Effects of Fuel Prices on Air Transportation Market Average Fares and Passenger Demand

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Abstract— This paper examines the Bureau of Transportation Statistics (BTS) Airline Origin and Destination Survey (DB1B) [1] database which contains a 10% ticket sample over the 4-year period from 2005 through 2008. During this period, significant fluctuations in airfares were observed. This study isolates the causes of fluctuations in terms of fuel prices, seasonality, distance flown, competition, and other economic impacts on demand and price.

Keywords: Regression analysis, Longitudinal analysis, Passenger Demand, Average Fares, La Guardia.

I. Introduction

Fuel prices have increased 131% over the past four years as shown by the average air carrier cost factors shown in figure 1. This fluctuation of fuel prices, followed by an economic downturn to the economy provides an excellent opportunity to analyze ticket data coupled with schedule changes, fuel prices and other airline activity to isolate the effects of fuel prices, seasonality, slot controls, distance flown, competition, and other economic impacts on demand and price.

Figure 1. Air Carrier Cost Factors.

Previous studies have predicted different behaviors by traveler-type (business versus leisure travelers), by trip distance, by the number of airlines serving the city; and by destination (domestic vs international).[2] [3] [4] [5] Previous studies have also identified that fares tend to be lower when there is competition between airlines for the market, especially when there is competition by low cost carriers.[6] This analysis will build upon the previous research by examining the effects of fuel prices, seasonality, distance flown, competition, and other economic impacts on demand and price.

The following section will outline the objectives and scope of this study. The methodology will be described in Section III. The results of the analysis will be described in Sections IV. Section V will summarize these results and discuss our future analytical efforts.

II. Objective and Scope of Study

The objective of this study is to examine the changes in fuel prices, seasonality, distance flown, competition, and other economic impacts on demand and price, as shown in figure 2.

Figure 2. NY & SF Metroplex Price Elasticity study.

This analysis will examine third quarter 2007 and 2008 to develop a model to represent differences in average fare and passenger demand between markets. Then first quarter 2007 and fourth quarter 2008 will be added to examine any seasonality effects from the third quarter.

III. METHODOLOGY

This study will apply a systematic approach to developing a mathematical model to represent passenger demand and average fare for La Guardia markets. Initially a longitudinal cluster analysis of markets will be performed. Variables will then be identified to explain demand and price fluctuations. This will be followed by a variance/ covariance analysis to determine the variables of interest. A regression analysis will be performed to determine the appropriate mathematic models to describe the market demand and price elasticities. Finally, a goodness of fit analysis will be performed with the resulting price elasticity models.

A. Longitudinal Analysis of Markets

The Longitudinal Cluster Analysis of Markets examines the changes in airline revenues, airline costs, ticket prices and demand over time. Specifically by examining price and demand as defined below:

1) *Price:* We report the average fare for each La Guardia market from the BTS DB1B market data base. This database contains the number of tickets purchased at each price point during a given quarter, as reported in the 10% price sample provided to BTS. Single segment fares were used for this analysis. This analysis does not completely include the cost of travel by the passenger since it does not reflect any baggage, fuel fees, or other incidentals (e.g. blanket, movie, food) not reported to BTS.

2) *Demand*: We report the total quarterly passengers that arrived or departed La Guardia from the BTS T100 segment database.

B. Identification of Variables to be Analyzed

Variables to be considered in this analysis include, by specific market, the average quarterly fare, quarterly passengers arriving or departing, origin/destination distance, fuel prices, seasonality, average load factors, type of market (hub, shuttle, primary airport, large city), frequency of service, number of airlines serving the market, area cost of living index as compared to New York, area population, plane size in term of number of seats, average flight times and average block (gate to gate) times.

C. Correlation Analysis

A correlation analysis will be performed using Minitab statistical software. This analysis will determine the primary variables to be used in the regression analysis. Variables that are highly correlated or that have lagged correlations will be noted.

