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Are passengers willing to pay more for additional legroom?

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Abstract

This paper investigates whether or not the efforts by two of the largest US airlines to increase seat pitch (i.e. legroom) across their aircraft fleet during 2000 resulted in fare premia relative to the other 'full service carriers'. Using panel data from 1998 to 2002, we estimate fixed-effects regressions in markets with overlapping service between large hub and spoke carriers and find that United's 'Premium Economy' program was more successful than American's 'More Room Throughout Coach' program at generating fare premia.

Keywords: Airline pricing; Product differentiation; Seat pitch

1. Introduction

The rapid expansion of low-cost carriers (LCCs) and recent bankruptcy filings by both United and US Airways has focused most of the recent attention regarding airline costs and service quality on the differences between the low cost (i.e., Southwest and JetBlue) and 'full service' (i.e., American and Delta) carriers.[1] In contrast, relatively little attention has been paid to the differences in service quality among carriers within either of these two groups. One area of service-quality competition that has received some recent attention is flight cancellations and delays (Mazzeo, 2003). Rather than explicitly attempting to link prices and service quality, this literature has focused primarily on the relationship between service quality and market concentration.[2] With regards to in-flight service quality, the literature has typically assumed that full service carriers are, for the most part, fairly homogeneous.

In any given city or airport-pair market, there are numerous of factors that may account for differences in average fares across full service airlines. Numerous studies (Borenstein, 1989; Evans and Kessides, 1993) have attempted to identify and assess the degree to which factors such as market share (both in the market and at the endpoint airports), network size, and the number of destinations served by a carrier from the endpoint airports impact a carrier's costs, potential market power and/or service quality—and hence its relative fares—in a given market. A unique change in relative service quality that occurred during 2000 among the 'full service' carriers in the US airline industry is examined. In particular, two of the largest US carriers—United and American—reconfigured their aircraft fleet to provide additional seat pitch (i.e., legroom) in their coach class cabins.[3] By literally removing seats from their aircraft, these two carriers reduced the seating capacity of their aircraft, improving in-flight service

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[1]See, for example, 'The Airlines' New Deal; It's Not Enough,' *Fortune*, April 28, 2003, and 'How to Fix the Airlines,' *BusinessWeek*, April 14, 2003.

[2]Rupp et al. (2003a, b) provide a closer link between pricing and delay/cancellation probability (their measure of service quality) in their examination of schedule recoveries following airport closures due to security breaches following September 11th.

[3]TWA experimented briefly with expanded coach class seating in 1993 after it re-emerged from bankruptcy, but quickly discontinued its 'Comfort Class' after it failed to generate price premiums. Source: 'New Coach Seating Configurations—Comfort Class Deja Vu All Over Again?', *Plane Business*, February 12, 2000.

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quality, but at the same time, increasing unit operating costs. Therefore, an implicit assumption made by both American and United was that passengers would be willing to pay a premium for what was deemed to be a higher quality service offering. The purpose of this paper is to test the assumption that passengers are willing to pay more for one particular aspect of service quality—additional seat pitch.

2. Service-quality competition in the airline industry

Since the deregulation of the US airline industry in 1978, service-quality competition, broadly defined, has evolved along two main lines: LCCs such as Southwest and JetBlue, and 'full service' carriers such as American, Delta, and United. LCCs primarily serve the most heavily traveled routes and are known for their simple, 'no frills' in-flight service and lower average fares (Morrison, 2001; Dresner et al., 1996). Full service carriers, on the other hand, differentiate themselves from LCCs by offering a number of service characteristics typically unavailable from LCCs such as extensive national and international route networks, pre-assigned seats, some degree of in-flight meal service on longer flights, multiple service/cabin classes, and comprehensive frequent flyer programs that permit passengers to earn and redeem miles on a wide range of domestic and international partners (both airline and non-airline). While most passengers can readily distinguish between the service quality of low cost versus full service carriers, many travelers would be hard-pressed to identify significant differences in service quality on comparable flights among the competing full service carriers. Thus, competition among the full service carriers in markets where their networks overlap has typically been in the form of price, flight frequency and schedule competition (Borenstein and Netz, 1999; Ross, 1997). Full service carriers have also attempted to differentiate themselves by comparing their on-time performance or even their amount of overhead luggage space. Carriers can also compete along less quantifiable service-quality dimensions such as crew friendliness.

