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The Effect of Market Structure on Airline Prices: A Review of Empirical Results

Michael W. Tretheway

Ian S. Kincaid

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I. INTRODUCTION

A. Deregulation Reduced Airline Fares

Within a few years of the passage of the Airline Deregulation Act of 1978, a number of studies began to provide empirical evidence of the impact of deregulation in terms of fare reductions. A 1982 report by the Civil Aeronautics Board, for example, found that average passenger yields had fallen by 22%, relative to the Standard Industry Fare Level ("SIFL"), which would have been authorized had regulation continued. A 1990 report by the Department of Transportation ("DOT") found that inflation-adjusted yields declined from 9.0 cents per passenger-mile to 7.6 cents from 1979 to 1988. The Committee for the Study of Air Passenger Service and Safety reported in their seminal 1991 Winds of Change report, published by the Transportation Research Board, that inflation-adjusted airline fares fell...
by an average 16% from 1979 to 1989 and by 25% from 1982 to 1989, after the second oil crisis.4

B. SOME MARKETS HAD HIGHER FARES

While deregulation’s overall impact on air fares was being hailed a success, researchers began to observe that the impact of deregulation on air fares was distributed unequally among routes.5 An early finding was that, while fares declined on long and medium-haul routes, they rose in short-haul markets, sometimes dramatically.6 This result was not surprising, as the regulated era had intentionally suppressed short-haul fares relative to costs, and an adjustment was widely expected.7

Of greater concern was a finding that fares tended to be higher on routes from those hub airports where one carrier had a “dominant” share of flights.8 While not the first researcher to make this observation,9 Borenstein’s 1989 paper is often cited.10 He found that a carrier with a 50% market share at both endpoints of a route sustained a fare, on average, 12% higher than a carrier with only a 10% market share at each endpoint.11 Borenstein’s study was rapidly followed by a series of other studies examining the impact of industry concentration on average fares paid by consumers, specifically, concentration at the newly emerging fortress hubs of the major air carriers.12 In 1990, the General Accounting Office (“GAO”) found that air fares were 27% higher at fifteen concentrated hub airports than fares at

4 TRANsp. RESEARCH Bd., WINDS OF CHANGE: DOMESTIC AIR TRANSPORT SINCE Deregulation—Special Report 230 (1990). The previous references were based on system-wide yields (average revenue per passenger-mile) whereas the WINDS of CHANGE Report used data on average fare levels (revenue per passenger) for individual routes.


6 Id.


9 GRAHAM & KAPLAN, supra note 2, at 195 (observing that “fares in monopoly markets are higher than those in relatively unconcentrated markets . . .”).

10 Borenstein, supra note 8; see also Severin Borenstein & Nancy L. Rose, Competition and Price Dispersion in the U.S. AIRLINE Industry, 102 J. Pol. Econ. 653 (1994) (describing the effect of factors such as market concentration on the variation in fares charged by air carriers).

11 Borenstein, supra note 8, at 360.

12 U.S. GEN. ACCOUNTING OFFICE, supra note 7.
thirty-eight unconcentrated airports. Given that a series of airline mergers had been authorized from 1985 to 1987, these empirical findings raised major public policy concerns. These concerns continue to the present as bankruptcies and the loss of market share to aggressive low-cost carriers have led the major network air carriers in the United States and elsewhere to seek mergers or alliances.

While early research found “hub premiums,” a series of papers began to reveal that the issue was not so simple, and that market concentration, by itself, did not have an effect as high as the observed hub premium. Hub markets have innate characteristics that would lead to higher fares, even without concentration. Hub cities, for example, have a higher proportion of businesses, which generates demand for flexible, last-minute air travel and creates a greater willingness to pay a premium for high-frequency service with flexible ticket conditions. Flights from hub cities also tend to be shorter than flights on comparison routes. Because costs per mile decrease with longer route distances, route economics would suggest the shorter-distance routes from hub cities would have somewhat higher fares.

C. The Evolution of the Literature

A rich body of literature has emerged that explores the impact of market structure on average fares paid by airline consumers. This literature has provided a greater degree of understanding of how various market forces and cost conditions interact in determining airline prices. In addition to showing how simple measures of hub premiums can distort the effect of market structure on airline fares, the literature has revealed how

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15 Id. at 3.
14 Id. at 31.
17 ECONOMIC EFFECTS OF AIRLINE DeregULATION, supra note 5, at 62.
18 Id. at 181 (describing flexible ticket conditions such as the ability to change plans without penalty, the ability to obtain a full refund, and the ability to purchase the ticket close to the date of flight, rather than in advance).
20 Abunassar & Koford, supra note 16.
the impact has changed over time as the industry has restructured and evolved. Discovering the impact of low-cost carriers ("LCCs") on prices in airline markets, including markets not directly served by LCCs, was especially important to the literature's evolution.21

The purpose of this paper is to review the literature concerning the impact of market structure on airline fares. And as will be seen, the literature has evolved over the past fifteen years.22 Understanding this evolution is important, because decisions based on selected early papers in the field could lead to erroneous public policy.23 At a time of industry consolidation, retrenchment and attempts at cross-border airline mergers (such as the recent Air France–KLM transaction), understanding the nuances of the effect of concentration on market outcomes is of considerable importance.24

Section II of the paper examines the initial literature on hub premiums.25 It shows how the literature gradually came to appreciate that factors other than market concentration contributed to the observed higher fares at dominated hubs.26 Section III looks at the impact of LCCs on average fares. The hub dominance research began to reveal anomalies such as little or no hub premium for those routes or hubs served by the original successful LCC, Southwest Airlines.27 Research indicated that the fare-reducing effect was not unique to Southwest and that this generalized LCC effect was larger than the hub premium, leading to continued research.28 Section IV looks at factors affecting entry by air carriers onto routes. If LCCs significantly reduce fares in airline markets, then understanding how and when LCCs enter markets is of critical importance.29 Section V looks at the related topic of incumbent response to LCC entry. While this literature is young, it is likely to generate additional interest, as authorities in the United States, Canada, Australia

22 Compare Levine, supra note 19, with Lee & Luengo-Prado, infra note 121.
23 Levine, supra note 19, at 395-96.
24 Id.
25 See, e.g., Levine, supra note 19, at 396.
26 Borenstein, supra note 8.
27 Abunassar & Koford, supra note 16, at 355.
28 Id.
and Europe have initiated anti-trust actions under their respective competition laws.\textsuperscript{30}

Section VI draws a set of conclusions and attempts a synthesis of the literature regarding the impact of market structure on airline fares. It also provides guidance for further research in the field and suggests those areas where further research would enrich our understanding of airline markets. The appendix that follows lists the forty-nine papers and reports reviewed in this survey and provides brief descriptions of their methodology and key results.

II. HUB PREMIUMS

A. EARLY STUDIES – SIMPLE COMPARISONS FOUND

Hub Premiums

While limited hub-and-spoke route systems existed in the United States prior to deregulation, the pre-existing air carriers quickly reorganized their routes into such systems after deregulation.\textsuperscript{31} As stated by Levine in 1987:

Yet another striking feature of deregulated airline markets has been the nearly universal emergence of the “hub and spoke” system as the route structure of choice for deregulated airlines. . . . Deregulated airlines have used hub and spoke systems almost exclusively. . . . The emergence of hub and spoke systems has reassured airlines concerned about survival and has worried competition-oriented analysts for the same reason. Hub and spoke systems seem to provide some protection from new entry and hence some market power at the hub city, power which is enhanced when the hubbing airline also operates the dominant computer reservation system at the hub.\textsuperscript{32}

In many instances, the hub airports became highly concentrated, with one or two airlines providing most of the service from the hub airport.\textsuperscript{33} A concern arose that this concentration allowed the dominant airlines to raise fares on flights to and


\textsuperscript{31} U.S. Gen. Accounting Office, \textit{supra} note 7, at 25.

