How to assess the percentage of transfer passengers at airports?

Discussion Paper

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1. Abstract

Data on the percentage of transfer passengers at airports are hardly available from official sources. However, such information can be useful for various analyses, such as assessments of airport cost drivers, lobbying and policymaking, or just airport categorization. We show how so-called segment split data provided by the Sabre-ADI (Airport Data Intelligence) database, which are compiled from MIDT booking data and estimates for non-CRS bookings, can be used to estimate transfer rates at the airport level. Hereby, segment-split means that the total of departing passengers at the airport level can be split by local, beyond, behind and bridge passengers. While the former two groups of passengers do not change planes at all, or at other airports only, the latter two are counted as transfer passengers at the airport in question. We briefly discuss the reliability of the Sabre-ADI dataset and then conclude with a short use case showing the development of the transfer rate over time at selected airports.

2. Background & Research Question

Data on on the share of transfer passengers at the airport level can be of use for the researcher, practicioner, policymaker or lobbyist on many occasions. Apart from hub definition and airport categorization in general, there are a number of issues in different contexts for which information on an airport's transfer rate may be needed:

- Airport management and economics: Does the share of transfer passengers impact on the structure or level of airport costs and/or of (non-aeronautical) revenues? (see e.g. Kanafani/Ghobrial (1985);
- Airport design: To what extent should an airport's infrastructure be designed to meet the demands of transfer passengers? (De Neufville/ Rusconi-Clerici, 1978);
- Simulation of airport processes;
- Airline economics: Will a high share of transfer passengers at its main hub have a negative impact on the financial performance of the hub carrier (as it may be argued that hub airline a high share of connecting passengers may be less profitable than those with strong local OD demand from the hub's catchment)?;
- Airport or airline market power analyses: Hub operations with a high transfer rate, i.e. with a relatively small number of local passengers, might be more exposed to competition than those with a higher share of passengers originating from the airport's catchment (Maertens, 2012);
- Policymaking and lobbying: Certain groups that advocate against capacity extensions at hubs might refer to the transfer rate to show that high percentages of the noise emissions come from connecting traffic which would not serve the local catchment (often forgetting to mention that local hub catchments usually benefit from the large choice of direct flights, though).

Compared to other industries, the air transport sector is relatively well covered by statistical sources. Examples include e.g. passenger numbers on the route or airport levels provided by Eurostat, ICAOdata, the German Federal Statistical Office or the British CAA, and global airline schedules available from OAG (Official Airline Guide) or Innovata.

Regular data on the share of transfer passengers on the airline or airport level, in contrast, is usually not revealed (see e.g. Redondi/Malighetti/Paleari, 2012), although the odd publication like e.g. Civil Aviation Authority (2008) or early contributions from De Neufville/Rusconi-Clerici (1978) or Kanafani/Ghobrial (1985) show selected data for isolated years or regions. Hence, researchers that examine e.g. the performance of airports often have to rely on own assumptions for the shares of connecting passengers, or on figures that may sometimes be provided by airports themselves, e.g. in annual reports or online (see e.g. Munich Airport, 2015).

In this paper, we present an alternative approach for the estimation of the percentage of transfer passengers at the airport level, using so-called "segment-split" data available from the "Sabre Airport Data Intelligence" (short: Sabre-ADI) database as basis. This database can be used both by industry stakeholders (like airports, airlines and consultants) and research institutions for market analyses.

3. The Sabre-ADI dataset

On its website, the web-based Sabre-ADI database is promoted as "leading solution for aviation passenger intelligence", offering "the most accurate and comprehensive collection of global passenger data and schedule information in the market today" (Sabre Airline Solutions, 2015). It uses validated raw bookings MIDT (market information data tapes) data from CRS (incl. Sabre, Travelport and Amadeus) at PNR (passenger name record) transaction level as its main source of data, combined and adjusted with data from external sources including IATA, RATI/Flightglobal, US DOT T100/, DOT T/1/2/3, DB1B or Eurostat, and with estimations for direct bookings and charter operations.[1]

Available outputs contain:

- Segment statistics: monthly passenger numbers and average fares on the segment airport/country/region pair level, airline (operating, marketing), cabin class, booking class; split by local, behind, beyond and bridge passengers;
- OD statistics: monthly passenger numbers and average fares by OD airport/country/region pair, airline (operating, marketing), cabin class, booking class; split by point of sale, intermediate airports (up to three), point-of-origin airport, point-of-sale to zip code level
- Future booking data;
- Capacity statistics;
- Flight schedules (provided by Innovata)

[1] Source: Non-public customer presentation on the newest Sabre-ADI product, held in June 2015.

