Journal of Air Transport Management xxx (2013) 1–12

Contents lists available at ScienceDirect

Journal of Air Transport Management

journal homepage: www.elsevier.com/locate/jairtraman

# Long-haul specialization patterns in European multihub airline networks – An exploratory analysis

Guillaume Burghouwt*

*SEO Economic Research/Airneth, Roetersstraat 29, 1018 WB Amsterdam, The Netherlands*

*Keywords:*
Multihub
Hub-and-spoke network
Long-haul
Europe
Airline

A B S T R A C T

Multihub airline networks are an important phenomenon in today's air transport market. An important question is to what extent different factors play a role in the specialization between hubs that are part of the same multihub network. This paper shows that total European market size to a certain long-haul destination and the ratio between the origin-destination market at the primary and the secondary hub are important variables for the role hubs play in the long-haul network of European multihub systems. Large long-haul markets are generally served from both the primary and secondary hub. Multihub carriers serve smaller long-haul markets uniquely from a single hub, depending on the relative advantage in the local origin-destination market. Looking at actual specialization patterns within European multihub networks, we distinguish between complementary multihub systems (such as Amsterdam–Paris CDG), overflow systems (such as Frankfurt–Munich) and regional systems (such as Paris CDG–Lyon).



## 1. Introduction

Multihub airline networks are an important phenomenon in today's air transport industry. Due to the consolidation of both the European and US air transport industry, more network carriers operate out of multiple connecting hubs. Within merged airline networks, the choice of the network structure is a key strategy for privatized airlines in order to be profitable. Hence, airlines revise and rationalize their networks in an attempt to improve financial performance and strengthen their defenses against new entrants and incumbents.

Network reorganization may have severe implications for the hubs within these networks: airlines may close down duplicating hubs or specialize in certain markets. Also the implications for the affected airports can be substantial. According to Redondi et al. (2012), 37 worldwide airports have been dehubbed over the period 1997–2009. Airports facing dehubbing suffer from substantial growth delays: dehubbed airports do not recover their original traffic level within 5 years after dehubbing took place.

The role and development of hubs within multihub networks is important from a regional economic perspective. A hub operation allows regions to benefit from a larger number of directly served destinations than comparable regions without a hub operation, at higher frequency with more opportunities for same-day return and more long-haul connections (Button et al., 1999). Having a broad portfolio of direct routes resulting from hubbing activities delivers economic benefits, in particular for the business community. The direct benefits of reduced generalized travel costs for consumers "ripple" through the rest of the economy, for example in the form of agglomeration effects, an improved business climate, regional employment and inbound tourism. Controlling for the reverse causality between employment and traffic, according Brueckner (2003) a 10% increase in passenger enplanements in a US metropolitan area leads to a 1% growth in employment in service-related industries. Bèl and Fageda (2008) find that a 10% increase in intercontinental direct routes results in a 4% growth in international headquarters in European metropolitan areas. According to a study on the economic impact of US hubs, the presence of a hub operation in a region increases high-technology employment over 12,000 (Button et al., 1999). Using Granger causality test, they find that hubs create employment rather than airlines selecting cities as hubs simply because they are important economic centers.

Given the economic importance of hubbing activities, the role of hubs within multihub airline networks is important from a societal perspective. Therefore, the question is what type of specialization patterns can be discerned empirically between different hubs in a single multihub airline network and which factors play a role in the specialization between hubs. Such insights are relevant for airports and governments that are faced with increasing uncertainty about the future role of the hub operations at their airports.

* Tel.: +31 20 525 1642.
*E-mail address:* g.burghouwt@seo.nl.

0969-6997/$ – see front matter © 2013 Elsevier Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.jairtraman.2013.07.008

Abundant literature exists on air transportation networks and the cost and demand conditions that are the main determinants of the network choice. However, much of this theoretical work is confined to the two polar cases of point-to-point and hub-and-spoke network configurations, as well the descriptive analysis of the topology and temporal structure of airline networks. Yet, the empirical body of literature on the actual specialization patterns within multihub airline networks is small, although the importance of this network configuration is increasing due to the ongoing process of airline consolidation.

This paper addresses the question why airlines operate multihub networks, what the drivers are for the development of multihub networks and provides an empirical, exploratory analysis of the long-haul specialization patterns in multihub airline networks. We firstly address the current body of literature on multihub airline networks. We show that the specialization patterns that have already been identified for Air France–KLM may give indications of the main determinants in the specialization process within multihub networks: total market size and the size of the origin-destination market. Secondly, we analyze if the same specialization criteria also hold for other multihub networks of European airlines.

