Spatial-Temporal Analysis of Recent Air Passenger Flows

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ABSTRACT
Airline mergers and acquisitions (MAs) are on the rise across the globe and have been a growing trend in the U.S. aviation industry in the last few years. MAs are taking several factors into consideration, such as cost efficiency, competition, and geographic coverage. For airlines, these transactions can eliminate overlapping routes and help reduce competition, leading airlines to achieve higher operating margins. For travelers, MAs often lead to lesser flight frequency, higher airfares or longer travel miles. To explore spatial-temporal variations from airline and passenger perspectives, this paper focuses on 55 major airports in the 50 largest cities between 2000 and 2010. The detailed results of passenger flow patterns suggest that some airports have more spatial imbalance than others in terms of passenger travel distances. Further, the findings indicate that the MAs have different effects on passenger flows and traveled distances, and the effect is complexly related to the airport’s spatial status.

Keywords: Airline Mergers and Acquisitions (MAs), Airline Origin and Destination Survey (DB1B) Database, Competition, Hub-and-Spoke Networks, Spatial-Temporal Variations

INTRODUCTION
It is well-known that the distance (cost) associated with air travel depends on a multitude of factors, such as connections, travel fares, network structure, airlines, etc. All of these factors vary across space. In this study, we examined spatio-temporal changes in the landscape of inter-city air passenger flows. In order to analyze how MAs change the differentials in hub service structure and affect travel distances associated with inter-city passenger travel, a spatial-temporal framework is proposed to derive a ratio of direct distance to flow distance, representing the efficiency of inter-city air travel among the top 55 large U.S. airports in 50 cities, and the 7 major Delta hubs. The results highlight the tremendous impact that changes in the hub structure service can have on the distance of inter-city air passenger travel. Moreover, the results provide important insights on how the level of service availability between cities in the U.S. varies across space (market segments).

In literature, traditional air passenger flows studies are based on airports or cities (Corsi, 1997; Jin, 2004; Wang, 2007). This approach provided a general understanding
of a node-based perspective of air passengers but did not successfully address a network aspect among airports to various factors. This gap can be overcome by incorporating market segments into the analysis. To illustrate the importance of a market-based approach, where each market (city pair) is a measurement unit for air passenger flows, there are several noticeable characteristics on air passenger flows. First, air passenger flows often occur in a direct flow and support the importance of a network relationship among airports. Second, air passenger flow by nature is not merely a city-based event but also largely related to the interaction among cities. Last, the market segment, rather than the airport itself, can efficiently identify a repeated pattern of air passengers over multiple periods. Due to these characteristics, a market-based air passenger analysis is an appropriate method to study air passenger flows collected over time. In this study, we analyze market-based, inter-city air passengers based on an 11-year database. The purpose of this research is to systematically study the relationship between the MAs and the changes in flow and distance in major airports. To do so, it statistically tests the hypothesis that the MAs increase the likelihood that a distance between hubs will decrease, and a distance between hub and spoke will increase.

This article is organized as follows. The following section explores issues relevant to the air passenger flow analysis and models shown in previous research. It reflects recent studies in air transportation and focuses on papers that address passenger flows and distances within the context of the airline network structure. The methodology section provides a brief explanation of a statistical test and time series analysis. The application of the methodology is demonstrated with the use of empirical analyses. Concluding remarks are then given in the final section.

PREVIOUS STUDIES

Fan et al. (2001) examined the important economic trends and industry forces that likely influence the macroscopic evolution of airline alliance and consolidation structure. It appears that economic forces inherent in the industry will likely pressure airlines into a greater degree of consolidation, subject to the pace of regulatory liberalization in passenger air transport and the public’s anti-trust concerns. Recently, some of the biggest airlines have merged, including the Delta Airlines 2008 acquisition of Northwest and the more recent United Airlines purchase (August 2010) of Continental. More consolidation is expected after Southwest Airlines’ announcement that it would buy AirTran Airways (New York Time, 2010). In addition to an expected growth of mergers, a recent trend in aviation markets is the emergence of airline acquisitions. One could argue that the emergence of acquisitions is a continuation of the concentration and consolidation process that was first characterized by the emergence of hub-and-spoke networks (Pels, 2001). The literature shows that passengers are likely to be better off if airlines enter alliance agreements. For example, Gagnepain and Martin (2010) showed that alliances with substitutes result in higher prices and, with complements, lower prices due to cost reduction. Adler and Smilowitz (2007) presented a framework to analyze global alliances and mergers in the airline industry under competition. Their framework can help airlines identify partners and network structures and help governments predict changes in social welfare before accepting or rejecting proposed mergers or alliances. With respect to hub-and-spoke networks, Aguirregabiria and Ho (2010) showed that the airline’s own entry decisions for different city-pairs depend on the airline’s profit function. Hassan et al. (2009) showed the impact of the Delta and Northwest Airlines merger. They claimed that the merging of the two carriers allows the creation of more coordinated flight services that improve all of the new carrier’s scheduled flights’ average load factors. They also demonstrated that the two carriers’ merging is estimated to significantly grow the number of flights because the model allows these two merging air carriers to fully reconfigure their networks. Their model
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