D. Regression Analysis

A regression analysis will be performed to identify models to explain differences in passenger demand and average segment fare for individual markets.

E. Goodness of Fit Analysis

A goodness of fit analysis of the resulting passenger demand and average fare models will be performed to determine the robustness of the models found.

IV. Results

This analysis expands upon the results from previous longitudinal analysis of the New York markets. This analysis finds four models that can be used to explain the differences in average fare and passenger demand among the La Guardia markets.

A. Longitudinal Analysis of Markets

Preliminary analysis of the economic impact of increased fuel prices on the passenger demand and average fare for the markets served by the New York Metroplex shows that clusters of markets can be identified. The initial data show that markets can be clustered by distance as shown in previous studies.[2] [7] [8] Other factors that impact price are: whether the market has shuttle service, whether a low cost carrier services the market, whether it is major hub, and whether it is a long or short haul market.

Additionally Airline Revenue and Cost were analyzed to determine the effects of fuel price increases. Overall, the 131% increase in fuel prices resulted in a 15% increase in fares, a 29% increase in airline revenue, and a 59% increase in operating costs (see table 1).

Metric	% Change 2005 to 2007		% Change 2007 to 2008		% Change 2005 to 2008	
	NY	SF	NY	SF	NY	SF
Fuel Prices	57%	57%	70%	70%	166%	166%
Markets	-3%	4%	-2%	0%	-4%	4%
Operating Cost	20%	9%	24%	28%	49%	39%
Revenue	22%	15%	5%	3%	28%	18%
Average Fare	8%	10%	7%	2%	15%	12%
Aircraft Size	-3%	-1%	1%	0%	-2%	-1%
Arrivals per Day	4%	4%	-6%	-5%	-3%	0%
Load Factors	3%	0%	-3%	-3%	1%	-3%
# of Flight Delays	39%	30%	-18%	-7%	14%	21%
Average Flight Delay	48%	29%	-14%	9%	27%	41%
Flight Cancellations	34%	47%	-18%	6%	10%	55%
Passenger Delay	66%	61%	-16%	1%	39%	63%

Table 1. Summary of NY and SF Metroplex Longitudinal Analysis

The Longitudinal Cluster Analysis of Markets found significant differences in the New York markets for aircraft size, flights per day, load factors, passenger demand, average fare and distance.

1) Aircraft Size

Two important events occurred in 2008: stricter slot controls were imposed and fuel prices soared. Either of these events might have triggered a reduction in frequency coupled with an upgauging to larger, more efficient aircraft since such actions can improve an airline's profitability. The data does not show any significant overall upgauging in aircraft (See figures 3). The analysis does indicate that on average, the aircraft size used to service shuttle markets (NY-BOS and NY-WAS) has increased, but is still significantly smaller than departures to other metroplexes. A slight down-sizing in seat sizes to other locales has kept the average aircraft size constant over time with little seasonal differences.

Figure 3. NY Metroplex Average Aircraft Size

2) Flights per day

There was a 4% increase of flights to the New York Metroplex from 2005 to 2007 and a 6% decrease in flights from 2007 to 2008, bringing the number of flights per day in 2008 to 3% less than the 2005 levels.

The increase in fuel costs and the downturn in the economy could have influenced the decision of airlines to reduce their schedules in 2008, since we see corresponding reductions in scheduled flights.

The imposition of slot controls imposed by Department of Transportation (DOT) in 2008 is the most likely cause of the increased reductions in scheduled flights in 2008 for the New York Metroplex, when reviewing schedules; we see that the schedule changes exactly match the regulations set by DOT. With the significant costs of fuel, we may have expected a greater decline in scheduled flights.

Figure 4. NY Metroplex Arrivals per Day

3) Average Fare

The average airfares paid by passengers since 1QT 2005 reflect the changes to fuel prices and show no seasonality, see figure 8. This analysis shows the average airfare for the New York and San Francisco Metroplexes increased 15% and 12% respectively.