\textsuperscript{32} Levine, \textit{supra} note 19, at 411-12.

\textsuperscript{33} \textit{Id.} at 412.
from their hubs. To determine whether fares were higher at concentrated airports, early research compared fares at concentrated hub airports with those at other airports, or they compared fares before and after a merger resulting in airport dominance.

In 1988, Huston and Butler conducted one of the first studies in this area, examining the impact of the 1986 merger of TWA and Ozark on service and average fares at their shared hub in St. Louis. Huston & Butler's analysis compared fares and service levels before and after the merger. They found that while hub connectivity improved—the number of destinations served increased—fares charged by the merged airline also increased. Fares to St. Louis increased by between 13 and 46%, while fares through St. Louis increased by between 6 and 19%. The lower fare increase on connecting flights was attributed to competition from other hubs for connecting traffic. The data set used by Huston and Butler was the Department of Transportation Data Base 1A ("DB1a"), a 10% sample of all domestic airline tickets sold in the U.S. This disaggregate dataset consists of

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34 See U.S. GEN. ACCOUNTING OFFICE, supra note 7, at 3. Note that airlines typically charge a range of prices in the market, with various types of restrictions on access to the various prices. This pricing practice has elements of price discrimination as well as cost based product differentiation. Even without changing any of the fares, by changing the number of seats available at a given price, airlines can affect the average fare paid by its consumers. In this paper, the terms fare and price are used interchangeably. As well, the phrase "raising fares" should be seen as synonymous with increasing the average fare paid. The focus of the literature on the effect of concentration on airline fares has largely been on the average fare paid by the consumer (or the air carrier's yield), with little or no attention as to how average fares changed, whether by changes in the actual prices charged or by changing the number of seats sold at a given price. See Levine, supra note 19, at 476-77.

35 Richard V. Butler & John H. Huston, The Effects of Fortress Hubs on Airline Fares and Service: The Early Returns, 24 LOGISTICS & TRANSP. REV. 203 (1988) (stating that it is generally believed that any hub premium applies mainly to routes originating or terminating at the hub). Routes connecting through the hub may benefit from competition from other hubs, so the hub airline may be unable to charge a premium on connecting traffic.

36 Id. at 203 (examining the impact of the Northwest/Republic merger on services levels, but not fares, at their hubs in Minneapolis, St. Paul, and Detroit).

37 Id. at 205, 207-10.

38 Id. at 211-12.

39 Id. at 213.

40 Id. at 214 n.1. This databank contains a 10% sample of all tickets originating in the United States on U.S. carriers, available on a quarterly basis (large air carriers and their code share partners are required to submit survey data taken directly from the airline ticket stub; smaller domestic scheduled carriers are ex-
observations on individual airline tickets and is available quarterly. This rich dataset was ideal for conducting studies of various effects on air fares, and most subsequent research used the data, although for increasingly expanded time periods.

In 1990, the GAO conducted another early study to quantify the hub premium. The study compared yields, equal to average revenue per passenger-mile, for trips originating at fifteen hub airports dominated by one or two carriers to yields at thirty-eight unconcentrated airports. The GAO’s simple comparative analysis concluded that yields at hub airports were 27.2% higher. The GAO defined a hub as “dominated” if 60% of all enplanements were by one carrier, or if 85% were by two carriers. The same, or similar, definitions of hub dominance have generally been adopted by subsequent researchers. The GAO study used the DB1a database, but filtered out tickets that appeared to be erroneously coded, such as those with exceptionally high or low fares. The GAO analysis was based on comparisons of average yields, computed across whatever domestic routes were served at the airports, without adjustment or exclusion.

The DOT carried out a similar study of hub premiums in 1990 by again comparing yields at concentrated and unconcentrated
In the analysis, the DOT compared routes of similar distance in an attempt to control for distance. Using this methodology, the DOT estimated an average hub premium of 18.7% for airports dominated by one airline and an average premium of 8.9% for airports dominated by two airlines.

Before proceeding, it is worth commenting on an argument put forth by a few researchers that the methodology employed the GAO and the DOT could hide fare premiums in certain instances. This argument is based on the fact that the GAO and the DOT methodologies separate airports into those that are deemed to be concentrated and those that are not. If entry occurs at an airport that is concentrated, the decline in market share of the dominant carrier could result in the hub changing classification to that of not concentrated. In the hypothetical case that the entrant’s fare is the same as that of the incumbent, then the measure of concentration at the airports served will fall without any change in the airport’s average fare level. As a result, it is possible that the average fare at concentrated hubs could decrease when they move from one category to the other, while the average fare at unconcentrated airports could increase, reducing the estimated hub premium even though there was no change in fares paid. This is a hypothetical argument that is not empirically established. While conceptually possible, it requires the challenging assumption that entry would occur, sufficient to lower the concentration ratio, without any fall in average fares.

B. Other Factors May Influence the Level of Fares at Hub Airports

The general conclusion from early research was that airport concentration led to charging premiums to passengers with an

49 Pricing Executive Summary, supra note 3, at 3.
50 Id. at 12.
51 Id. at 12-13. The DoT’s defined a hub as concentrated if one carrier had more than 75% of enplanements, a different criteria to the 1990 GAO study.
52 U.S. Gen. Accounting Office, supra note 7; Pricing Executive Summary, supra note 3.
54 Id.
55 Id.
56 Id.
57 Id.
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origin and/or destination at a hub airports.\(^{58}\) However, subsequent research pointed out that these studies made little attempt to adjust for other factors that impact average fares paid, such as traffic-mix, carrier identity and unit-cost differences.\(^{59}\) For example, hub airports may have a higher proportion of business travelers who typically pay higher fares than non-hub airports because hub airports tend to be based near major cities.\(^{60}\) Thus, any observed hub premium may simply be due to the characteristics of travel demand at hub cities, rather than to market dominance.\(^{61}\) The DOT study controlled for route distance and found a lower hub premium.\(^{62}\)

This led researchers to use more sophisticated econometric models in order to more fully control for factors other than market concentration that could explain higher fares for trips to and from hub cities.\(^{63}\) Some of these factors included characteristics of the airport itself or the community served by the hub airport.\(^{64}\) One factor already identified by the DOT study is distance or stage-length of a route.\(^{65}\) Substantial costs are incurred in getting an aircraft off the ground to cruising altitude, and then getting it back down again.\(^{66}\) This is due to the physics of getting a heavy object into the air, as well as to economic factors such as landing fees, which do not vary with the stage-length of a flight. Short routes will thus have higher costs per mile than longer routes, which can spread these fixed costs over more kilometers. This is relevant for measuring any hub premium, since routes from hubs are typically shorter than non-hub routes. The latter will often include many long transcontinental flights. Hubs, on the other hand, are generally located more centrally and, at least in the United States, have a preponderance of short and medium-haul routes. Thus, any observed hub premium may simply be a result of shorter route distances, rather than exploiting market dominance.

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58 Abunassar & Koford, supra note 16, at 373.
59 Economic Effects of Airline Deregulation, supra note 5, at 62.
60 Id.
61 Ito & Lee, supra note 30, at 14.
62 Pricing Executive Summary, supra note 3, at 11.
63 Borentein, supra note 8. While it is not the purpose of this paper to provide detailed commentary on the econometric techniques used, we note that most researchers used two-stage or ordinary least squares regression analysis.
64 Ito & Lee, supra note 30, at 14.
65 Pricing Executive Summary, supra note 3, at 11.
66 There are also costs associated with processing passengers before and after the flight, which do not vary with distance.
Another important factor affecting fares at some major airports is congestion. Economic scarcity, rather than market power per se, may be a source of fare premiums at hub airports. Limitations on airport capacity can generate scarcity rents that accrue to all airlines using the congested airport, not only to the dominant airlines.