## 2. The drivers for specialization in multihub networks: review of literature

### 2.1. The value of hubs

Hubs are not a goal in themselves but a means to add value to airlines on both the demand and cost side. They are "factories to create route density" according to former Northwest executive Mike Levine. In general, hubs add value to an airline through beyond market access. Moreover, they average out natural peaking of demand, can generate rents (hub premiums, density and scope economies) and provide opportunities for mixing prices (Button, 2002; Gillen and Morrison, 2005). As Nero (1999) points out, the advantages of hubbing become stronger with a growing network, because of the externalities and spillover effects of additional spokes.

Multihub networks are not an optimal solution compared to the single hub solution, as a number of theoretical studies on optimal airline network configurations have pointed out: each additional hub in the network reduces density economies. Furthermore, additional hubs bring in complexity costs (Duedden, 2006; Wojahn, 2001a,b).

### 2.2. Optimality of the single hub solution

Some studies provide empirical support for the optimality of the single hub solution as consolidation in the US and European airline industry has forced airlines to close down secondary hubs in relative close proximity to primary hubs (de Wit and Burghouwt, 2005; Dennis, 1994; Redondi et al., 2012). Examples in Europe include the dehubbing of Geneva by Swissair, Barcelona by Iberia, Gatwick by British Airways and Milan Malpensa by Alitalia. In a network simulation study for Europe, Adler and Berechman (2001) find that only multihub networks with an effective geographical division tend to have the best ability for airlines to generate profits. O'Kelly (1998, p.177) states that 'a pure single hub allocation model would result in an efficient system, but one with great inconvenience for the passenger'. Given the fact that growth in the number of flights to and from the hub results in a non-linear growth of connections via the hub, one large hub attracts significantly more transfer passengers than two hubs of half the size (Goedeking, 2010).

History shows that regional hubs in multihub networks, such as Clermont-Ferrand and Basle, are generally considered not to be viable network solutions in the long-run. Low-cost competition and landside substitutes decrease their value, in particular when fuel prices are soaring. In addition, long transfer time relative to the total travel time in short-haul markets makes the use of regional hubs less attractive for consumers. Finally, the evidence on the existence of density economies at regional hubs remains scant.

### 2.3. Reasons to deviate from the single hub network

Although there are advantages of consolidating the network on a single hub, there are clear reasons for airlines to deviate from the single hub solution in practice.

*Spatial coverage*: airlines need multiple hubs to increase spatial coverage and serve thin markets, either through multiple hubs in their own networks or through alliance hubs (Tretheway and Oum, 1992). Single hub systems reach a natural ceiling when too many important transfer connections require excessive detours (Goedeking, 2010). In addition, most of the world's origin-destination markets can only be served with connecting service through hubs. Many of the world's aviation markets are too small for a single connect service and can only be served profitably with multiple hub transfers.

*Level of demand*: Swan (2002) states that the natural development of airline networks is from skeletal to connected. Early airline network developments build passenger loads at hubs to use larger airplanes and achieve density economies. The focus is then on a minimum number of hubs. As demand grows, later network developments bypass initial hubs. Bypassing saves the costs of connections and establishes secondary hubs. Here, frequency development outweighs the loss of density economies. Duedden (2006) further supports Swan's argument for the long-haul market. He demonstrates that long-haul, direct services from non-hub airports can grab a major share of the premium market. If additional revenues from direct services from a secondary hub are larger than the additional costs of direct services, the profit maximizing network configuration can take the shape of a multihub network. An example of such a development is the intercontinental route development at Dusseldorf by Lufthansa.

*Frequency game*: airlines can use a multihub system to play the 'frequency game', if total demand to an intercontinental destination allows for daily service from multiple hubs. By well-synchronizing the flights to the same destination from both hubs, the airline can offer competitive, complementary services on many connecting markets linked to this particular destination at different times of the day (Goedeking, 2010). In addition, the airline will benefit from the high-yield local market at both hubs at the same time.

*Capacity shortages at the primary hub*: Airlines may decide to open a secondary hub in order to accommodate market growth, when capacity constraints restrict growth at the primary hub's infrastructure. Examples are Lufthansa's secondary hub at Munich and BA's (dismantled) hub at Gatwick.

*Strategic positioning and entry deterrence*: Strategic positioning can be a reason for airlines to continue or start operating a secondary hub. A secondary hub can be used to deter entry by 'baby-sitting' scarce slots (Adler and Berechman, 2001; de Wit and Burghouwt, 2005). In addition, hub airlines have competitive advantages over new entrants in local hub markets (Zhang, 1996). Finally, hubbing gives the airline some bargaining power over the airport in terms of visit costs and airport development issues.

*Better aircraft utilization*: the use of multiple hubs allows hub airlines to schedule an aircraft departure from one hub and return to hub two. From an aircraft utilization perspective such aircraft routings can be more attractive than returning to the same hub.

Please cite this article in press as: Burghouwt, G., Long-haul specialization patterns in European multihub airline networks – An exploratory analysis, Journal of Air Transport Management (2013), http://dx.doi.org/10.1016/j.jairtraman.2013.07.008