Low-Cost Carriers and Low Fares:
Competition and Concentration in the U.S. Airline Industry

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Abstract

This analysis will examine the current structure of the domestic airline market to determine the amount of market power incumbent carriers wield, the market dynamics that exist in short haul and long haul routes, and the impact of a new breed of air carrier, the low-cost carrier, on the distribution of airfares. The analysis seeks to determine if the pricing strategies of competitors differ depending on a low-cost carrier's presence on a route. The presence of a low-cost carrier is a more important determinant of the competitiveness of a particular route than the extent of route and hub concentration on that route. Moreover, this paper argues that previous analyses overestimate the effect of route concentration, hubs, and other route specific characteristics on the distribution of market prices. The emerging significance of the low-cost carrier may indicate a shift in the structure of the airline market away from hub-and-spoke networks and towards point-to-point networks.

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1. Introduction

This paper analyzes the current state of the airline market to determine the impact of a new breed of air carrier, the low-cost carrier, on airfares, the market dynamics that exist in short haul and long haul routes, and by what degree previous analyses overstate the importance of hubs and concentration. Although, financial turmoil surrounds the airline industry today, the evolution of the domestic airline market, in the United States, continues. Since deregulation in 1978, the cost of air travel has fallen and the size of the airline industry has grown rapidly. The early predictions of economists that airline deregulation would improve consumer welfare have been proven to be correct (Borenstein 1992). Over ten years after deregulation, Borenstein (1989) finds that high levels of route and hub concentration are correlated with higher airfares. Hubs impact the entire distribution of fares for all flights originating or terminating at those hub airports. Moreover, potential competition has little if any disciplining affect on market prices.

The conclusions that Borenstein (1989) derives from an analysis of the airline market are still valid today; moreover, without controlling for the presence of low-cost carriers, hubs and high levels of concentration skew the price distribution and shift it rightwards. Even after controlling for route specific characteristics such as distance, load factor, and aircraft equipment route and airport concentration are estimated to raise prices at each point of a route's price distribution. Today's airline market has evolved markedly since the late 1980s. While low-cost carriers only carry 15% of the domestic traffic in the United States, their impact on prices is significant and broadly distributed over the marketplace (Parker Oct 17, 2002).This paper argues that most of the hub effect is due to the lack of a low-cost carrier serving that hub and not associated with the hub itself. More generally, the measurable change in price distributions associated with high levels of route and airport concentration is overstated. Much of the concentration effect is directly attributable to the presence of a low-cost airline or in this case the lack thereof.

The disciplining force of the low-cost carrier is apparent in the regional airline market, where Richards (1996) finds that the potential presence of Southwest measurably lowers airfares. Yet, Richards postulates that Southwest (a low-cost carrier) does not have the same impact in the long haul market as it does in the regional market. This analysis argues that low-cost carriers, such as Southwest and JetBlue, continue to discipline prices in the regional market but also discipline prices in the long haul market. A significant change in the distribution of prices is no longer a direct consequence of levels of route and airport concentration when low-cost carriers are represented in the estimated equations.

The impact of a low-cost carrier is independent of market distinctions and subdivisions. On each route, regardless of its characteristics, a low-cost presence alters the distribution of airfares to produce a distribution with a tighter range and lower median fare. Borenstein shows that high levels of route and airport concentration, characteristic of airline hubs, raise fares at the high-end of the market's price distribution; however, low-end fares are not untouched, these factors raise low-end fares as well. Thus measures of route and airport concentration affect the range and height of each and every route price distribution. Although, concentration levels may alter each fare in a distribution, Borenstein argues that these measures impact the highest percentile fares to the greatest extent. This paper determines that the largest shift in the expected price paid is consistently at the upper tail of the price distribution. To this day, route and hub concentration continue to primarily alter the shape of the composition of airfares to a greater degree at higher price percentiles. This paper's baseline estimates would imply that the concentration effect is as much of a factor today as in the Borenstein (1989) analysis; however, important interactions, not limited to concentration measures, call into question the validity of this paper's baseline equations. The level of concentration, along with other often used route characteristics, no longer provides as accurate an account of the airline market as possible.

A low-cost presence lowers prices at the low end, median, and high-end of ticket prices in all market segments. In other words, this new breed of air carrier disciplines market prices at any price point within a given market. The broadening impact of the low-cost carrier across price points suggests that the airline market is evolving; moreover, the level of many of the effects economists have attributed to concentration levels, hubs, and slot constraints may in fact be overstated. Instead of measuring the relationship between concentration levels, hubs, slot constraints and prices this paper argues that previous econometric analyses may have actually been measuring the impact on a route or airport of not having a low-cost carrier. An understanding of the significance of the low-cost carrier requires insight into what constitutes a low-cost carrier. The ability of the low-cost carrier to compete with established hub-and-spoke carriers on price represents an evolution of the airline market in the United States.

This thesis argues that a change in the conventional method of analysis is necessary to build an accurate dynamic model for estimating prices. That critical change involves altering standard models of analysis in order to measure the impact of low-cost carriers. Concentration levels are no longer the most important factor in determining the level of market prices; moreover, measures of concentration may have never been as key to understanding the dynamics of the airline market as previously suggested. Not controlling for low-cost carriers, today's airline market resembles the market of the late 1980s even though a variety of structural changes have taken place since then. The measurable impact of the low-cost carriers has two implications. First, the presence of a low-cost carrier causes the distribution of prices to flatten and shift left. The median fare is lower and price volatility is lower. Second, the lack of a low-cost presence raises prices. Borenstein is not only measuring the impact of concentration with controls for route and airport dominance, but also is measuring the lack of a low-cost presence through those variables.

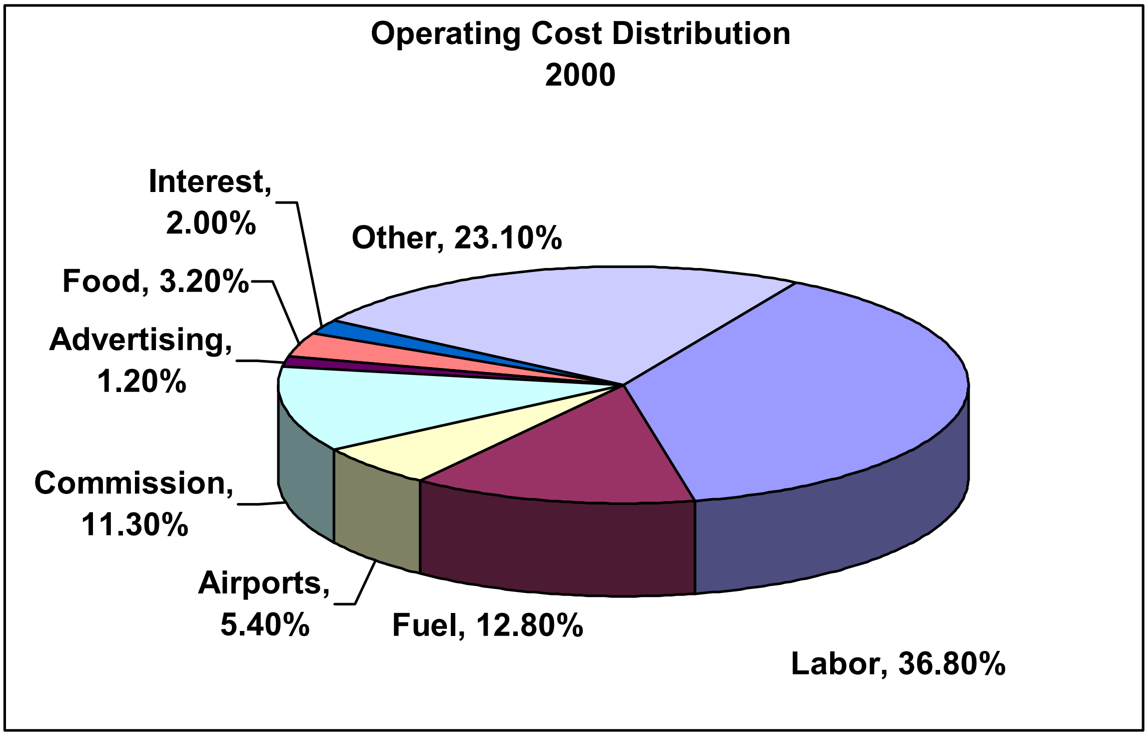
Low-cost carriers cause price distributions to compact and shift lower across all market segments. Hence, a large fraction of the concentration effect is directly due to the lack of a low-cost presence. An examination of previous literature written on the airline markets and the principle market participants provides a solid superstructure within which a model can be built to determine the range of the low-cost carriers' impact on the marketplace. The low-cost carriers' growing market share brings to light the consequence of competitive entry in the airline industry. Moreover, a low-cost presence is correlated with a flatter price distribution, a higher degree of competitiveness, and a decline in the relevance of concentration, frequency, hubs, and capacity constraints in predicting market prices. This result suggests any future analysis of the competitive structure of the airline industry should take into account the low-cost effect.

2. Low-Cost Carrier: A Definition

This paper defines the low-cost carrier to be an airline that operates a point-to-point network, pays employees below the industry average wage, and offers no frills service. The two most prominent low-cost carriers, JetBlue and Southwest, both have labor costs 30% to 40% lower than the mainline carriers. A traditional major carrier often has a number of tools at its disposal, which it can use to deter entry or lessen the competitiveness of recent entrants. These tools include predatory pricing, loyalty programs, and congestion at the nation's most popular airports. Yet, these tools are not effective against low-cost carriers with point-to-point networks. A low-cost airline can engage in Bertrand competition, with a high-cost competitor, without pricing at its own marginal cost. The low-cost carrier can successfully neutralize the dominance of its competitors, by competing on price.

The lower cost structure can be quantified by aggregating the cost savings of point-to-point networks, wage savings, and savings from not providing numerous add-on services. While labor costs are the largest single cost item for airlines, there are many other costs. The pie chart in Figure 1 illustrates the composition of costs for the aggregate airline industry in 2000. The cost differential between the low-cost and major carriers is not only attributable to the wage differential. Although, the primary cost for any carrier is labor related. Controlling labor costs can improve the bottom line. The operating cost distribution below suggests that lowering labor costs by 10% can lower the average airline's total cost by 3.68%.

Figure 1 Airline Operating Cost Distribution



Source: Air Transport Association, 2001.

The lower cost structure of a point-to-point network is a consequence of a number of factors. They include: Airport congestion, which causes costly delays at hubs and is not as prevalent at airports used by point-to-point carriers. For every major metropolitan airport there are often two to three secondary airports. Low-cost carriers can achieve fast turnarounds and pay less for leasing airport facilities at secondary airports like TF Green airport outside Providence, Rhode Island. Low airport lease rates and gate costs also contribute to the lower cost structure of low-cost carriers. Under utilized secondary airports often levy lower charges for the use of their facilities.

In comparison, hubs require a large number of gates and personnel per flight, due to the banks of flights that are used at hubs. The banks of flights result in the majority of flights arriving and departing within 20-30 minutes of each other. These peak periods result in a high demand for facilities and personnel for short periods of time. For example, at its Dallas Fort Worth hub American operates banks of flights to make connections convenient. While at neighboring Dallas Love Field Southwest spaces its flights out due to the lower emphasis it places on connecting traffic. Like other hub-and-spoke carriers, American Airlines has peak times when a considerable number of planes land at its hubs and passengers rush off to get on their next flight. The system provides customers a high level of convenience but creates operating inefficiencies. Employees stand around between peaks. Planes sit on the ground longer and get caught in line waiting to take off. The hub-and-spoke structure raises an airline's costs at a hub compared to operating that same hub with a de-peaked structure. In particular, the higher number of personal required per flight to effectively operate a traditional hub may be an important factor in the different cost structures of traditional and low-cost carriers. "Spreading out peak travel times at hub airports by several more hours each day, a concept known as rolling hubs, may be one way to make operations more efficient" (Business Week Oct 23, 2002). Major carrier American Airlines is experimenting with a rolling hub in Chicago in an attempt to achieve lower operating costs.

The two most prominent low-cost carriers, JetBlue and Southwest, both have lower labor costs than the large incumbent carriers. Analysts estimate that Low-cost carriers such as Southwest and JetBlue have labor costs 30% to 40% lower than the mainline carriers. For example, United Airlines, American Airlines, Northwest Airlines, and Continental Airlines all have costs at least 40% higher than Southwest. Although, Delta Air Lines and Alaska Airlines have the lowest costs of the majors, each of them has unit costs 30% higher than Southwest's (Wall Street Journal Oct 9, 2002). Table 1 provides a break down of costs and revenue on an ASM (available seat mile) basis for major and low-cost carriers. The comparison is the same for JetBlue, which has a cost structure marginally lower than Southwest's. Low-cost carriers have substantially lower unit costs; however, they do not have substantially lower unit operating revenue.

Table 1 Operating Cost and Revenue for Carriers of Interest

Domestic Carrier	Operating cost per available seat mile (cents) / 2001	Operating revenue per available seat mile (cents) / 2001
American Airlines	11.41	9.22
Continental Airlines	9.58	9.78
Delta Airlines	10.14	9.39
JetBlue Airways	6.81	8.26
Northwest Airlines	9.78	9.17
Southwest Airlines	7.54	8.51
United Airlines	12.00	9.80

Note: All figures are for the twelve month period ended December 31, 2001, except for the JetBlue figures which are for the first quarter of 2002.

Source: 10-K, for fiscal year ended December, 31 2001 for each respective carrier, except for the JetBlue figures which are sourced from the firm's 10-Q, for the quarterly period ended March, 31 2002.

The lack of unionization among low-cost airlines can be characterized as a myth. Of the two largest low-cost airlines one is unionized and the other isn't. Although, most of Southwest's workforce is unionized and all of JetBlue's is not, the aggregate cost structure of the two carriers is almost identical; unionization isn't necessarily correlated with high labor costs for low-cost carriers. These carriers also use fewer employees, because they operate point-to-point networks.

The third and perhaps the most obvious attribute of the low-cost carrier is the no frills service that these carriers provide passengers. Instead of providing passengers with a menu of product choices priced within a range, the low-cost carriers offer a single type of product, coach service. Low-cost carriers do not provide meals on flights, which results in a savings of 5 to 10 dollars per coach passenger. No meals equates to a savings of up to 3.2% from the average carrier's operating cost (see Figure 1). These airlines lack elaborate loyalty programs, which necessitate extra employees, to provide more personalized service, and expensive facilities, like airport clubs. Low-cost airlines do not provide costly services, which are only profit enhancing for a hub-and-spoke carrier able to extract a high level of rents from customers with a high willingness to pay, business travelers. The main advantage of the low-cost carrier is that it can compete on price, with the high-cost traditional carriers. The functional structure of the low-cost carrier is perceptible; moreover, this paper argues that the impact of this unique structure on the airline market is just as evident.

3. Background: The Principal Players

To motivate the econometric model and analysis it is useful to survey briefly the literature on the airline industry and the present condition of four important agents in the airline market at present. The section on concentration and low-cost carriers examines the analysis of past authors. This section provides the reader with a general understanding of the two largest hub-and-spoke carriers, American Airlines and United Airlines, and the two dominant low-cost carriers JetBlue Airways and Southwest Airlines. To explain how two market forces, concentration and low-cost presence, evolved and currently impact the market requires an understanding of these four representative airlines.

3.1. Major Carrier: American Airlines

American Airlines began as “Robertson Aircraft Corporation of Missouri, which was the second aviation company to hold a U.S. airmail contract” (AMR Corp. 2002). Charles Lindbergh flew the first mail freight flight for Robertson on the morning of April 15, 1926. The pace of consolidation increased rapidly as the nascent airline industry grew. In 1930 Robertson Aircraft subsidiaries were incorporated into American Airways, which was renamed American Airlines in 1934.

The introduction of the DC-7 on the New York to Los Angeles route in 1953 was a harbinger of the importance of transcontinental routes to American’s profitability throughout its history. In 1959 American became the first airline to offer nonstop coast to coast jet service with the Boeing 707. This event validated the importance of transcontinental routes to American. A move that would solidify the dominance of

American on many of its routes was the introduction of SABRE. “At the end of 1959 and into the early 1960s, American, teaming up with IBM, introduced and implemented SABRE (Semi-Automated Business Research Environment), the largest electronic data processing system for business use” (AMR Corp. 2002). SABRE served as a powerful device with which profitable price discrimination could be implemented through yield management techniques.

Almost 15 years elapsed between the introduction of SABRE and the implementation of two important complementary initiatives. First, American began marketing SABRE to travel agents in 1975. SABRE’s presence at travel agencies provided American with a direct conduit to market its travel to the consumer. American could use the system to track the amount of business travel agents provided American. Also, American implemented incentives tied to the amount of business an agent did with American. The second initiative was the introduction of the Super Saver ticket. “On April 24, 1977, American introduced the most popular fare in its history, the Super Saver. Initially offering discount fares from New York and California, Super Saver was expanded to all of American's routes in March 1978 and later to Mexico and Canada” (AMR Corp. 2002). The Super Saver allowed American to charge last minute travelers, often business travelers, high fares while charging travelers, who plan ahead and as a group have a more elastic demand curve, lower fares.

In a bid to build brand loyalty, “in 1981, American introduced the AADVANTAGE travel awards program, a revolutionary marketing program to reward frequent fliers” (AMR Corp. 2002). Borenstein (1992) argues that a locally dominant airline can achieve market power through the use of frequent flyer programs. These programs attract repeat business from lucrative business customers. The programs' incentives lower the probability that a customer will choose a competing product. However, every major carrier has a frequent flier program and all of those programs are very similar. The similarity of these programs and the fact that carriers will provide complimentary membership to encourage customers to switch (to their own program) suggests that the market power derived from these programs is not material. Thus SABRE and other innovations provided American with a platform from which it could strengthen its market power. The success of these initiatives may have also spurred the increasing importance of hubs.

Only 6 years after the introduction of SABRE American established its Dallas/Fort Worth hub on June 11, 1981. The Dallas/Fort Worth hub increased concentration levels and may have allowed American to raise prices. The success of its first hub coupled with the use of SABRE and Super Saver tickets prompted American to add "…new cities and routes to strengthen its hub-and-spoke networks" (AMR Corp. 2002). In fact, "…competition has tended to decrease on direct routes to and from the hub (airports)" (Borenstein 1992). Likewise it has been shown that decreased competition often results in higher prices.