One of the first studies to attempt to account for these factors, and one that became highly influential in the hub-premium debate, was Borenstein’s 1989 study. Borenstein estimated an econometric model that related the median route fare charged by each airline to a number of operational and market factors, such as route distance, unit-costs, traffic-mix, carrier identity and airport constraints, route concentration and airport concentration. This analysis found a statistically significant impact of airport concentration on fare. For example, based on Borenstein’s analysis, a carrier with a traffic share of 50% at both endpoints of a route is able to charge 12% higher fares than a carrier with only a 10% share at each endpoint. While Borenstein’s research demonstrated a statistically significant hub premium associated with airport concentration, he did not estimate the scale of the premium experienced at dominated hubs. He did not produce a figure that can be directly compared with the 27.2% and 18.7% premiums estimated by the GAO and DOT, respectively. The 12% figure is based on a hypothetical situation which may or may not reflect the concentration levels at airports at the time of the analysis.

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67 Id. at 25.
68 Id.
69 Borenstein, supra note 8, at 347.
70 Id. at 348-51. Borenstein’s 1989 study, like most of the econometric analysis that followed, included variables to differentiate between route and airport dominance. For example, an airline could dominate a given route as it carries most of the traffic on the route, but represent only a fraction of the total traffic at the endpoint airports, and so would not dominate the airport. This analysis provided an estimate of the premium achieved by dominating an airport separate to that that could be achieved by dominating a route.
71 Id. at 362.
72 Id. at 360. This premium is based on the combined impact of airport dominance and route dominance. Id. at 358. Borenstein assumes, not unreasonably, that an increase in airport dominance is associated with an increase in route dominance such that each 1% increase in the share of originations at the airport causes an increase in route share of up to 0.33%, depending on existing route share. Id.
73 Id.; see supra notes 44, 51 and accompanying text.
74 Borenstein, supra note 8, at 360. A similar analysis was carried out in 1993 by Evans and Kessides (1993). William N. Evans & Loannis N. Kessides, Localized
An important methodological improvement of Borenstein's 1989 research is that he controlled for the set of routes at the airport. The 1990 GAO study simply computed the average yield across all airlines at an airport for whatever set of domestic routes were served. Borenstein looked at the average fare of a specific carrier on a specific route and asked whether that carrier charged a premium on routes serving an airport that the carrier dominated.

In 1989, Hurdle and others examined the impact of potential entry on yields on routes operated from major air carrier hubs. While the analysis did not estimate a hub premium per se, it did indicate that potential entry moderated fares levels. The authors regressed average route yield against distance, route market concentration and a measure of the “likely potential entrants” on the route. The analysis found that a reduction in the number of carriers on a route increased yields on the route; for example, a reduction from two to one carrier on a route

Marked Power in the U.S. Airline Industry, 75 Rev. of Econ. & Stat. 66 (1993). Controlling for distance, airline and route characteristics (through dummy variables which captured, in part, traffic mix effects), the authors still found a statistically significant premium associated with airport concentration, but, like Borenstein, the authors did not provide an estimate of the hub premium. Id. at 67-68, 71.

Borenstein, supra note 8, at 357.

U.S. Gen. Accounting Office, supra note 7, at 33. In a later paper, Borenstein (1990) carried out a before-and-after fares analysis of the TWA/Ozark and Northwest/Republic mergers, both of which occurred in 1986. Severin Borenstein, Airline Mergers, Airport Dominance, and Market Power, 80 Am. Econ. J. 400, 400-01 (1990). Although the analysis was less sophisticated than his 1989 analysis, it still controlled for distance. Id. Borenstein found that fares on routes from Minneapolis St. Paul had increased 9.5% following the Northwest/Republic but found no conclusive evidence of a fares increase following the TWA/Ozark merger. Id.

Borenstein, supra note 8, at 354. It is worth noting that Borenstein’s definition of a hub premium differs from that assumed by the GAO and that of the DoT. In essence, Borenstein estimated the hub premium charged by the dominant airline relative to airlines without airport dominance, while the previous studies estimated the degree to which the average fare at a concentrated hub (across all airlines) differs from average fare at unconcentrated airports (i.e., it is not specific to the dominant airline). Id. at 355. Most of the research subsequent to Borenstein follows his definition with the exception of Simat, Helliesen and Eichner (1989) and Abunassar and Koford (1994). U.S. Gen. Accounting Office, supra note 7, at 34; Pricing Executive Summary, supra note 3, at 12; Simat, Helliesen, & Eichner, supra note 21; Abunasser & Koford, supra note 16, at 369.

Hurdle, supra note 53, at 119-22.

Id. at 137.

Id. at 122-24. The measure of likely potential entrants was based on the number of large carriers at the route endpoints currently not serving the route.
increased average route yields by 12 to 33%. The analysis also found that the number of likely potential entrants had a significant negative effect on yields, provided they were large enough to overcome economies of scale and scope enjoyed by the incumbent. However, the hypothesis that all city-pair markets are perfectly contestable was rejected.

Another attempt to control for various other factors on airline prices was carried out in 1989 by Simat, Helliesen and Eichner for the Air Transport Association. The study involved stepwise regression analysis of the factors determining fares, such as traffic-mix and airport characteristics, using data from 30 hub and 30 non-hub airports. The results of the regression found that the leading carrier’s market share at an airport had no significant impact on fares. The technical specification of the regression analysis was criticized in a 1994 paper by Abunassar and Koford, due to the absence of certain variables and citing evidence of multicolinearity. Abunassar and Koford estimated a revised version of the regression model that corrected for these problems. Their revised estimation indicated that monopoly dominance of an airport resulted in fares 10% higher, relative to an unconcentrated airport.

III. The Low Cost Carrier Effect

Both the Simat, Helliesen and Eichner study and the revised analysis by Abunassar and Koford included a variable capturing the impact of the presence of a low cost carrier (LCC) at the airport. As the analysis was based on 1989 data, this largely meant the impact of Southwest but did include some other air-

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81 Id. at 131-32.
82 Id. at 137.
83 Id.
84 Simat, Helliesen & Eichner, supra note 21.
85 Id.
86 Id. The authors also undertook a simple comparison of hub and non-hub averages fares and found that hub fares were 2.2% to 3.8% above non-hub fares—a small difference. Id.
87 Abunassar & Koford, supra note 16, at 369.
88 Id.
89 Id. at 373. The 10% finding is based on the difference between an airport served by 10 equal sized air carriers versus an airport served by a monopolist air carrier. Id.
90 Simat, Helliesen & Eichner, supra note 21; Abunassar & Koford, supra note 16, at 368.
lines fitting the same business model.\textsuperscript{91} Both studies found that the presence of an LCC had a significant downward influence on fares.\textsuperscript{92} Both papers produced similar results, finding that the LCC reduces fares by as much as 40%.\textsuperscript{93} While this was a secondary focus of the papers, it is interesting that the impact of the LCC was found to be four times the impact of airport concentration.\textsuperscript{94}