4. Transfer rate estimation based on segment passenger split figures

The 'segment split' data from the ADI database can be used as basis to estimate the percentage of transfer passengers at the airport level.

For each airport, the database is capable of providing departing segment passenger numbers. These split in the following four categories as shown for the sample airport Düsseldorf (DUS):

a) **Local passengers:** Passengers flying locally on an "isolated" segment out of DUS, e.g. **DUS-AUH**. They do not change planes at all.
b) **Beyond passengers:** Passengers whose air journey starts in DUS and who will change planes at the segment destination, e.g. **DUS-AUH**-HKT-(XXX). They do not change planes at DUS.
c) **Behind passengers:** Passengers who start their air journey elsewhere, change planes at DUS and continue from DUS on their last segment of the trip, e.g. (XXX)-CPH-**DUS-AUH**.
d) **Bridge passengers:** Passengers who fly from DUS elsewhere, with at least one additional beyond and behind segment each, e.g. (XXX)-CPH-**DUS-AUH**-HKT-(XXX).

For each airport, Sabre-ADI can provide the aggregated monthly, quarterly or yearly amounts of local, beyond, behind and bridge passengers respectively. Further splits by airline, booking class, etc. are possible. In all cases, flights combined in separate bookings ("self-made hubbing") cannot be analysed, as it is impossible identifying that these bookings are connected.

Using the Sabre-ADI segment split outputs, airport-specific transfer rates may be calculated as follows:

$$t_{X,Y} = \frac{pax\_beh_{X,Y} + pax\_br_{X,Y}}{pax\_all_{X,Y}} = \frac{pax\_beh_{X,Y} + pax\_br_{X,Y}}{pax\_loc_{X,Y} + pax\_bey_{X,Y} + pax\_beh_{X,Y} + pax\_br_{X,Y}}$$

with:
$t_{x,y}$: percentage of transfer passengers at airport X in the year Y
$pax\_all_{X,Y}$: all departing terminal passengers at airport X in the year Y
$pax\_loc_{X,Y}$: local passengers at airport X in the year Y
$pax\_beh_{X,Y}$: behind passengers at airport X in the year Y
$pax\_bey_{X,Y}$: beyond passengers at airport X in the year Y
$pax\_br_{X,Y}$: bridge passengers at airport X in the year Y

For Düsseldorf, the segment split figures for 2014 as reported by Sabre-ADI are as shown in Table 1:

Table 1: Segment split figures for Düsseldorf Airport, 2014

Segment Split	Departing passengers (2014)
Local	7,728,562
Bridge	141,694
Beyond	1,503,757
Behind	1,189,006

Source: Sabre-ADI.

Hence, the calculated transfer rate at Düsseldorf in 2014 amounts to:
(1,189,006 + 141,694) / (7,728,562 + 141,694 + 1,503,757 + 1,189,006) = 12.6%

5. Data quality

The authors have been using the Sabre-ADI database in various research projects, allowing them to perform a number of plausibility checks in comparing e.g. segment data as provided by Sabre-ADI with data from other sources, such as Eurostat or the German Federal Statistical Office. In general, the quality of the Sabra/ADI data seems to be the better for more aggregated queries than for highly disaggregated analyses, like on a small airport or small country level.

While we cannot compare our results with official transfer passenger statistics directly, as EUROSTAT or national statistical offices do usually not provide origin-destination passenger statistics which would allow a breakdown into local, behind, beyond and bridge passengers, we have conducted a small plausibility check of the segment figures reported by Sabre-ADI. For this purpose, the table in Annex 1 shows the deviations between Sabre-ADI and Eurostat data for EU28 countries and a number of important European airports.

In most cases, Sabre ADI seems to slightly underestimate segment passenger numbers as reported by EUROSTAT, with deviations in the single-digit percentage level. More substantial differences may be explained e.g. by different or unclear definitions of “charter” and “scheduled” traffic or by substantial ticket sales over non-GDS channels on certain routes, which are covered within Sabre-ADI by estimations only.