More recently, American earned record profits during the late 1990s by raising business fares on a regular basis. American's profitability seemed to validate the dominance of the hub-and-spoke system. The collapse of the airline industry post September 11th and the continued quagmire, in which the airlines find themselves, suggests that American's post deregulation strategy championed by Robert Crandall is no longer effective. In fact, during the spring of 2003 American Airlines found itself embroiled in a fight with its labor unions to lower its labor costs. The failure of the unions to approve the required wage concessions would have resulted in American declaring immediate bankruptcy. Throughout its storied history American has behaved like a rational market participant, most recently building out a profit maximizing hub-and-spoke network. However, American's attempts to salvage its hub-and-spoke strategy may prove to be a fatal mistake. The importance of the point-to-point carriers is rising and shows no signs of abating.

3.2. Major Carrier: United Airlines

The recent turbulence United has experienced contrasts sharply with the calm that enveloped the firm prior to deregulation. That calm reflects the conservative nature of United's management throughout its history. "When it comes to its business decisions, United has been one of the more conservative airlines. For instance, before purchasing a fleet of jets in the late 1950s, United conducted a year-long study to learn the economic effects jet travel would have on its airline operations" (Corporation for Public Broadcasting). While American was aggressively using new technologies and strategies, United always took the more conservative route. United's purchase of bankrupt PanAm's Asia-Pacific routes expanded the scope of its hub-and-spoke network. Ironically this neoconservative purchase, to adopt and strengthen the hub system, may have ultimately led to United filing for bankruptcy in November of 2002.

Although, United was often more conservative than its competitors when it came to strategic business decisions the airline was nonetheless mired in financial managerial trouble for much of its history. "The company ran through a string of six presidents between 1970 and 1989, and changed its name twice as it continued its corporate expansion until forced to divest and return to its core airline business in 1987. It was a period of major hurdles for the airline's senior management team, which faced its biggest challenge when the industry was deregulated in 1978" (UAL Corporation). Given that United had difficulty maintaining profitability in a regulated environment, United's ability to adapt with the changing airline market post 1978 is remarkable.

United remained almost exclusively a domestic airline for several decades. But in the mid 1980s and early 1990s, the airline broke into the international market. A financially-troubled Pan Am sold its fabled Pacific Division to United in 1985. In 1990, United added several European destinations, and a year later, Latin American routes (Corporation for Public Broadcasting). At about the same time United began to construct a set of fortress hubs and started to leverage its yield management technology to more accurately match ticket prices to the individual demand curves of passengers.

The bankruptcy of United Airlines along with its peer US Airways begs the question: Are the days of the hub-and-spoke carrier(s) numbered? United's turbulent and conservative history points to the success of the hub-and spoke system when coupled with frequent flier programs and other anticompetitive practices. Even with all of its troubles United managed to attain record profitability during the late 1990s with its hub-and spoke network. The future for United, American, and the other major carriers is unclear. The ability of these airlines to maintain high levels of concentration, let alone the importance of high concentration levels, is diminishing as a new breed of carrier brings the point-to-point network back into fashion.

American Airlines and United Airlines are typical hub-and-spoke carriers. Each airline's development showcases the major carrier's market strategy since deregulation. The goal of these strategies is to increase the level of profit each firm derives from its own network. Borenstein (1989) argues that hub dominance results in higher prices. The major carriers' strategic activities involve implementing dominance enhancing programs, like frequent flier programs, with the goal of raising profit levels. Thus the widespread use of dominance enhancing programs suggests that concentration levels and hub airports have an effect on price distributions and ultimately the fare each passenger pays.

3.3. Low-Cost Carrier: Southwest Airlines

Although, the history of the low-cost carrier is brief, this form of airline is now a crucial factor in predicting market prices for domestic airline routes. In 1971 Southwest Airlines inaugurated service between Dallas, Houston, and San Antonio Texas. Arguably America's most unique airline Southwest pioneered the low-cost carrier and successful no frills service at a low price. From its humble beginnings as an intra-Texas carrier to its position today as the fourth largest carrier in the United States, Southwest has proven that its business and network models work (Southwest Airlines). A pioneer of the single aircraft type fleet, Southwest also initiated customer friendly initiatives such as electronic ticketing while maintaining a competitive fare structure. The major carriers have attempted to fend of Southwest through allegedly anticompetitive behavior and creating low-cost subsidiaries, such as United Express, Continental Lite, and Delta Express, which have all failed. The failure of competitors to dislodge Southwest from the markets it serves reflects the strength the firm derives from its low-cost structure and extensive route network.

An examination of the Southwest route map reveals that the airline serves secondary airports such as Providence RI, instead of Boston Logan (Southwest.com). Thus Southwest avoids competing directly with the major carriers by serving airports that the majors have little if any service to (Reuters 03/12/02). Southwest only enters routes that it can be profitable on, as opposed to routes where it would have to compete with competitors, who have substantial market power. Southwest's aggressive pricing strategy encourages its competitors to price closer to marginal cost. A simple residual demand example shows how a firm responds to the aggressive pricing of others by pricing more aggressively itself. Case in point, Southwest directly competes with American on Los Angeles area to San Jose flights and as a result American's fares are half as expensive on a price/cost ratio basis versus its own long haul flights (Southwest.com, AA.com). Moreover, in late 2002 American responded to Southwest's competitive pressure by replacing mainline aircraft with cheaper to operate regional jets, from its American Eagle subsidiary, in an attempt to lower its operating costs.

Southwest ends up carrying price conscious passengers, who are willing to forgo certain services and fly from less desirable/convenient airports. Numerous travelers prefer secondary airports that are often closer to suburban households and lack the congestion of city centric airports. While Southwest certainly has brought competition to the routes it has entered, Southwest has chosen to ignore high profit long haul routes (Richards 1996, Pg. 33). Southwest's strategic choice to minimize its competitive interactions with American et al adds validity to the previous arguments by Borenstein that American and United have considerable dominance over the market and have the resources to preserve their dominance over lucrative routes.

Southwest's success will highlight a couple important points, which will aid in explaining JetBlue's strategy. Southwest is a low-cost carrier that charges low prices for its tickets, yet manages to maintain profitability year after year. An analysis of the Southwest effect confirms that, "potential competition appears to be no substitute for actual competition" (Borenstein 1992, Pg. 511). Richards (1996) finds that the pricing strategies of incumbent carriers differ depending on Southwest's presence. Southwest's presence can alter the competitiveness of a route and the composition of the distribution of fares for a route.

3.4. Low-Cost Carrier: JetBlue Airways

Enter JetBlue, an upstart airline that is going head to head with the major carriers on long haul transcontinental routes from John F. Kennedy (JFK) airport. David Neeleman, veteran airline executive, started JetBlue 4 years ago. Mr. Neeleman is familiar with the low-price airline business; he started Morris Air, which is a low fare airline that he sold to Southwest in 1994 (New York Times 08/27/01). JetBlue started with the largest initial capitalization of any airline, over 160 million dollars. Likewise, powerful New York politicians, upset with high intra New York state fares, provided JetBlue with a remarkable 75 slots at JFK, a slot restricted airport (New York Times 08/27/01). Since JetBlue obtained a large quantity of slots, capacity constraints do not protect its competitors. JetBlue has the financial resources to be a formidable competitor and has overcome slot restrictions at a premier airport through intense lobbying of the Clinton Administration (New York Times 08/27/01).

JetBlue resembles Southwest in a number of ways. First, just like Southwest JetBlue operates a fleet made up of a single type of aircraft, the Airbus A320 (JetBlue.com). While Southwest started with second hand aircraft, JetBlue's A320s are all straight from the factory. Operating a single type of airplane lowers JetBlue's operating costs. Moreover, newer aircraft are cheaper to operate than comparable older aircraft. This may explain why JetBlue has a lower cost basis than Southwest. Second, both Southwest and JetBlue have a single class of service, coach; however, JetBlue outfitted its aircraft with "…live satellite TV at every leather seat" (New York Times 08/27/01). Third, at present both airlines have non-hostile relationships with their respective employees (Time Magazine 07/10/01, *Culture and Control* 02/07/98). Most of Southwest's employees belong to unions, while JetBlue hopes to keep costs down by keeping its workforce non-union (New York Times 08/27/01). From a distance JetBlue appears to be a carbon copy of Southwest in every respect; however, the juxtaposition of the two revels that JetBlue is modeling itself after image conscious Virgin Atlantic as much as it is trying to emulate bare bones Southwest (New York Times 08/27/01).

Unlike other startups such as National Airlines, Pro Air, and Legend Airlines JetBlue entered the airline industry with a multitude of advantages those failed airlines lacked. As stated above, JetBlue started with a cash amount almost 5 times more than the amount Legend Airlines, a failed startup partially funded by Las Vegas casinos, began with. JetBlue also serves the primary airport for the New York City area, with millions of potential customers, who lack a low-cost alternative within the New York city metropolitan area (New York Times 08/27/01). These advantages are critical to JetBlue's future success.

Southwest Airlines and JetBlue Airways are typical low-cost point-to-point carriers. Each airline's expansion showcases the low-cost carrier's market strategy in today's marketplace. The goal of these strategies, just as for the major carriers, is to increase the level of profit each firm derives from its own network. Richards (1996) argues that Southwest's presence lowers airfares. The low-cost carriers' strategic activities involve implementing cost control programs, like high aircraft utilization rates, with the goal of raising profit levels. These programs maintain a low-cost airline's competitive advantage, its cost structure. Thus the widespread use and success of cost containment programs suggests that a low-cost presence on a route may have an effect on the route's fare distribution.

4. Importance of Concentration & Low-Cost Carriers

The academic work of economists was a significant force in the movement towards the deregulation of the domestic airline industry in the early 1970s (Borenstein 1992). Post deregulation, most analysis of the airline markets focuses on the lack of competition among the airlines; however, the early predictions of economists that airline deregulation would improve consumer welfare have in fact been proven to be correct (Borenstein 1992). Moreover, Borenstein (1992) argues that the most important lessons that have been learned from the deregulation of the airline industry are not with regard how to deregulate, but are a better understanding of the strategies and results of competition in a complex and innovative service industry.

Before the deregulation of the airline industry many economists anticipated a historic opportunity to study and examine a prominent industry transition from government regulation to a competitive free market system. During the past twenty years economists have produced numerous papers and analyses of the airline industry. The papers written by authors such as Borenstein (1989, 1992) and others explain many aspects of the airline industry. The importance of hub dominance in airline pricing (Evans 1993) and the ability of low-cost carriers to have a significant affect on pricing (Richards 1996) are critical pieces of evidence that lend support to this paper's hypothesis. Moreover, these articles serve as a foundation, which supports the conclusion that JetBlue is a competitive force.

As the airline industry matures, in a parallel fashion the analysis and understanding of the airline industry matures as well. During the 1980s, journal articles, which argued that the airline industry would exhibit perfect contestability, accompanied the recent deregulation of the airline industry (Beesley 1986). The analysis of Beesley (1986) in the United States and Joy (1986) in Australia suggested that airlines could not sustain ticket prices far in excess of marginal cost, because new entry could easily take place due to the low barriers to entry of the airline industry.

However, “It has now been well established that airline pricing does not closely reflect the perfect contestability ideal” (Borenstein 1989, P. 344). The airline market is not perfectly contestable, because barriers to entry make it difficult for new entrants to break into the airline market. Price discrimination is the norm not the exception, on routes with high barriers to entry. As a result, much of the recent analysis of the airline industry has focused on trying to explain what factors prevent entry, which would increase competition and result in lower fares.

Borenstein (1989) chooses to focus on the importance of route and airport dominance in determining the degree of market power exercised by an airline. The results of the paper indicate that an airline’s share of passengers on a route and at the endpoint airports significantly influences its ability to mark up price above cost. However, these high markups tend to only benefit the dominant carriers, with smaller operators not achieving any greater degree of pricing control. Borenstein echoes the argument of Levine (1987) that airlines value airport dominance for the insulation such dominance may give them from competition.

The two primary factors that determine the difficulty of entry into an airport are slot and gate constraints (Borenstein 1989). Capacity restrictions, or more formally control of a dominant share of slots or gates, “…can allow an airline to inhibit profitable entry" (Borenstein 1989, P. 348). While no airline directly controls the capacity of any airport, capacity restrictions can benefit incumbent carriers. "Slot restrictions have a positive effect on yields" and along with airport dominance and computer reservation systems, slot constraints provide carriers operating from slot-constricted airports with greater market power (Richards 1996, P. 44). Not surprisingly, the originating and terminating airports of long haul routes are either slot constricted or suffer severe capacity restrictions due to a lack of infrastructure. Raising fares at an airport with no capacity constraints attract entrants, which in turn force the fare back down. In contrast, if an airport is slot restricted or capacity constrained, an incumbent can raise its fares and competitors may be unable to enter in full force or even at all. Thus a sizable percentage of the incumbents price increase will remain intact.

Route and hub concentration are critical aspects that must be considered when examining the competitiveness of the airline markets. There are a number of programs that airlines use to increase their ability to price discriminate. Marketing devices give an advantage to a dominant carrier and amplify the market power of that incumbent airline (Borenstein 1989). In particular, frequent flier programs encourage airline loyalty, especially among customers who primarily fly from an airport that is a fortress hub of an airline (Levine 1987). Fortress hubs are airports where the dominant carrier operates a majority of the flights departing and arriving at the airport.

Both airline ownership of computer reservation systems (CRS) and scarce airport facilities increase an airline's localized market power (Evans 1993). American and United were early entrants into the computer reservation service industry. Sabre (American) and Apollo (United) signed up many travel agents early on and continue to be two of the most dominant CRSs to this day (Borenstein 1992). However, Sabre is now an independent company, although American is currently Sabre's primary customer. The effect of Sabre and Apollo is far reaching and creates bias in travel agent booking, called the "halo effect" (Borenstein 1992). The "halo effect" is when a travel agent using an Apollo system books on average a disproportionate share of his or her tickets on United Airlines (Borenstein 1992). An airline's CRS system enhances its market power; however, the growth in internet bookings calls into whether these programs allow an airline to more effectively defend its profits from entrants.

The results of the Borenstein (1989) analysis support the observation that an airline charges higher prices when it has a dominant position at an airport. Moreover, at hub airports the dominant carrier charges higher prices than it does in the remainder of its system. Cost factors do not explain the discrepancy in prices (Borenstein 1989). The primary conclusion is that an individual airline's share of traffic on the route and at the endpoint seems to be a principle determinant of a carrier's ability to raise the price of its product (Borenstein 1989). These results build upon and support the results of previous authors, who wrote on the importance of route concentration; however, Borenstein (1989) shows that analyses that focus only on route concentration invariably ignore one of the most important factors in airline competition, airport concentration.

Evans (1993) reiterates a number of points of past authors concerning marketing devices and slot restrictions; however, he disagrees with the conclusion of Borenstein (1989) that route and airport concentration together are the primary factors that determine the competitiveness of an airline route. Evans (1993) refines Borenstein's (1989) earlier article by distinguishing between the impact of route dominance versus airport dominance on an airline's level of market power. Evans tests whether the observed dominance of most intercity-pair markets and airports in the United States airline industry by single carriers confers pricing power on the dominant firm. Evans concludes that airport dominance by a carrier does confer significant pricing power, whereas dominance at the route level seems to confer no such pricing power. Thus, over time the identified cause of the lack of competition transitioned from route concentration to route and airport concentration to airport concentration. More recent articles shift the focus of the analysis away from what causes a lack of competition to what forces bring about competition in the airline markets.

Whinston and Collins (1992) conduct an event study analysis of People Express, in order to measure the competitive structure of deregulated airline markets. Instead of examining measures of concentration, Whinston and Collins (1992) consider an alternative approach that uses the reactions of incumbent airlines' stock prices to announcements of entry by People Express to determine the competitive structure of the airline markets. The stock reactions reveal significant route-specific profits. This indicates that the contestable market model cannot be used to model airline routes. The average incumbent on a route lost roughly \$3 - \$6 million in value when People Express announced entry into that route (Whinston and Collins 1992). A decline in an incumbent airline's equity value suggests that equity market participants recognize that entry will reduce an incumbent's profits. While the analysis of Whinston and Collins is unique, the use of an airline's equity price as a proxy for competitiveness on a route may not be the most accurate or direct way to measure competitiveness. Moreover, there are a number of other factors that can influence the movement of an airline's stock price. Richards chooses to examine the airline markets in an innovative manner, but uses a more direct and often used model to measure the competitiveness of airline routes.

Richards (1996) begins her paper by noting the work of Joesch and Zick (1994), who along with others developed studies that indicate that airline markets are not perfectly contestable. The overview of the industry is based upon the writings of other authors including Borenstein (1992) and Whinston and Collins (1992). The relationship between market concentration and airfares is statistically insignificant in the early 1980s under regulation, but significant during the late 1980s and early 1990s (Joesch & Zick 1994). Airline markets are not perfectly contestable and concentration can explain why airfares are high on particular routes. In particular there is a positive and statistically significant relationship between airfares and hub concentration (Evans 1993). The market conditions that cause high fares are now well explained; however, there has been little if any discussion as to what type of market participant can cause significant and lasting downward pressure on airfares.

The residual demand model highlights the impact of an airline such as Southwest. The model demonstrates that a firm responds to the aggressive pricing of competitors by pricing more aggressively itself. This economic model represents the core of the argument that the presence of a low-cost carrier causes airfares to fall (Richards 1996). Richards estimates a series of fare equations to ascertain the effects of actual and potential competition by Southwest on markets for air travel. The results of the analysis suggest that pricing strategies of competitors differ depending on Southwest's presence on a route (Richards 1996). The particular or actual presence of a low-cost competitor seems to be a more important determinant of fares than conventional measures of concentration. Thus Richards (1996) offers the reader an alternative hypothesis as to what factor influences competitiveness of the airline industry to the greatest extent. The presence of a low fare carrier may be a more important determinant of the ticket pricing on a particular route than the extent of route and hub concentration on that route. The analysis and conclusion of Richards (1996) parallels the analysis and forthcoming conclusion of this paper.

The major carriers successfully use dominance enhancing strategies to raise concentration levels that in turn raise the market price for air travel. Moreover, low-cost entry disciplines prices on short haul routes. The rapid expansion of the low-cost presence in the airline markets over the last half decade and the continued dominance of the major carriers together raise the following question. Are concentration levels or a low-cost presence the more important predictor of market fares? The juxtaposition of these opposing factors in this paper provides an answer to the question of which factor is critical to understanding the dynamics of pricing in the airline markets.