In 1992, Dresner and Windle carried out an alternative form of analysis,\textsuperscript{95} comparing yields on flights to a hub with yields on flights from a hub.\textsuperscript{96} The contention of the paper was that, if market power was being exercised, yields on the flights from the hub would be higher than yields to the hub.\textsuperscript{97} The analysis, which controlled for distance and airport characteristics, indicated the presence of a small hub premium.\textsuperscript{98} The example they give is that a 28% higher airport market share at the origin airport leads to a 1% to 2% premium on yields.\textsuperscript{99} The authors characterized this premium as small but statistically significant and postulated that it was due to the higher proportion of business travelers at hub airports.\textsuperscript{100}

\textsuperscript{91} Simat, Helliesen & Eichner, supra note 21; Abunassar & Koford, supra note 16, at 368.
\textsuperscript{92} Simat, Helliesen & Eichner, supra note 21; Abunassar & Koford, supra note 16, at 372.
\textsuperscript{93} Simat, Helliesen & Eichner, supra note 21; Abunassar & Koford, supra note 16, at 372. The 40% finding is based on a hypothetical case of the LCC serving 100% of enplanements at the airport. \textit{Id.} For lower LCC shares, the impact of its presence is proportionately less. Abunassar & Koford, supra note 16, at 371, 373.
\textsuperscript{94} Simat, Helliesen & Eichner, supra note 21. The analysis is complicated because as the LCC share increases, the dominant air carrier effect presumably would also apply, resulting in a lower net impact of the LCC, presumably a net impact of only—30%. Abunassar & Koford, supra note 16, at 371.
\textsuperscript{96} \textit{Id.} at 320.
\textsuperscript{97} \textit{Id.} at 334. The concept seems to be that residents at a hub would be subject to exploitation of any market power available, as most destinations they wished to reach were served by the dominant carrier. \textit{Id.} Those residents elsewhere would presumably have other choices for much of their flying. \textit{Id.}
\textsuperscript{98} \textit{Id.} at 329.
\textsuperscript{99} \textit{Id.}
\textsuperscript{100} In 1993, Windle and Dresner also examined the hub premium at a monopoly hub versus a duopoly hub. \textit{Id.} at 334. They found that, on average, monopoly hubs had a 2.8% fares premium over duopoly hubs. Robert Windle & Martin Dresner, \textit{Competition at "Duopoly" Airline Hubs, in the U.S.}, 33 Transp. J. 22, 29 (1993).
A. OTHER STUDIES THAT CONTROL FOR VARIOUS MARKET FACTORS IN THE ANALYSIS

A number of studies followed Borenstein’s 1989 study. In their widely cited book, *The Evolution of the Airline Industry*, Morrison and Winston argue that some of the previous analysis had not fully accounted for traffic mix, distance, frequent flier tickets, carrier identity and connecting services. Frequent flier tickets had generally been excluded from previous analyses but Morrison and Winston argue that they should be included as, in their view, frequent flier travel represents, effectively, a discount on travel. For example, the 1990 GAO study filtered out zero-fare tickets used for frequent flier reward travel, possibly biasing upwards the fare premium estimate at concentrated hubs.

Another overlooked factor is carrier identity. According to Morrison and Winston, Delta may charge higher fares at its hub in Atlanta, because it charges higher fares at all the airports it serves, and, thus, the premium observed at the concentrated hub might be a service-quality premium, rather than a manifestation of market power. Hubs also tend to have a greater

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102 *The Evolution of the Airline Industry*, *supra* note 16, at 46. Traffic mix refers to factors such as the amount of travel that is for business purposes versus leisure or visiting friends and relatives. One reviewer observed to the authors of this paper that observing a high proportion of usage of “business fares” does not constitute unambiguous evidence that there is a high proportion of travel for business purposes, since an airline with market power might be able to force other travellers into the higher and more flexible fare categories. *Id.* Travel intentions data would need to be used to unambiguously address this issue. *Id.*
103 *Id.* at 48-49, 53.
104 *U.S. Gen. Accounting Office, supra* note 7, at 51. The argument for bias is that at concentrated hubs, residents are more likely to do all or most of their travel on the dominant carrier, and thus qualify more often for frequent flyer reward tickets, a form of quantity discount. *Id.* At an unconcentrated hub (or at spoke ends), travelers may need to disperse their travel among several airlines reducing their ability earn and use frequent flyer reward tickets. *Id.*
105 *The Evolution of the Airline Industry*, *supra* note 16, at 46. Borenstein (1999) observed that a service quality premium would be sustained in a competitive market only if it is more costly to provide. Severin Borenstein, Hub Dominance & Pricing 3 (Jan. 21, 1999) (unpublished manuscript) (on file with author). The academic literature does not address empirical issue of whether the higher quality services, such as high frequency, service redundancy, and rapid flight connections, of many hub carriers are more costly to provide. *Id.*
106 *The Evolution of the Airline Industry*, *supra* note 16, at 46-47. The general (as opposed to hub) premium charged by some air carriers may reflect a
proportion of non-stop trips than non-hubs.\textsuperscript{108} Since trips requiring a connection are less attractive to travelers, they are likely to have a lower fare. Again, the hub premium may simply be a reflection of a higher-quality service.

To illustrate their point, the authors compared the hub premium estimated using the simple methodology in the 1990 GAO study with a similar approach that controlled for the factors discussed above.\textsuperscript{109} Using DB1a data from 1978 to 1993, the authors compared yields at fifteen hub airports and yields at a control group of twenty-seven unconcentrated non-hub airports.\textsuperscript{110} Through this analysis, the hub premium was estimated to be only 5.2% in 1993, having ranged from 4% to 10% between 1978 and 1993.\textsuperscript{111} Applying the GAO’s methodology (a straight comparison of hub and non-hub fares with no adjustment for the factors above), the hub premium was calculated to be 33.4% in 1993.\textsuperscript{112} Thus, their work could both replicate the GAO’s findings as well as explain away much of what was thought to be a hub premium. The authors explain the 28.2 percentage point difference between the GAO’s estimate and their own as follows:

- 18.6 percentage points were due to distance and non-stop versus connecting flights;
- 4.6 percentage points were due to airline-specific effects;
- 2.5 percentage points were due to the frequent flier adjustment;
- 2.5 percentage points were due to the exclusion of nine tourism-heavy airports from the control group (effectively adjusting for traffic mix by comparing business hub airports with business non-hub airports).\textsuperscript{113}

The authors contend that the hub premium is much smaller than previously reported, and, even with the premium, fares were substantially below the levels that occurred before deregulation.

\textsuperscript{108} Id. at 46.
\textsuperscript{109} Id. at 46-47.
\textsuperscript{110} Id. at 47-48.
\textsuperscript{111} Id. at 48.
\textsuperscript{112} Id.
\textsuperscript{113} Id. at 48-49.
Morrison and Winston were able to adapt the methodology used by the GAO to control for a number of factors that might affect fares at hub airports and isolate the effect of airport concentration. Although Morrison and Winston’s analysis lacked the sophisticated economic approach of some studies, it is similar to Borenstein’s 1989 analysis.

In 1997, Morrison further demonstrated the need to control for other factors, in particular LCCs, when estimating the hub premium. Using DB1a data from 1996, Morrison compared the average fare at eleven concentrated airports with the average fare across all airports in the United States. This simple comparison produced a hub premium estimate of 22%. However, simply by removing airports served by Southwest from the control group, the fares at the concentrated airports were found to be 6% lower than the remaining airports. While this analysis lacked the sophistication of other research papers as, for example, it did not control for variables such as distance, traffic mix and frequent flier travel, it clearly demonstrated the importance of controlling for other factors. Morrison also found that fares at airports served by Southwest were, on average, 39% lower than fares at airports not served by Southwest.