New York and San Francisco Metroplex Average Airfare (2005-2008)

Figure 5. NY & SF Metroplex Cost

4) Passenger Demand

The following chart shows the National Air System (NAS) passenger demand recovered from the post 9/11 drop in demand, peaked in 2007 and has decreased as a result of the economic downturn in 2008. However, the passenger demand for the New York and San Francisco Metroplexes have remained relatively constant through this timeframe.

Figure 6. Passenger Demand from 1990 to 2008

5) Average Load Factor

The following chart shows the National Air System (NAS) and New York and San Francisco Metroplexes average load factors consistently increased to 75% before a slight reduction as a result of the economic downturn in 2008.

Figure 7. Average Load Factors from 1990 to 2008

B. Identification of Variables to be Analyzed for Regression Analysis

Variables to be considered in this analysis include by specific market the average quarterly fare, average quarterly passenger demand, origin/destination distance, fuel prices, seasonality, average load factors, type of market (hub, shuttle, primary airport, large city), frequency of service, number of airlines serving the market, area cost of living index, area population, average size planes (measured in number of seats), average flight times and average block (gate to gate) times (see table 2). Table 2 indicates whether or not a variable had different values for different quarters “Quarterly Diff” or for different markets “Market Diff”

Variable	Description	Source	Market Diff	Quarterly Diff
Avgfare	Average Fare	BTS DB1B	X	X
PAX	Passenger Demand	BTS T100	X	X
Log_demand	Log of Passenger Demand	BTS T100	X	X
Distance	distance to market	BTS T100	X	X
Sqrt_Dist	sqrt of distance	BTS T100	X	X
Averagelf	avg load factor (pax/seats)	BTS T100	X	X
Avgsize	avg plane size (seats)	BTS T100	X	X
DailyAvgFreq	avg daily arrivals & departures	ASPM	X	X
No_Carriers	Number of carriers serving market	ASPM	X	X
Avgschedblk	Avg scheduled gate to gate time	ASPM	X	X
Avgactblk	Avg actual gate to gate time	ASPM	X	X
Avgactair	Avg actual air time	ASPM	X	X
CLI	Cost of living index compared to NY	www.bestplaces.net	X	
Population	2000 Census Population for city	Census Bureau	X	
Fuel	Avg fuel price	BTS P52		X
Dummy Variables	Description	Source	Market Diff	Quarterly Diff
Map_B	big city	Census Bureau	X	
P	primary airport	ACAIS 2008	X	
Hub	large or medium hub	ACAIS 2008	X	
Shuttle	Multi-modal price elasticity curve	BTS DB1B	X	
3QTR	Third Quarter data			X

Table2. Variables analyzed for predicting Passenger Demand and Average Fare

C. Correlation Analysis

Initial inspection of distance, average block times and air times showed a high degree of correlation, see figure 8.

Figure 8. Distance, Average block times, and Average air time correlation

Graphically there appears to be little correlation between the variables selected for the Passenger Demand model, see figure 9. Specifically, there appears to be little correlation between the number of passengers going between a NY city pair and the average load factor, average size of aircraft, the number of carriers servicing this city-pair or the cost of living index comparison to New York City's cost of living index (CLI). Because load factors have remained steady for virtually all markets, and because most city-pairs use a standard size plane for that market it is not surprising that the correlations are low. Similarly, the number of carriers is not likely to impact the number of passengers flying as much as it is likely to impact how much these passengers pay.

Figure 9. Correlation plot for Passenger Demand Model

Statistically there is little correlation between the variables selected for the Passenger Demand model, see table 3.