5. The Data

In order to determine whether or not low-cost carriers significantly impact the pricing of tickets in airline markets this paper will conduct an econometric analysis using the Department of Transportation's Databank 1B database. The Databank 1B database is a domestic only subset of the Databank 1A database. The database is a 10% random sample of all domestic tickets sold in the United States. This analysis employs the second quarter 2002 dataset. This particular dataset includes valuable pricing information on a per ticket basis. This analysis will focus on nonstop flights that do not include plane changes or stops. The effect of plane changes and stops is well documented in papers written by Borenstein (1989) and others. The inclusion of parameters to test for the effect of on-plane stops and plane changes would not significantly alter the results of this analysis, because these variables do not significantly alter Borenstein's results. This dataset includes over 1,650,000 individual ticket observations. The dataset includes 35 carriers, 415 airports, and 9150 different routes. Hence, the dataset for the regressions contains a total of 21,573 route carrier pairs.

The Origin and Destination survey also includes data on length of the observed route and number of passengers on the route. The Herfindahl-Hirschman Indices are derived from this dataset. Low-cost market share measures are constructed from the dataset by segregating the market share measures based on whether or not the carrier is deemed to be a low-cost carrier. For the purposes of this analysis, there are 11 low-cost carriers. A comprehensive list of all the represented airlines is included in Table 5. Routes of 500 miles or less are included in the data, since Southwest primarily flies short haul routes. Unlike Richards (1996), long haul routes of over 1000 miles are included in the dataset to measure the impact of JetBlue and Southwest on the long haul market. Furthermore, this dataset has served as the primary source of data for many of the articles discussed in the section on concentration and low-cost carriers.

To compute cost per available seat mile (CASM) figures for all 35 airlines, subsections of Department of Transportation's Schedule T-1 and Schedule P-12 datasets are utilized to construct the CASM figure of the dataset for this analysis. The schedule T-1 dataset summarizes the T-100 by providing monthly compilations, by carrier and service classification, of such items as available seat miles, available ton miles, revenue passenger miles, revenue miles flown, and revenue departures performed. The Schedule P-12 provides quarterly profit and loss statements for carriers with annual operating revenues of $20 million or more. The data include operating revenues, operating expenses, depreciation and amortization, operating profit, income tax, and net income. The 2002 Schedule P-12 dataset does not include total operating expenses figures for Airtran Airways, Northwest Airlines, Horizon Air, and TCI Skyking. As a result, the average CASM (for the 31 other carriers) is substituted for the actual value. Rerunning the set of regressions, without these carriers, does not significantly alter the estimated coefficients for any of the equations. The cost per available seat mile (CASM) figures are calculated for the year 2002.

Frequency, load factor, and equipment variables are constructed using data aggregated from the Department of Transportation T-100 Domestic Segment dataset for the months of April, May, and June 2002. Thus the union of the three datasets corresponds to the second quarter of 2002. The T-100 Domestic Segment dataset contains data reported by US air carriers operating non-stop between airports located within the boundaries of the United States and its territories. The data fields contain information by aircraft type and service class for departures performed, available capacity and seats, passengers enplaned, freight and mail enplaned, scheduled departures, aircraft hours ramp-to-ramp and airborne. Unlike the Databank 1B database, the T-100 Domestic Segment database is not a 10% sample, but in fact is a comprehensive dataset. The T-100 dataset is similar in form to the DOT Service Segment Data, used in analysis of Borenstein (1989) and colleagues. The Department of Transportation Databank 1B, Schedule T-1, Schedule P-12, and T-100 Domestic Segment databases are all publicly available through the recently constructed Bureau of Transportation Statistics (BTS) TransStats website.[1]

[1] The BTS TransStats website can be found at the following web address: http://www.transtats.bts.gov.

6. Methodology

Having outlined the progression of academic thought on the factors that influence ticket prices and having argued that low-cost carriers have a fundamentally different cost structure than their competitors, an analysis examining the impact of the low-cost carrier is warranted. The 3 econometric models developed in this section of the thesis estimate the marginal benefit of low-cost entry by quantifying the impact of several measures of concentration on the market price for air travel. The three models include a baseline model that closely resembles Borenstein's (1989) equation, a 6-segment distance model that includes the baseline variables plus dummy variables measuring the change in price over discrete 500 mile segments, and a short/long haul segment model that includes the baseline variables plus 2 indicators that classify a route as either belonging to a regional market or a long haul market.

The price equation is estimated as a function of costs, service quality, market demand characteristics, and other factors such as route concentration, route characteristics, hub concentration, low-cost carrier route concentration, and low-cost carrier hub concentration. Roundtrip tickets are treated as two one way tickets and roundtrip fares are adjusted accordingly. The equations that follow will be used in conjunction with the constructed dataset to show that low-cost carriers have a significant impact on prices and may have a greater impact on prices than concentrations levels.

The baseline, 6-segment distance, and short/long haul segment models capture the impact of mainline carriers' market power on price. Following Borenstein (1989), each of the three models is regressed on the sample 20^{th}, 50^{th}, and 80^{th} percentile fare for each route-carrier pair. As Borenstein notes, the segmentation of each equation into three regressions provides insight into the impact of concentration levels and low-cost participation on different strata of the ticket price spectrum. The paper includes three basic models, regressed with and without a set of low-cost carriers and additionally regressed on three distinct percentiles of price. As a result, 18 regressions are run in order to provide a comprehensive analysis of the current state of the airline markets. These 18 equations converge to three hybrid models that seek to explain (determine the significance of) two primary variables, which can affect the supply curve for air travel, the level of competition, and concentration in the airline markets.

The baseline equation, based on a Borenstein (1989) pricing equation, provides a logical starting point from which to begin further analysis exploring the impact of low-cost carriers and the current state of the regional (short haul) and long haul airline markets. Since all analysis in this paper focuses on nonstop tickets (roundtrip and one way) the baseline equation excludes variables measuring the impact of stops and directness on pricing. In fact, the results of the Borenstein (1989) regression clearly show that stops do not have a significant impact on price, but that the circuitousness of a route raises prices in a statistically significant manner. The baseline equation, regressed on second quarter 2002 Department of Transportation data, brings Borenstein's (1989) analysis to the present day and brings to light any changes that have occurred in the market structure over the last 15 years.

The baseline equation is also estimated with a set of variables that measure the importance of the low-cost carriers. These variables include low-cost market share and a dummy variable that indicates whether or not an endpoint airport is a hub of a low-cost airline. The low-cost variables are analogous to the POTCOMP (potential competition) variable that Borenstein (1989) includes in his second set of regressions. However, the POTCOMP measure does not distinguished between mainline and low-cost carriers. The measure only includes carriers that have a presence on the route of less than 1% of the total traffic of the route in question. Thus the measure only quantifies the effect of potential competition and not actual competition. It is important to note that, "(the) inclusion of the potential competition variable does not change the results (of the regression) substantially, though it may have a significant effect itself at least on lower fares" (Borenstein 1989, P. 359). Borenstein's results suggest low-cost carriers may only be an important factor acting on prices at the 20th percentile. The inclusion of the low-cost variables may indicate whether Borenstein's (1989) initial conclusion still holds. The juxtaposition of these two sets of regressions should reveal the impact of the low-cost carrier on pricing in the airline market.

Baseline Equation

$$\ln P_{ij} = \acute{\alpha}_i + \beta_1 \ln MKTDIST_j + \gamma_1 \ln LOADFAC_{ij} + \gamma_2 \ln EQUIP_{ij} + \gamma_3 \ln FREQ_{ij} + \delta_1 \ln ORGSHARE_{ij} + \delta_2 \ln ORGHERF_j + \delta_3\, RUTSHARE_{ij} + \delta_4\, RUTHERF_j + \delta_5 \ln COMPCOST_{ij} + \delta_6\, TOURIST_j + \delta_7\, HUB_j + \delta_8\, LWCSHUB_j + \delta_9\, SLOT_j$$

Baseline Equation with Low-Cost Variables

$$\ln P_{ij} = \acute{\alpha}_i + \beta_1 \ln MKTDIST_j + \gamma_1 \ln LOADFAC_{ij} + \gamma_2 \ln EQUIP_{ij} + \gamma_3 \ln FREQ_{ij} + \delta_1 \ln ORGSHARE_{ij} + \delta_2 \ln ORGHERF_j + \delta_3\, RUTSHARE_{ij} + \delta_4\, RUTHERF_j + \delta_5 \ln ORGLWCSHARE_j + \delta_6\, LWCSTSHARE_j + \delta_7\, LWCSTHERF_j + \delta_8 \ln COMPCOST_{ij} + \delta_9\, TOURIST_j + \delta_{10}\, HUB_j + \delta_{11}\, LWCSHUB_j + \delta_{12}\, SLOT_j$$

Market distance can impact the price of a ticket due to the change in cost structure over different route lengths. Takeoffs and landings are highly inefficient and require up to 50% of a flight's fuel. As a result, longer routes, on which the fixed cost of the takeoff and landing is spread out, are less expensive to operate per mile. However, different market distances are not just associated with direct costs to the airlines. Using a continuous variable such as MKTDIS establishes a linear relationship between route distance and price. This linear relationship may indicate a general trend as route length increases; however, a significant coefficient on MKTDIS does not answer the question of whether or not distance is linearly related to price. In order to determine if the relationship between distance and price varies over length it is necessary to test discrete segments of length.

This paper categorizes different route lengths as separate markets in order to test the hypothesis that each of these market segments has a unique competitive structure. High prices may categorize certain route lengths due to the variability of concentration levels over several types of routes. To quantify the impact of the distance of a route on ticket pricing this analysis employs a second set of equations that employ 6 dummy variables representing 6 consecutive 500 mile increments in route length. The baseline and excluded variable is MKTDIS_1, the 1-500 mile market segment. With these 6 dummy variables it is possible to construct a segment by segment relationship between price and distance. As with the baseline equation, the six segment equation is constructed in its base form and with 4 low-cost variables to measure the impact of low-cost carriers on pricing over the 6 distance segments. In particular, these equations may identify the relative importance of low-cost carriers over distance. Do low-cost carriers only impact pricing on short haul routes as Richards (1996) postulates?

Six Segment Distance Equation

$$\ln P_{ij} = \acute{\alpha}_i + \beta_1 \ln MKTDIST_j + \gamma_1 \ln LOADFAC_{ij} + \gamma_2 \ln EQUIP_{ij} + \gamma_3 \ln FREQ_{ij} + \delta_1 \ln ORGSHARE_{ij} + \delta_2 \ln ORGHERF_j + \delta_3 RUTSHARE_{ij} + \delta_4 RUTHERF_j + \delta_5 \ln COMPCOST_{ij} + \delta_6 TOURIST_j + \delta_7 HUB_j + \delta_8 SLOT_j + \delta_9 MKTDIS\_1_j + \delta_{10} MKTDIS\_2_j + \delta_{11} MKTDIS\_3_j + \delta_{12} MKTDIS\_4_j + \delta_{13} MKTDIS\_5_j + \delta_{14} MKTDIS\_6_j$$

Six Segment Distance Equation with Low-Cost Variables

$$\ln P_{ij} = \acute{\alpha}_i + \beta_1 \ln MKTDIST_j + \gamma_1 \ln LOADFAC_{ij} + \gamma_2 \ln EQUIP_{ij} + \gamma_3 \ln FREQ_{ij} + \delta_1 \ln ORGSHARE_{ij} + \delta_2 \ln ORGHERF_j + \delta_3 RUTSHARE_{ij} + \delta_4 RUTHERF_j + \delta_5 \ln ORGLWCSHARE_j + \delta_6 LWCSTSHARE_j + \delta_7 LWCSTHERF_j + \delta_8 \ln COMPCOST_{ij} + \delta_9 TOURIST_j + \delta_{10} HUB_j + \delta_{11} LWCSHUB_j + \delta_{12} SLOT_j + \delta_{13} MKTDIS\_1_j + \delta_{14} MKTDIS\_2_j + \delta_{15} MKTDIS\_3_j + \delta_{16} MKTDIS\_4_j + \delta_{17} MKTDIS\_5_j + \delta_{18} MKTDIS\_6_j$$

The impact of low-cost carriers may vary over market distance; moreover, there are two primary market segments in the United States, short haul (regional) routes and long haul routes. This paper categorizes regional routes as being 0-1500 miles in length. Long haul routes are defined to be 1501-3000 miles in length. It is not a coincidence that this dichotomy loosely relates to the set of routes that serve meals and those that do not. Traditionally low-cost carriers, such as Southwest, serve regional routes and avoid competing on higher profile long haul routes. Recently, Southwest is adding longer routes and maintaining the same level of in-flight service that it offers on other flights. Moreover, JetBlue with hubs at John F. Kennedy Airport (JFK) and Long Beach Airport (LGB) is directly targeting long haul transcontinental routes, prior to which these routes lacked a low-cost presence. Although, JetBlue's presence on long haul routes (1500 miles in length or more) is still small this paper seeks to determine if that presence significantly disciplines the pricing behavior of the incumbent nationwide carriers.

The two additional indicator variables (MKTDISREG and MKTDISLNG) provide a direct means with which to measure the growing importance of the low-cost carrier. Richards (1996) articulates the importance of Southwest in routes less than 1000 miles in length. In a similar vein, Borenstein (1989) suggests that the impact of potential competition on prices is rather small. He observes that these potential competitors are not materially important for the 50^{th} and above percentile airfares. The airline market has evolved since the mid 1990s and because low-cost carriers no longer only fly routes under 1000 miles in length it is important to determine the extent of the importance of the presence of low-cost carriers in the two primary market segments, regional and long haul.

Short/Long Haul Market Segment Equation

$$\ln P_{ij} = \acute{\alpha}_i + \beta_1 \ln MKTDIST_j + \gamma_1 \ln LOADFAC_{ij} + \gamma_2 \ln EQUIP_{ij} + \gamma_3 \ln FREQ_{ij} + \delta_1 \ln ORGSHARE_{ij} + \delta_2 \ln ORGHERF_j + \delta_3 RUTSHARE_{ij} + \delta_4 RUTHERF_j + \delta_5 \ln COMPCOST_{ij} + \delta_6 TOURIST_j + \delta_7 HUB_j + \delta_8 SLOT_j + \delta_9 MKTDISREG_j + \delta_{10} MKTDISLNG_j$$

Short/Long Haul Market Segment Equation with Low-Cost Variables

$$\ln P_{ij} = \acute{\alpha}_i + \beta_1 \ln MKTDIST_j + \gamma_1 \ln LOADFAC_{ij} + \gamma_2 \ln EQUIP_{ij} + \gamma_3 \ln FREQ_{ij} + \delta_1 \ln ORGSHARE_{ij} + \delta_2 \ln ORGHERF_j + \delta_3 RUTSHARE_{ij} + \delta_4 RUTHERF_j + \delta_5 \ln ORGLWCSHARE_j + \delta_6 LWCSTSHARE_j + \delta_7 LWCSTHERF_j + \delta_8 \ln COMPCOST_{ij} + \delta_9 TOURIST_j + \delta_{10} HUB_j + \delta_{11} LWCSHUB_j + \delta_{12} SLOT_j + \delta_{13} MKTDISREG_j + \delta_{14} MKTDISLNG_j$$

MKTDIST (market distance) is the nonstop distance measured in miles from one endpoint of a route to another. Longer routes should have higher prices; however, time spent cruising at altitude is proportionally higher on longer routes, which suggests that longer routes have a lower per mile cost. The higher per mile cost of short routes is due to the large amount of fuel that is burned during takeoff and landing. DISTANCE should be positive, but costs increase proportionately more slowly as the route distance lengthens. The average flight distance on a major carrier is less than a low-cost airline. The median flight segment for the major carriers is 821.0 miles and is 866.0 miles for the low-cost carriers. However, the difference is small suggesting that neither the major nor low-cost carriers have a cost advantage from flying a much longer set of routes than other carrier group. Low-cost carriers may lower prices in markets and fly a high proportion of short haul flights. DISTANCE may not be significant when controlling for the presence of low-cost carriers, depending on whether the low-cost carrier or operating cost factor has a greater impact on price. At the time of the Borenstein (1989) article low-cost carriers had a diminutive presence in the United States.

Ceteris paribus a longer route should have a higher market price than a shorter route with the same characteristics. Longer routes require more fuel and are more costly to operate (on an absolute basis) compared to shorter routes. However, most of the fuel for a flight is burned during takeoff and landing. When the plane is at cruising altitude the fuel efficiency of the plane is higher. Hence longer transcontinental flights have a lower cost per mile than flights of 500 miles or less. As a result, an increased distance may not result in as large of an increase in price as initially thought. It is important to note that the dominant low-cost carrier, Southwest, primarily operates short haul routes, yet still charges lower fares than its competitors. Distance should explain a large percentage of the price level in a market, but in no way does distance explain the disparity in prices between carriers.

The transcontinental market illustrates this disparity suitably. JetBlue provides its product at a price that undercuts its competition by up to 75%. An unrestricted coach ticket from JFK to LAX on American or United costs approximately $2500. In comparison, a comparable ticket on JetBlue costs $598. This example also raises the possibility that past analyses have overestimated the impact of distance, because low-cost competition did not exist on long haul routes until recently. Prior to low-cost competition, long haul prices may have had proportionally higher prices because airlines had more market power on the longer routes. The possible discrepancy in past analyses bolsters the importance of including variables in the price equation to control for the presence of low-cost carriers.

LOADFAC (load factor) is the mean load factor of all flights of an airline that serves the observed route. The per passenger cost of a flights decreases as the load factor rises, which suggests that LOADFAC has a negative coefficient. Also low-cost carriers tend to have higher load factors than their competitors. This may result in prices falling on routes with a higher load factor. However, flights with high load factors tend to operate during peak travel times in the morning and late afternoon. Congestion during peak travel times raises the cost of a flight, both in terms of delays and increased personal needed to handle the banks of flights that arrive and depart within a small window of time. Also, the highest load factor flights tend to originate or terminate in hub cities, which have high levels of congestion during peak periods. Congestion impacts low-cost carriers to a lesser degree, since these firms operate out of less crowded airports. The weakening correlation between congestion and load factor over the last decade would suggest that a higher load factor would lower prices. Due to the growing presence of low-cost carriers and the lower operating cost of full flights (on a per capita basis) the effect of LOADFAC is uncertain.

