



# Airline competition in connecting markets

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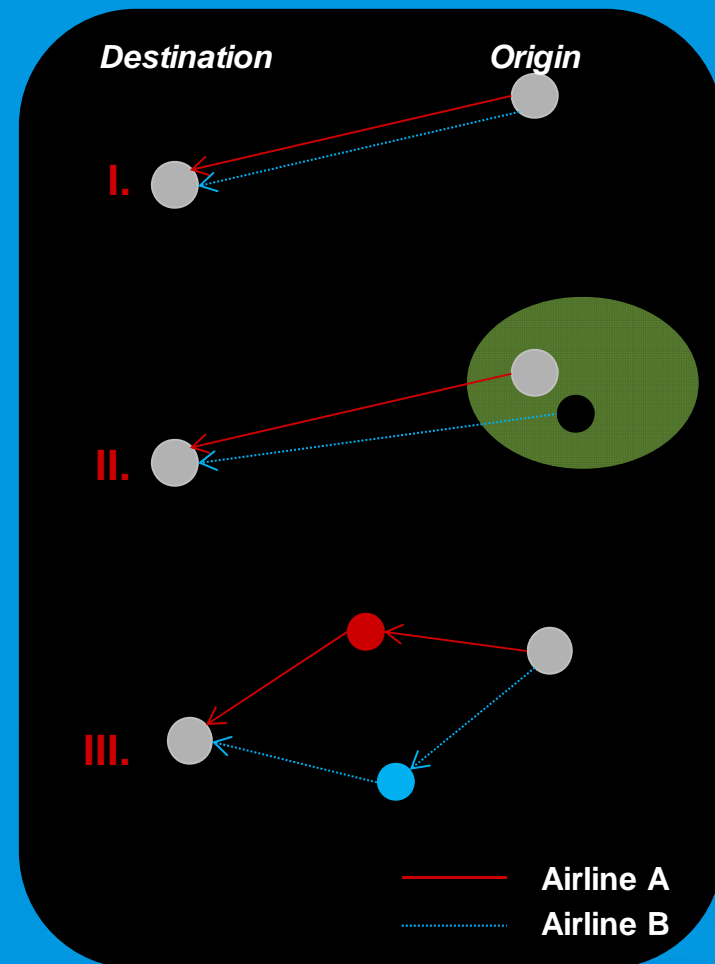
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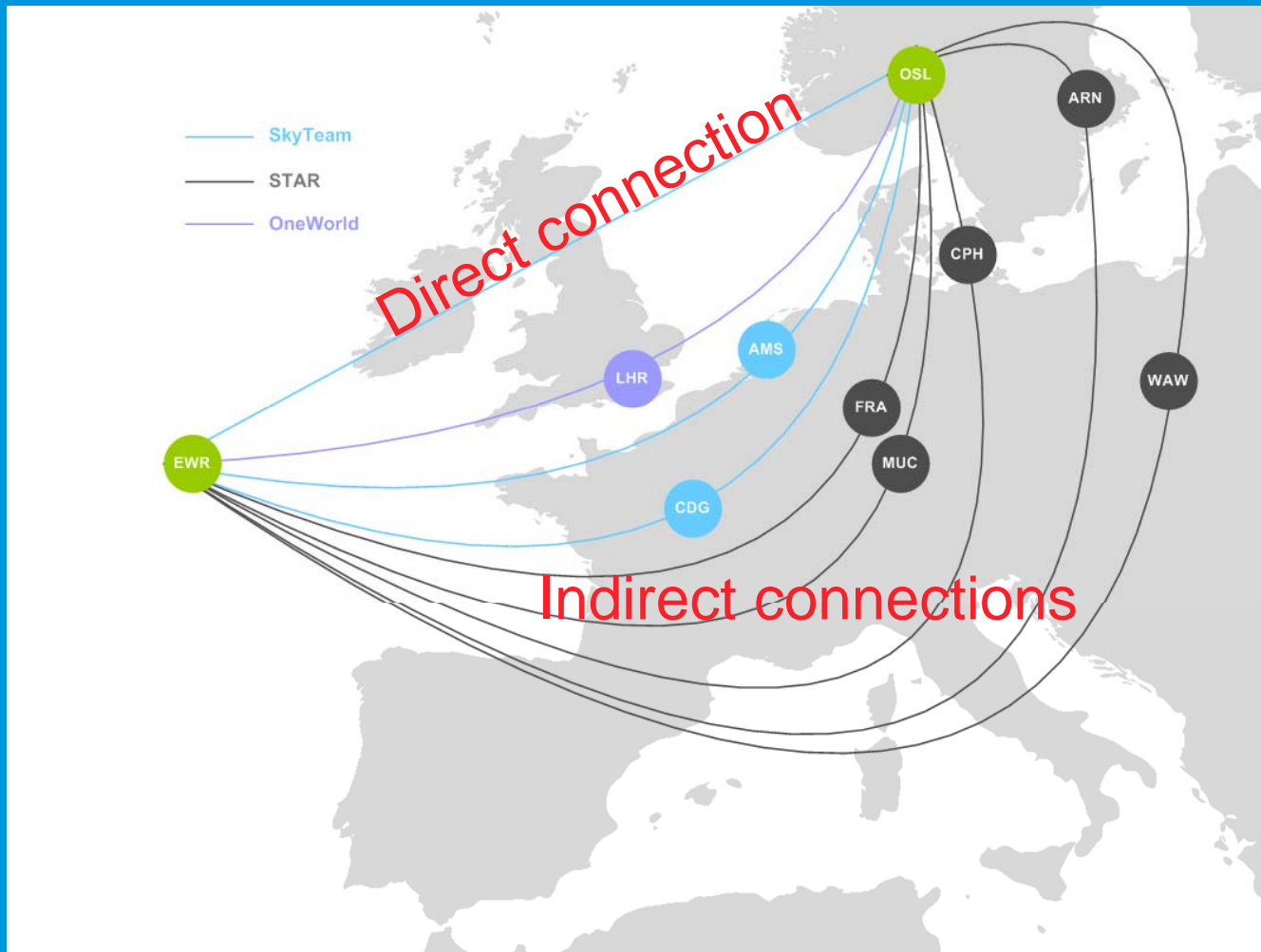
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# Background: airline competition