For this reason, we assume segment passenger figures from Sabre-ADI, and hence our estimates for transfer rates, to be of relatively good quality at least for large hubs dominated by legacy carriers that still tend to sell large proportions of their capacity via traditional sales channels (GDS) which are fully covered by MIDT/Sabre-ADI.

This assumption is also backed by a small sample of data used to compare our results with figures on transfer rates communicated by airports directly, or in other sources (Table 2 - The only airport for which we discovered a full time-series of the share of transfer passengers is Munich). In most cases, the Sabre-ADI estimations are quite in line with externally communicated figures. One possible explanation for deviations could be self-hubbing which might be considered in airport data coming from passenger surveys.

Table 2: Comparison of transfer rates estimated based on Sabre-ADI data with officially communicated figures

Airport	Year	Share of transfer passengers		Other Source
		Sabre-ADI	Other source	
ICN	2013	20.59%	18.50%	CAPA (2015)
ATL	2011	65.53%	69.90%	RICONDO & ASSOCIATES (2012)
SIN	2014	27.07%	30%	Changi Airport Group (2015)
FRA	2014	55.08%	55%	PR Newswire (2015)
RIX	2012	31.25%	35%	Riga Airport (2012, JAN-JUN only)
YYZ	2011	28.55%	27.50%	Greater Toronto Airports Authority (2012)
MSP	2014	42.90%	46%	MSP Airport (2015)
MUC	2014	39.10%	37%	
MUC	2013	37.93%	39%	
MUC	2012	37.84%	39%	
MUC	2011	41.39%	40%	
MUC	2010	38.98%	37%	Munich Airport (2015)

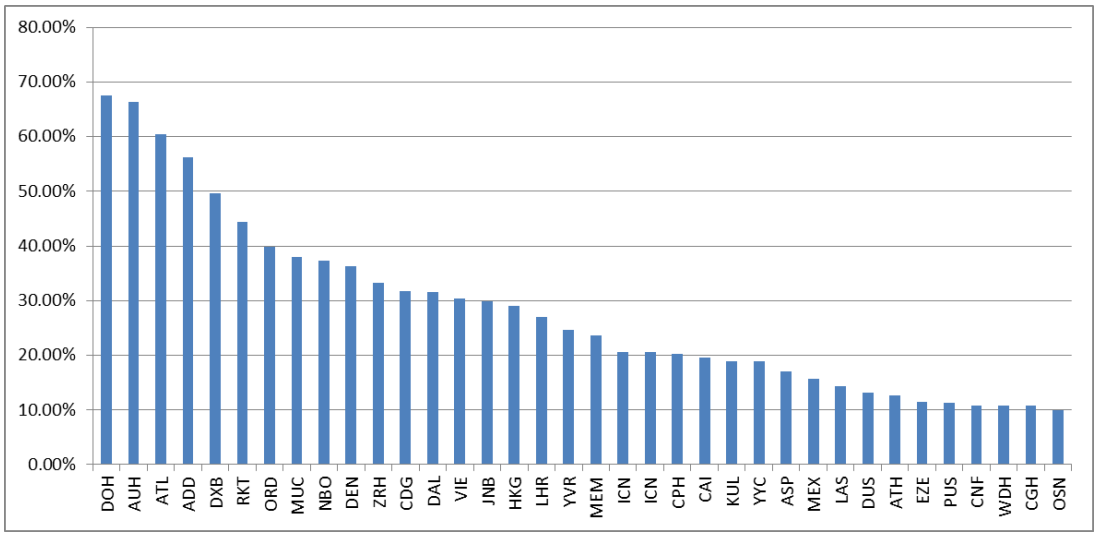
MUC	2009	36.88%	37%	
MUC	2008	37.04%	36%	
MUC	2007	36.92%	35%	
MUC	2006	35.63%	34%	
MUC	2005	35.70%	34%	
MUC	2004	34.16%	33%	

Sources: See column “Other Source”.

