Evolution of the business air travel network in the US from 1993 to 2011: A descriptive analysis using AIRNET

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ABSTRACT

Despite recent attention focused on business air travel, most existing analyses rely on cross-sectional data drawn from a single year or season. To address this gap, this paper provides a descriptive portrait of business passengers' movements among 108 US metropolitan areas in each year from 1993 to 2011. The business air travel networks are examined at three levels: the node, the dyad, and the system. Node-level analysis reveals small fluctuations among historically dominant business cities, but also the recent rise of smaller emerging business cities. Dyad-level analysis highlights the continued importance of traditionally high-volume business routes (*e.g.* New York–Los Angeles), but that economic complementarity between smaller cities can also be a source of high-volume business traffic. Finally, system-wide analysis suggests that business travel among US cities is becoming more symmetric and evenly dispersed. The paper concludes with a discussion of these findings implications for managerial practice and their contribution to scholarly knowledge.

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1. Introduction

For several decades, scholars have recognized the importance of networks for cities' economic development, with many studies of globalization and world cities now focused on locating cities' positions within global networks. Given the continuing importance of business travel in an information age, cities' positions within networks of business travel are particularly significant. For example, cities that occupy central positions in business travel networks are more probable sites of economic growth because they offer their businesses accessibility, both in a physical sense as transportation hubs, and in a virtual sense, as points of convergence for information and capital (Brueckner, 2003; Debbage & Delk, 2001; Neal, 2011). However, as airlines modify their route structures and businesses modify their location strategies, the structure and organization of the business air travel network is dynamic. Thus, while mapping the structure of business travel and other urban networks is useful, examining their evolution is still more important for making sense of urban and national economic development trends.

To this end, this paper examines dynamic business air travel networks among US cities from 1993 to 2011, constructed from publically available data using the AIRNET program. These data offer researchers a more nuanced picture of air traffic patterns than previously available because they focus specifically on business passengers as a distinctive subset of all airline passengers, and because they trace the flows of passengers *between* cities rather than simply the total numbers of

passengers *within* cities. By exploring these data at three different levels of analysis – the node, the dyad, and the system – they provide multiple perspectives on changes in the structure and organization of business air travel network in the US. At the nodal level, individual cities' positions within the network are examined, focusing on the rise and fall of historically dominant business centers, and the emergence of new ones. At the dyadic level, high traffic routes between pairs of cities are examined, again with a focus on the rise and fall of historically dominant business pairs, and the emergence of new synergies between complementary cities. Finally, at the system level, longitudinal trends in the network's overall organization and flow patterns provide clues about the developmental trajectory of business travel patterns in the US. The paper concludes with a discussion of these findings' implications for managerial practice and their contribution to scholarly knowledge.

2. Research questions and methods

Although there is a wealth of research about business growth in individual US metropolitan areas and in the US generally, there is relatively little research about growth and change in the business passenger segment of the airline industry. Some have examined the similarities and differences between business and leisure passengers (Dresner, 2006), while others have explored business passengers' willingness to use low cost carriers (Mason, 2000; Neal & Kassens-Noor, 2011). Research on the structure and organization of business air travel networks is still more limited, driven largely by the difficulties associated with identifying business passengers and compiling large-scale data on their movements. Here, two promising streams

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of research have emerged. First, some have sought explanations from the perspective of the firm, viewing business travel as a strategy used by firms to link spatially distributed subsidiaries, and thereby to 'produce' global firms (Beaverstock, Derudder, Faulconbridge, & Witlox, 2009; Faulconbridge, Beaverstock, Derudder, & Witlox, 2009). Second, others have sought explanations from the perspective of the individual, mapping the travel patterns of individual business passengers within the US in 2006 (Neal, 2010), throughout Western Europe in 2001 (Limtanakool, Dijst, & Schwanen, 2007; Limtanakool, Schwanen, & Dijst, 2007), and globally in 2001 (Derudder, Witlox, Faulconbridge, & Beaverstock, 2008) and 2005 (Derudder, Devriendt, Van Nuffel, & Witlox, 2010). These studies have demonstrated that business travel has more substantial impacts on metropolitan and regional economic outcomes than leisure travel, and they have made substantial contributions to the methodological sophistication of business air travel network measurement and analysis. However, they have each been restricted in temporal scope to a cross-sectional analysis of business travel in a single year, and thus provide little information about changes over time.

Given the limited research to date on the evolution of business air travel networks, this analysis examines an exploratory set of research questions intended to provide a descriptive portrait of business travel in the US from multiple network perspectives over a wide timeframe, from 1993 to 2011. The first set of questions focuses on cities, for which high volumes of business passengers represent economic development potential. Which US cities receive the greatest share of business passengers? Is their status as key business passenger destinations stable? And, what cities are emerging as new business passenger destinations to challenge their status? The second set of questions focuses on routes, where high volumes of business passengers suggest a degree of economic complementarity between the origin and destination. Which intercity routes carry the greatest share of business passengers? Is their role as primary business routes stable? And, what city pairs are emerging as new high-volume business routes? The final question focuses on the business air travel network as a complete system, where concentration brings both the advantages of economies of scale and the risks of vulnerability. Is business air travel in the US tending toward a diffuse multi-centric system, or toward greater concentration in specific cities?