EQUIP (equipment) is the mean size of the planes on flights that carry passengers on the observed route and airline. Larger equipment tends to have lower operating costs on per passenger basis. Also, larger planes operate more efficiently on longer routes, which may indicate a degree of interaction between DISTANCE and EQUIP. On the other hand, larger planes, usually with two aisles, are thought to be preferred by travelers. The higher preference for higher capacity aircraft may increase demand on routes with larger aircraft, which would in turn raise prices. Likewise, the high-cost major carriers tend to operate a higher proportion of larger aircraft than low-cost rivals, such as Southwest and JetBlue. For this reason, a larger mean aircraft size may indicate higher prices.

FREQ (frequency) is the average frequency of flights available to passengers on the observed airline and route. Controlling for other factors, a higher frequency of flights raises the value of the product to the passenger. Passengers traveling on business have a high opportunity cost for travel and value the convenience increased frequency provides them. One would expect that increased value leads to higher demand and finally higher prices. Higher frequency also allows airlines to operate aircraft more efficiently and for longer utilization periods. Increased efficiency lowers an airline's marginal cost and ticket prices. Low-cost carriers tend to operate routes with a high frequency of service to achieve cost reductions. With the widespread influence of low-cost carriers one would expect that a high frequency may lower ticket prices. Thus the estimated effect of FREQ on price is uncertain.

ORGSHARE (origin & dest. market share) is the weighted average of the observed airline's share of passenger originations at the two endpoints of a route. ORGSHARE is weighted by the ratio of passengers on the route who start their trips at the two endpoints divided by the total number of passengers, who originate travel at all endpoints. An increase in ORGSHARE may allow airlines to exercise greater market power. With greater market power an airline can raise prices to increase its profits.

Because the vast majority of flights still take place on hub-and-spoke carriers the coefficient of ORGSHARE may diverge from ORGLWCSHARE.

ORGHERF (origin & dest. Herfindahl) is the weighted average of the Herfindahl indexes of passengers' originations at the two endpoints of the observed route (measured from zero to one). The weighting of ORGHERF is the same as ORGSHARE. The competitive factors that provide an airline with increased market power correspond to a dominant carrier having many small competitors. However, an airline may prefer having a single larger competitor in order to facilitate illegal, but profitable collusion. Case in point, when American Airlines CEO Robert Crandall called Braniff International Airlines CEO Howard Putnam to collude, he suggested doing so would be easy due to their large shares of the market in question. This scenario is less likely to be viable now due to the extensive presence of price aggressive competitors. In particular low-cost carriers are unlikely to engage in collusion and prefer instead to compete on price with higher cost incumbents. Both competitive models can result in higher prices, if the dominant carrier exercises its market power or engages in collusion. An airline may prefer either competitive landscape and as a result the effect of ORGHERF on fares is uncertain.

RUTSHARE (route market share) is the observed airline's share of passengers on the observed route (origin to destination traffic). Elementary economic theory would suggest that increased route share corresponds to increased market power, which results in higher prices for the consumer. The passenger will pay a higher price whether or not the dominant firm's market power has an umbrella effect. One can expect that increased route share results in higher prices.

RUTHERF (route Herfindahl) is the Herfindahl index for passengers on the observed route (measured from zero to one). If the observed route has a small number of large participants, collusion is logistically easier. Through collusive practices the carriers can raise the consumer's cost of travel. However, if there is a dominant firm with a competitive advantage and many smaller participants, the dominant firm's pricing power may not extend to its competitors. The change in the mean price on the observed route depends not only on the value of the Herfindahl index, but also on the competitive state of the dominant firm.

ORGLWCSHARE (low-cost origin & dest. market share) is a weighted average of low-cost carriers' share of the daily passengers at the endpoints of the route in question. As in ORGSHARE the weighting is proportional to the number of total passengers who originate travel at the two endpoints, not just passengers traveling on low-cost carriers. Assuming increases in ORGSHARE will lead to increases in market power; increases in ORGLWCSHARE indicate that low-cost carriers transport a larger percentage of the passengers at the endpoint airports. An increase may result in lower levels of market power and prices. Ceteris paribus including the type of the route, the number of firms, and each company's market share, ticket prices will be higher in a market with no low-cost carriers compared to the same market with a single low-cost carrier replacing one of the traditional airlines. Higher ORGLWCSHARE may lead to reduced levels of market power and lower prices. However, low-cost carriers charge lower fares than the major carriers. A larger market share for a low-cost carrier may cause downward pressure on ticket prices.

LWCSTSHARE (low-cost route market share) is the share of all origin and destination passengers on that route transported by low-cost carriers. The larger the percentage of people transported by low-cost carriers the lower the airfare will likely be. Since RUTSHARE, which measures the importance of concentration levels, is also measured it may be the case that RUTSHARE is no longer significant when LWCSTSHARE is included. This would indicate that low-cost route share, not general levels of route concentration, explain the movements in ticket prices. If RUTSHARE has a positive sign and LWCSTSHARE has a negative sign then each has an opposite impact on pricing than the other variable. Such a result would be consistent with basic economic theory, which suggests that concentration raises prices and entry lowers prices.

LWCSTHREF (low-cost route Herfindahl) is the Herfindahl index (measured from zero to one) for the origin and destination passengers carried on low-cost carriers on a particular route. The measure is included to show the likely discrepancy between the normal Herfindahl index (RUTHREF) and this variable, which only measures the market share of low-cost carriers.

COMPCOST (comparable cost) is the weighted average of the cost per seat mile of every airline on the observed route other than the observed firm. Each carrier's share of passengers on the observed route determines its corresponding weighting. Clearly, each airline's system wide cost per seat mile only approximates the actual cost per seat mile on the observed route. The system wide figure is an accurate, but not necessarily precise proxy. If the marginal cost of its competitors rises, the observed carrier can raise prices without altering its market share. Of course a firm may choose to not raise its prices in order to raise its market share. Low-cost carriers have lower operating costs than their competitors; however, low-cost carriers do not price tickets as if they had the same cost basis. On a global basis it appears that a rise in COMPCOST may cause prices to rise. However, the elasticity of COMPCOST (for a specific route) may be higher dependent on whether or not the observed airline is a low-cost carrier. As the market share of low-cost carriers has grown the elasticity of COMPCOST is likely to have fallen. As a result, COMPCOST may play a less significant role in the pricing equation than in the Borenstein (1989) analysis.

In addition, conventional wisdom suggests that there is a tight and positive relationship between an airline's cost per seat mile and the price it charges to the consumer. Likewise, if the production costs of an airline's competitors rises then the observed airline would be expected to raise its price in response to capture a higher level of profits. However, low-cost carriers often price tickets far below the major airlines' level in order to gain market share, which can insulate a low-cost carrier from a competitor's predatory pricing scheme. An analysis of the models will explain whether the low-cost carrier, with its unique cost structure, is a factor in market prices.

TOURIST (tourist route) measures the degree to which the observed route is a tourist or leisure route. TOURIST is a dummy variable set to 1 if one of the endpoints of the route is vacation oriented and 0 otherwise. This variable is critical, especially with this paper's focus on low-cost carriers. It may be the case that low fare carriers charge less for tickets. However, the misconception that low-cost carriers only serve tourist oriented airports, is just that, a misconception. The expansion of Southwest's route network and emergence of JetBlue is a direct result of low-cost carriers targeting non tourist routes. Controlling for tourist oriented routes in the regression equation removes an important factor that might otherwise obscure the significance of the variables testing the significance of low-cost carrier presence. Tourists tend to have a more elastic demand curve than other travelers. The highly elastic demand curve on tourist routes suggests that a higher proportion of tourists on a route will lower prices. Thus, TOURIST should have a negative coefficient.

Table 2 Tourist Oriented Airports

Airport	Airport Code
Aspen, Colorado	ASE
Fort Lauderdale International, Florida	FLL
Hilo International, Hawaii	ITO
Honolulu International, Hawaii	HNL
Palm Springs Metropolitan Area, California	PSP
Jacksonville International, Florida	JAX
Kahului Airport, Hawaii	OGG
Kona, Hawaii	KOA
Las Vegas Mccarran Intl, Nevada	LAS
Melbourne Intl, Florida	MLB
New Orleans International, Louisiana	MSY
Orlando International, Florida	MCO
Reno/Tahoe Int'l, Nevada	RNO
Tampa International, Florida	TPA
West Palm Beach International, Florida	PBI

Note: The compiled list of tourist airports is derived from Richards (1996).

HUB is a dummy variable equal to 1 if one of the endpoints of the observed route is a hub of a major carrier, and 0 otherwise. Note that the major carriers are limited in this analysis to American Airlines, United Airlines, Northwest Airlines, Delta Airlines, and Continental Airlines. See below on page 49 for a list of hub cities, segregated by major carrier. The analysis of Borenstein (1989) and others suggests that airlines wield higher levels of market power at hub airports. As a result consumers face higher prices for travel, if their route includes a hub airport at one of the endpoints. One expects that the sign of HUB will be positive.

Table 3 **Major Carrier Hubs**

Major Carrier	Hub Airports
American Airlines	Chicago O'Hare International – ORD
	Dallas Fort Worth – DFW
	Lambert St. Louis – STL
	Miami International – MIA
	San Juan Luis Muñoz Marin – SJU
Continental Airlines	Houston Intercontinental – IAH
	Newark International – EWR
Delta Airlines	Atlanta Hartsfield International – ATL
	Cincinnati Northern Kentucky – CVG
	Dallas Fort Worth – DFW
	Salt Lake City – SLC
Northwest Airlines	Detroit International – DTW
	Memphis International – MEM
	Minneapolis-St. Paul – MSP
	Tokyo Narita – NRT
United Airlines	Chicago O'Hare International – ORD
	Denver International Airport – DEN
	San Francisco International – SFO
	Washington Dulles – IAD

Note: The hubs for the five largest major carriers in the United States are self-reported. This list is built from airline documents taken from the corporate websites of each respective carrier. Each of these documents and websites is listed in the bibliography.

LWCSHUB (low-cost hub at origin or dest.) is a dummy variable equal to 1 if one of the endpoints of the observed route is the hub of a low-cost carrier, and 0 otherwise. Table 4 on page 50 is a list of low-cost carrier hubs. Dominant airlines tend to have a higher level of market power at a hub, where a high concentration of flights are operated by the dominant firm. However, a low-cost hub on an observed route may result in lower prices. A low-cost carrier's dominant presence may indicate that most of the airfares on the route are priced at a level set by the lowest cost producer, JetBlue or Southwest. Instead of wielding traditional market power in order to raise profits, low-cost carriers compete on price in order to win market share, which ultimately raises profits.

Table 4 Low-Cost Hubs

Low-Cost Carrier	Hub Airports
JetBlue Airways	John F. Kennedy Airport – JFK Long Beach Airport – LGB
Southwest Airlines	Chicago Midway – MDW Dallas Love Field – DAL Phoenix Sky Harbor International – PHX

Note: Only Southwest and JetBlue have prominent hub airports. Hence, the primary airports for the other low-cost carriers are not included in this analysis. Also, the hubs for these low-cost carriers are self-reported. This list is built from airline documents taken from the corporate websites of each respective carrier. Each of these documents and websites is listed in the bibliography.

SLOT is a dummy variable equal to 1 if one of the endpoint airports of the observed route is a slot restricted airport and 0 otherwise. It should be noted that slot restrictions have been lifted at Chicago O'Hare, New York LaGuardia, and New York JFK. Slot restrictions are currently only in place at Reagan National Airport, which serves Washington D.C.

$MKTDIS\_1_j$, $MKTDIS\_2_j$, $MKTDIS\_3_j$, $MKTDIS\_4_j$, $MKTDIS\_5_j$, $MKTDIS\_6_j$. (market distance) The MKTDIS variables control for the distance of a route with finer granularity than MKTDIST. Each of the six variables is a dummy variable that takes on the value 1 if the route length falls within the given MKTDIS variable's range and 0 otherwise. These variables will help determine the extent of pricing differences, which are tied to the length of a route. MKTDIS_1 refers to routes from 1 to 500 miles in length, MKTDIS_2 refers to routes from 501 to 1000 miles in length, MKTDIS_3 refers to routes from 1001 to 1500 miles in length, MKTDIS_4 refers to routes from 1501 to 2000 miles in length, MKTDIS_5 refers to routes from 2001 to 2500 miles in length, MKTDIS_6 refers to routes from 2501 to 3000 miles in length.

MKTDISREG (regional market distance group) variable is an indicator variable which takes on the value 1 when the observed route is between 1 and 1500 miles in length and 0 when the observed route is 1501 to 3000 miles in length. This variable along with MKTDISLNG may indicate the extent of low-cost carrier penetration. While low-cost pioneer Southwest has avoided flying routes in excess of 1000 miles recently low-cost carriers are expanding their long haul presence with JetBlue the most notable example. Since MKTDISREG and MKTDISLNG are perfectly collinear, MKTDISREG is excluded from the regression and as a result serves as a baseline measure.

MKTDISLNG (long haul market distance group) variable is an indicator variable which takes on the value 1 when the observed route is between 1501 and 3000 miles in length and 0 when the observed route is 1 to 1500 miles in length. This variable along with MKTDISREG may point out the scope of low-cost carrier penetration. JetBlue is the only low-cost carrier primarily targeting long haul routes. However, Southwest has a small presence on long haul routes. In 2002 Southwest inaugurated its longest route from Baltimore/Washington, D.C. (BWI) to Los Angeles. The new route has a distance of 2,329 miles (Silicon Valley / San Jose Business Journal 2002). Hence, the MKTDISLNG variable may serve as a proxy for the impact of Southwest and JetBlue on long haul transcontinental routes. Since MKTDISREG and MKTDISLNG are perfectly collinear, MKTDISLNG is included in the regression and measures the difference in pricing from the baseline regional market.

Table 5 includes a comprehensive list of the airlines included in the dataset constructed for this analysis. Since the Databank 1B dataset is a 10% random sample of all ticket travel, the airlines included in Table 5 are randomly selected, with a weighting proportional to the market share of each carrier. The low-cost carrier designation is based on the definition of a low-cost carrier described in section 2 of this paper. That definition is not an industry standard, because there is no standard system for determining if an airline is a low-cost carrier. The definition included in this paper selects the major low-cost carriers, Airtran, Frontier, Southwest, and JetBlue. Moreover, the other low-cost carriers, in Table 5, are small in comparison and so should not impact the estimated results in a significant manner.

The equations and methodology described in this section are used to determine whether low-cost carriers impact the distribution of prices in different segments of the airline market. The equations include a comprehensive set of parameters to estimate which factors influence the distribution of market prices. Controls for route specific characteristics are included to maximize the accuracy of the estimated equations. Moreover, these estimated equations will also establish whether including the low-cost parameters was warranted. If the low-cost variables are not significant the low-cost equations will resemble the baseline equations; otherwise, any differences between the two sets of equations may characterize what the effect of a low-cost presence is on fare distributions.

Table 5 **Comprehensive Carrier List**

Carrier Code	Carrier Name	Low-Cost Carrier
9N	Trans States Airlines	0
AA	American Airlines	0
AQ	Aloha Airlines	0
AS	Alaska Airlines	0
B6	JetBlue Airways	1
CO	Continental Airlines	0
CS	Continental Micro	0
DL	Delta Air Lines	0
EV	Atlantic Southeast Airlines	0
F9	Frontier Airlines	1
FL	Airtran Airways	1
G4	Allegiant Air	0
HA	Hawaiian Airlines	0
HP	America West Airlines	0
JI	Midway Airlines	0
MQ	Simmons Airlines	0
N7	National Airlines	1
NJ	Vanguard Airlines	1
NK	Spirit Airlines	1
NW	Northwest Airlines	0
OH	Comair	0
OW	OneWorld Alliance	0
PN	Pan America Airways	0
QX	Horizon Air	0
RU	TCI SkyKing	0
SM	Sunworld Airlines	1
SY	Sun Country Airlines	1
TZ	America Trans Air	1
UA	United Airlines	0
US	US Airways	0
WN	Southwest Airlines	1
XJ	Mesaba Airlines	0
XP	Casino Express Airlines	1
YX	Midwest Express Airlines	0
ZW	Air Wisconsin	0

Note: 1 designates that an airline is a low-cost carrier and 0 designates that an airline is not a low-cost carrier. Also, although Sunworld Airlines, Sun Country Airlines, Casino Express Airlines, and America Trans Air are considered to be low-cost carriers in this analysis, each of these airlines primarily flies charter flights. Thus the impact of these carriers is expected not to be material to the results of this analysis.

7. Results

The results of this analysis bring up to date Borenstein's (1989) results and interpretations while providing insight into the impact of low-cost carriers on airfares, the market dynamics of short haul and long haul routes, and to what extent previous analyses overstate the importance of hubs and concentration. Tables 9 through 26 include the regression results for each of the 18 regressions. Tables 9, 11, and 13 are the baseline regression results and are in large part consistent with Borenstein's results. An individual airline's market share on a route and to a lesser extent at the endpoint airports still determines a carrier's ability to raise prices. At the 20th, 50th, and 80th percentile fares the Route Market Share (RUTSHARE) coefficient is significant at the 1% level. The variation of the coefficient value over price is low indicating that route concentration provides pricing power to airlines at any fare level. Controlling for route specific characteristics, the equation estimates that a 1% increase in a carrier's share on a route results in an increase in prices between 0.15% and 0.21%. Of note is the narrow range of the price impact. Borenstein (1989) estimates an analogous range of 0.03% to 0.22%. Thus the impact of route concentration is more prominent today, especially at the low-end of fares.

The highest levels of route and endpoint airport concentration are often found on routes that originate or terminate at a major nationwide carrier's hub. Table 3 enumerates the primary hubs for each major carrier. The baseline equation estimates that the presence of a hub at either or both endpoints of a route raises prices between 6.8% and 29.2%. These coefficients from the 20th, 50th, and 80th percentile equations are significant at the

1% level. The effect of a hub is significant, large, and proportional to the type of fare. Ceteris paribus, this equation predicts that a hub raises the median fare by 17.5%. The stronger effect of hubs on the higher end, 29.2% vs. 17.5% at the median, suggests that loyalty programs targeted at business travelers provide a hub carrier with increased market power. This result is consistent with Borenstein's (1989) hypothesis that travelers that purchase full fare tickets are more likely to participate in frequent flier programs.