During 2000, two of the largest full service carriers in the US, American and United, engaged in an overt (and heavily marketed) form of in-flight service-quality competition by reconfiguring their aircraft fleets to increase the 'seat pitch' in their coach class cabins. Seat pitch refers to the horizontal distance between the same part (i.e., front) of two seats in consecutive rows of an aircraft, and thus, greater seat pitch should be weakly preferred by passengers (all other things equal) to less seat pitch. Prior to these changes, each of the large network carriers offered industry standard seat pitches of 31 to 32 inches. While American and United were the only two full service carriers to increase seat pitch in their coach class cabins, they adopted very different approaches.[4] American's program, referred to as 'More Room Throughout Coach' increased the seat pitch for all coach class seats across its entire aircraft fleet to between 33 and 35 inches. In contrast, United's 'Economy Plus' class increased seat pitch to an industry-leading 36 inches, but the increased pitch was limited to the first 6–11 rows of the coach class cabin depending on aircraft type. Thus, while all coach class passengers on American experienced 'More Room Throughout Coach' starting in 2001, only a subset of coach class passengers (in general, high yielding business passengers) received extra legroom on United. In particular, United's Economy Plus seats are typically reserved for their top tier frequent flyers or passengers purchasing full fare or only moderately discounted (Y, B or M class) coach tickets.[5]

While increased seat pitch—all things equal—would likely please most passengers, it is both costly and risky for an airline to provide given the competitive nature of the industry. Since increased seat pitch necessarily reduces the number of seats per flight and most operating costs remain constant regardless of the number of seats, a carrier that increases its seat pitch also increases its unit operating costs. (Fewer seats would also result in less weight, which in turn would reduce fuel costs, however, this impact is likely to be negligible.) These higher unit costs can potentially be overcome if passengers value extra seat pitch enough to pay a premium for it.[6] There is no guarantee, however, that passengers—even if they are aware of the difference in seat pitch—are willing to pay a fare premium relative to other carriers for this added element of in-flight service quality.

3. Model and data

Our analytical approach is to estimate fixed-effects price equations using a cross section of airport-pair markets prior to and following the changes in seat pitch. Controlling for factors that are known to impact relative fares and assuming that no other changes in relative service quality occurred over the same period, comparing the difference between coefficients on carrier dummy

[4]JetBlue recently announced it too would increase seat pitch in roughly two-thirds of its seats to 34 inches. See 'JetBlue Adds More Legroom Across Fleet,' company press release, November 13, 2003.

[5]Source: www.ual.com.

[6]It is also possible that the higher unit costs could be overcome by increasing load factors. However, since both carriers' programs reduced seating capacity at a time when load factors were high by historical standards (for example, American's domestic load factor in 2000 was 70.4% versus an average of 62.6% during 1990–1999), it is likely that the carriers' primary goal was to attract higher paying passengers.

variables prior to and following the changes should allow us to determine what impact—if any—the change in seat pitch had.

Since our goal is to identify the impact of changing one particular element of service quality, it is important that we control for other service quality factors as much as possible. We attempt to do this in two main ways. First, a data set is built using a sample of passengers purchasing as close substitutes as possible. Second, a number of independent variables are included that are widely regarded to impact a carrier's relative service quality and hence, its relative fares in a particular airline market.

The data for the analysis are from the US Department of Transportation's OD1A database, a 10% sample of all domestic Origin and Destination (O&D) passengers traveling on US scheduled carriers. Only passengers traveling on the full service airlines, commonly referred to as the 'Big Six' carriers: American, United, Delta, Northwest, Continental, and US Airways, are considered. Many studies of the airline industry (i.e. Brueckner and Whalen, 2000) have shown that passengers are typically willing to pay more for non-stop versus connecting service. Likewise, it has been well documented (i.e. Morrison and Winston, 1995) that one-way tickets are priced higher than round-trip tickets and that fares on routes to and from hubs differ from those which neither originate nor terminate at a major carrier's hub. To control for any potential price premia associated with these factors, the data are restricted to passengers who purchased a roundtrip coach class ticket, neither originated nor terminated at any of the 'Big Six' carriers' hub airports,[7] and travelled on a one-stop itinerary. Moreover, to control for any price differences that may result from either cost or willingness to pay differences associated with 'mainline' versus regional/commuter aircraft, the data is further limited to include only those itineraries in which passengers flew exclusively on large jet (i.e. mainline) aircraft. Both American and United implemented changes in their seating configuration throughout 2000 and the data are constructed as a 5-year panel using annual data for the years 1998–2002.[8]