B. CONTROLS AND LCC EFFECTS

A 2003 paper by Lee and Luengo-Prado controlled for many of these same factors and, in addition, examined the impact of LCCs. They estimated a regression model of average route yield that controlled for distance, traffic density, traffic mix, presence of an LCC, and other operational factors (the analysis did not incorporate frequent flier tickets). Their analysis was
able to estimate hub premiums for individual hub airports.\textsuperscript{123} The premiums ranged from \(-5\%\) at Miami to \(31\%\) at Newark.\textsuperscript{124} The overall average premium for coach fares was \(12\%\), while the average premium for other fares was \(13\%\).\textsuperscript{125} The analysis also found that the presence of an LCC on a route reduced coach fares by as much \(14\%\) and also premium fares by \(6\%\).\textsuperscript{126}

Finally, a 2004 paper by Hofer, Dresner and Windle investigated whether LCCs affect the network carrier’s ability to capitalize on market concentration and power, and whether LCCs earn hub premiums.\textsuperscript{127} The authors estimated a regression model of average fares on the top 1,000 routes in 1993, 1997 and 2002.\textsuperscript{128} They concluded that market concentration and airport market power are positively correlated with average fares, that the presence of an LCC reduces fares in a market, and that LCC presence consistently lowers hub premiums.\textsuperscript{129} They also found that LCCs appear to earn little or no hub premium at airports where they are the dominant carrier.\textsuperscript{130}

Hofer, Dresner, and Windle provide two conclusions that summarize the results of fifteen years of research into the issue of hub premiums:

- “Hub premiums are less of an issue today than they were in the earlier stages of hub premiums research and, therefore, may not warrant regulatory intervention.
- Average fares and hub premiums will likely decrease in the future, as LCCs expand their operations and continue to challenge established network carriers.”\textsuperscript{131}

Despite this recent research, the DOT maintains that there is a substantial and problematic hub premium, referring to hubs as “pockets of pain” in a 2001 report, and rejects many of the arguments to the contrary.\textsuperscript{132} In 2001, the DOT argued that pas-

\textsuperscript{123} Id. at 7, 8, 21, 22.
\textsuperscript{124} Id. at 30.
\textsuperscript{125} Id. at 15-16.
\textsuperscript{126} Id. at 30.
\textsuperscript{127} Christian Hofer, Martin Dresner, & Robert Windle, Hub Premiums in an Era of Low-Cost Carriers and Financial Distress, Address at the 2004 Air Transport Research Society World Conference in Istanbul, Turkey (July 2, 2004) [hereinafter Low-Cost Carrier Competition and Hub Premiums].
\textsuperscript{128} Id.
\textsuperscript{129} Id.
\textsuperscript{130} Id.
\textsuperscript{131} Id.
\textsuperscript{132} Office of the Assistant Secretary for Aviation and Int’l Affairs, Dominated Hub Fares 21 (2001).
senger-mix or the "Southwest effect" are not factors that explain away the hub premium, but rather are symptoms of the problem. The DOT's main contention is that average fares have consistently declined at major hubs following entry by an LCC, such as Southwest, indicating that the hub carrier was exploiting its monopoly position prior to the LCC's arrival. This is a possibility, but it denies the findings that part of the hub premium may be due to service-quality differences, such as non-stop versus connecting flights or frequent flyer reward travel as a form of quantity discount. If the DOT view is true, it does appear the hub premium problem is one that has been corrected to a large extent by market forces.

The issue of the hub premium continues to be controversial, but it appears that some conclusions can be drawn after more than fifteen years of research. Early studies found substantial premiums at hubs. However, subsequent research showed that these failed to control for other factors, such as traffic-mix, frequent flyer reward tickets, low cost carriers and distance. More recent studies have attempted to control for these factors and have revealed a smaller premium. The investigation of hub premiums has also revealed that another factor was influencing fares paid. That is whether a low cost carrier such as Southwest is present in the market. While this was of secondary interest in the original development of the literature, the research results indicated that the LCC effect was large, potentially as important as hub premiums in explaining differences in air fares in different markets. The next section examines the literature on the LCC effect.

133 Id. at 11.
134 Id. at 11-12.
135 Borenstein, supra note 8, at 355-56; U.S. GEN. ACCOUNTING OFFICE, supra note 7, at 32-34.
137 Lee & Luengo-Prado, supra note 121, at 7.
138 Morrison Statement, supra note 116, at 2. Much of the research into the LCC phenomena refers to the "Southwest Effect" as it is by far the largest and long-lived of the LCCs. Id.
139 DOMINATED HUB FARES, supra note 132, at 11.
C. Impact of the Low Cost Carriers on Average Air Fare on a Route

In 1993, Bennett and Craun of the DOT published a report charting the rise of Southwest Airlines. The authors characterized Southwest as focused on short-haul, high-density markets, offering point-to-point service, with unit costs one-half to two-thirds of its network carrier competitors. They found that routes served by Southwest had average fares 49-56% lower than similar-length routes without Southwest service. They also described Southwest’s impact on the California corridor, from San Francisco to Los Angeles. Operating out of Oakland, the carrier started service to Los Angeles International, Los Angeles Ontario, and Los Angeles Burbank.

From the 1989 start of these routes, Southwest’s traffic grew dramatically, to the point where it became the largest carrier in the corridor with a 42% traffic share, despite not serving San Francisco International Airport. Average fares (across all airlines) on the Oakland-Ontario route declined by 60%, and traffic trebled after Southwest entered. In addition, average fares also declined on parallel, competing routes that Southwest did not serve, such as San Francisco-Los Angeles, resulting in increased traffic on those routes. The research observed that many airlines eventually exited the market, unable to compete alongside Southwest. Remarkably, the authors raised concerns that Southwest’s success may result in it being a monopoly carrier in many markets and that government policy needs to encourage new LCC entry to discipline Southwest.

In 1995, Windle and Dresner examined the impact of LCC-entry on fares and traffic levels on a route and considered

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141 Bennett & Craun, supra note 140, at 3.
142 Id. at 12-13.
143 Id. at 6, 14-19.
144 Id. at 6.
145 Id. at 6, 7, 14.
146 Id. at 7.
147 Id. at 9.
148 Id. at 7.
149 Id. at 9.
whether the impact differed from entry by a network carrier.\textsuperscript{150} They also examined whether the fare and traffic effects continued past an initial "promotional" period after the carrier entered the market.\textsuperscript{151} Computing changes in average fares (averaged over all routes with entry) for the four quarters before and after entry, they found that, on average, route fares declined by 12\% immediately following entry by a network carrier and, one year later, increased to reach a fare-level that was 5\% below the pre-entry level.\textsuperscript{152} Traffic was 17\% above pre-entry levels one year after entry.\textsuperscript{153} By contrast, entry by Southwest reduced the average route-fare by 48\% and remained close to that level over the ensuing four quarters.\textsuperscript{154} Traffic levels on these routes increased by 200\%, on average, one year after entry.\textsuperscript{155} The impact of other non-network carriers were less dramatic than Southwest but larger than the network carriers; fares declined by 20\% one year after entry, and traffic increased by 50\%.\textsuperscript{156} The authors also observed that, if the entrant later exited the market, average route fares did not increase, and traffic levels remained at pre-exit levels.\textsuperscript{157}

In a 1996 study, Dresner, Lin and Windle further examined the impact on fares resulting from the entry of an LCC.\textsuperscript{158} Their research examined not only the impact on fares on the route entered, but also the impact on fares on other routes from the same airport and on parallel routes from nearby airports.\textsuperscript{159} The authors examined Southwest's entry into Baltimore/Washington airport (BWI), flying to Cleveland and Chicago Mid-