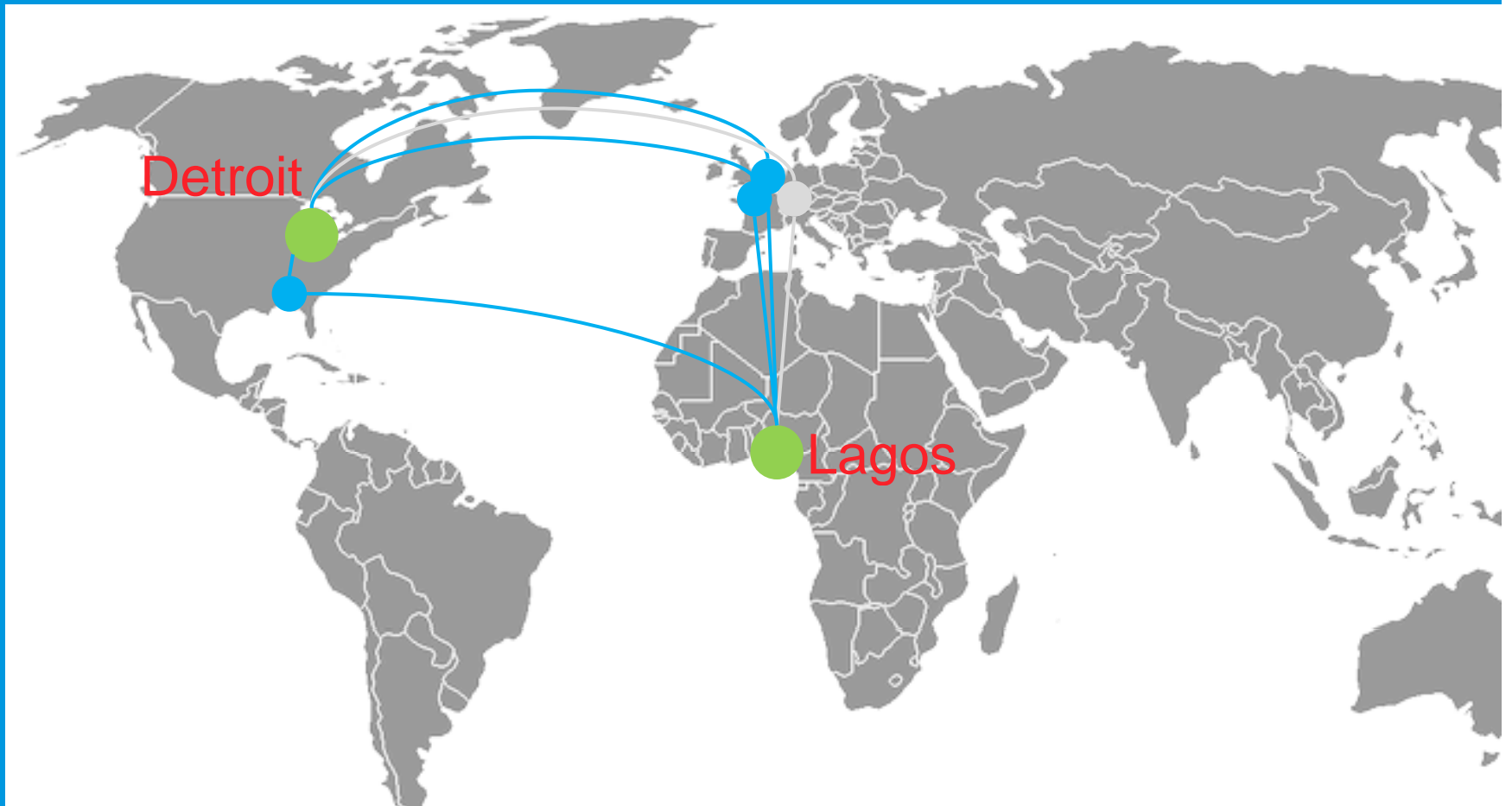
- Hub-and-spoke networks essential feature of many airline networks since deregulation US domestic market (1978)
- HS-networks has changed competition between airlines.
- In a certain origin-destination market, airlines compete..
  - I. direct, head-to-head
  - II. from various airports sharing the same catchment area (hinterland competition) (if any)
  - III. But also indirectly via their hub airports (in connecting markets)



# Direct versus indirect competition: in the NY Newark (EWR) to Oslo (OSL) market, many airlines/hubs compete for the O-D passenger



Whereas in the Lagos to Detroit market, the number of hubs competing is much lower; no direct flights