Annual rather than quarterly data is used to avoid fluctuations in the data caused by short-term labor disruptions or price wars. Based on this sub-sample of the raw data, directional airport-pair markets are constructed that consider only those markets where either American or United and at least one other 'big six' carrier (i.e., Delta) each served 500 or more passengers during each of the 5 years of our sample. Airport-pairs are used rather than city-pair markets to control for differences in willingness-to-pay based on different airports within a metropolitan area. Likewise, directional markets are used rather than non-directional markets to control for differences in marketing or frequent flyer loyalty at the different endpoints of a market. Separate samples of markets for American and United are used to see if changes in their respective seat pitch impacted relative fares in markets where they had overlapping connecting service with other carriers. The American sample consists of 994 unique markets and the United sample consists of 771 markets. Within the data, American has the most overlapping markets with Delta (712) and the fewest with US Airways (228). Similarly, United has the most overlapping markets with American (542) and the fewest with US Airways (220). The combined revenues of the Big Six carriers for connecting passengers in our dataset each year is between \$1.25 and \$2 billion.

Finally, during the period of time covered by our analysis—1998 to 2002—the use of Internet channels such as Orbitz, Expedia or Travelocity to instantly compare airfares across different carriers became a widespread phenomena. Consequently, the increased price transparency afforded by the emergence of Internet travel sites would lead one to expect any fare premia that existed at the beginning of our data set to diminish as time passed.

Fixed effects fare equations are estimated for both datasets which allows us to control for unobservable effects correlated with the observed explanatory variables, lessening possible omitted variable biases. The market fixed effects control for demand and cost differences that are common for all airlines serving the same market (such as distance, total market size or competition from LCCs) yet vary across markets. Note that this approach does not permit identifying the effects of variables that do not vary within a market. The equation is:

$$F_{ij} = X'_{ij}\beta + u_j + \varepsilon_{ij},$$

where F_{ij} is carrier i's passenger-weighted average roundtrip fare (net of all taxes and fees) in dollars in market j, X_{ij} is a vector of regressors that varies with the airline's identity within a market and u_j are the market fixed effects. The random error ε_{ij} is assumed to be i.i.d. with zero mean and variance σ^2_ε. The vector X includes independent variables that control for carrier identity and time, as well as other elements of service quality and/or potential market power:

$share_{ij}$, (market share). The carrier's share (in percentage points) of all O&D passengers (connecting

[7]The hubs we include for each carrier are: American (DFW, ORD, MIA and STL), Continental (CLE, EWR and IAH), Delta (ATL, CVG and SLC), Northwest (DTW, MEM, MSP), United (DEN, IAD, ORD, and SFO) and US Airways (CLT, PHL and PIT).

[8]While United's conversion of its Boeing 777 fleet is still ongoing, this aircraft is used primarily for international service. Moreover, to account for American's acquisition of TWA in 2001—and the subsequent conversion of TWA's fleet to include 'More Room Throughout Coach'—American's itineraries that connected via St. Louis are excluded.

and non-stop) in market j. To deal with possible endogeneity in the determination of fares and market shares in a given airport-pair market, we instrument for $share_{ij}$ using the previous year's market share.

$dist_{ij}$, (itinerary distance). The average distance (in hundreds of miles) traveled by passengers on carrier i in market j, passenger weighted by specific routing. We also include the squared distance. Longer distances resulting from more circuitous routings may be considered less desirable, lowering fares. On the other hand, more circuitous routings also cost more to provide, which could result in higher fares.