\textsuperscript{151} \textit{Id.} at 14.
\textsuperscript{152} \textit{Id.} at 17-18.
\textsuperscript{153} \textit{Id.} at 19.
\textsuperscript{154} \textit{Id.} at 18.
\textsuperscript{155} \textit{Id.} at 19.
\textsuperscript{156} \textit{Id.} at 18-19.
\textsuperscript{157} \textit{Id.} at 20. In the same paper, the authors formalized their findings using a regression model which related average route fare to distance, route concentration, other market factors and airline specific dummy variables. \textit{Id.} The regression analysis also found that the presence LCCs, such as Southwest, on a route had a much larger impact of fares than any network carrier. The impact of carrier identity were so large as to make the coefficient on route concentration insignificant, therefore, the identity of the carriers on the route is more important than the number of carriers on a route or their market share. \textit{Id.}
\textsuperscript{159} \textit{Id.}
Dresner, Lin and Windle found that average fares on the Southwest routes from BWI declined by 60-75%, and that fares on other routes from BWI not operated by Southwest declined by 18-40%. The effect was more pronounced on routes of a similar length to those operated by Southwest. They also observed fare reductions at nearby Washington Dulles and National airports on routes to Ohio and Chicago, though the reductions were modest.

The authors carried out regression analysis to produce more generalized results and to control for other factors that affect fares. Using data on route yields rather than average fares, they found that entry by an LCC onto a route reduced average route yields by 38%. If the LCC was Southwest, yields were reduced by 53% – a larger impact than the average LCC. Entry of an LCC at an airport reduced yields by 41% on routes not served by the LCC, with reductions in yields being larger the greater the number of routes the LCC operated from that airport. The authors concluded that the influence of LCCs extended beyond the routes they served and impacted other airports.

In 2001, Morrison also examined the impact of LCC entry, specifically entry by Southwest, on other routes from the same airport (referred to as “potential competition”) and on competing parallel routes from nearby airports (referred to as “adjacent competition”). Using data from 1998, the authors used a regression model to analyze the correlation between (1) the average fare on a route to distance, (2) number of carriers on the route, (3) other market factors, and (4) dummies indicating whether Southwest operated on the route, on a competing route, or from the same airport. The analysis found that

160 Id. at 312.
161 Id. at 313, 314, 316, 317.
162 Id.
163 Id. at 314.
164 Id. at 319. While their analysis of fares before and after entry examined impacts on parallel routes from nearby airports, the regression analysis did not do so, examining only the impact on other routes from the same airport. Id.
165 Id. at 326.
166 Id.
167 Id. at 327.
168 Id.
170 Id. at 243, 245-47.
Southwest's presence as a potential competition on a route reduced fares by an average of 46% and that Southwest's presence on a competing parallel route as an adjacent competitor reduced average fares by between 15% and 26%, depending on route characteristics. The analysis also included a dummy variable that indicated whether either endpoint airport was dominated by one airline – determined by whether one airline accounted for 60% or more of enplanements – and found that airport dominance increased fares by 4%. This analysis suggests that, in general, the competitive impact of entry by an LCC greatly outweighs any monopoly pricing power enjoyed by dominant hub airlines. Morrison took the analysis one stage further to estimate the total annual savings to travelers of Southwest's presence. In 1998, Southwest was estimated to induce $12.9 billion in savings to travelers per annum, $9.6 billion of which was due to actual and adjacent competition and $3.3 billion due to potential competition.

In 2001, Vowles also examined the impact of Southwest's entry into an airport on fares on competing routes at other nearby airports with no Southwest service. For example, the average fare on the Chicago O'Hare–Columbus route before and after the startup of Southwest's Chicago Midway–Columbus service. The analysis found that, in general, airports near an airport that Southwest enters also experience a decline in average air fares. Of forty-seven routes examined, thirty-six induced a reduction in average fares at a nearby airport. Vowles also found that, generally, the airports that lowered fares did not experience an increase in traffic; rather, the lowered fares were required to maintain or to avoid a significant reduction in traffic levels due to competition from Southwest.

171 Id. at 249.
172 Id. at 249-50.
173 Id. at 247-48.
174 Id. at 250.
175 Id. at 253-54; Timothy M. Vowles, The Southwest Effect in Multi-Airport Regions, 7 J. AIR TRANSPORT MGMT. 251-58 (2001).
176 Id.
177 Id. at 253.
178 Id. at 251-52.
179 Id. at 252.
180 Id.
A number of conclusions can be drawn from the literature. First, there is a consensus that the entry or presence of an LCC on a route, particularly Southwest, results in a dramatic and permanent reduction in fares. Second, the influence of the LCC appears to extend beyond the routes it operates. Average fares for other routes operated from the same airports, or even nearby airports, have declined, despite having no LCC service. Third, the impact of the presence of an LCC on a route is very large and generally exceeds the effects found in the preceding section for hub dominance.

Given the findings of the sizeable impact of LCCs on average fares paid by consumers, additional research has been carried out to explore what induces an LCC to enter a route, how the incumbent airlines react to the entry of a new carrier, and how that reaction impacts the entrant.181 These are the subjects of the next two sections.

IV. FACTORS AFFECTING ENTRY BY A NEW CARRIER

A number of research studies have explored market conditions under which LCCs and other carriers will enter a route.182 In 1990, Morrison and Winston examined the factors that affect route entry and exit decisions of network carriers and LCCs.183 Using data from 1979 to 1988 on thirteen domestic airlines, the authors estimated probit models of route entry and route exit.184 The route entry model related the probability of entry to the airline’s market share at the origin and destination airports (percentage of departures), the same market share of the largest competitor airline, average route yield relative to other routes of similar distance, population at the origin and destination and a dummy indicating a slot-constrained airport at either endpoint.185 The route exit model related probability of exit to the same variables.186

181 See Dynamics of Airline Pricing and Competition, supra note 30, at 391; see also Martin Dresner and Robert Windle, Competition Responses to Low Cost Carrier Entry on U.S. Domestic Air Routes, 35 Logistics & Transp. Rev. 60 (1999).
183 Dynamics of Airline Pricing and Competition, supra note 30.
184 Id. at 392.
185 Id.
186 Id.
The route entry model for both network carriers and LCCs found that the carrier’s own airport network size, as measured by the market share at the origin and destination airports, had the largest influence on route entry.\textsuperscript{187} However, a competitor’s airport network size had no significant impact on entry decisions.\textsuperscript{188} The analysis also showed that, contrary to the authors’ initial expectations, higher route yields deterred entry.\textsuperscript{189} While this effect is relatively small, they suggest that high fares may signal higher costs to operate the route, barriers to entry such as frequent flier programs, incumbent response or all three.\textsuperscript{190} The authors were careful to point out that the findings do not imply that high-fare routes are immune from entry.\textsuperscript{191} Entry can and does occur from a carrier with a strong network.\textsuperscript{192} The results also showed that slot controls at an airport were found to be a deterrent to entry.\textsuperscript{193} The route exit model found similar results as the route entry model, but of opposite sign, suggesting market symmetry.\textsuperscript{194} This includes the paradoxical impact of high fares.