While route share and hub effects are measurable and significant over a range of prices, origin and destination market share (ORGSHARE) only impacts the highest priced tickets. At the 80th percentile fare, the equation (represented in Table 13) estimates that a 1% increase in a carrier's share of a route's endpoint airport traffic results in a 0.032% rise in prices. This result is significant at the 1% level. At the 20th percentile and median price the effect of origin and destination market share is negligible and not significant at the 10% level. The effect of origin and destination market share is not consistent over across different types of airfares; moreover, this result diverges from the equation Borenstein (1989) estimates. The growth in air traffic at secondary airports and the stagnation of traffic growth at the largest most concentrated airports is one possible explanation for the declining effect of origin and destination market share, especially at the low-end of the market.

The effect of a slot restricted airport (SLOT) parallels the hub effect.[2] The baseline equation estimates that a slot restricted airport at the origin or destination causes the 20th, 50th, and 80th percentile fares to rise 6.8%, 11.2%, and 22.3% respectively. The 80th percentile estimate is significant at the 1% level, while the median and 20th percentile

[2] Borenstein (1989) does not include a parameter to measure whether airports are slot restricted. However, this parameter is included to highlight the effect of capacity constraints, in this case government enforced, on the marketplace.

estimates are statistically significant at the 2% level. The uniformly positive and increasing effect of slot constraints across airfares suggests that capacity constraints, whether imposed by the government or the market, reduce that ability of competitors to enter a market and discipline prices. More generally, this analysis proposes that capacity constraints hinder competitive entry and raise airfares.

The remaining set of estimated parameters are, with the exception of one parameter, consistent with expectations when significant. Tourist oriented routes, represented by the parameter TOURIST, are expected to have airfares 10.6% lower than non-tourist routes at the median fare. While the signed relationship between TOURIST and HUB is reverse, the increases in magnitudes are parallel across types of fares. Tourist oriented routes differ from the baseline route the least at the lowest fare and the most at the highest fare. This estimated outcome agrees with the premise that tourist oriented routes carry a higher percentage of price sensitive tourists. These price sensitive passengers are more likely to purchase the lowest priced fares; moreover, on these routes frequent flier programs do not markedly enhance the market dominance of the observed carrier. Price sensitive travelers are not very loyal to any single carrier.

The market distance parameter (MKTDIST) is positive and significant at the each regressed fare percentile. This estimated result is as expected; although longer routes are more efficient to operate on a per mile basis, a longer route is still more costly and as such necessitates a higher airfare. The load factor variable (LOADFAC) is negative and significant at the 1% level in the 80th percentile baseline equation (Table 13). For the median fare LOADFAC is negative and significant at the 2% level and is not significant for the lowest fares. This relationship is inverse to the one Borenstein predicts, where

LOADFAC is negative and only significant at the 20th percentile. However, the result of this analysis is consistent with the argument that higher load factors indicate that a plane is more efficiently utilized, which in turn lowers a carrier's cost and the airfares that carrier will charge on the observed route. Equipment (EQUIP) is estimated to effect each price percentile in a negative and significant (at the 1% level) manner. Larger equipment is more efficient to operate and allows an airline to lower fares.

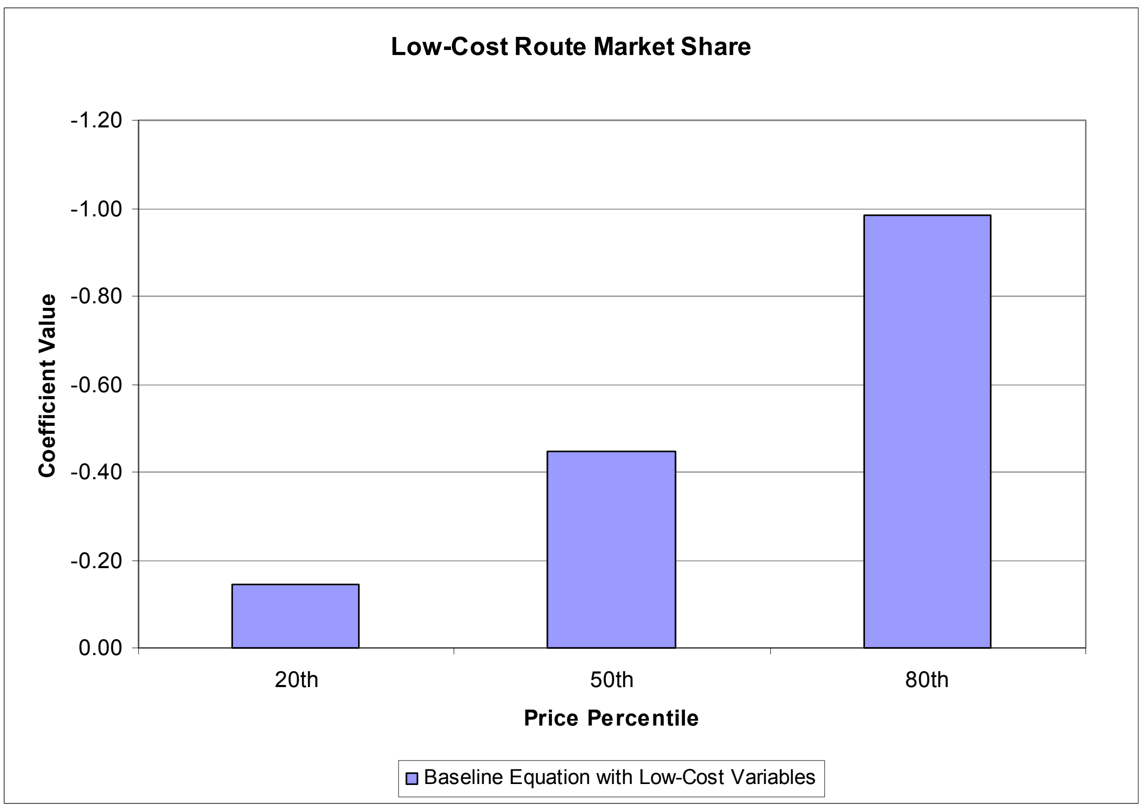
The effect of the frequency of flights on a route (FREQ), served by a particular carrier, is positive and significant at the 1% level over each fare percentile. A higher frequency of flights is associated with more traveled business routes. This estimate corroborates the argument that travelers with a high value of time will pay a premium for expanded service. On the other hand, the effect of competitor's cost (COMPCOST) is not significant at any fare level. The impact of the weighted route Herfindahl (RUTHERF) is only significant in the estimated equation regressed on the 80th percentile fare. The result of the 3 baseline estimates upholds the conclusion that ceteris paribus, routes with a single dominant carrier have higher prices. Moreover, market dominance of an airline is enhanced when that observed carrier controls a large percentage of a route's traffic and has a number of small competitors.

While Borenstein (1989) finds that potential competition has little if any disciplining affect on market prices, this analysis argues that low-cost carriers have a significant and far-reaching impact on the airline market.[3] The estimated baseline equations with low-cost variables, presented in Tables 10, 12, and 14, reveal that the

[3] It is important to note that Borenstein (1989) does not control for low-cost carriers. Instead, the paper controls for potential competition, which is not an accurate proxy for measuring the magnitude of low-cost presence. If the Borenstein had controlled for low-cost carriers the paper may have estimated lower magnitudes for the concentration and hub effects. Hence, the negligible effect of potential competition does not imply that low-cost carriers had little if any impact on the airline market in the late 1980s.

effect of a low-cost carrier is uniform across every type of fare. The low-cost route market share (LWCSTSHARE) parameter is significant at the 1% level for all three percentiles. At the 20th percentile, a 1% increase in the share of passengers carried by all the low-cost carriers on the route results in a 0.14% drop in price. A 1% rise in low-cost route market share lowers the median fare by 0.44%. The effect on the 80th percentile is the highest; a 1% rise in the low-cost route market share lowers the estimated price by 0.98%. The chart below illustrates the dramatic rise in the magnitude of the low-cost route share effect across fare types.

Figure 2 **Low-Cost Effect on Routes**



Note: The low-cost route market share parameter is significant at the 1% level for all three percentiles.

The presence of a low-cost carrier is not only important on routes; the level of low-cost endpoint airport market share (estimated with the parameter ORGLWCSHARE) also impacts market fares. If low-cost carriers control 50% of the originating passengers at the two endpoints of a route this analysis estimates that the observed carrier's price would fall by 0.005%, 0.026%, and 0.028% for the 20^{th}, median, and 80^{th} percentiles respectively. Thus controlling for the observed carrier's share on the route increases in low-cost market share, either on the route or at the endpoint airports, lower the carrier's low-end prices and the median and high-end prices by 5 times the magnitude of the low-end effect.

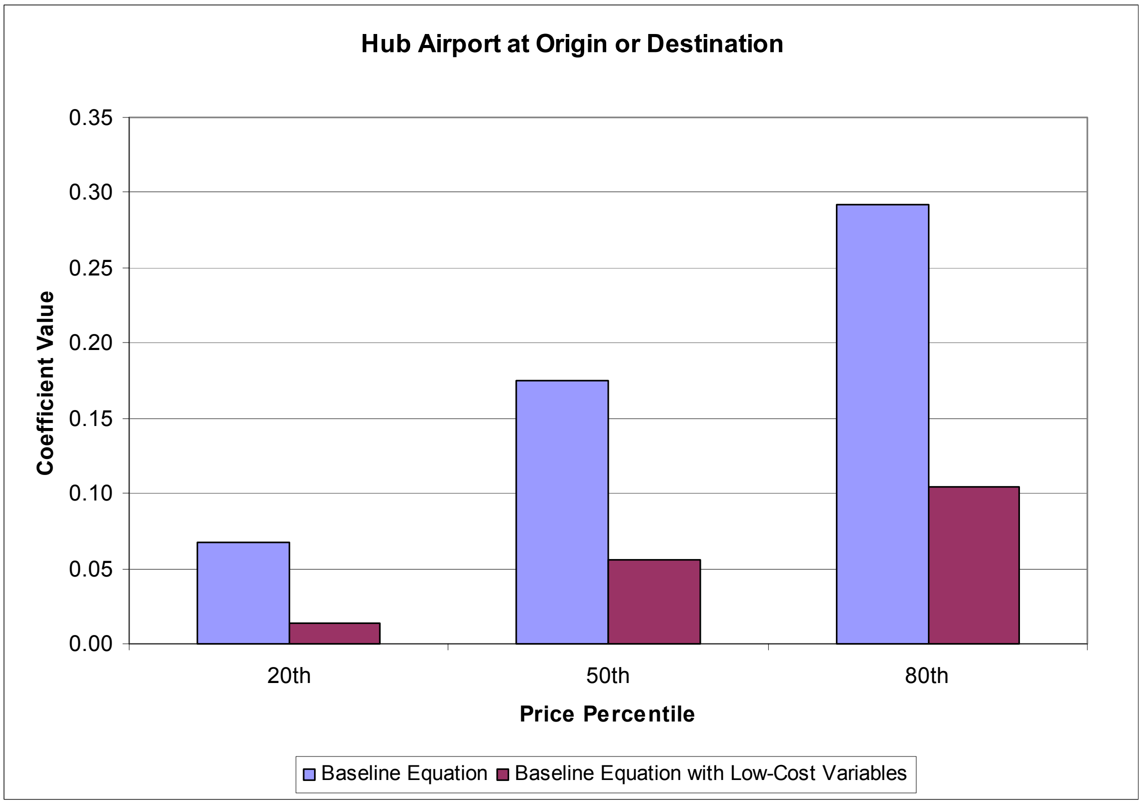
Controlling for low-cost route market share reveals a downward force on prices; however, the effect of a low-cost hub at either or both of the endpoints is not significant at any of the 3 fare levels. The lack of a negative and significant low-cost hub effect is not consistent with the other low-cost parameters. However, low-cost hubs are not always exclusively served by low-cost carriers. For example, JetBlue's primary hub is at New York John F. Kennedy (JFK) airport. Since this is a major metropolitan airport, with a large base of business travelers, the low-cost hub does not significantly affect the fares of flights terminating and originating the JFK.

The effect on prices of the presence of a low-cost carrier on a route, as explained above, is negative and significant. In contrast, the effect of the level of low-cost participation on a route, as measured by the low-cost route Herfindahl, is positive and significant at the 50^{th} and 80^{th} percentile price. This result indicates that having one low-cost carrier on a route does not provide the maximum low-cost effect and downward movement in market prices. A lower Herfindahl index (HHI) reduces the magnitude of the estimated effect of the low-cost route Herfindahl (LWCSTHERF) parameter. Thus both the presence and level of the low-cost presence on a route is necessary to determine the full low-cost route effect.

The estimated baseline equation with low-cost variables also reveals that the low-cost effect is not limited to the 4 low cost variables. The low-cost effect extends to concentration and route characteristic parameters as well. In fact, this analysis argues that many of the concentration effects and the hub effect that Borenstein (1989) and others suggest are critical to understanding airline pricing are significantly less important than previously suggested. Case in point, the baseline equation estimates that the presence of a hub at either or both endpoints of a route raises prices between 6.8% and 29.2%. Controlling for the presence of low-cost carriers, with 4 low cost variables, the estimated effect of a hub ranges from 1.4% to 10.5%. Thus at the low-end the hub effect fell by 80% and at the high-end the hub effect declined by 64%.

Without a low-cost presence a carrier at a hub can expect to add a 29.2% premium to the highest fares; however, once a low-cost carrier enters the hub market the incumbent carrier's hub premium is only 10.5%. Much of the hub effect is actually due to the lack of a low-cost presence. Low-cost carriers carry 12.1% of all domestic traffic originating and terminating at a major carrier's hub airport. The low-cost carriers' small hub market share results in a comparatively large decline in both the hub effect and the level of localized market dominance. In the estimated baseline equations with low-cost variables, the HUB variable is no longer significant in the 20th percentile equation; the HUB variable is significant at the 1% level in the median and 80th percentile equations. The low-cost impact on hubs is noteworthy, because 49.3% of all airline traffic originates and or terminates at a major carrier's hub. Thus understanding how low-cost carriers affect the hub effect provides some intuition for their impact on the larger airline market. Figure 3 diagrams that low-cost effect on the hub parameter across the three fare percentiles.

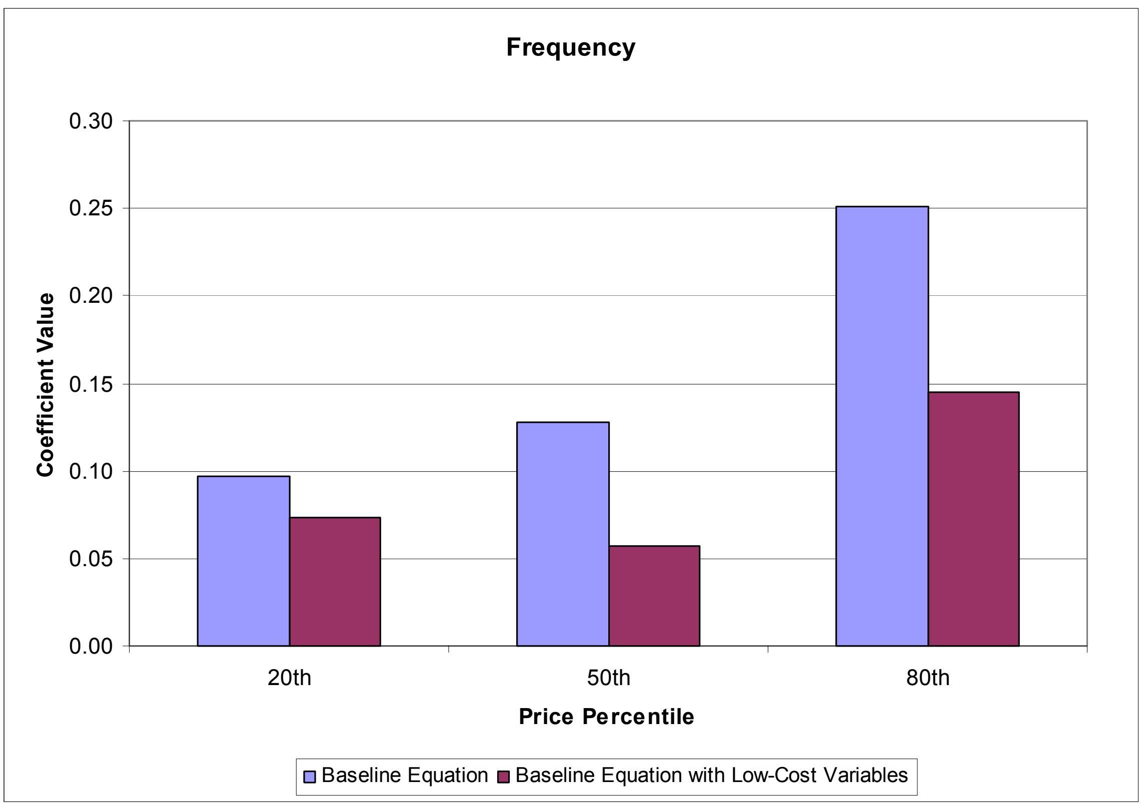
Figure 3 Impact of a Low-Cost Presence on Hubs



Note: HUB is significant at the 1% level in the baseline equation at all three percentiles. It is significant at the 1% level in the 50th and 80th percentile low-cost equations and is not significant in the 20th percentile equation.

The estimated change in price associated with hubs is overstated; moreover, the effect of frequency and slot constraints on the market price is also over estimated. The estimated effect of the frequency of flights on a route (FREQ), served by a particular carrier, is positive and significant at the 1% level over each fare percentile. This is the case for both the baseline and low-cost baseline equations. The coefficients of FREQ in the low-cost baseline equation are 0.07, 0.05, and 0.14 for the 20th, 50th, and 80th percentiles respectively. The addition on the 4 low-cost variables lowers the baseline equation's FREQ parameters by 25% at the 20th percentile, 55% at the median, and 42% at the 80th percentile. Thus the additional market power that carriers may derive from offering a high frequency of flights is significantly lower when a low-cost carrier is present on a route. Moreover, a large percentage of the frequency effect is attributable to lack of a low-cost presence on the route, not the actual frequency level. Figure 4 provides a visual representation of the impact the low-cost parameters on the coefficient value of FREQ across fares.