$orgshare_{ij}$, (originating share). Carrier i's share (in percentage points) of passengers across all markets at the originating airport in market j, among the Big Six carriers. Numerous researchers (Evans and Kessides, 1993) have noted that high market shares at endpoint airports may provide carriers with a pricing advantage on markets served from that airport due to frequent flyer program loyalty or other marketing advantages.

$frequency_{ij}$, (schedule frequency). Higher flight frequency in a market represents higher quality service for most passengers. We construct our schedule frequency variable in the following way. Travel between the origin and destination of market j on carrier i can involve routings over a number of potential hubs. The schedule frequency for each of these hub routings is computed as the minimum of the average daily flights from the origin to the hub and the average daily flights from the hub to the destination. For each market and carrier, $frequency_{ij}$ is then computed as the sum of these minimum daily routing values across all of the possible hubs for that carrier. There are two elements of scheduling that are not fully account for—the precise timing of flights throughout the day and elapsed travel time. Passengers may prefer flights that depart during one part of the day more than others. Likewise, routings with longer distances may still have shorter elapsed travel times.

$business_{ij}$, (business passengers). Passenger mix can have a significant impact on average fares (i.e. Lee and Luengo-Prado, 2002). $business_{ij}$ is the proportion of carrier i's passengers in market j purchasing tickets with fares of 60% or more of the market's 95th percentile fare. Business passengers are proxied using this method since the fare coding definitions in the DOT's OD1A database may not be comparable across carriers or may have changed over time.

$nsdum_{ij}$, (non-stop dummy). If a carrier offers non-stop service in market j, it may impact its pricing strategies for its connecting service in this market. For example, a carrier may price its non-stop service less aggressively than it otherwise would if it also offered non-stop service in that market, for fear of cannibalizing its higher quality (i.e., non-stop) service. $nsdum_{ij}$ is a dummy variable that takes the value 1 if carrier i served market j with non-stop service and takes the value 0 otherwise.

$ontime_i$, (ontime performance). Carriers with superior on-time performance may be able to charge higher prices on competitive routes if passengers are aware of such performance. On the other hand, higher on-time performance lowers costs, which in turn may be passed along to consumers in the form of lower fares. $ontime_i$ measures the percentage of carrier i's system-wide flights that arrived on-time, as measured by the Department of Transportation's *Air Travel Consumer Reports.* We chose system-wide rather route specific on-time performance since on-time performance tends to be reported in the media on a system-wide, rather than route specific basis. Moreover passengers who experience poor on-time performance on a given carrier are likely to associate this element of service quality to the carrier as a whole, rather than the carrier on a specific route.

$leverage_i$, (firm financial condition). Busse (2002) indicates that a carrier's financial condition may impact its proclivity to price more aggressively to meet its debt payment obligations. To allow for this, we include the carrier's leverage ratio (defined as Total Assets/Total Stock Equity) as an indicator of its financial condition using data from the Department of Transportation's Form 41 database. Since US Airways' leverage becomes negative in 2002, the 2001 level is used.

trend, (time trend). A time trend is used to reflect the steady decline in average airfares since 1990 (Lee, 2003).

$D(carrier)_{\text{pre}}$ and $D(carrier)_{\text{post}}$ (carrier dummies). Since the primary interest is in determining the impact American and United's increased seat pitch programs had on their fares relative to other full service carriers, a number of carrier dummy variables are used. For each carrier, there are two dummies, one taking the value one (zero otherwise) if the year is prior to or during the change in seat pitch (1998, 1999 or 2000) and the other taking the value one (zero otherwise) if the year is after the change occurred (2001 and 2002).

Although load factor is another possible candidate for an independent variable, average fares and load factors tend to be endogenous. Since there is no obvious instrument for load factor and since it was found to be insignificant when included, it is exclude from the list of independent variables. Summary statistics are presented in Table 1.