Over a decade later in 2003, Ito and Lee examined the factors affecting route entry decisions by LCCs\textsuperscript{195} and estimated a probit model of LCC entry.\textsuperscript{196} The estimation related the probability of LCC entry onto a route to route-traffic density, distance, route and airport concentration, price before entry and other market factors.\textsuperscript{197} The estimation results indicated that traffic density and pre-entry price were the most important factors in deciding entry, both having a positive impact on the probability of entry.\textsuperscript{198} Income and population had a negative impact on the probability of entry,\textsuperscript{199} suggesting that LCCs tend to avoid large metropolitan areas and large business centres in favour of secondary airports. The presence of a network hub at

\begin{thebibliography}{9}
\bibitem{187} Id. at 391.
\bibitem{188} Id. at 391-92.
\bibitem{189} Id. at 392.
\bibitem{190} Id.
\bibitem{191} Id.
\bibitem{192} Id.
\bibitem{193} Id.
\bibitem{194} Id.
\bibitem{195} Ito & Lee, \textit{supra} note 30, at 7 (estimating the benefits of removing the severe restrictions on markets which could be served from Dallas Love Field).
\bibitem{196} Id.
\bibitem{197} Id. at 9-11.
\bibitem{198} Id. at 13.
\bibitem{199} Id. at 14.
\end{thebibliography}
either route endpoint reduced the probability of LCC entry, as did airport congestion.\textsuperscript{200} The variables relating to route and airport concentration were not significant\textsuperscript{201} suggesting that pre-existing competitive factors do not play an important role in LCC entry decisions.

The model was also used to estimate the extent of LCC entry in the future, by applying the model to a large selection of routes currently without LCC service.\textsuperscript{202} The model estimated an additional 24\% of network carrier domestic revenues could be exposed to LCC competition, increasing their total revenue exposure from 32\% in 2002 to 56\% in long-term.\textsuperscript{203}

\section*{V. INCUMBENT RESPONSE TO LCC ENTRY}

Given the importance of LCC entry for the average air fare paid by consumers, the issue of incumbent response to LCC entry has received some recent attention.\textsuperscript{204} In 1999, Windle and Dresner examined how incumbent carriers responded to entry by an LCC.\textsuperscript{205} Their paper responded to the 1996 research by the DOT, which examined the impact of LCC entry on Delta Airlines’ fares at its hubs in Atlanta and Salt Lake City.\textsuperscript{206} The DOT found that Delta charged lower fares on routes with LCC competition and higher fares on routes without LCC competition.\textsuperscript{207} The DOT suggested the higher fares on the non-LCC routes were to compensate for losses/reduced profits on the LCC-affected routes.\textsuperscript{208} Windle and Dresner focused on Delta’s response to entry by the LCC, Valujet, at its hub in Atlanta.\textsuperscript{209} The analysis took the form of regression models relating changes in Delta’s yields on individual routes to distance, population at the route endpoints and other market factors.\textsuperscript{210} Separate models were estimated for routes with and without

\begin{footnotes}
\item[200] \textit{Id.}
\item[201] \textit{Id.} at 15.
\item[202] \textit{Id.} at 19.
\item[203] \textit{Id.} at 25.
\item[204] See, e.g., Windle & Dresher, \textit{supra} note 150, at 60; Ito & Lee, \textit{supra} note 30. A small body of research has also developed on the factors leading to fare wars in the airline business.
\item[205] Windle & Dresner, \textit{supra} note 150, at 60.
\item[206] \textit{Id.} at 59.
\item[207] \textit{Executive Pricing Summary, supra} note 3, at 14.
\item[208] \textit{Id.} at 16.
\item[209] Windle & Dresner, \textit{supra} note 150, at 61. ValueJet subsequently merged with another LCC to form Air Tran.
\item[210] \textit{Id.} at 60-61.
\end{footnotes}
competition from ValuJet, as well as for direct and connecting markets. The results of the analysis showed that Delta’s yields declined by roughly 25% on routes where ValuJet had entered. However, on routes where Delta did not compete with ValuJet, yields were roughly the same and, in some cases, lower. The authors found no evidence of Delta increasing yields on non-ValuJet routes to compensate for yield reduction on routes with competition from ValuJet. In Windle and Dresner’s view, this supports the argument that airlines practice rational economic pricing on their networks, that carriers do not increase fares on non-LCC routes as they are already maximizing profit on those routes. They suggest that the DOT analysis did not correct for exogenous and endogenous factors, which may have affected the results.

In a later paper, Lin, Dresner and Windle examined, in a more generalized way, incumbent response to entry by a new carrier. The analysis covered entry by network carriers as well as LCCs, focusing on the factors affecting the incumbent’s fare response. The difference in the incumbent’s fare before and after entry of another carrier was regressed against the incumbent’s health and size, the entrant’s health and size, the entrant’s entry strategy and various market factors. On average, the incumbent’s fare declined by 9-10% following successful entry by another carrier. The regression analysis also indicated that the lower the entrant’s fare was, the greater the incumbent response; in other words, the incumbent matched the fare behavior of the entrant. Also, the greater the number of passengers the entrant attracted, the more the incumbent discounted its fares. However, the incumbent reduced fares less aggressively the lower the unit-cost of the entrant, indicating that the

211 Id.
212 Id. at 65.
213 Id.
214 Id.
215 Id. at 66.
216 Id. at 68.
218 Id.
219 Id. at 11-12.
220 Id. at 14, 16.
221 Id. at 18.
222 Id.
incumbent believes price cuts will be less effective against an efficient carrier with a cost advantage. The incumbent discounted less aggressively if the entrant was Southwest or another non-major carrier than if the entrant was a major network carrier. Smaller incumbents tended to discount more aggressively. The most aggressive discounter was Southwest, indicating that it protects its position as the price leader. The analysis also found evidence that incumbent fares remained low even if the entrant later abandoned the routes, possibly to deter future entry.

In a second 2003 study, Ito and Lee examined incumbents’ reactions to LCC entry into routes to and from their hubs. Using data from 1991 to 2002, they observed that, on average, the LCC entered a route with a fare 50% less than the incumbent’s pre-entry fare and provided about one third the capacity of the incumbent. In general, the response of the incumbent was modest – capacity was increased by 3-4%, on average, and fares declined by 15%. The responses varied by airline; Delta Air Lines was most aggressive in reducing fares, by an average of 25%, and American Airlines was the least aggressive reducing fares, by an average of 8%.

The authors then estimated a probit model examining the incumbent responses most likely to result in the LCC exiting the market. The probit analysis related the probability of the LCC’s exit from a route to the incumbent’s change in capacity and fare, the LCC’s initial capacity and fare, the size of the LCC in terms of total passengers and other market factors. The analysis found that the incumbent’s capacity response had no impact on the probability of the LCC exiting. However, while the incumbent’s fare response had a negative impact, the larger the fare reduction, the smaller the probability the LCC would exit. The authors suggest that this somewhat surprising result

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223 Id.
224 Id. at 19.
225 Id.
226 Id.
227 Id.
228 Ito & Lee, supra note 30, at 3.
229 Id. at 11.
230 Id. at 23.
231 Id.
232 Id. at 15.
233 Id. at 17-18.
234 Ito and Lee, supra note 30, at 20-21.
indicates that LCCs are more successful in markets that had pre-existing higher margins. Overall, the authors found no strong evidence that an incumbent’s capacity expansion or pricing decisions following LCC entry increased the probability that the LCC would exit the market. Rather, factors relating to the route and the LCC’s own characteristics, such as the pre-existing market density, the entrant’s initial capacity choice and the LCC’s pre-entry presence at the market endpoints of a route, were more likely to impact their entry and exit decisions.

Researches Li Zou, Martin Dresner, and Robert Windle’s 2004 study suggests that LCCs demonstrate a very different competitive response to multi-market contact than network carriers. The authors test the mutual forbearance theory first put forward by Edwards in 1955, which states that when two firms meet in multiple-product or geographic markets, they may hesitate to contest a given market vigorously for fear of retaliatory attacks in other markets that would erode prospective gains. However, where firms have very different cost structures, this mutual forbearance may not apply, as the firm with the cost advantage can apply that advantage across all markets. Zou, Dresner and Windle found that network carriers did appear to collude in accordance to the mutual forbearance theory, as their regression analysis found that multi-market contact had a positive influence on network carrier fares. However, increased multi-market contact by LCCs had a negative impact on fares. The authors suggest that it is not in an LCC’s best interest to collude, given its lower unit-cost structure.

