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Has market concentration fostered on-time performance? A case study of seventy-two U.S. airports

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ABSTRACT

The study compares a multivariate with a quantile regression model to determine whether utilized airport capacity, departure and airborne delays, departure and arrival demand, and market structure explained variations in on-time gate arrivals and arrival delays. In both models, airport departure delays, arrival and departure demand explained variations in the two response variables in prioritized and non-prioritized metroplexes, holding other variables constant. After 2008, the consolidation of the airline industry through mergers coincided with the implementation of NextGen programs, which may have contributed to improvements in on-time performance, especially at prioritized metroplexes where airspace was redesigned.

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1. Introduction

This paper evaluates whether the consolidation of the airline industry and the implementation of NextGen[1] programs after the 2008 recession had a significant impact on two on-time performance metrics (i.e., the percent of on-time gate arrivals and gate arrival delays). This study focused on prioritized versus non-prioritized metroplexes rather than hubs versus non-hubs. Prioritized and non-prioritized metroplexes include a mixture of hub and non-hub airports. As the Federal Aviation Administration (FAA) started to deploy NextGen programs and redesign some airspaces after the 2008 recession, this analysis assumed that selected operational factors, market structure, and airline industry consolidation would have had a more significant effect on on-time performance at prioritized metroplexes where airspace was redesigned. The timeline of airline consolidation is included in Fig. 1 of the appendix.

This study is of interest to aviation analysts because it presents a methodology to assess the influence of both operational factors (the percentage of airport capacity utilized, airport departure and airborne delays, departure and arrival demand) and market structure (Herfindahl-Hirschman index) on two on-time performance metrics. It also contrasts prioritized with non-prioritized metroplexes to evaluate the impact of NextGen programs. On the one hand, a multivariate regression model served to determine whether the effects of the selected independent variables on each on-time performance metrics were robust overall. On the other hand, a quantile regression was used to measure differences in the impact of the selected independent variables at the first, second, and third quantiles of the response variables. A key advantage of quantile regression is that estimates are more robust to outliers than those of an ordinary least squares model.

As part of NextGen, the FAA and the aviation industry agreed to prioritize twelve metroplexes that would yield benefits by 2025. A metroplex represents an airspace where larger commercial and smaller general aviation airports operate in close proximity. The seventy-two sampled airports and their status are listed in Table 3 of the appendix. NextGen programs are designed to improve access of general aviation aircraft into smaller secondary airports, to increase capacity utilization at larger congested airports, and to reduce delays through more direct routing through performance-based navigation. As a portfolio of programs rather than a single program, NextGen supports the transition from the present radar-based, air-traffic-controlled to a satellite-based, air-traffic-managed navigation system in which aircraft can provide position, heading, and airspeed information automatically to controllers and surrounding aircraft. NextGen's satellite-based technologies enable more accurate position information, allowing for closer spacing of

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[1] NextGen is the abbreviation of the Next Generation Air Transportation System.

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aircraft and computer-generated rerouting. This, in turn, is likely to reduce airborne delays, improve traffic flows, and reduce the workload of air traffic controllers who can communicate flight instructions through aircraft's flight management systems (Data Communication).

2. Literature review

In this analysis, actual gate arrival times were compared with the last flight plan filed prior to takeoff instead of published schedules (Rupp et al., 2006) or excess travel time (Mayer and Sinai, 2003). Comparing actual with arrival times filed in flight plans is more likely to reflect airlines' anticipation of actual surface and enroute conditions before leaving the airport. Moreover, flight plans may indicate how airlines are internalizing delays due to poor weather conditions, enroute and airport congestion, as well as traffic management initiatives (TMI) when they estimate flight routing and duration.

Several studies determined that airline schedules were more likely to be padded in order to anticipate airborne and surface delays (Skaltsas, 2011; Morisset and Odoni, 2011; Wu, 2010, 2005; Mayer and Sinai, 2003). Mazzeo (2003) reported that monopoly routes had longer scheduled flight times. Most of the studies that focused on the effect of competition on on-time performance analyzed route-level data for selected months. This study uses yearly data, which are more suited for overall program evaluation and forecast. It does account for the status of airports as hubs as the focus is prioritized versus non-prioritized metroplexes.