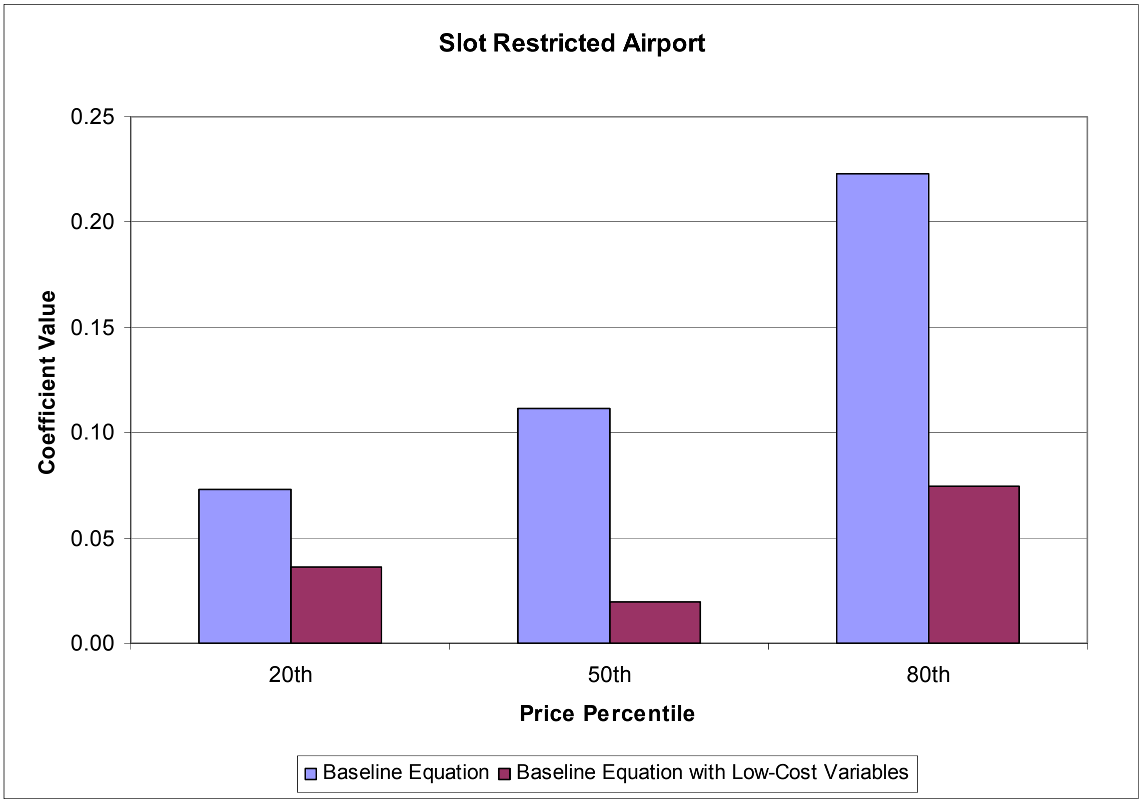
Figure 4 Impact of a Low-Cost Presence on Frequency



Note: FREQ is significant at the 1% level in the baseline equation at the median and 80th percentile. FREQ is significant in the 20th percentile baseline equation at the 2% level. It is not significant in any of the low-cost equations.

The effect of slot constraints on prices is over estimated. The estimated effect of the slot constraints on a route (SLOT) is not significant at the 10% level for any fare percentile in low-cost baseline equations. The baseline equation estimates that a slot restricted airport at the origin or destination causes the 20th, 50th, and 80th percentile fares to rise 6.8%, 11.2%, and 22.3% respectively. However, none of the SLOT coefficients are significant in low-cost baseline equations, thus the SLOT effect is nonexistent when controlling for low-cost carriers. Thus the additional market power that carriers may derive from barriers to entry, like slot constraints, are not material with the presence of a low-cost carrier. Moreover, the entire slot effect can be ascribed to the lack of a low-cost presence. Figure 5, below, provides exemplifies the impact the low-cost variables on the coefficient value of SLOT across each price level.

Figure 5 **Impact of a Low-Cost Presence on Slot Constraints**



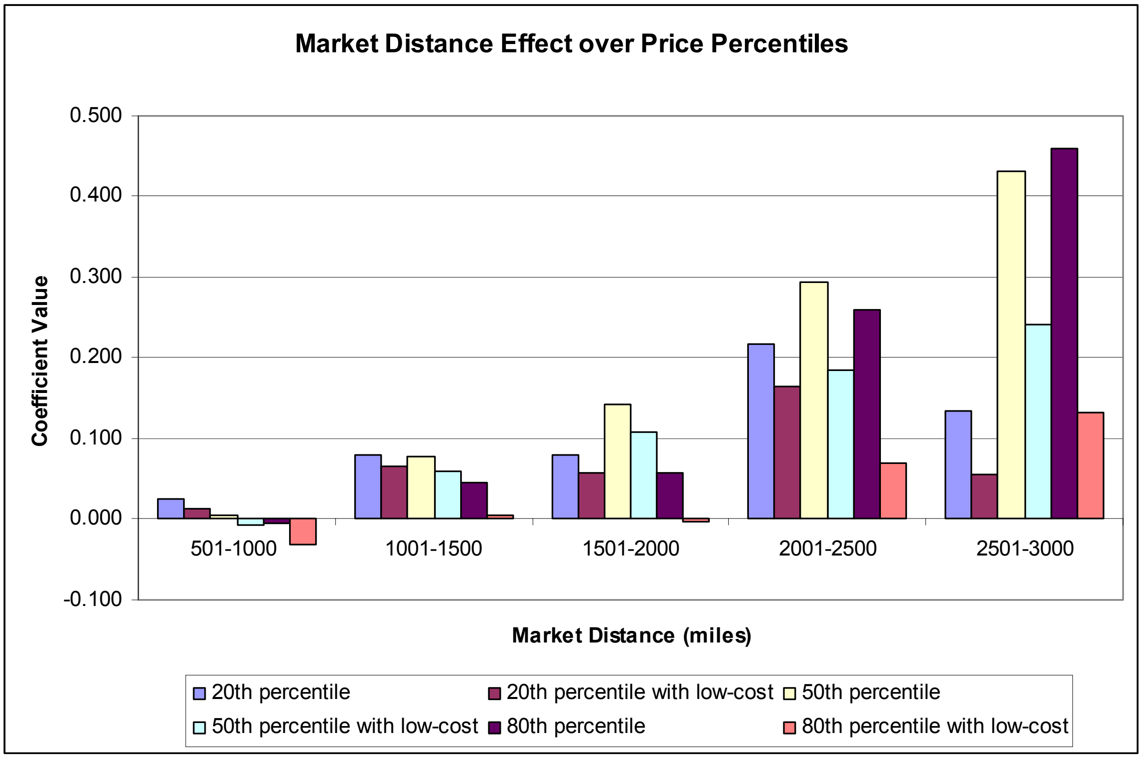
Note: SLOT is significant at the 1% level in the baseline equation at the median and 80th percentile. SLOT is not significant in the 20th percentile baseline equation. It is also not significant in the 20th and 50th percentile low-cost equations. SLOT is significant at the 10% level in the low-cost equation at the 80th percentile.

Including low-cost parameters in the baseline equation has a similar de-magnifying effect on EQUIP. At each fare percentile the coefficient value drops, but remains significant. Without a low-cost presence the downward effect of larger aircraft is overestimated. Thus the cost savings implied in EQUIP are lower than the baseline equation suggests. The effect of TOURIST is also overestimated in the baseline equation. The inclusion of low-cost controls lowers the absolute value of the TOURIST effect to between 12.5% and 36.6%. Thus a large percentage of the TOURIST effect is dependent upon a low-cost presence or lack thereof. This result is consistent with the fact that low-cost carriers transport 40.8% of all tourist traffic. Furthermore, this low-cost presence effect is of note because 28.2% of all traffic travels on tourist oriented routes. Even though tourist oriented routes carry a higher percentage of price sensitive passengers (Richards 1996), the low-cost effect is still significant. A comparatively higher low-cost market share (in the range of 40% to 50%) is needed to impact (induce a low-cost effect on) a price sensitive market segment, whereas on relatively price insensitive routes, such as those originating and or terminating at a hub, a much lower market share of 10-15% is necessary.

The low-cost parameters have no material impact on the market distance (MKTDIS), route Herfindahl (RUTHERF), or the cost parameter (COMPCOST). Likewise, there is no significant change in the route market share (RUTSHARE) variable. Thus Borenstein (1989) and the baseline equation of this analysis do not overestimate the impact of route concentration on prices. The route concentration effect continues to be strong and an important factor in estimating market prices. The stability of the route concentration effect contrasts sharply with the overestimated effects associated with hubs, airport concentration, slot constraints, etc.

The three estimated six segment distance equations quantify the change in market prices over 500 mile market segments. The inclusion of the 500 mile market distance dummy variables does not change the estimated coefficients for the variables described thus far. The baseline six segment distance equation, which does not contain low-cost variables, brings to light the rising price premium linked to longer routes. A flight 501 to 1000 miles in length is estimated to have a price 0.5% higher than a flight of 1 to 500 miles in length, for the median fare. This analysis estimates effect of a 2501 to 3000 mile route over the baseline distance is a 43.1% increase in price, for the median fare. This positive relationship between price and the segmented distance effect also holds for the 20th and 80th percentile equations. Figure 6 diagrams the growth in the price premium over the baseline route length as the route distance rises. Table 7 includes a list of significance levels for the market distance coefficients included in Figure 6. It is important to note that this graduated increase appears to take a log linear form, which is at odds with the linear increase in route length that the indicator variables measure. The price of tickets on longer routes rises more quickly than the route length. A route 1 to 500 miles longer than the baseline is estimated to have a 0.5% premium, while a route 1500 to 2000 miles longer has a 29.4% premium. The longest routes command a high premium; however, a large percentage of the estimated distance effect is in point of fact due to the lack of a low-cost presence.

Figure 6 **Impact of a Low-Cost Presence on the Market Distance Effect**



The six segment distance equations with low-cost parameters quantify the low-cost effect within distinct 500 mile market segments. Across each fare type and each fare percentile the effect of the market distance on price is lower when controlling for the presence of low-cost carriers. The 501-1000 mile segment parameter is not significant at any fare percentile in the six segment equation with low-cost variables. The 1501-2000 mile parameter's level of significance changes with the introduction of the low-cost parameters. At the 20th percentile the MKTDIS_4 (1501-2000 mile) variable is significant at the 10% level and is no longer significant with the low-cost measures. The same low-cost effect is apparent at the 80th percentile as well. MKTDIS_4 is significant at the 20% level, but in the estimated equation with the low-cost variables MKTDIS_4 is no longer significant.

The largest flattening of the change in the price distribution caused by the market segment effect is at the high end of the distribution. A larger percentage change in a percentile airfare is not due to a higher level of low-cost market share in that market segment. Table 6 provides a breakdown of low-cost market share by 500 mile segments. Figure 6 and the summary statistics in the table below refute the assertion that a large low-cost presence is required to significantly alter the distribution of airfares in a market segment. Longer routes, with a lower percentage of price sensitive passengers, require a lower low-cost presence to compact and shift the price distribution lower. This result has two implications. First, the lower market presence of low cost carriers in longer routes implies that higher barriers to entry exist on longer routes. However, the late arrival of low-cost carriers to the long haul market may also explain the market share distribution in Table 6. Second, shorter routes with already compact price distributions require a comparatively large low-cost market share to produce a measurable low-cost effect on these routes. If prices are already low a comparatively larger low-cost presence is needed to discipline prices further.

Table 6 Low-Cost Market Share by Market Segment

Market Segment	Total Passengers	Low-Cost Passengers	Low-Cost Market Share
0-500 miles	2201362	987145	44.84%
501-1000 miles	2116413	576565	27.24%
1001-1500 miles	1024699	294356	28.73%
1501-2000 miles	576565	123472	21.42%
2001-2500 miles	375908	71013	18.89%
2502-3000 miles	155277	18533	11.94%

In general, including the low-cost variables causes the estimated market distance coefficients values to rise and level of significance to fall. This trend along with the fall in the coefficient values supports the assertion that the effect of distance on prices is overstated in the estimated baseline equations, which lack low-cost variables. Moreover, since the baseline results are similar to Borenstein (1989) it is expected that the inclusion of low-cost variables in the estimated equations would produce a similar result. Table 7 summarizes the significance levels of each of the market distance variables. The summary establishes that the market distance is, on average, a less important predictor of price than the regular six segment equation suggests.

Table 7 Summary of Significance Levels for Market Distance Variables[4]

Market Segment (miles)	Price Percentile 20th	20th low-cost	50th	50th low-cost	80th	80th low-cost
501-1000	0.265	0.548	0.821	0.714	0.808	0.162
1001-1500	0.016	0.049	0.010	0.043	0.196	0.868
1501-2000	0.058	0.175	0.000	0.004	0.182	0.930
2001-2500	0.000	0.001	0.000	0.000	0.000	0.154
2501-3000	0.032	0.390	0.000	0.000	0.000	0.035

An important hypothesis of this paper is that the low-cost effect is quantifiable in the regional and the long haul market as well. This paper estimates that 83.2% of airline traffic is regional and the remainder is long haul. In place of the 500 mile segmented distance variables two dummy variables are used. A representative route for the long haul market segment is New York (JFK) to Los Angeles (LAX). This route is the most traveled long haul route in the United States; moreover, the low-cost market share on the route is 0.06%. American Airlines is the dominant carrier on the route with a market share of 46.3%. The most traveled regional route is Washington National (DCA) to New York LaGuardia (LGA). Delta Airlines has the highest market share on the route at 53.5%. Also, there is no low-cost presence on the DCA to LGA route. Although, the most

[4] The left column represents each 500 mile market segment that was included in the six segment market distance regressions. Each of the table's interior cells correspond to an estimated significance level for a particular 500 mile market segment estimated in an equation regressed on a particular price percentile, noted in the column heading.

prominent regional and long haul markets lack a nontrivial low-cost presence, the low-cost effect is significant in both market segments.

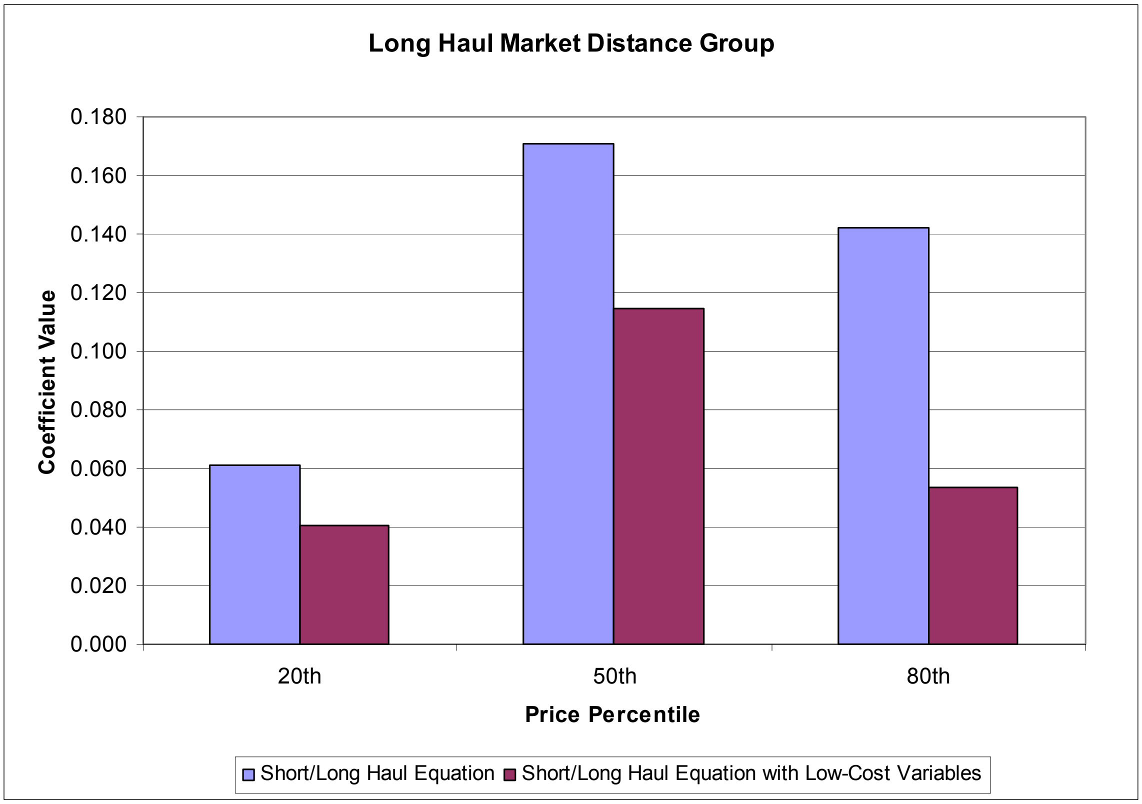
The long haul route, with the highest number of low-cost passengers, is Chicago Midway (MDW) to Las Vegas (LAS). The dominant carriers on this route include American Trans Air with 43.1%, National Airlines with 31.0%, and Southwest with a 25.8% market share. In fact, low-cost carriers transport 100% of the traffic on this tourist oriented route. In the regional market, the most traveled route with a low-cost presence is Los Angeles (LAX) to Oakland (OAK). Southwest dominates this regional route with a market share of 92.6%; Southwest is the only low-cost carrier on the route. LAX to OAK exemplifies the low-cost carrier's preference for having either one or both of the endpoint airports be a secondary airport. Even though low-cost carriers often do not compete with the major airlines directly, the low cost presence is felt across market segments.

The short/long haul market segment equations indicate that the low-cost effect extends across the entire airline market; moreover this effect is significant at each measured fare percentile. Note that the effects of the other parameters discussed previously remain the same unless otherwise noted. Tables 21-26 contain the summary results of each of the short/long haul equations. The estimated results of three baseline short/long haul equations demonstrate the high price premium associated with long haul routes versus regional routes. Case in point, the effect of the long haul market distance group variable on price is estimated to be 0.06, 0.17, and 0.14 at the 20th, 50th, and 80th percentiles respectively. Thus, at the median airfare, a long haul route is estimated to have a price 17% higher than a regional route controlling for route specific characteristics besides length.

The result at the median mirrors the results at the 20th and 80th percentiles; moreover, each of the long haul market distance group (MKTDISLNG) parameters is significant at the 1% level. Thus there is a considerable price premium associated with the long haul market that cannot be explained by the higher total (though lower per mile) cost of long haul routes. A possible explanation for the price premium is that low-cost carriers have a much smaller exposure to the long haul market than the regional market. This lower market penetration rate triggers a lower level of competitive pressure on the incumbent major carriers, which are not inclined to lower ticket prices. As a result, long haul routes carry a price premium and make obvious the dominance of the major carriers.