235 Id. at 21.
236 Id. at 22.
237 Id. at 21.
239 Id. (citing C. Edwards, Conglomerate Bigness as a Source of Power, in National Bureau of Economic Research Conference Report 335 (1995)).
240 Edwards, supra note 239, at 336.
241 Many Fields of Battle, supra note 238.
242 Id.
VI. CONCLUSION AND DIRECTIONS FOR FURTHER RESEARCH

This paper has reviewed the literature concerning the economic effect of market structure on air fares following deregulation of the U.S. airline market, focusing on two related areas—hub premiums and low cost carriers. Economic literature began to appear in the 1980s, investigating whether hub dominance resulted in exploitation of market power by the dominant hub carrier, a topic that caught the attention of government agencies and the media.243

The initial literature concerning hub dominance found that fares were higher for trips that originated from concentrated hub airports.244 A 1990 study by the GAO suggested that the hub premium was 27%.245

Some of the early studies did not, however, control for key market characteristics that might explain why hubs would naturally have higher fares. To address this, researchers began to estimate statistical regression models with control variables to separate the effects of market characteristics from the effects of hub dominance.246 Many later studies found that much of the premium could be explained by other factors, such as route distance, traffic mix, the higher value placed by consumers on nonstop versus connection flights, airport constraints and frequent flyer tickets.247 For example, research by Morrison and Winston found that a 33% hub premium estimated using the GAO methodology was reduced to only 5.2% after accounting for market characteristics.248

After fifteen years of research, the literature continues to find that market concentration at hub airports significantly affects average air fares paid by consumers.249 In recent papers, however, the magnitude of this effect has been whittled down to single-

244 See, e.g., Borenstein, supra note 8, at 362; U.S. Gen. Accounting Office, supra note 243, at 3.
246 Borenstein, supra note 8, at 349-51; The Evolution of the Airline Industry, supra note 16, at 471.
247 Borenstein, supra note 8, at 362; The Evolution of the Airline Industry, supra note 16, at 48-49.
249 See, e.g., Lee & Luengo-Prado, supra note 121.
digit levels.\textsuperscript{250} Other variables were found to be more influential on the higher fares paid at concentrated hubs.\textsuperscript{251}

As researchers continued the investigation of hub premiums, they began to quantify another post-deregulation phenomenon—the impact of LCCs on average airline fares paid by consumers. This research on LCCs found that:

- Regardless of market structure, the presence of an LCC has a dramatic and permanent impact on fares in the market.\textsuperscript{252}
- An LCC-effect is also present on routes not directly served by the LCC, such as where it provides service at one or both ends of the route. This effect is smaller than the direct effect of LCC presence on a route, but is statistically significant.\textsuperscript{253}
- The LCC-effect is much larger than any hub premium that might be present in a market. LCC entry, for example, was credited with reducing average fares by up to 48\%.\textsuperscript{254}
- LCCs were not deterred from entering a route by the incumbent airline’s hub dominance.\textsuperscript{255}
- Dominant airlines at a concentrated hub were largely unable to use their dominance to force LCCs out of the market once they had entered, likely due to the lower unit-cost structure enjoyed by the LCCs.\textsuperscript{256}

While the recent paper by Hofer, Dresner and Windle suggested that hub premiums are less of an issue today,\textsuperscript{257} there are a number of areas that warrant further examination. First, the literature described above was entirely based on U.S. data. Industry structure issues have arisen in Canada, the European Union, Australia, New Zealand and elsewhere. The U.S. findings, while of interest to policy makers in these jurisdictions, are not fully transferable. Not only are there differences in market sizes, but market characteristics also vary, including average route distances, the degree of airport congestion, and entry barriers such foreign ownership restrictions. It would be worthwhile to examine whether the same findings would apply elsewhere. This would

\textsuperscript{250} The Evolution of the Airline Industry, supra note 16, at 48.
\textsuperscript{251} Borenstein, supra note 8, at 362; The Evolution of the Airline Industry, supra note 16, at 48-49.
\textsuperscript{252} Lee & Luengo-Prada, supra note 121.
\textsuperscript{253} Morrison, supra note 169, at 249-50.
\textsuperscript{255} Dynamics of Airline Pricing and Competition, supra note 30, at 20-21.
\textsuperscript{256} Ito & Lee, supra note 30, at 20-21.
\textsuperscript{257} Low-Cost Carrier Competition and Hub Premiums, supra note 127.
provide insight into airline policy in those jurisdictions, as well as test the robustness of the findings from U.S. airline markets.

In part, the lack of research on the effect of market concentration on average airline fares outside the United States is due to the fact that, in other countries, publicly available data on individual ticket purchases is difficult to obtain. Very few jurisdictions have publicly available data similar to the Department of Transportation’s DB1a dataset. Foreign studies may require the use of expensive commercial data, the use of surveys to gather primary data, or the use of propriety data from government agencies or the air carriers themselves. The authors of this review have conducted some research using commercial and/or propriety Canadian, European, and Australian data and indicate that this line of research, while not complete, shows promise.

Additionally, experiences in other jurisdictions demonstrate what happens when radical restructuring takes place. Canadian Airlines was merged into Air Canada, resulting in a market structure where the resulting dominant carrier had a market revenue share of close to 90%.258 In Australia, the failure of Ansett resulted in Qantas dominating the market with an unanticipated 90% share in domestic markets.259 The transitions in these markets have much to tell economists regarding determinants of average fares.

Second, LCCs have grown to share over 25% of domestic passengers carried in the United States and higher shares in Canada, Australia and the United Kingdom.260 LCCs are also rapidly increasing market shares in Malaysia, Brazil, Germany and other countries in the European Union. Some routes and/or airports are now only served by LCCs. Does this provide LCCs with the opportunity to extract premiums of their own? Should the LCCs grow to market shares approaching or possibly exceeding 50% of traffic carried? Issues of LCC rivalry and the impact on air fares will be of importance to competition authorities.261 The recent research by Hofer, Dresner and Windle pro-

258 Id.
259 Id.
260 Id.

261 In 2004, Tretheway discussed the potential market share of the LCCs. Michael Tretheway, Distortions of Airline Revenue: Why the Network Airline Business Model is Broke, 10 J. AIR. TRANSPORT MGMT. 13-14 (2004).
vides some initial evidence on this issue, opening a new focus for research.262

Third, as the LCCs have greatly increased their share of the air market in the United States, Canada, Australia, Europe, Brazil, Malaysia and elsewhere, some of the large network carriers have responded by creating pseudo-LCCs subsidiary carriers (or brands), including Ted (United Airlines), the now defunct ZIP and Tango (Air Canada), JetStar (Qantas – Australia) and Freedom (Air New Zealand). In Europe, British Airways created Go, and KLM created Buzz, but both of these were eventually sold and ultimately merged into the LCCs Ryanair and EasyJet, respectively.263 Do these quasi-LCCs provide the same type of pricing discipline that independent LCCs provide, or are they a form of incumbent response?

Finally, the existing literature accounts for the effect of LCCs on average fares in the market, but does not precisely indicate the effect of an LCC on hub premiums. It would be useful to have analysis that explicitly controls for whether or not an LCC is present when determining the existence and/or magnitude of the concentrated hub premium.

262 Low-Cost Carrier Competition and Hub Premiums, supra note 127.
263 Id.
Comments