# Empirical airline competition studies focus mainly on direct and catchment area competition

- **Airline competition in direct markets has been subject of many studies, including:**
  - Development of competition levels in the US domestic market (Borenstein 1992; Abda et al. 2009)
  - Airline concentration at European airports (Frenken et al. 2003)
  - Liberalization and airline competition in Europe (Dobruszkes 2009)
  - Competition in the Amsterdam-London market (Uittenbogaart 1997)
- **Also competition between airports/airlines sharing the same catchment area has received considerable attention:**
  - E.g. Ashford & Benchemam (1987); Cohas et al. (1995); Windle & Dresner (1995); Pels et al. (2003); Hess & Polak (2007); Wilken et al. (2007)
- **Empirical research on competition in connecting markets quite scarce. Exceptions:**
  - Burghouwt & Veldhuis (2006) measure direct and indirect competition between hub carriers in the Transatlantic market
  - GAP (2010). AMS exposure to competition for transfer passengers by CDG, LHR and FRA.
  - Redondi et al. (2010). Hub competition and travel times in the worldwide airport network.



# Research question

**What is the competition level in the connecting markets served by the major European hubs and their home carriers?**



# Outline

- **Delineation of the study**
- **Methodology: measuring competition in direct and indirect markets**
- **Empirical results**
- **Conclusions and further research**



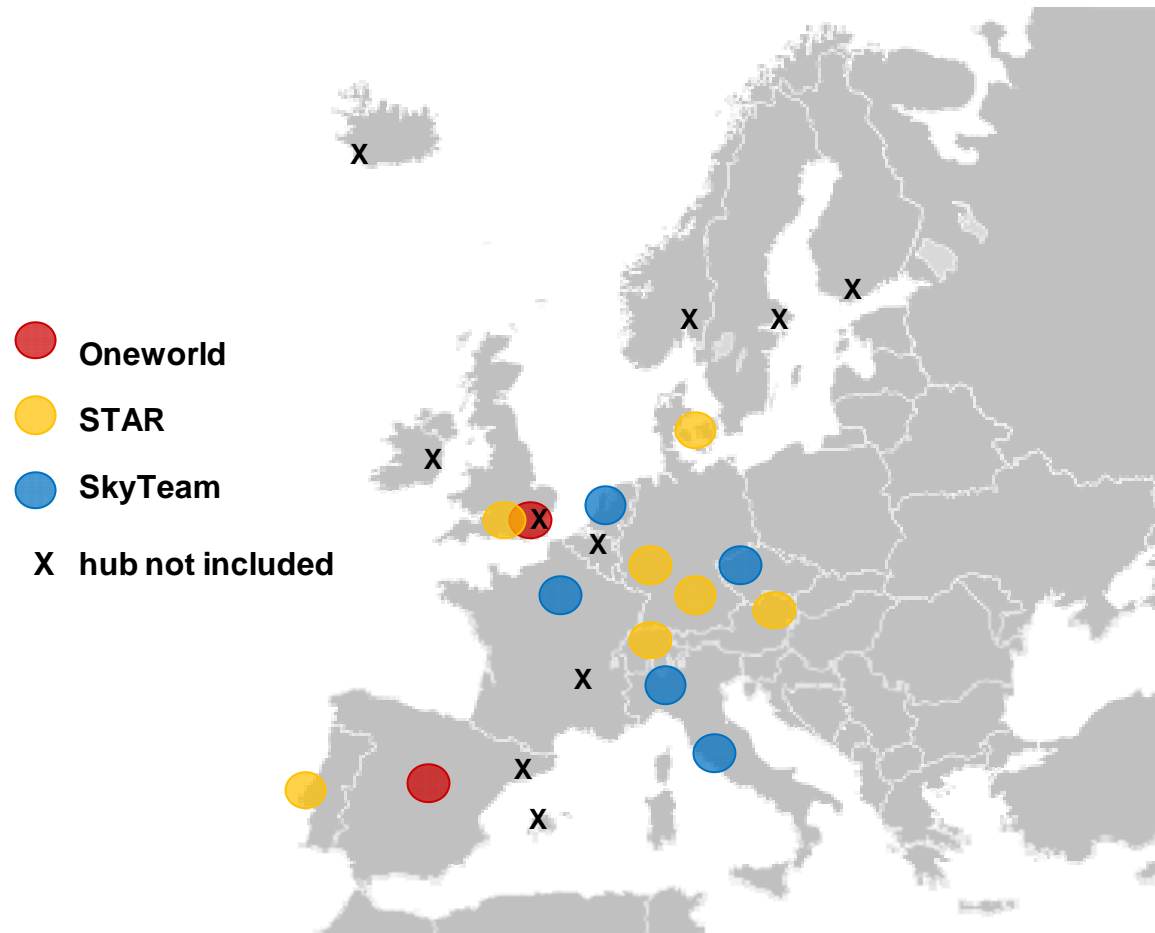
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# Delineation of the research

- **We limit our analysis to the competition levels on connecting routes via 13 major European hubs and their home carriers:**
  - Frankfurt, Heathrow, Schiphol, Paris CDG, Munich, Madrid, Copenhagen, Vienna, Rome Fiumicino, Milan Malpensa, Lisbon, Zurich and Prague
  - These hubs provide >80% of the transfer connections via European hubs
  - Minor hubs such as Brussels, Gatwick, Oslo, Stockholm, Dublin, Barcelona, Palma de Mallorca, Lyon, Reykjavik have not been included
- **Note: competition levels have been calculated by taking into account all possible competing substitutes (European and non-European)**
- **Relevant market: we measure competition for airport-pair markets (e.g. Amsterdam-Bangkok)**
  - City-pair markets subject for future research