Just as the price premium associated with the frequency of flights is overestimated so is the price difference between regional and long haul routes at each of the three measured fare percentiles. At the 20th, 50th, and 80th percentiles the long haul distance effect (the price premium over a comparable regional route) is estimated to be 4.1%, 11.4%, and 5.4%. The 20th percentile coefficient is significant at the 10% level, the median coefficient is significant at the 1% level, and the 80th percentile coefficient is significant at the 5% level. Not only has the estimated magnitude of each MKTDISLNG variable fallen, but the level of significance has fallen as well. The declining level of significance indicates that regional and long haul price distinctions are less important than the baseline short/long haul equation would imply. Moreover, between 33% and 62% of the long haul market distance effect is explained by the lack of a low-cost presence. Figure 7 illustrates the significant impact of low-cost carriers on the long haul market, across all types of fares.

Figure 7 **Impact of a Low-Cost Presence on the Long Haul Effect**



Note: MKTDISLNG is significant at the 1% level in all three baseline short/long haul equations. It is also significant at the 10% level, 1% level, and 2% level in the 20^{th}, 50^{th}, and 80^{th} percentile low-cost equations respectively.

An implication of the short/long haul equation results is that there is a difference in pricing between regional and short haul routes regardless of a low-cost presence; however, the more important observation is that low-cost carriers significantly lower the difference in prices between regional and long haul routes. Thus the low-cost carrier is no longer pigeon holed to the regional market; however, the regional market still accounts for 83.2% of all airline traffic. The three largest long haul low-cost carriers Southwest, America Trans Air, and JetBlue account for 75.4% of all long haul low-cost traffic. Table 8 summarizes the low-cost carriers that serve the long haul market (routes 1501-3000 miles in length) and provides each carrier's market share. It is important to note that

Southwest is the largest low-cost carrier in the long haul market as well as the regional market. JetBlue is the third largest low-cost carrier and only carries 3.12% of all long haul traffic. A carrier's share of the low-cost traffic may be proportional to that carrier's share of the low-cost effect. Thus much of the low-cost effect on MKTDISLNG and more generally HUB, SLOT, FREQ, and ORGSHARE can be directly attributed to Southwest and not JetBlue.

Table 8 Low-Cost Airline Market Share in the Long Haul Market

Airline	Passengers	Share of Low-Cost Traffic	Share of all Traffic
JetBlue Airways	33496	15.70%	3.12%
Frontier Airlines	7585	3.56%	0.71%
National Airlines	30244	14.18%	2.82%
Vanguard Airlines	1482	0.69%	0.14%
Spirit Airlines	11644	5.46%	1.08%
Sun Country Airlines	1095	0.51%	0.10%
America Trans Air	36405	17.07%	3.39%
Southwest Airlines	90971	42.65%	8.47%
Casino Express Airlines	298	0.14%	0.03%

Low-cost carriers carry only 19.8% of all long haul traffic; however, the impact of these airlines on the pricing structure of the long haul market is large and significant. Competitive entry does not have to be large, but has to be low-cost to affectively discipline prices in the long haul market. Moreover, low-cost carriers only carry one fifth of all long haul traffic, but their presence or lack thereof explains 33% to 62% of the market distance effect measured by MKTDISLNG. This analysis argues that the estimated effect of a low-cost presence must be taken into account in order to derive an accurate understanding of the current state of the airline industry. Not taking into account the low-cost presence in a marketplace results in an overestimation of the estimated effect of critical market factors, such as airport concentration, hub presence, and flight frequency on the distribution of prices.

8. Conclusion

In the current airline market, the impact of a new breed of air carrier, the low-cost carrier, on airfares, is significant and broadly distributed. Previous industrial organization literature argues that concentration measures are critical to understanding the dynamics of pricing in the airline markets. The previous analyses of Borenstein (1989) and others lacked a key insight: the low-cost carrier is an important market participant. However, the Borenstein paper lays a solid groundwork that forms the base of this thesis. Without the low-cost parameters in the 3 sets of equations, the estimated results of this paper closely resemble Borenstein's results. The inclusion of the low-cost parameters in the baseline equation results in a set of estimated results that provide a more accurate accounting of what factors really impact airline industry price distributions and more specifically the prices that each consumer pays.

The low-cost effect results in the compaction of price distributions and the lowering of the associated central tendency of those distributions across all market segments. Moreover, a low-cost presence is correlated with a higher degree of competitiveness and a decline in the relevance of concentration, frequency, hubs, and capacity constraints in predicting market prices. The low-cost effect is statistically significant and measurable across the entire distribution of airfares. The effect is also significant and measurable for a route of variable length. A low-cost presence lowers prices at the low end, median, and high-end of the price distribution on regional and long haul routes. In fact, the largest degree of flattening occurs at the high end of the price distribution. Thus routes with the highest levels of market dominance would experience the largest change in their distribution of prices, with the entry of a low-cost carrier.

Moreover, a low-cost presence is estimated to cause a flatter price distribution, a higher degree of competitiveness, and a decline in the relevance of concentration, frequency, hubs, and capacity constraints in predicting market prices. This new breed of air carrier disciplines the incumbent major carriers that rely on market dominance to extract higher rents to support the higher cost basis of the hub-and-spoke networks these airlines use. The disciplining effect of low-cost carriers on the premium major airlines derive from hub airports may indicate that the higher cost basis of a traditional hub is no longer justified. Moreover, the low-cost airline model, which is built around using a point-to-point network, should continue to be a successful model for new entrants. While it is unlikely that any major carriers will completely abandon their hub-and-spoke networks, the partial dismantling of those hubs, in the form of de-peaking, will continue. Market forces have and will continue to cause these structural changes. Furthermore, there are policies can accelerate this shift and the magnitude of the low-cost presence in the airline markets.

This paper argues that a shift in critical thought is necessary to analyze today's airline industry; moreover, policies to encourage competition and a flatter price distribution will only bring about change if these policies are designed to encourage a larger low-cost presence in the marketplace. Policies that try to reduce concentration levels or dismantle hub airports will face stiff political opposition. The estimated baseline results suggest that regulations targeting these factors would change the distribution of airfares. In reality, the concentration and hub effects are significantly smaller than this paper first proposes. Targeting these factors would not result in a dramatic change in the competitiveness of airline routes as measured by the shape and location of the fare distribution curve. Moreover, this kind of targeted policy would incite fierce lobbying by the major nationwide carriers. The recent success of these carriers to obtain multi-billion dollar subsidies from the federal government points to the strength of the corporate airline lobby and airline union lobby.

Given that traditional policies, which encourage lower levels of concentration, are relatively ineffectual and politically infeasible, is there a viable alternative? Instead of attempting to reduce the impact of factors with a negative effect on the market, a successful policy must try to raise the impact of factors with a positive effect on the market. A viable policy must provide ample opportunity for low-cost entry in order to compact the fare distribution and return rents to the American consumer. The primary barrier to low-cost entry is the lack of airport infrastructure at many of America's largest metropolitan airports. In order to achieve the disciplining effect of a low-cost presence, the government should implement policies that encourage capacity constrained airports to build new infrastructure. Moreover, regulatory barriers to airport expansion should be loosened. A lower level of airport expansion regulation would encourage airports to undertake needed infrastructure improvements to increase capacity.

A build out of airport infrastructure, targeted at the most congested airports, would encourage low-cost carriers to enter a greater number of non-secondary markets. The newly constructed airport resources need to be allocated so that incumbent carriers do not receive a preferential claim to those resources. New resources alone do not discipline markets and compact the price distribution. Low-cost carriers must have access to those resources; otherwise, the infrastructure projects are nothing more than a subsidy to the major carriers. With greater access to once congested markets, the low-cost effect, on the market price distribution in these congested markets, should continue to increase in magnitude. Although, hubs still have higher fares than other airports, even when controlling for low-cost carriers, the significant role of the low-cost carrier in today's airline market indicates that dominance and market power do not go unchecked in the U.S. airline industry; moreover, this paper estimates that the entry of a low-cost carrier lowers fares while at the same time it lessens the effect of concentration and increases competition in the U.S. airline industry.

9. Regression Tables

Table 9 – Baseline Equation – 20th Percentile[5]

Dependent Variable: Price (ln)

	Beta	Std. Error	Std. Beta	t	Sig.
(Constant)	2.433	0.128		19.067	0.000
Market Distance (ln)	0.337	0.009	0.530	35.922	0.000
Load Factor (ln)	0.008	0.018	0.005	0.430	0.667
Equipment (ln)	-0.080	0.016	-0.273	-5.130	0.000
Frequency (ln)	0.097	0.016	0.322	6.187	0.000
Origin & Dest. Market Share (ln)	-0.034	0.008	-0.073	-4.297	0.000
Origin & Dest. Herfindahl (ln)	0.044	0.013	0.051	3.316	0.001
Route Market Share	0.154	0.034	0.104	4.477	0.000
Route Herfindahl	0.033	0.042	0.014	0.792	0.428
Comparable Cost (ln)	-0.010	0.007	-0.032	-1.417	0.157
Tourist Route	-0.077	0.017	-0.058	-4.598	0.000
Hub Airport at Origin or Dest.	0.068	0.014	0.062	4.940	0.000
Slot Restricted Airport	0.073	0.048	0.018	1.530	0.126

Table 10 – Baseline Equation – 20th Percentile with Low-Cost Variables

Dependent Variable: Price (ln)

	Beta	Std. Error	Std. Beta	t	Sig.
(Constant)	2.433	0.128		18.940	0.000
Market Distance (ln)	0.337	0.009	0.528	35.788	0.000
Load Factor (ln)	0.013	0.017	0.009	0.755	0.450
Equipment (ln)	-0.055	0.016	-0.188	-3.429	0.001
Frequency (ln)	0.073	0.016	0.243	4.546	0.000
Origin & Dest. Market Share (ln)	-0.037	0.008	-0.079	-4.648	0.000
Origin & Dest. Herfindahl (ln)	0.070	0.015	0.080	4.762	0.000
Route Market Share	0.147	0.034	0.098	4.262	0.000
Route Herfindahl	0.033	0.045	0.014	0.738	0.460
Low-Cost Origin & Dest. Market Share (ln)	-0.011	0.005	-0.033	-2.200	0.028
Low-Cost Route Market Share	-0.146	0.078	-0.084	-1.866	0.062
Low-Cost Route Herfindahl	-0.003	0.091	-0.002	-0.035	0.972
Comparable Cost (ln)	-0.010	0.007	-0.033	-1.478	0.139
Tourist Route	-0.066	0.017	-0.050	-3.824	0.000
Hub Airport at Origin or Dest.	0.014	0.015	0.013	0.891	0.373
Low-Cost Hub at Origin or Dest.	-0.034	0.023	-0.019	-1.507	0.132
Slot Restricted Airport	0.036	0.048	0.009	0.755	0.451

[5] In each of the summary tables the estimated equations are presented in the following format. Beta represents the coefficient value of each regressed variable. Std. Error is the standard error associated with each variable. Likewise, Std. Beta is the standardized beta coefficient value. The t-statistic for each beta is listed under the heading t. Finally, Sig. stands for the significance level of each parameter. A table with the R^2 figures and number of observations for each of the 18 equations is included in this paper as Table 27.

Table 11 – Baseline Equation – 50th Percentile

Dependent Variable: Price (ln)

	Beta	Std. Error	Std. Beta	t	Sig.
(Constant)	3.542	0.118		30.037	0.000
Market Distance (ln)	0.256	0.009	0.451	29.484	0.000
Load Factor (ln)	-0.039	0.016	-0.030	-2.401	0.016
Equipment (ln)	-0.120	0.014	-0.459	-8.331	0.000
Frequency (ln)	0.128	0.015	0.476	8.820	0.000
Origin & Dest. Market Share (ln)	-0.009	0.007	-0.020	-1.155	0.248
Origin & Dest. Herfindahl (ln)	0.000	0.012	0.000	0.025	0.980
Route Market Share	0.207	0.032	0.156	6.497	0.000
Route Herfindahl	0.017	0.039	0.008	0.446	0.655
Comparable Cost (ln)	0.005	0.006	0.019	0.819	0.413
Tourist Route	-0.106	0.016	-0.090	-6.858	0.000
Hub Airport at Origin or Dest.	0.175	0.013	0.180	13.761	0.000
Slot Restricted Airport	0.112	0.044	0.030	2.531	0.011

Table 12 – Baseline Equation – 50th Percentile with Low-Cost Variables

Dependent Variable: Price (ln)

	Beta	Std. Error	Std. Beta	t	Sig.
(Constant)	3.374	0.115		29.330	0.000
Market Distance (ln)	0.253	0.008	0.446	30.070	0.000
Load Factor (ln)	-0.021	0.016	-0.017	-1.369	0.171
Equipment (ln)	-0.047	0.014	-0.180	-3.267	0.001
Frequency (ln)	0.057	0.014	0.213	3.976	0.000
Origin & Dest. Market Share (ln)	-0.021	0.007	-0.050	-2.911	0.004
Origin & Dest. Herfindahl (ln)	0.079	0.013	0.102	6.055	0.000
Route Market Share	0.177	0.031	0.133	5.748	0.000
Route Herfindahl	-0.010	0.040	-0.005	-0.260	0.795
Low-Cost Origin & Dest. Market Share (ln)	-0.053	0.004	-0.178	-11.784	0.000
Low-Cost Route Market Share	-0.446	0.070	-0.289	-6.376	0.000
Low-Cost Route Herfindahl	0.213	0.082	0.114	2.603	0.009
Comparable Cost (ln)	0.001	0.006	0.003	0.132	0.895
Tourist Route	-0.071	0.015	-0.060	-4.583	0.000
Hub Airport at Origin or Dest.	0.056	0.014	0.058	4.047	0.000
Low-Cost Hub at Origin or Dest.	0.001	0.020	0.000	0.039	0.969
Slot Restricted Airport	0.019	0.043	0.005	0.456	0.648

Table 13 – Baseline Equation – 80th Percentile

Dependent Variable: Price (ln)

	Beta	Std. Error	Std. Beta	t	Sig.
(Constant)	3.546	0.134		26.553	0.000
Market Distance (ln)	0.358	0.010	0.516	36.484	0.000
Load Factor (ln)	-0.106	0.018	-0.068	-5.762	0.000
Equipment (ln)	-0.214	0.016	-0.666	-13.069	0.000
Frequency (ln)	0.251	0.016	0.761	15.233	0.000
Origin & Dest. Market Share (ln)	0.032	0.008	0.062	3.811	0.000
Origin & Dest. Herfindahl (ln)	-0.052	0.014	-0.055	-3.776	0.000
Route Market Share	0.189	0.036	0.116	5.237	0.000
Route Herfindahl	0.110	0.044	0.044	2.490	0.013
Comparable Cost (ln)	0.006	0.007	0.017	0.785	0.432
Tourist Route	-0.237	0.018	-0.165	-13.501	0.000
Hub Airport at Origin or Dest.	0.292	0.014	0.245	20.256	0.000
Slot Restricted Airport	0.223	0.050	0.050	4.458	0.000

Table 14 – Baseline Equation – 80th Percentile with Low-Cost Variables

Dependent Variable: Price (ln)

	Beta	Std. Error	Std. Beta	t	Sig.
(Constant)	3.355	0.126		26.713	0.000
Market Distance (ln)	0.354	0.009	0.510	38.498	0.000
Load Factor (ln)	-0.080	0.017	-0.051	-4.684	0.000
Equipment (ln)	-0.102	0.016	-0.318	-6.484	0.000
Frequency (ln)	0.145	0.016	0.441	9.198	0.000
Origin & Dest. Market Share (ln)	0.015	0.008	0.030	1.941	0.052
Origin & Dest. Herfindahl (ln)	0.038	0.014	0.040	2.686	0.007
Route Market Share	0.138	0.034	0.085	4.095	0.000
Route Herfindahl	0.031	0.044	0.012	0.711	0.477
Low-Cost Origin & Dest. Market Share (ln)	-0.055	0.005	-0.152	-11.215	0.000
Low-Cost Route Market Share	-0.984	0.076	-0.521	-12.879	0.000
Low-Cost Route Herfindahl	0.577	0.089	0.252	6.460	0.000
Comparable Cost (ln)	0.000	0.007	0.001	0.029	0.977
Tourist Route	-0.175	0.017	-0.122	-10.397	0.000
Hub Airport at Origin or Dest.	0.105	0.015	0.088	6.907	0.000
Low-Cost Hub at Origin or Dest.	-0.019	0.022	-0.010	-0.852	0.394
Slot Restricted Airport	0.075	0.047	0.017	1.605	0.109

Table 15 – Six Segment Distance Equation – 20th Percentile

Dependent Variable: Price (ln)

	Beta	Std. Error	Std. Beta	t	Sig.
(Constant)	2.755	0.157		17.506	0.000
Market Distance (ln)	0.285	0.019	0.447	14.873	0.000
Load Factor (ln)	0.005	0.017	0.004	0.285	0.776
Equipment (ln)	-0.090	0.016	-0.310	-5.752	0.000
Frequency (ln)	0.108	0.016	0.362	6.838	0.000
Origin & Dest. Market Share (ln)	-0.030	0.008	-0.064	-3.729	0.000
Origin & Dest. Herfindahl (ln)	0.037	0.013	0.043	2.770	0.006
Route Market Share	0.134	0.035	0.091	3.876	0.000
Route Herfindahl	0.033	0.042	0.014	0.779	0.436
Comparable Cost (ln)	-0.013	0.007	-0.040	-1.806	0.071
Tourist Route	-0.087	0.017	-0.066	-5.169	0.000
Hub Airport at Origin or Dest.	0.071	0.014	0.066	5.138	0.000
Slot Restricted Airport	0.077	0.048	0.019	1.612	0.107
Market Distance of 501-1000 miles	0.026	0.023	0.024	1.116	0.265
Market Distance of 1001-1500 miles	0.080	0.033	0.055	2.415	0.016
Market Distance of 1501-2000 miles	0.079	0.042	0.041	1.897	0.058
Market Distance of 2001-2500 miles	0.217	0.049	0.091	4.411	0.000
Market Distance of 2501-3000 miles	0.134	0.063	0.035	2.147	0.032

Table 16 – Six Segment Distance Equation – 20th Percentile with Low-Cost Variables

Dependent Variable: Price (ln)