6. Transfer rate estimates for selected airports

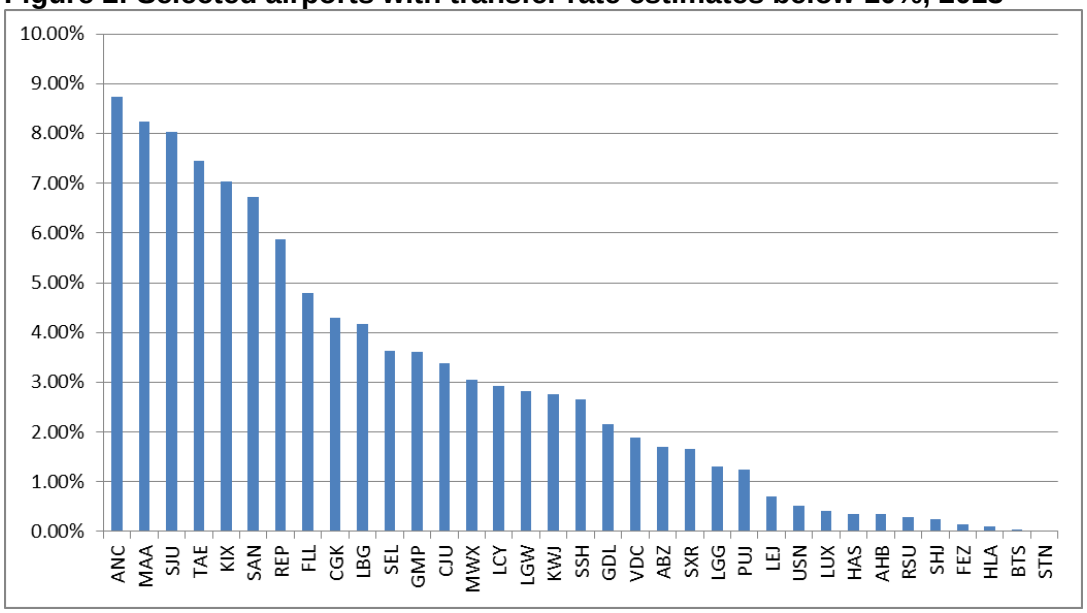
As a first use case, we estimate the transfer rates for a number of randomly selected airports for the year 2013 (see Figures 1 and 2). Among the airports with the highest percentages of transfer passengers are Doha (DOH, 68%), Abu Dhabi (AUH, 66%), Atlanta (ATL, 60%) or Addis Ababa (ADD, 56%). Secondary airports with a still remarkable transfer rate include Las Vegas (LAS, 14%), Düsseldorf (DUS) or Athens (ATH, 13% each). Among the airports with a small transfer rate (<5%) are Fort Lauderdale (FLL, 4.8%), Jakarta (CGK, 4.3%), London Gatwick and City (LGW/LCY; 2.8% and 2.9% respectively) or Luxemburg (LUX, 0.4%). The quality of this airport-level data remains to be analysed in detail. For instance, the result fro Jakarta seems to be relatively low as it serves as main gateway for Indonesia.

Figure 1: Selected airports with transfer rate estimates exceeding 10%, 2013



Source: Sabre-ADI; airport codes see Annex 2.

Figure 2: Selected airports with transfer rate estimates below 10%, 2013



Source: Sabre-ADI; airport codes see Annex 2.

7. Historical development of the share of connecting passengers at selected airports

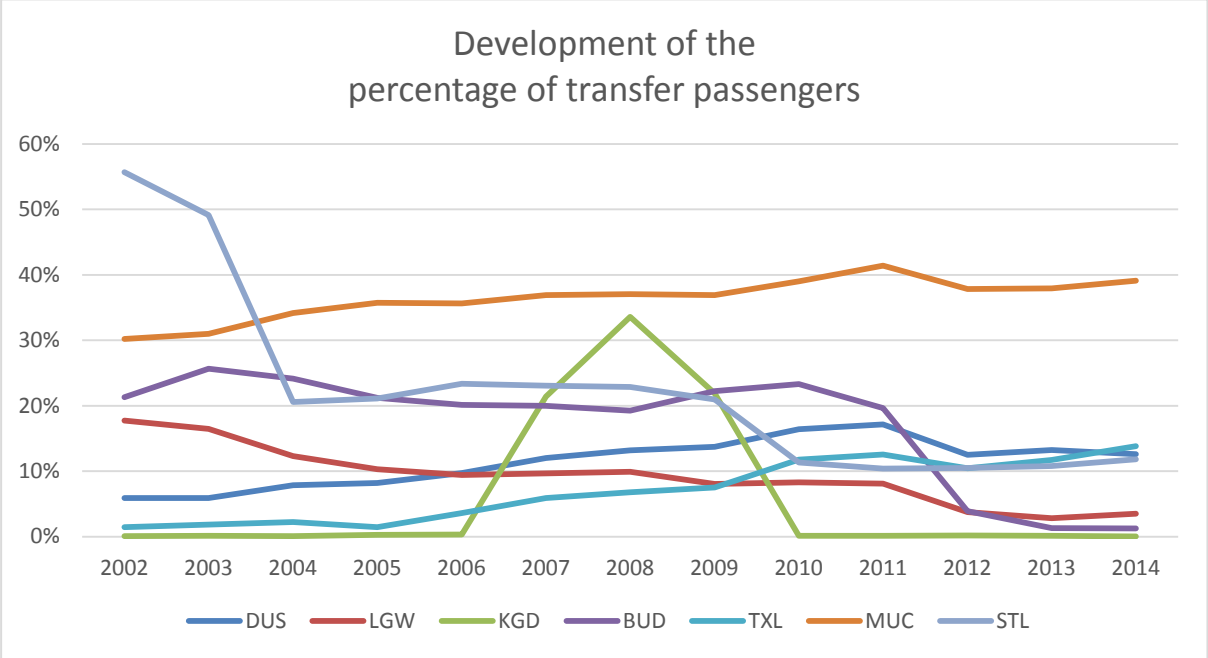
As a second use case, we have a brief look at the long-term (2002-2014) development of the percentages of transfer passengers at seven selected airports: Berlin-Tegel, Budapest, Düsselorf, Kaliningrad, London-Gatwick, Munich, and St. Louis.