# The selection of hubs represents primary gateways of the three worldwide airline alliances in Western Europe



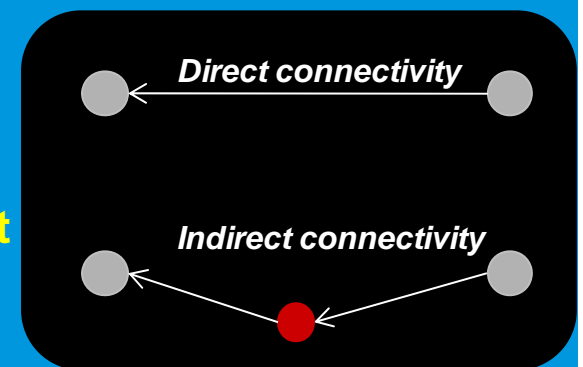


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# How to measure competition between airlines in connecting markets? Input variables

- No demand data on passenger travel available to us to investigate competition levels in indirect (connecting) markets (e.g. MIDT booking data)
- Instead, we measure competition using the level of **connectivity** offered by each airline in a certain market as the input variable
- But how to measure connectivity?
- We determine level of connectivity with the *Netscan* connectivity model
  - See Veldhuis 1997; IATA 2000; Burghouwt & Veldhuis 2006; Matsumoto 2008; Burghouwt et al. 2009; Burghouwt & Redondi 2010
- *Netscan* counts the number of both **direct** and **indirect** connections in a certain market and weighs each connection for its quality





## Methodology: how the Netscan model works

- Netscan assigns quality index to each individual connection, ranging between 0 and 1
- Direct, non-stop connection: quality index of 1
- Indirect connections constructed from OAG flight schedules using algorithm
- Indirect connections have lower quality for the passenger due to detour time and transfer time at the hub
  - Quality index= function of maximum perceived travel time allowed for a certain market and the estimated perceived travel time of the specific connection
  - Perceived travel time depends on theoretical non-stop travel time, transfer time at hub and detour time
  - When quality index is zero, connection is considered to be unviable, i.e. not a realistic choice option for the passenger
- Frequency \* quality index: number of connectivity units (CNU)



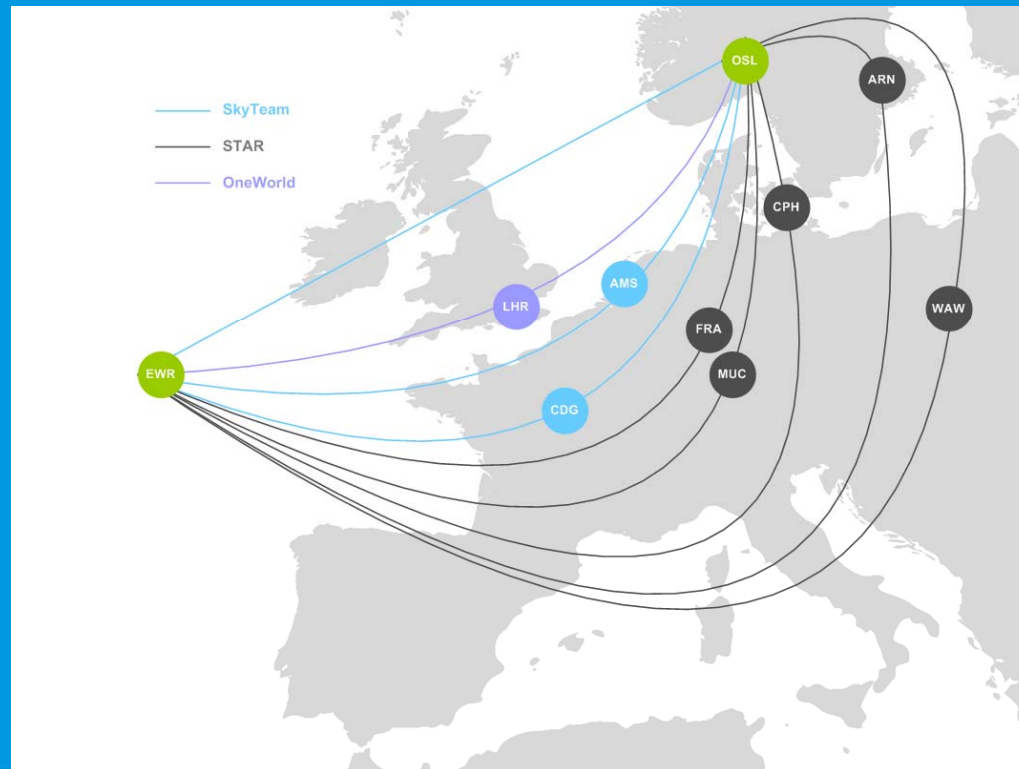
# Methodology: measuring competition using the HHI

- Various measures available to measure concentration in a market: Concentration ratio, Hirschman-Herfindahl Index (HHI), entropy coefficient, Gini index
- In this paper, we use the HHI:
  - A high HHI indicates strong market concentration among one or a few airlines
  - Low HHI indicates weak market concentration

$$HHI_{xy} = \sum_a \left( \frac{\sum_h CNU_{x(h)ya}}{\sum_a \sum_h CNU_{x(h)ya}} \right)^2$$

