The percentage of the top European hubs’ transfer O&D traffic exposed to competition of Dubai, Doha, Abu-Dhabi and Istanbul, increased by 20-30 percentage points and in most cases it already exceeds 50%. The strength of competition in terms of traffic impact intensified even more. A large share of the transfer traffic increase through the Middle Eastern hubs was a result of market stimulation and growth. Their expansion did not lead to a decrease of traffic at most European hubs but it slowed down, or even prevented, their growth.

This study has some limitations. First, we considered only competition on an O&D city-pair level. We didn’t take into account the fact that passengers may choose alternative airports in cities well connected to their preferred origin or destination with other modes of transport. For example, passengers from Manchester might choose to start their air trip to Asia from London.

Second, we focused only on passenger numbers. Obviously, various types of passengers have a different value for a hub or an airline (although the value of a given passenger from the perspective of a transfer hub and of an airline can be different). Data sources on detailed revenues are rarely available for such studies but the passenger value can be approximated by e.g. booking/cabin class, distance traveled, or origin and type of trip (travelers of various nationalities spend various amount of money in the transfer retail area). The methodology proposed in this paper can easily be adapted to account for such differences by weighting the passenger numbers with a given factor (e.g. O&D distance).
Third, we used estimated passenger traffic data as a measure of the overall quality of service but we didn’t further examine which factors (price, frequency, hub geographical location, schedule temporal synchronization etc.) influence this quality. Some of those factors can be analyzed by incorporating schedule data, fares or revenues (if available) and combining it with an itinerary choice model in a wider network or schedule planning context, see e.g. Garrow (2010); Goedeking (2010); Grosche (2009). Such analysis would allow not only to measure the exposure and strength of competition but also to identify the competitive advantages of hubs on various markets.

Finally, our study was based on traffic estimations and might involve a certain bias. There is no source available that would provide measured global O&D traffic data on a detailed level so any analysis of total air traffic is limited either to estimations (e.g. provided by e.g. Amadeus, Sabre or IATA) or to measured data sources that cover only a part of the market (e.g. booking data from Global Distribution Systems, or carriers’ own data). Therefore, in practical applications analysts and policy makers should aim to use various sources to validate results based on their sources of traffic data.

References