Fixed effects two-stage least squares using two model specifications are used for estimation. Model 1 pools all carriers—other than the base carrier of interest—while Model 2 uses carrier specific dummy variables (Table 2). The overall fits of the regressions are quite strong and the estimated coefficients tend to have the expected sign and are typically significant at the 1% or 5% level. The estimated coefficients on *share*, *orgshare*, *frequency* and *business* are positive and significant at the 1% level in all

Table 1
Summary statistics

Variable	American airlines Overlap markets		United airlines Overlap markets	
	Mean	Std. dev	Mean	Std. dev
fare	345.89	123.53	347.76	127.89
share	14.97	14.79	14.56	14.50
dist	19.92	6.97	20.32	6.68
orgshare	21.10	13.95	20.96	13.92
frequency	6.12	3.94	6.41	4.23
business	21.90	12.90	21.04	12.35
nsdum	0.10	0.30	0.12	0.32
ontime	77.88	4.83	77.18	5.44
leverage	4.46	2.11	4.73	2.28
N	16,760		13,275	
Markets	994		771	

four regressions, consistent with the previous literature. Likewise, the estimated coefficients on *leverage* and *trend* are negative when significant, consistent with our a priori beliefs.

The coefficient on *ontime* is negative, indicating that as a carrier's on-time performance improves, all other things equal, the carrier's average fares decline. This suggests that superior on-time performance does not provide a carrier with a pricing advantage. Rather, the negative estimated coefficient for *ontime* suggests that there may be cost savings that are being partially passed along to consumers when carriers experience relatively fewer delays. The estimated coefficient on *distance* is consistently positive and significant at the 1% level, indicating that all things equal, longer routings are relatively more expensive. This indicates that cost considerations prompt carriers to price circuitous routings higher than more direct routings.

Looking at the dummy variables, there is evidence that American's 'More Room Throughout Coach' program failed to yield any price premia. To the contrary, Model 1 indicates that prior to implementing the program, American typically received a $10.47 premium per ticket relative to all other carriers. After implementing 'More Room Throughout Coach' however, its overall premium relative to the other full service carriers fell to $2.10, a net drop of $8.37 per ticket. Likewise, relative to its own service before the change, American's fares fell by $16.88 after the change, all other things equal, as indicated by the estimated coefficient on $D(itself)_{post}$. Model 2 confirms that on a head-to-head basis with other carriers, American's premium declined versus every carrier except US Airways. Prior to the change, for example, American had price premia versus Continental and Delta of $25.70 and $16.45, respectively. Following the change, American's premium versus Continental was reduced to $.62 while its premium versus Delta became a small deficit(− $2.06). American maintained a positive premium versus Northwest, but it declined from $22.23 before the change to $14.96 after the change. Finally, prior to the change, American already had a price deficit

Table 2
Estimation results

	American		United	
	Model 1	Model 2	Model 1	Model 2
share	0.898**	0.996**	1.245**	1.160**
	(0.076)	(0.076)	(0.089)	(0.090)
business	2.380**	2.075**	2.407**	2.240**
	(0.048)	(0.048)	(0.056)	(0.056)
distance	6.856**	7.599**	8.295**	7.093**
	(1.206)	(1.185)	(1.307)	(1.301)
orgshare	0.420**	0.337**	0.386**	0.380**
	(0.044)	(0.046)	(0.051)	(0.052)
frequency	2.456**	2.071**	2.670**	2.540**
	(0.198)	(0.195)	(0.208)	(0.207)
nsdum	4.148	4.743**	2.224	1.766
	(1.789)	(1.759)	(1.963)	(1.947)
ontime	−1.631**	−0.283	−0.390**	−1.368**
	(0.135)	(0.178)	(0.138)	(0.168)
leverage	−1.058**	−0.05	−4.308**	1.277
	(0.274)	(0.654)	(0.324)	(0.659)
trend	−10.547**	−8.069**	−13.109**	−16.885**
	(0.733)	(0.742)	(1.086)	(1.068)
$D(all\ others)_{pre}$	−10.468**		−24.946**	
	(1.305)		(1.906)	
$D(itself)_{post}$	−16.877**		9.290**	
	(2.754)		(3.055)	
$D(all\ others)_{post}$	−18.975**		−27.039**	
	(2.448)		(2.830)	
$D(American)_{pre}$		Dropped		1.863
				(2.677)
$D(Continental)_{pre}$		−25.700**		−38.109**
		(2.126)		(3.178)
$D(Delta)_{pre}$		−16.451**		−15.579**
		(1.765)		(3.136)
$D(Northwest)_{pre}$		−22.229**		−24.623**
		(2.142)		(2.925)
$D(United)_{pre}$		17.127**		Dropped
		(2.362)		
$D(US\ Airways)_{pre}$		−27.453**		−24.789**
		(3.042)		(3.262)
$D(American)_{post}$		−35.122**		−3.266
		(2.944)		(3.131)
$D(Continental)_{post}$		−35.737**		−10.182**
		(3.309)		(3.799)
$D(Delta)_{post}$		−33.062**		−4.901
		(2.961)		(3.732)
$D(Northwest)_{post}$		−50.081**		−15.818**
		(3.120)		(3.669)
$D(United)_{post}$		−11.092**		7.916**
		(3.529)		(3.059)
$D\ US\ Airways)_{post}$		−84.114**		−63.495**
		(5.933)		(4.342)
Observations	16,760	16,760	13,275	13,275
Number of markets	994	994	771	771
$\bar{R}^2$	0.7902	0.8008	0.7985	0.8024