Where CNU is the number of connectivity units

# Example: what is the competition level in the Newark to Oslo market?



# (1): service levels in the Newark (EWR) to Oslo (OSL) market

Origin	Hub	Destination	Alliance	Frequency
EWR	-	OSL	SkyTeam	7.0
EWR	A'dam	OSL	SkyTeam	35.0
EWR	Paris CDG	OSL	SkyTeam	14.0
<i>Subtotal</i>				<i>56.0</i>
EWR	Arlanda	OSL	STAR	19.0
EWR	Copenhagen	OSL	STAR	22.0
EWR	Frankfurt	OSL	STAR	20.0
EWR	Munich	OSL	STAR	6.0
EWR	Warsaw	OSL	STAR	3.0
EWR	Lisbon	OSL	STAR	7.0
<i>Subtotal</i>				<i>77.0</i>
EWR	Heathrow	OSL	OneWorld	14.0
<i>Subtotal</i>				<i>14.0</i>
<b>Total</b>				<b>147.0</b>

Source: OAG, 3rd week June 2008; Netscan

## (2) Market shares in the Newark (EWR) to Oslo (OSL) market

Origin	Hub	Destination	Alliance	Frequency	Con. units	Share
EWR	-	OSL	SkyTeam	7.0	7.0	12%
EWR	A'dam	OSL	SkyTeam	35.0	14.1	23%
EWR	Paris CDG	OSL	SkyTeam	14.0	5.0	8%
<i>Subtotal</i>				<i>56.0</i>	<i>26.2</i>	<i>43%</i>
EWR	Arlanda	OSL	STAR	19.0	8.9	15%
EWR	Copenhagen	OSL	STAR	22.0	8.6	14%
EWR	Frankfurt	OSL	STAR	20.0	6.8	11%
EWR	Munich	OSL	STAR	6.0	3.7	6%
EWR	Warsaw	OSL	STAR	3.0	1.2	2%
EWR	Lisbon	OSL	STAR	7.0	0.0	0%
<i>Subtotal</i>				<i>77.0</i>	<i>29.2</i>	<i>49%</i>
EWR	Heathrow	OSL	OneWorld	14.0	4.8	8%
<i>Subtotal</i>				<i>14.0</i>	<i>4.8</i>	<i>8%</i>
<b>Total</b>				<b>147.0</b>	<b>60.2</b>	<b>100%</b>

Source: OAG, 3rd week June 2008; Netscan

# (3) Concentration in the Newark (EWR) to Oslo (OSL) market

Origin	Hub	Destination	Alliance	Frequency	Con. units	Share
EWR	-	OSL	SkyTeam	7.0	7.0	12%
EWR	A'dam	OSL	SkyTeam	35.0	14.1	23%
EWR	Paris CDG	OSL	SkyTeam	14.0	5.0	8%
<i>Subtotal</i>				56.0	26.2	43%
EWR						15%
EWR						14%
EWR						11%
EWR						6%
EWR	Warsaw	OSL	STAR	3.0	1.2	2%
EWR	Lisbon	OSL	STAR	7.0	0.0	0%
<i>Subtotal</i>				77.0	29.2	49%
EWR	Heathrow	OSL	OneWorld	14.0	4.8	8%
<i>Subtotal</i>				14.0	4.8	8%
<b>Total</b>				<b>147.0</b>	<b>60.2</b>	<b>100%</b>

$$HHI_{EWR-OSL} = \left( \left( \frac{26.2}{60.2} \right)^2 + \left( \frac{29.2}{60.2} \right)^2 + \left( \frac{4.8}{60.2} \right)^2 \right) = 0.43$$