On-time performance is one of the key airlines' strategic objectives because it serves to maintain passenger satisfaction and loyalty, and it often represents an effective marketing tool to differentiate one airline from its competitors. Suzuki (2000) argued that on-time performance affected a carrier's market share primarily through the passengers' experience. Airline performance is usually compared with published schedules in government surveys (i.e., the monthly Airline Service Quality Performance report released by the Bureau of Transportation Statistics). On-time performance also supports predictability, which is another concern of airlines because schedule disruptions can be very costly. In a recent study, J.D. Power claimed that “the airline industry is evolving from merely providing transportation to being a hospitality and services business, and the carriers most focused on providing a pleasant experience are being rewarded with higher customer satisfaction and loyalty.”[2] It explained that “when the airline provides good service, passengers are generally less critical when there is a departure delay or a late arrival.” However, “complaints also increased, and on-time performance declined, when Delta Air Lines (DAL) and Northwest Airlines (NWA) combined during 2009 and 2010,” according to CNN Money.[3] The J.D. Power 2015 North America Airline Satisfaction Study included costs and fees, in-flight services, boarding/deplaning/baggage, flight crew, aircraft, check-in, and reservation, but not the percent of on-time gate arrivals and gate arrival delays.

A PricewaterhouseCoopers (PwC) report (2014:4) maintained that “US carriers have measurably improved operating performance over the past five years. These improvements may be attributed in part to the impact of consolidation: As airlines have merged, carriers have removed capacity from the system and increased overall efficiency in their operations.” The PwC study concluded that “passengers on average are enjoying increased reliability when flying domestically.” Factors such as gate departure and arrival delays, taxi-in and out times at the twenty busiest airports were used to measure on-time performance. In this analysis, airport departure delays measure airport congestion, while airborne delays account for aircraft utilization, flight time predictability, and, to some extent, passenger experience.

The Office of the Inspector General found that market concentration is likely to reduce on-time gate arrivals.[4] Yet, market structure should not be isolated from operational factors. Airports face different constraints (operational factors) and airlines' network strategies (point-to-point versus hubbing). Mayer and Sinai (2003) argued that the relationship between on-time performance and market structure was likely to depend on the hubbing activity of an airport. Using data on all domestic flights by major U.S. carriers from 1988 to 2000, Mayer and Sinai examined network benefits related to hubbing and congestion externalities as two factors that may explain air traffic congestion. In their view, hubbing represented the primary economic contributor to air traffic congestion. It allowed dominant air carriers to add flights without considering their marginal costs on other airlines' increased travel time. The failure of hub carriers to internalize delays further created airport congestion. However, congestion may not only depend on the dominant carrier's hubbing strategy. This study argues that on-time performance also depends on the complexity of the airspace around a large metropolitan area, which makes it difficult for airports to manage demand and capacity.

Mayer and Sinai maintained that, although some of the excess travel time occurred in the air, most of the delays could be attributed to taxi-in and gate arrival delays. This motivated the inclusion of airport departure and airborne delays as two independent variables in the present study. Moreover, hub airports would have more traffic and greater delays than non-hub airports of equivalent size and with equal local demand. However, the implementation of NextGen technologies, procedures, and airspace redesign was assumed to provide an edge to prioritized metroplexes in terms of on-time performance compared with non-prioritized metroplexes.

Based on 2000 data from the Bureau of Transportation Statistics (BTS), Mazzeo (2003) examined whether the lack of competition on particular routes resulted in worse on-time performance. His sample included individual flights between fifty major airports during three months in 2000. He found that the prevalence and duration of flight delays were significantly higher on routes where only one airline provided direct service. He argued that additional competition was correlated with better on-time performance. While weather, congestion, and scheduling decisions contributed significantly to explaining flight delays, they were likely to influence the distribution of flight delays, which makes the use of quantile regression more compelling.

Rupp et al. (2006) maintained that flights to and from hubs were more likely to arrive on time and have shorter average delays than non-hubs. They used fixed instead of random effects to estimate on-time performance. All fixed effects were conditional on the particular route selected. The authors suspected that the better performance of non-hub carriers was due to fewer peak-time departures. However, there was no difference in service quality (on-time performance) between hub and non-hub carriers when flights were destined for hub airports. They founded their analysis on the

[2] See J.D. Power and Associates (May 13, 2015). Airlines: A Transportation or Hospitality Business, Press Release, retrieved at http://www.jdpower.com/press-releases/2015-north-america-airline-satisfaction-study#sthash.qGSCl7lF.dpuf.

[3] US Airways-American Airlines to Merge, CNN Money, February 14, 2013, retrieved at http://money.cnn.com/2013/02/14/news/companies/us-airways-american-airlines-merger/index.html.

[4] U.S. Department of Transportation, Office of the Inspector General. “Reduction in competition increases flight delays and cancellations,” Report # CR-2014-040, April 23, 2014.