*Significant at the 5% level; **significant at the 1% level.

versus United of −\$17.13 and following the change, this deficit increased to −\$24.03 per ticket.

For United's 'Economy Plus' program, Model 1 indicates that prior to the change, United generated a significant fare premium of \$24.95 per ticket versus the other full service carriers as a whole. Following the change, United's fare premium expanded to \$36.33, an increase of \$11.38 per ticket. The positive and significant estimated coefficient on $D(itself)_{post}$ confirms that United's Premium Economy program helped it boost its average fare, all other things equal. From Model 2, we see that United had fare premia versus all of its full service competitors (with the exception of American, which was not significant) prior to the change in seat pitch.[9] Following the change, United, unlike American, maintained fare premia versus all five of its full service competitors. United's fare premium increased following the change versus American and US Airways, declined modestly versus Northwest (\$24.62–\$23.74) and Delta (\$15.58–\$12.82), and fell more significantly (\$38.11–\$18.10 per ticket) versus Continental.

4. Conclusions

There is no evidence that passengers were willing to pay a premium for the extra legroom offered by American's More Room Throughout Coach program. To the contrary, the evidence is that the program resulted in lower average fares for American. In contrast, United's Premium Economy program was effective in attracting passengers willing to pay higher fares for greater seat pitch when offered a choice of otherwise comparable service among competing full service carriers. Thus, United's Economy Plus program would seem to have been more effective at generating or maintaining fare premia than American's More Room Throughout Coach program. Indeed, the relative success of United's program compared to American's sheds some insight as to why American recently announced it would discontinue its 'More Room Throughout Coach' program in roughly one-quarter of its fleet.[10]

The fact that United's increased seat pitch program aimed squarely at the 'business' traveler segment of the market appears to have performed better may be a reflection of the importance of business travelers to the full service carriers. Many leisure travelers are likely to choose the lowest-priced carrier, regardless of service quality. Business travelers on the other hand, tend to be less price-elastic, and since United's Economy Plus seats offer the greatest coach class seat pitch of the major carriers, those passengers who value the extra space the most may be willing to pay a fare premium for United's service. In this sense, the analysis provides empirical evidence to support models of spatial competition (Hotelling, 1929).

Nevertheless, the full impact of this aspect of service-quality competition will likely not be known for some time to come. For example, since many leisure passengers travel by air infrequently, it may take time for passengers to experience and learn about differences in the aspect of in-flight service quality we study in this note. Likewise, while the focus of our analysis has been on whether or not the increased seat pitch programs generated fare premia, it is important to note that the carriers themselves are likely to focus more heavily on the overall revenue impact. Thus, while 'More Room Throughout Coach' does not appear to generated fare premiums for American, it is possible that the revenue impact may have been positive if the higher quality service resulted in higher load factors. Finally, some of the differences in relative fares we find may have been caused by other changes in service quality during the period of our analysis that we have not been able to control for, such as perceived safety and crew friendliness.

[9] The estimated coefficient for $D(United)_{pre}$ in American Model 2 differs from the estimated coefficient on $D(American)_{pre}$ in United Model 2 because the data include different sets of markets where the airlines do not compete.

[10] See 'American Airlines Charts Course for Brighter Future: CEO Arpey Unveils 'Turnaround Plan' at Annual Meeting,' company press release, May 21, 2003.

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