	Beta	Std. Error	Std. Beta	t	Sig.
(Constant)	2.683	0.159		16.889	0.000
Market Distance (ln)	0.299	0.019	0.468	15.504	0.000
Load Factor (ln)	0.010	0.017	0.007	0.595	0.552
Equipment (ln)	-0.067	0.016	-0.230	-4.091	0.000
Frequency (ln)	0.086	0.016	0.286	5.213	0.000
Origin & Dest. Market Share (ln)	-0.033	0.008	-0.072	-4.154	0.000
Origin & Dest. Herfindahl (ln)	0.060	0.015	0.069	4.010	0.000
Route Market Share	0.133	0.035	0.090	3.862	0.000
Route Herfindahl	0.031	0.045	0.014	0.698	0.485
Low-Cost Origin & Dest. Market Share (ln)	-0.007	0.005	-0.022	-1.408	0.159
Low-Cost Route Market Share	-0.118	0.079	-0.069	-1.491	0.136
Low-Cost Route Herfindahl	-0.020	0.092	-0.010	-0.222	0.824
Comparable Cost (ln)	-0.012	0.007	-0.039	-1.719	0.086
Tourist Route	-0.079	0.017	-0.060	-4.519	0.000
Hub Airport at Origin or Dest.	0.021	0.016	0.020	1.342	0.180
Low-Cost Hub at Origin or Dest.	-0.043	0.023	-0.024	-1.857	0.063
Slot Restricted Airport	0.044	0.048	0.011	0.912	0.362
Market Distance of 501-1000 miles	0.014	0.023	0.013	0.600	0.548
Market Distance of 1001-1500 miles	0.066	0.033	0.045	1.970	0.049
Market Distance of 1501-2000 miles	0.057	0.042	0.030	1.355	0.175
Market Distance of 2001-2500 miles	0.165	0.050	0.070	3.325	0.001
Market Distance of 2501-3000 miles	0.055	0.064	0.014	0.860	0.390

Table 17 – Six Segment Distance Equation – 50th Percentile

Dependent Variable: Price (ln)

	Beta	Std. Error	Std. Beta	t	Sig.
(Constant)	4.031	0.144		27.994	0.000
Market Distance (ln)	0.180	0.018	0.316	10.268	0.000
Load Factor (ln)	-0.044	0.016	-0.035	-2.736	0.006
Equipment (ln)	-0.142	0.014	-0.546	-9.887	0.000
Frequency (ln)	0.151	0.014	0.565	10.426	0.000
Origin & Dest. Market Share (ln)	0.001	0.007	0.002	0.129	0.898
Origin & Dest. Herfindahl (ln)	-0.014	0.012	-0.018	-1.142	0.254
Route Market Share	0.168	0.032	0.127	5.307	0.000
Route Herfindahl	0.027	0.039	0.013	0.702	0.483
Comparable Cost (ln)	0.000	0.006	-0.002	-0.070	0.944
Tourist Route	-0.113	0.015	-0.096	-7.306	0.000
Hub Airport at Origin or Dest.	0.188	0.013	0.195	14.854	0.000
Slot Restricted Airport	0.123	0.044	0.034	2.827	0.005
Market Distance of 501-1000 miles	0.005	0.021	0.005	0.226	0.821
Market Distance of 1001-1500 miles	0.079	0.030	0.060	2.579	0.010
Market Distance of 1501-2000 miles	0.143	0.038	0.083	3.730	0.000
Market Distance of 2001-2500 miles	0.294	0.045	0.139	6.548	0.000
Market Distance of 2501-3000 miles	0.431	0.057	0.125	7.533	0.000

Table 18 – Six Segment Distance Equation – 50th Percentile with Low-Cost Variables

Dependent Variable: Price (ln)

	Beta	Std. Error	Std. Beta	t	Sig.
(Constant)	3.712	0.142		26.171	0.000
Market Distance (ln)	0.205	0.017	0.360	11.906	0.000
Load Factor (ln)	-0.026	0.016	-0.021	-1.680	0.093
Equipment (ln)	-0.069	0.015	-0.265	-4.723	0.000
Frequency (ln)	0.080	0.015	0.298	5.435	0.000
Origin & Dest. Market Share (ln)	-0.014	0.007	-0.034	-1.974	0.048
Origin & Dest. Herfindahl (ln)	0.063	0.013	0.081	4.720	0.000
Route Market Share	0.156	0.031	0.118	5.039	0.000
Route Herfindahl	-0.004	0.040	-0.002	-0.095	0.925
Low-Cost Origin & Dest. Market Share (ln)	-0.047	0.005	-0.159	-10.311	0.000
Low-Cost Route Market Share	-0.388	0.071	-0.253	-5.498	0.000
Low-Cost Route Herfindahl	0.174	0.082	0.094	2.121	0.034
Comparable Cost (ln)	-0.003	0.006	-0.009	-0.421	0.674
Tourist Route	-0.082	0.016	-0.070	-5.271	0.000
Hub Airport at Origin or Dest.	0.075	0.014	0.077	5.288	0.000
Low-Cost Hub at Origin or Dest.	-0.013	0.020	-0.008	-0.641	0.522
Slot Restricted Airport	0.037	0.043	0.010	0.859	0.390
Market Distance of 501-1000 miles	-0.008	0.021	-0.008	-0.366	0.714
Market Distance of 1001-1500 miles	0.060	0.030	0.046	2.021	0.043
Market Distance of 1501-2000 miles	0.108	0.038	0.062	2.858	0.004
Market Distance of 2001-2500 miles	0.185	0.044	0.087	4.166	0.000
Market Distance of 2501-3000 miles	0.241	0.057	0.070	4.235	0.000

Table 19 – Six Segment Distance Equation – 80th Percentile

Dependent Variable: Price (ln)

	Beta	Std. Error	Std. Beta	t	Sig.
(Constant)	3.927	0.164		24.003	0.000
Market Distance (ln)	0.302	0.020	0.432	15.180	0.000
Load Factor (ln)	-0.109	0.018	-0.070	-6.011	0.000
Equipment (ln)	-0.232	0.016	-0.727	-14.222	0.000
Frequency (ln)	0.270	0.016	0.821	16.380	0.000
Origin & Dest. Market Share (ln)	0.042	0.008	0.081	4.994	0.000
Origin & Dest. Herfindahl (ln)	-0.064	0.014	-0.067	-4.593	0.000
Route Market Share	0.159	0.036	0.098	4.421	0.000
Route Herfindahl	0.131	0.044	0.052	2.978	0.003
Comparable Cost (ln)	0.002	0.007	0.005	0.246	0.806
Tourist Route	-0.240	0.018	-0.166	-13.677	0.000
Hub Airport at Origin or Dest.	0.309	0.014	0.260	21.412	0.000
Slot Restricted Airport	0.232	0.049	0.052	4.687	0.000
Market Distance of 501-1000 miles	-0.006	0.024	-0.005	-0.243	0.808
Market Distance of 1001-1500 miles	0.045	0.035	0.028	1.294	0.196
Market Distance of 1501-2000 miles	0.058	0.044	0.027	1.334	0.182
Market Distance of 2001-2500 miles	0.260	0.051	0.100	5.091	0.000
Market Distance of 2501-3000 miles	0.460	0.065	0.108	7.071	0.000

Table 20 – Six Segment Distance Equation – 80th Percentile with Low-Cost Variables

Dependent Variable: Price (ln)

	Beta	Std. Error	Std. Beta	t	Sig.
(Constant)	3.448	0.155		22.178	0.000
Market Distance (ln)	0.346	0.019	0.495	18.351	0.000
Load Factor (ln)	-0.082	0.017	-0.053	-4.806	0.000
Equipment (ln)	-0.113	0.016	-0.354	-7.070	0.000
Frequency (ln)	0.156	0.016	0.474	9.681	0.000
Origin & Dest. Market Share (ln)	0.019	0.008	0.037	2.402	0.016
Origin & Dest. Herfindahl (ln)	0.032	0.015	0.033	2.189	0.029
Route Market Share	0.133	0.034	0.082	3.940	0.000
Route Herfindahl	0.043	0.044	0.017	0.968	0.333
Low-Cost Origin & Dest. Market Share (ln)	-0.052	0.005	-0.143	-10.390	0.000
Low-Cost Route Market Share	-0.940	0.077	-0.500	-12.159	0.000
Low-Cost Route Herfindahl	0.542	0.090	0.237	6.027	0.000
Comparable Cost (ln)	-0.001	0.007	-0.002	-0.086	0.931
Tourist Route	-0.180	0.017	-0.125	-10.535	0.000
Hub Airport at Origin or Dest.	0.119	0.015	0.100	7.710	0.000
Low-Cost Hub at Origin or Dest.	-0.025	0.022	-0.012	-1.102	0.270
Slot Restricted Airport	0.084	0.047	0.019	1.796	0.073
Market Distance of 501-1000 miles	-0.031	0.023	-0.027	-1.400	0.162
Market Distance of 1001-1500 miles	0.005	0.033	0.003	0.166	0.868
Market Distance of 1501-2000 miles	-0.004	0.041	-0.002	-0.088	0.930
Market Distance of 2001-2500 miles	0.069	0.049	0.027	1.425	0.154
Market Distance of 2501-3000 miles	0.132	0.062	0.031	2.110	0.035

Table 21 – Short/Long Haul Market Segment Equation – 20th Percentile

Dependent Variable: Price (ln)

	Beta	Std. Error	Std. Beta	t	Sig.
(Constant)	2.558	0.131		19.475	0.000
Market Distance (ln)	0.318	0.011	0.500	29.465	0.000
Load Factor (ln)	0.006	0.017	0.004	0.323	0.746
Equipment (ln)	-0.086	0.016	-0.295	-5.497	0.000
Frequency (ln)	0.104	0.016	0.347	6.584	0.000
Origin & Dest. Market Share (ln)	-0.032	0.008	-0.068	-3.956	0.000
Origin & Dest. Herfindahl (ln)	0.039	0.013	0.045	2.922	0.003
Route Market Share	0.141	0.035	0.095	4.076	0.000
Route Herfindahl	0.028	0.042	0.012	0.666	0.505
Comparable Cost (ln)	-0.011	0.007	-0.036	-1.609	0.108
Tourist Route	-0.083	0.017	-0.063	-4.943	0.000
Hub Airport at Origin or Dest.	0.068	0.014	0.063	4.919	0.000
Slot Restricted Airport	0.077	0.048	0.019	1.610	0.108
Long Haul Market Distance Group	0.061	0.021	0.042	2.858	0.004

Table 22 – Short/Long Haul Market Segment Equation – 20th Percentile with Low-Cost Variables

Dependent Variable: Price (ln)

	Beta	Std. Error	Std. Beta	t	Sig.
(Constant)	2.536	0.133		19.072	0.000
Market Distance (ln)	0.324	0.011	0.507	29.877	0.000
Load Factor (ln)	0.011	0.017	0.008	0.632	0.528
Equipment (ln)	-0.063	0.016	-0.215	-3.870	0.000
Frequency (ln)	0.082	0.016	0.272	5.000	0.000
Origin & Dest. Market Share (ln)	-0.034	0.008	-0.074	-4.298	0.000
Origin & Dest. Herfindahl (ln)	0.061	0.015	0.071	4.143	0.000
Route Market Share	0.138	0.035	0.093	4.002	0.000
Route Herfindahl	0.028	0.045	0.012	0.620	0.536
Low-Cost Origin & Dest. Market Share (ln)	-0.007	0.005	-0.022	-1.459	0.145
Low-Cost Route Market Share	-0.136	0.078	-0.079	-1.744	0.081
Low-Cost Route Herfindahl	-0.005	0.091	-0.002	-0.055	0.956
Comparable Cost (ln)	-0.011	0.007	-0.035	-1.555	0.120
Tourist Route	-0.074	0.017	-0.056	-4.256	0.000
Hub Airport at Origin or Dest.	0.018	0.016	0.016	1.138	0.255
Low-Cost Hub at Origin or Dest.	-0.039	0.023	-0.022	-1.702	0.089
Slot Restricted Airport	0.042	0.048	0.010	0.891	0.373
Long Haul Market Distance Group	0.041	0.022	0.028	1.870	0.061

Table 23 – Short/Long Haul Market Segment Equation – 50th Percentile

Dependent Variable: Price (ln)

	Beta	Std. Error	Std. Beta	t	Sig.
(Constant)	3.829	0.121		31.748	0.000
Market Distance (ln)	0.209	0.010	0.368	21.110	0.000
Load Factor (ln)	-0.043	0.016	-0.034	-2.655	0.008
Equipment (ln)	-0.133	0.014	-0.512	-9.277	0.000
Frequency (ln)	0.143	0.014	0.533	9.837	0.000
Origin & Dest. Market Share (ln)	-0.003	0.007	-0.008	-0.426	0.670
Origin & Dest. Herfindahl (ln)	-0.011	0.012	-0.014	-0.912	0.362
Route Market Share	0.179	0.032	0.135	5.623	0.000
Route Herfindahl	0.015	0.039	0.007	0.386	0.699
Comparable Cost (ln)	0.002	0.006	0.006	0.244	0.807
Tourist Route	-0.109	0.015	-0.093	-7.056	0.000
Hub Airport at Origin or Dest.	0.180	0.013	0.186	14.202	0.000
Slot Restricted Airport	0.121	0.044	0.033	2.757	0.006
Long Haul Market Distance Group	0.171	0.020	0.131	8.691	0.000

Table 24 – Short/Long Haul Market Segment Equation – 50th Percentile with Low-Cost Variables

Dependent Variable: Price (ln)

	Beta	Std. Error	Std. Beta	t	Sig.
(Constant)	3.579	0.119		30.120	0.000
Market Distance (ln)	0.223	0.010	0.392	23.039	0.000
Load Factor (ln)	-0.025	0.016	-0.020	-1.583	0.113
Equipment (ln)	-0.060	0.014	-0.232	-4.156	0.000
Frequency (ln)	0.071	0.015	0.267	4.900	0.000
Origin & Dest. Market Share (ln)	-0.017	0.007	-0.040	-2.305	0.021
Origin & Dest. Herfindahl (ln)	0.066	0.013	0.085	4.989	0.000
Route Market Share	0.161	0.031	0.122	5.220	0.000
Route Herfindahl	-0.013	0.040	-0.006	-0.314	0.754
Low-Cost Origin & Dest. Market Share (ln)	-0.048	0.005	-0.164	-10.650	0.000
Low-Cost Route Market Share	-0.428	0.070	-0.279	-6.132	0.000
Low-Cost Route Herfindahl	0.211	0.082	0.114	2.590	0.010
Comparable Cost (ln)	-0.001	0.006	-0.004	-0.176	0.860
Tourist Route	-0.076	0.016	-0.065	-4.933	0.000
Hub Airport at Origin or Dest.	0.066	0.014	0.069	4.762	0.000
Low-Cost Hub at Origin or Dest.	-0.009	0.020	-0.006	-0.458	0.647
Slot Restricted Airport	0.031	0.043	0.009	0.737	0.461
Long Haul Market Distance Group	0.114	0.019	0.088	5.901	0.000

Table 25 – Short/Long Haul Market Segment Equation – 80th Percentile

Dependent Variable: Price (ln)

	Beta	Std. Error	Std. Beta	t	Sig.
(Constant)	3.779	0.137		27.533	0.000
Market Distance (ln)	0.321	0.011	0.459	28.435	0.000
Load Factor (ln)	-0.108	0.018	-0.070	-5.935	0.000
Equipment (ln)	-0.223	0.016	-0.699	-13.659	0.000
Frequency (ln)	0.261	0.016	0.795	15.834	0.000
Origin & Dest. Market Share (ln)	0.036	0.008	0.070	4.300	0.000
Origin & Dest. Herfindahl (ln)	-0.060	0.014	-0.064	-4.341	0.000
Route Market Share	0.170	0.036	0.105	4.715	0.000
Route Herfindahl	0.110	0.044	0.043	2.490	0.013
Comparable Cost (ln)	0.003	0.007	0.010	0.449	0.654
Tourist Route	-0.238	0.018	-0.165	-13.524	0.000
Hub Airport at Origin or Dest.	0.297	0.014	0.250	20.608	0.000
Slot Restricted Airport	0.230	0.050	0.051	4.626	0.000
Long Haul Market Distance Group	0.142	0.022	0.089	6.350	0.000

Table 26 – Short/Long Haul Market Segment Equation – 80th Percentile with Low-Cost Variables

Dependent Variable: Price (ln)

	Beta	Std. Error	Std. Beta	t	Sig.
(Constant)	3.444	0.130		26.457	0.000
Market Distance (ln)	0.341	0.011	0.488	32.176	0.000
Load Factor (ln)	-0.081	0.017	-0.052	-4.740	0.000
Equipment (ln)	-0.106	0.016	-0.333	-6.705	0.000
Frequency (ln)	0.149	0.016	0.455	9.363	0.000
Origin & Dest. Market Share (ln)	0.017	0.008	0.033	2.117	0.034
Origin & Dest. Herfindahl (ln)	0.035	0.015	0.037	2.405	0.016
Route Market Share	0.136	0.034	0.084	4.020	0.000
Route Herfindahl	0.031	0.044	0.012	0.718	0.473
Low-Cost Origin & Dest. Market Share (ln)	-0.053	0.005	-0.148	-10.769	0.000
Low-Cost Route Market Share	-0.977	0.076	-0.519	-12.773	0.000
Low-Cost Route Herfindahl	0.577	0.089	0.253	6.463	0.000
Comparable Cost (ln)	0.000	0.007	0.000	0.000	1.000
Tourist Route	-0.177	0.017	-0.123	-10.437	0.000
Hub Airport at Origin or Dest.	0.110	0.015	0.093	7.212	0.000
Low-Cost Hub at Origin or Dest.	-0.024	0.022	-0.012	-1.073	0.284
Slot Restricted Airport	0.080	0.047	0.018	1.717	0.086
Long Haul Market Distance Group	0.053	0.021	0.033	2.519	0.012

Table 27 – Summary Statistics for the Regression Equations

Dependent Variable: Price	20th		50th		80th	
	R^2	N	R^2	N	R^2	N
Baseline Equation	0.271	21,573	0.217	21,573	0.329	21,573
Baseline Equation (Low-Cost)	0.280	21,573	0.274	21,573	0.421	21,573
Six Segment Equation	0.267	21,573	0.230	21,573	0.341	21,573
Six Segment Equation (Low-Cost)	0.274	21,573	0.274	21,573	0.421	21,573
Short/Long Haul Equation	0.264	21,573	0.222	21,573	0.330	21,573
Short/Long Haul Equation (Low-Cost)	0.272	21,573	0.271	21,573	0.418	21,573

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12. Bibliography

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