2.1. Measuring business air travel networks over time

The primary challenge to exploring these research questions has been the measurement of longitudinal business air travel networks, however the AIRNET program offers a solution. This program, written for the Stata statistical software package and freely available by typing 'ssc install airnet' in the Stata command line, is described in detail by Neal (2013). In brief, it processes public data from the US Bureau of Transportation Statistics' (BTS) Origin and Destination Survey into air travel networks. The Origin and Destination Survey contains details on a 10% random sample of all air passenger travel taken wholly within the US, and is available in quarterly intervals, from 1993Q1 through present, making it the ideal data for examining the evolution of air travel networks. Of particular interest for this analysis is its ability to construct longitudinal networks that capture business passengers' movements. In these networks, the strength of a connection from City A to City B is an estimate of the number of business passengers initially originating in A and flying round trip to City B. Notably, any connections and layovers are ignored, thus keeping the focus on where business passengers travel, rather than on the routes they take to get there.

The BTS from which AIRNET derives air travel networks does not explicitly identify passengers' travel purpose. However, Neal (2010) has shown that passengers' fare paid and number of traveling companions can be used to identify those likely traveling for business. Using these variables, AIRNET flags passengers as likely traveling for

business when they (a) paid a fare that was statistically significantly ($\alpha = 0.05$) above average for the given origin, destination, and quarter of travel, and (b) flew alone.[1] This approach focuses narrowly on a specific segment of the broader business air passenger population: corporate travelers for whom convenience and flexibility are paramount, while cost considerations are secondary. However, it is consistent with other approaches to conceptualizing and defining business travel and business passengers. First, it focuses on individual characteristics, rather than on cabin class, which Derudder, Beaverstock, Faulconbridge, Storme, and Witlox (2011) suggest are more indicative of travel purpose. Flying in business class tells us more about a passenger's desire for a more comfortable seat than about why the passenger is traveling. In contrast, willingness to pay a substantially higher fare and traveling alone are individual characteristics relatively common among business passengers, but relatively uncommon among leisure passengers, regardless of their selected cabin class. Second, business passengers are increasingly considering lower-cost alternatives to traditional business fares, including carriage on low-cost carriers (Dresner, 2006; Huse & Evangelho, 2007; Mason, 2000, 2001; Neal & Kassens-Noor, 2011). Nonetheless, because business passengers often lack the flexibility to decide when and where to travel they are still likely to pay more than leisure passengers on the same flight, for whom travel dates and destinations are flexible. Accordingly, this approach views business passengers as most likely those paying fares in the upper "tail" of the fare distribution, but recognizes that the shape of this distribution varies based on origin, destination, and time of travel. Thus, the fare paid by those traveling on business, who are not flexible on time and destination, is partly a function of how much cost-sensitive and flexible leisure passengers were willing to pay.

As a proxy for measuring passengers' actual travel purpose, this approach is not without its limitations. It may fail to classify as business passengers those who are traveling for business, but for whom cost considerations are significant, including academic traveling to conferences and those whose employers have shifted to using low-cost carriers for corporate travel (Mason, 2000; Neal & Kassens-Noor, 2011). Conversely, it may also incorrectly classify as business passengers those high-income individuals for whom cost is a secondary consideration even for leisure travel. As a consequence of these potential misclassifications, this approach does not yield *absolute* counts of business passengers traveling between cities, but rather yields *relative* counts that are proportional to the actual volume of business traffic. Thus, the analyses that follow examine relative changes in the business network and focus on proportional shares of business passengers, rather than making inferences about absolute numbers of passengers.

Despite its limitations, this approach to measuring business passenger travel offers several advantages to existing approaches. First, it is less costly than conducting a specialized travel survey (*e.g.* Dateline Consortium, 2003; Limtanakool, Schwanen, & Dijst, 2007) because it relies on existing data collected for government regulatory purposes. Second, it can be replicated by other researchers because it relies on publically available, rather than costly proprietary (*e.g.* Derudder, Witlox, Faulconbridge, & Beaverstock, 2008; IATA, 2012), data. Third, it directly reflects business passengers' actual travel behaviors by relying on demand-side data, rather than supply-side data on seat availability that only captures where air carriers believe passengers want to fly (*e.g.* Zook & Brunn, 2006). Finally, by using individuals' actual willingness to pay rather than passengers' cabin class (*e.g.* Derudder, Witlox, Faulconbridge, & Beaverstock, 2008), it more accurately classifies those who purchase unusually high-cost last-minute tickets in coach class as business travelers and those who

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[1] To simplify the identification of statistically significant fares, only round trip itineraries with a single destination are included in the constructed business network. Other types of itineraries (*e.g.* multiple-destination chain itineraries) have more complex fare structures and are rare in these data.