We have chosen these airports as we expected their transfer rates to have developed quite differently:

- A declining transfer rate was assumed for Gatwick, St. Louis or Budapest due to reductions of the H&S activities[2]
- Increasing transfer rates due to increased hubbing activities: Berlin-Tegel, Düsseldorf (both due to growing H&S activities of airberlin) and Munich[3]
- Fluctuating shares of connecting passengers: Kaliningrad (due to the rise and fall of KD Avia)

2002 has been chosen as base year since this is the first year included in the Sabre-ADI dataset.

Figure 3: Transfer rates development at Budapest, Düsseldorf, Gatwick, Kaliningrad, Munich, Berlin-Tegel and St. Louis airports, 2002-2014



Source: Own calculations based on Sabre-ADI data.

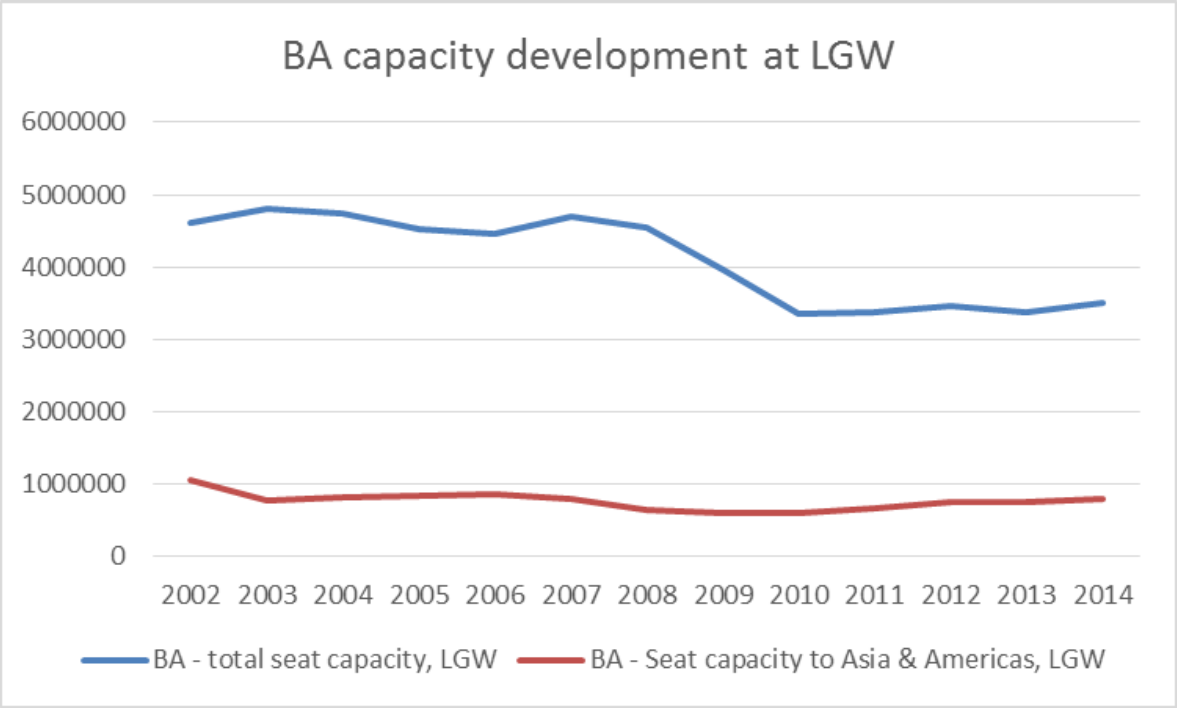
Figure 3 shows the developments of the transfer rates at these airports which are in line with the above expectations: The percentage of transfer passengers at Düsseldorf airport has more than doubled from between 2002 and 2014, with an even stronger growth at Berlin-Tegel. Also Munich airport could strengthen its position as a hub, albeit at a much higher level than Berlin and Düsseldorf.