Source: OAG, 3rd week June 2008; Netscan

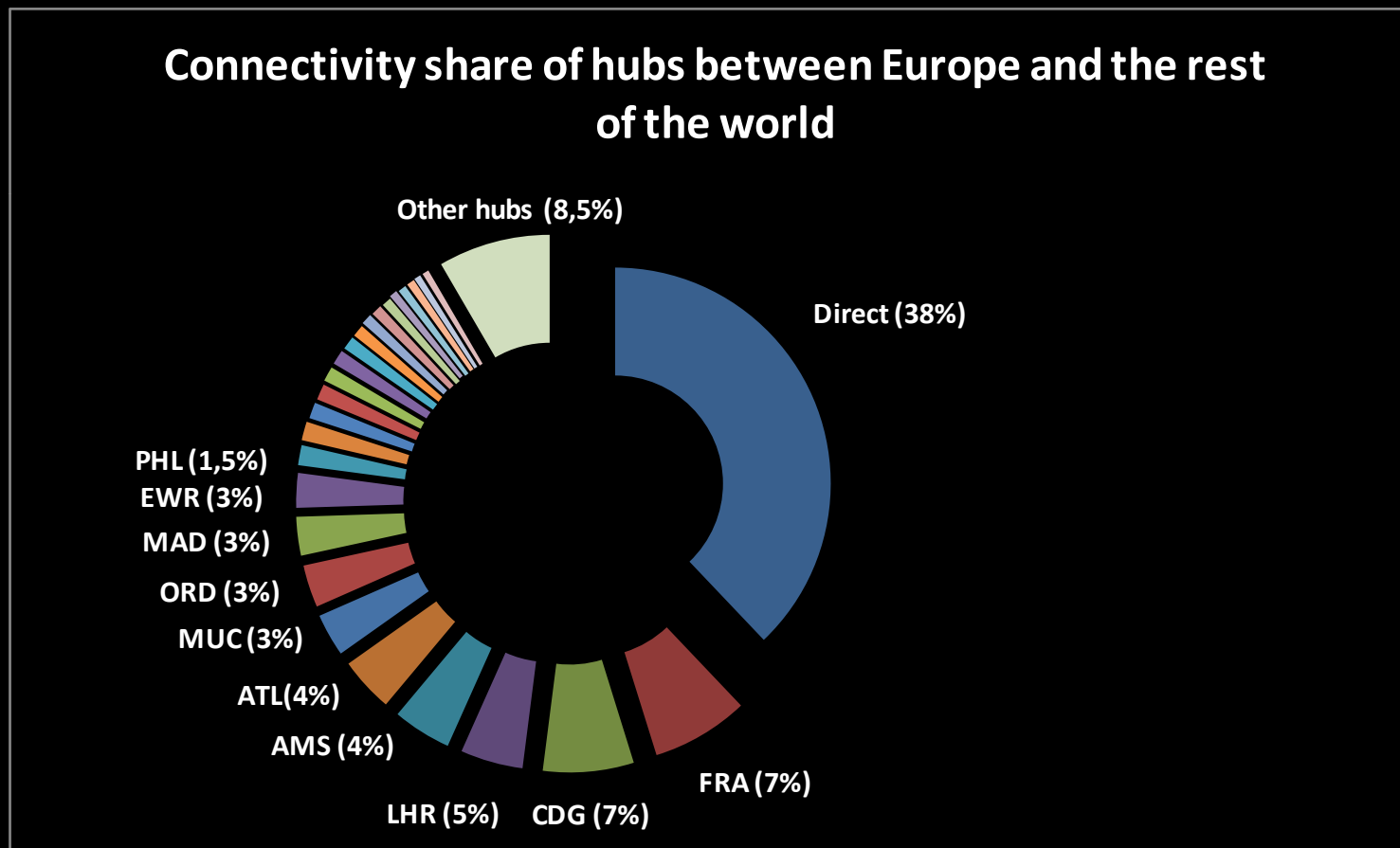


# Outline

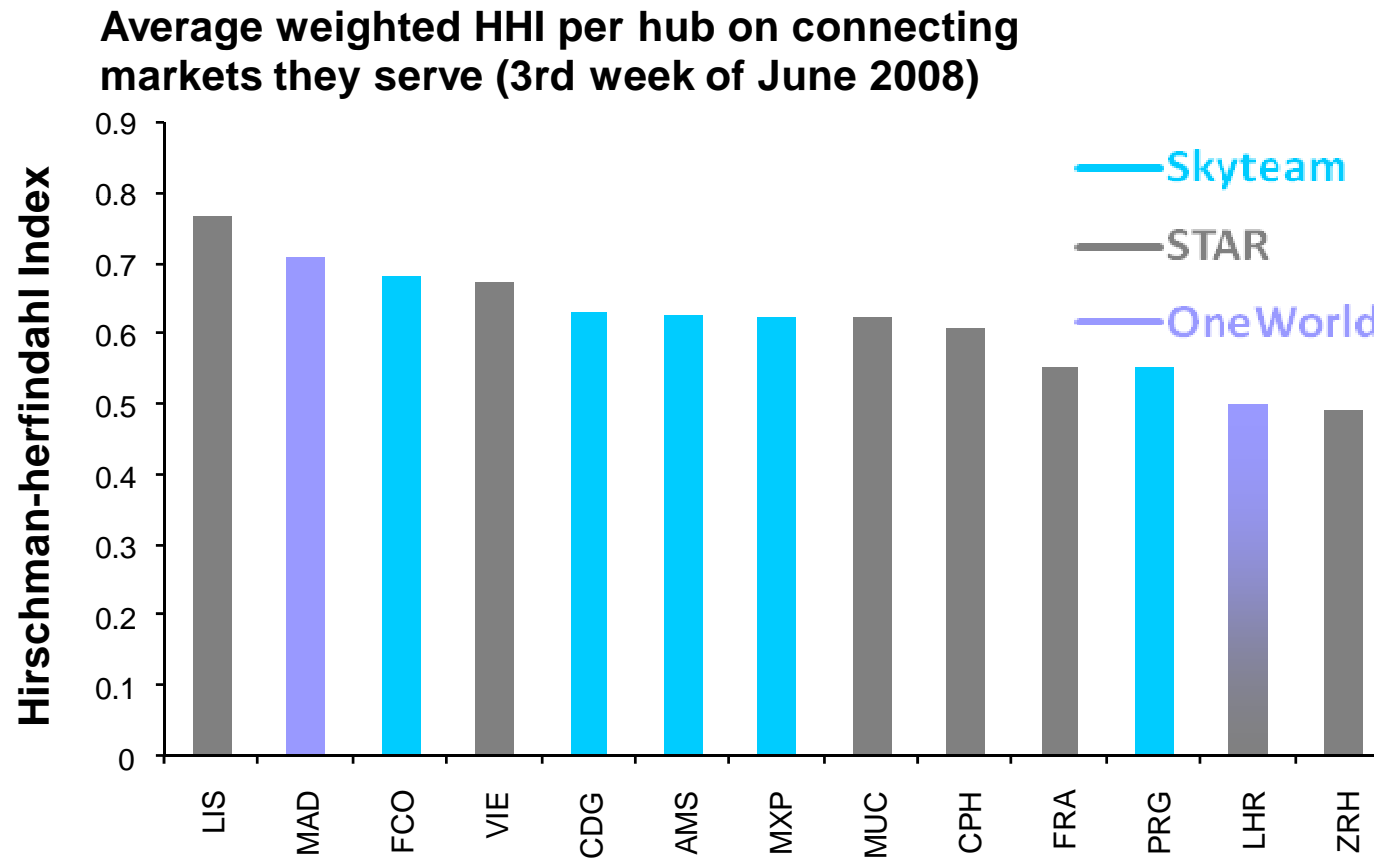
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**Direct connectivity accounts for almost 40% of connectivity between Europe and rest of the world**