[2] Other airports with declining transfer rates are supposed to include Paris-Orly (shift of many Air France services to CDG) or Nürnberg (withdrawal of the Air Berlin winter hub).

[3] Other airports with increasing transfer rates are supposed to include Doha (Qatar Airways), Istanbul-Atatürk (Turkish Airlines), Istanbul-Sabiha Gökcen (Turkish Airlines and Pegasus), Riga (airbaltic) and Cologne/Bonn (germanwings).

At Gatwick, the trend is quite contrary. BA's activities have consistenly been reduced, as Figure 4 indicates. Nowadays, Gatwick is dominated by point-to-point traffic offered by LCC.

Figure 4: BA Capacity development at Gatwick, 2002-2014 (seats p.a. on departing flights)



Source: Own calculations based on Sabre-ADI

Kaliningrad has only been playing a major role in European air transport except for the three years 2007-2009 when locally-based and now defunct KD Avia operated a H&S network connecting Western and Northern Europe with places in Eastern Europe.

The collapses of the St. Louis (ex TWA) and Budapest (ex Malev) hubs are also visible in Figure 3.

8. Summary

Data on the percentage of transfer passengers at airports are usually not available from official sources but might be useful for many occasions and analyses, such as assessments of airport cost drivers, lobbying and policymaking, or just airport categorization.

To fill this data gap, we have developed a methodology to derive transfer passenger shares at the airport level from so-called 'segment split data' provided by the Sabre-ADI (Airport Data Inteligence) database. This database, which is compiled from MIDT data and estimates for non-CRS bookings, is widely used by airlines, airports, researchers and consultants for market analyses.

In the 'segment-split module', the Sabre-ADI database can split the total number of departting passengers at the airport level by local, beyond, behind and bridge passengers.

While the former two groups of passengers do not change planes at all, or at other airports only, the latter two are counted as transfer passengers at the airport in question.

Comparisons e.g. with Eurostat indicate that the quality of the Sabre-ADI segment data – and hence our estimations for the transfer rates – should be relatively good.

We conclude in presenting estimations for transfer rates at a randomly selected sample of airports, and with a small case study on the developments of the transfer rates at:

- Munich (continuous rise of the share of connecting passengers)
- Berlin Tegel and Düsseldorf (strongly growing number of transfer passengers)
- London Gatwick (continuously declining share of connecting passengers)
- Budapest: sharp decrease of the transfer rate following the Malev collapse
- St. Louis: massive decline of the transfer rates following the closure of the former TWA hub
- Kalingrad (one-off peak due to shortlived H&S activities by KD Avia in the 2007-2009 period).

9. Annexes

Annex 1: Comparison of segment passenger numbers as reported by Eurostat and Sabre-ADI

Data Level	Geographical scope	Departing Segment Passengers (2013)		Difference Sabre ADI compared to EUROSTAT in %
		EUROSTAT (scheduled)	Sabre ADI (scheduled)	
EU	Total EU 28 Member States	610.681.465	590.974.511	-3,2%
Country	Austria	12.460.298	12.113.367	-2,8%
	Belgium	12.473.108	11.996.714	-3,8%
	Bulgaria	2.278.383	2.319.774	1,8%
	Croatia	2.793.736	2.718.693	-2,7%
	Czech Republic	5.312.283	5.150.290	-3,0%
	Cyprus*	2.603.080	2.540.563	-2,4%
	Denmark	13.235.158	13.431.707	1,5%
	Estonia	872.395	870.631	-0,2%
	Finland	8.608.631	8.160.680	-5,2%
	France	81.045.609	72.288.897	-10,8%
	Germany	98.711.881	94.604.058	-4,2%
	Greece	10.771.208	13.477.244	25,1%
	Hungary	4.075.195	4.035.403	-1,0%
	Ireland	11.942.367	11.940.983	0,0%
	Italy	69.564.498	66.402.845	-4,5%
	Latvia	2.311.987	2.328.938	0,7%
	Lithuania	1.596.976	1.639.098	2,6%
	Luxembourg	978.746	936.481	-4,3%
	Malta	1.867.506	1.804.153	-3,4%
	Netherlands	26.920.489	25.867.529	-3,9%
	Poland	10.964.556	10.886.343	-0,7%
	Portugal	15.326.316	14.739.380	-3,8%
	Romania	5.234.988	4.773.077	-8,8%
	Slovakia	529.131	566.598	7,1%
	Slovenia	549.763	513.860	-6,5%
	Spain	84.482.811	82.439.578	-2,4%
	Sweden	19.173.799	18.078.547	-5,7%
	United Kingdom	103.996.567	104.349.080	0,3%
Airport	LONDON/HEATHROW	35.878.730	35.083.587	-2,2%
	PARIS/CHARLES DE GAULLE	30.375.673	28.588.285	-5,9%
	FRANKFURT/MAIN	28.777.200	26.979.415	-6,2%
	AMSTERDAM/SCHIPHOL	24.357.514	23.229.936	-4,6%
	MADRID/BARAJAS	19.588.114	19.090.727	-2,5%
	MUNICH	19.143.345	18.179.439	-5,0%
	ROME/FIUMICINO	17.814.814	16.742.495	-6,0%
	LONDON/GATWICK	15.396.688	14.718.218	-4,4%
	BARCELONA	17.004.839	16.087.870	-5,4%

	PARIS/ORLY	13.897.128	13.383.053	-3,7%
	COPENHAGEN/KASTRUP	11.300.877	11.367.575	0,6%
	PALMA DE MALLORCA	9.737.809	9.591.635	-1,5%
	VIENNA/SCHWECHAT	10.881.396	10.342.532	-5,0%
	DÜSSELDORF	10.173.621	9.560.571	-6,0%

*) Sabre ADI statistics without the airport of Ercan in Northern Cyprus.

Annex 2: Airport Decoding

Airport code	Airport name
ABZ	Aberdeen
ADD	Addis Ababa
AHB	Abha
ANC	Anchorage
ASP	Alice Springs
ATH	Athens
ATL	Atlanta
AUH	Abu Dhabi
BTS	Bratislava
CAI	Cairo
CDG	Paris
CGH	Sao Paulo
CGK	Jakarta
CJU	Jeju
CNF	Belo Horizonte
CPH	Copenhagen
DAL	Dallas
DEN	Denver
DOH	Doha
DUS	Duesseldorf
DUS	Duesseldorf
DXB	Dubai
EZE	Buenos Aires
FEZ	Fez
FLL	Fort Lauderdale
FRA	Frankfurt
GDL	Guadalajara
GMP	Seoul
HAS	Hail
HKG	Hong Kong
HLA	Johannesburg
ICN	Seoul
ICN	Seoul

JNB	Johannesburg
KIX	Osaka
KUL	Kuala Lumpur
KWJ	Gwangju
LAS	Las Vegas
LBG	Paris
LCY	London City
LEJ	Leipzig/Halle
LGG	Liege
LGW	London Gatwick
LHR	London Haethrow
LUX	Luxembourg
MAA	Chennai
MEM	Memphis
MEX	Mexico City
MSP	Minneapolis
MUC	Munich
MUC	Munich
MWX	Muan
NBO	Nairobi
ORD	Chicago
OSN	Osan
PUJ	Punta Cana
PUS	Busan
REP	Siem Reap
RKT	Ra'sal-Khaymah
RSU	Yeosu
SAN	San Diego
SEL	Seoul
SHJ	Sharjah
SIN	Singapore
SJU	San Juan
SSH	Sharm el Sheikh
STN	London Staansted
SXR	Srinagar
TAE	Daegu
USN	Ulsan
VDC	Vitoria Da Conquista
VIE	Vienna
WDH	Windhoek
YVR	Vancouver
YYC	Calgary
ZRH	Zurich

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