**Frankfurt, Paris CDG, Heathrow and Amsterdam most important hubs**

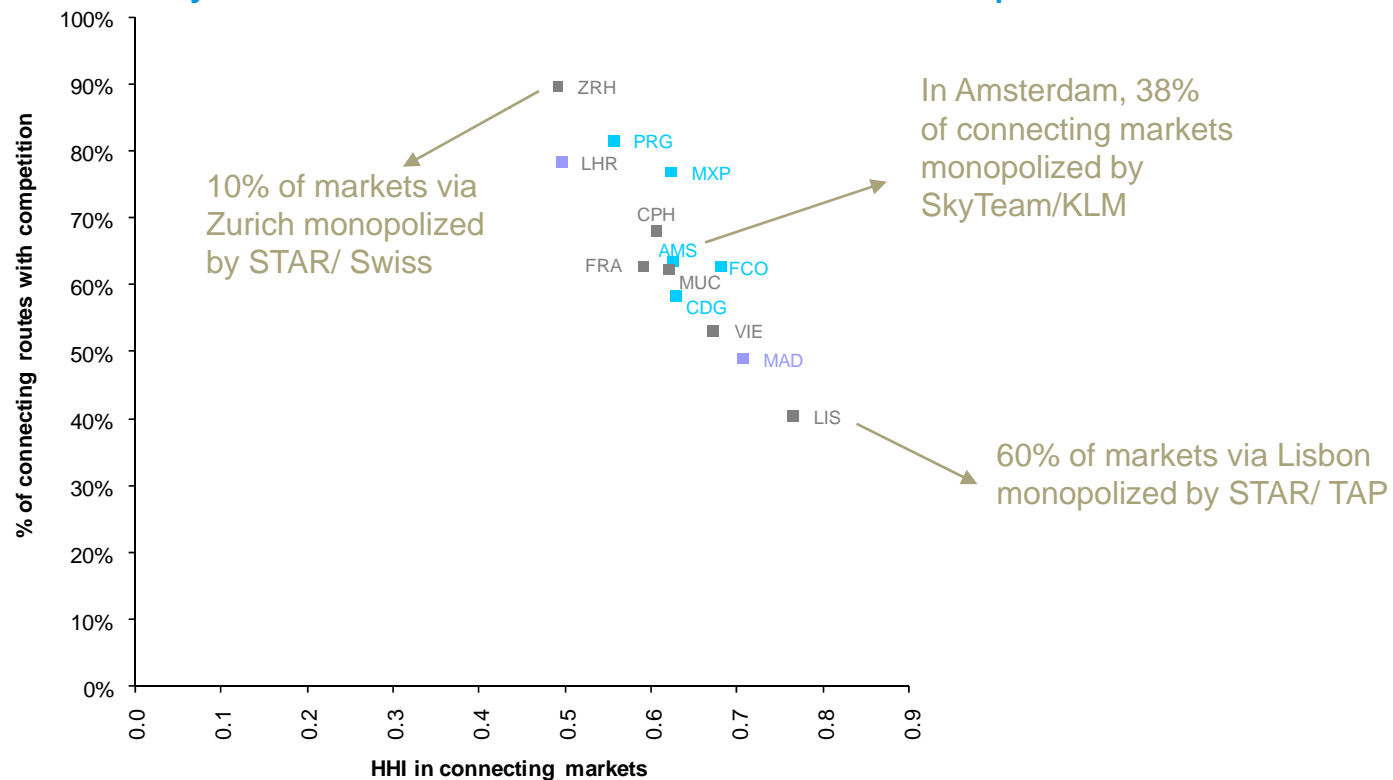


# Heathrow and Zurich face most competition on their connecting markets; Lisbon and Madrid least



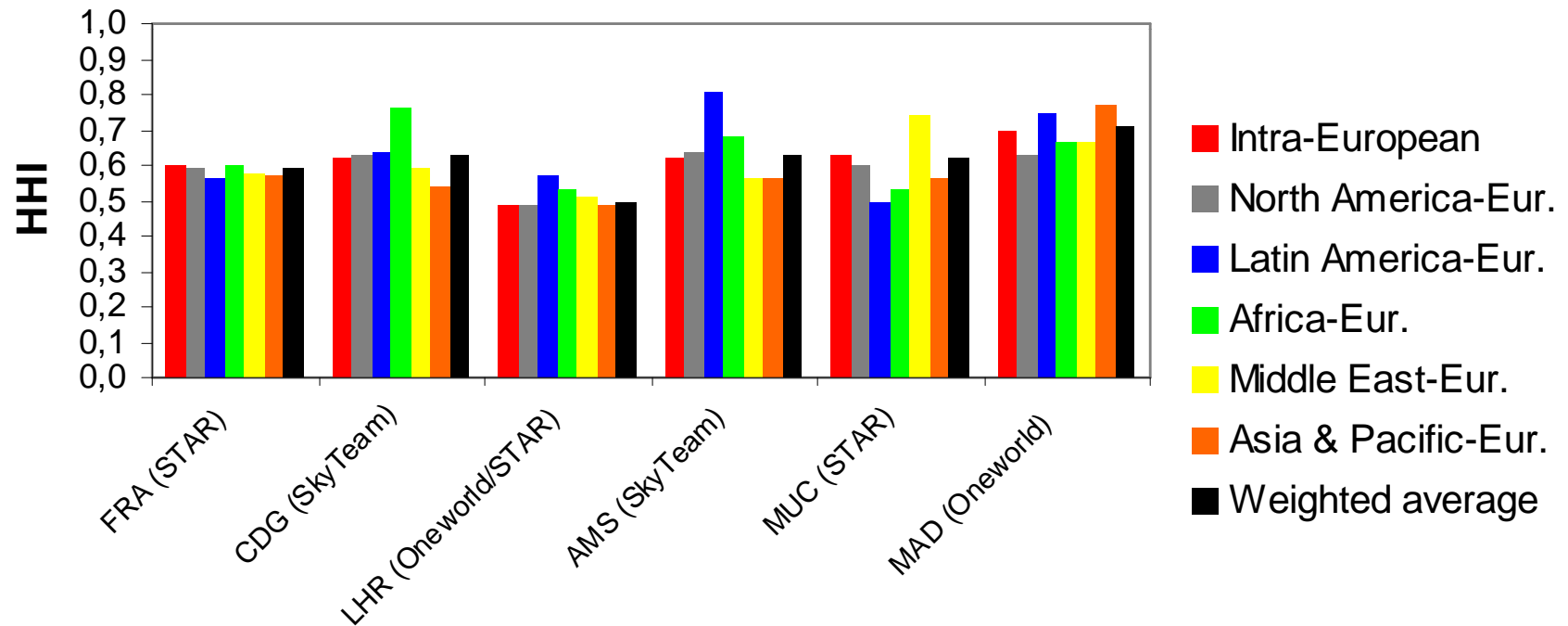
# Hubs facing most competition on connecting markets also have least monopolized markets

Average weighted competition levels per hub airport on connecting markets they serve versus % of markets with competition



# However, large differences between geographical submarkets

Average weighed competition levels in connecting markets (per hub) and geographical destination market, 3rd week of June 2008



# Most important competitors of hubs in connecting markets: direct flights, Frankfurt, Paris CDG, Heathrow, Amsterdam and Munich

Hub	Five most important competitors in terms of connectivity (CNU)				
FRA	<b>CDG (12%)</b>	Direct (12%)	LHR (11%)	AMS (7%)	<i>[MUC (6%)]</i>
CDG	<b>FRA (13%)</b>	<b>LHR (10%)</b>	Direct (9%)	<i>[AMS (7%)]</i>	MUC (5%)
LHR	<b>FRA (14%)</b>	<b>CDG (10%)</b>	Direct (8%)	AMS (7%)	MUC (5%)
AMS	<b>FRA (13%)</b>	<b>LHR (13%)</b>	<i>[CDG (12%)]</i>	Direct (9%)	MUC (5%)
MUC	<i>[FRA (16%)]</i>	Direct (14%)	<b>LHR (11%)</b>	<b>CDG (11%)</b>	AMS (6%)
MAD	Direct (13%)	<b>CDG (13%)</b>	<b>FRA (10%)</b>	<i>[LHR (9%)]</i>	AMS (4%)
ZRH	Direct (15%)	<b>LHR (14%)</b>	<i>[FRA (13%)]</i>	<b>CDG (11%)</b>	<i>[MUC (6%)]</i>
VIE	Direct (19%)	<i>[FRA (15%)]</i>	<b>LHR (10%)</b>	<i>[MUC (8%)]</i>	<b>CDG (7%)</b>
FCO	<i>[CDG (14%)]</i>	Direct (14%)	<b>FRA (11%)</b>	<b>LHR (9%)</b>	<i>[AMS (5%)]</i>
CPH	Direct (17%)	<i>[FRA (14%)]</i>	<b>LHR (14%)</b>	<b>CDG (8%)</b>	AMS (7%)
LIS	<b>CDG (14%)</b>	Direct (14%)	<i>[FRA (10%)]</i>	<b>LHR (8%)</b>	MAD (8%)
PRG	Direct (25%)	<b>FRA (10%)</b>	<i>[CDG (9%)]</i>	<b>LHR (8%)</b>	<i>[AMS (6%)]</i>
MXP	<i>[CDG (18%)]</i>	Direct (16%)	<b>LHR (9%)</b>	<b>FRA (9%)</b>	<i>[FCO (7%)]</i>



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# Conclusions

- **Airline hub-and-spoke networks have changed way in which airlines compete**
  - Not only direct, head-to-head & catchment area competition
  - but also indirect competition via hub airports
- **Traditional competition measurements fail to take into account indirect competition**
- **Data on indirect travel (transfer passengers) very scarce or expensive**
- **We have presented a methodology of calculating competition levels based on connectivity, taking into account both direct & indirect connections**
- **Our competition analysis restricted to supply indicators**
  - Actual passenger choice not only sensitive to service variables but also to air fares and value of time (amongst other things)
  - See Burghouwt, Lieshout & Veldhuis (2008) for methodology to take into account air fares and value of time using disaggregate route choice modeling



## Conclusions & further research (cont.)

- Question remains to what extent the competition levels in the individual O-D markets calculated in our study can be explained by a set of variables, including:
  - Distance of the O-D market
  - (Estimated) market size
  - Level of liberalization on direct O-D market
  - Capacity restrictions at both end points of the market
  - Capacity restrictions at intermediate hubs
  - Geographical centrality of the hubs