	PAX	AverageLf	CLI	avgsz	No_Carriers	avgschblk	DailyAvgFreq	avgfare	Population	Map_B	SHUTTLE	P	fuel
AverageLf	0.322												
p-value	0												
CLI	0.094	0.065											
p-value	0.069	0.209											
avgsz	0.513	0.471	0.284										
p-value	0	0	0										
No_Carriers	0.271	0.047	0.204	-0.043									
p-value	0	0.367	0	0.405									
avgschblk	0.234	0.241	0.116	0.549	-0.25								
p-value	0	0	0.025	0	0								
DailyAvgFreq	0.861	0.124	0.043	0.254	0.516	0.035							
p-value	0	0.016	0.403	0	0	0.5							
avgfare	0.128	-0.045	-0.048	0.141	-0.259	0.715	0.047						
p-value	0.013	0.388	0.352	0.006	0	0	0.36						
Population	0.183	0.09	0.055	0.269	0.148	0.085	0.14	-0.089					
p-value	0	0.088	0.299	0	0.005	0.108	0.008	0.09					
Map_B	0.029	0.195	-0.089	0.181	0.033	0.135	0.028	-0.036	0.075				
p-value	0.581	0	0.086	0	0.528	0.009	0.586	0.484	0.152				
SHUTTLE	0.098	-0.071	-0.109	-0.048	0.131	-0.083	0.211	0.168	-0.075	0.123			
p-value	0.058	0.172	0.035	0.354	0.011	0.107	0	0.001	0.156	0.017			
P	0.125	0.34	0.033	0.25	0.182	0.155	0.121	0.002	0.081	0.393	0.11		
p-value	0.015	0	0.527	0	0	0.003	0.019	0.973	0.121	0	0.033		
fuel	-0.009	0.099	0.008	-0.018	-0.033	0.006	-0.023	0	-0.011	-0.04	-0.009	-0.012	
p-value	0.856	0.055	0.884	0.728	0.528	0.912	0.663	0.997	0.839	0.438	0.868	0.818	
Hub	0.503	0.299	0.22	0.62	0.374	0.403	0.474	0.092	0.387	0.132	0.012	0.202	-0.015
p-value	0	0	0	0	0	0	0	0.075	0	0.01	0.809	0	0.771

Table 3. Correlation analysis of Variables considered for the Passenger Demand Model

Graphically there is little correlation between the variables selected for the Average Fare model, see figure 10.

Figure 10. Correlation plot for Average Fare Model

4. Statistically there is little correlation between the variables selected for the Average Fare model, see table

	avgfare	log_demand	sqrt_dist	AverageLf	CLI	avgsz	No_Carriers	DailyAvgFreq	Population	Map_B	SHUTTLE	P	fuel
log_demand	0.211												
p-value	0												
sqrt_dist	0.744	0.255											
p-value	0	0											
AverageLf	-0.045	0.252	0.282										
p-value	0.388	0	0										
CLI	-0.048	0.068	0.085	0.065									
p-value	0.352	0.189	0.101	0.209									
avgsz	0.141	0.262	0.555	0.471	0.284								
p-value	0.006	0	0	0	0								
No_Carriers	-0.259	0.461	-0.248	0.047	0.204	-0.043							
p-value	0	0	0	0.367	0	0.405							
DailyAvgFreq	0.047	0.675	0.063	0.124	0.043	0.254	0.516						
p-value	0.36	0	0.224	0.016	0.403	0	0						
Population	-0.089	0.016	0.023	0.09	0.055	0.269	0.148	0.14					
p-value	0.09	0.767	0.659	0.088	0.299	0	0.005	0.008					
Map_B	-0.036	0.099	0.146	0.195	-0.089	0.181	0.033	0.028	0.075				
p-value	0.484	0.056	0.005	0	0.086	0	0.528	0.586	0.152				
SHUTTLE	0.168	0.2	-0.029	-0.071	-0.109	-0.048	0.131	0.211	-0.075	0.123			
p-value	0.001	0	0.579	0.172	0.035	0.354	0.011	0	0.156	0.017			
P	0.002	0.188	0.161	0.34	0.033	0.25	0.182	0.121	0.081	0.393	0.11		
p-value	0.973	0	0.002	0	0.527	0	0	0.019	0.121	0	0.033		
fuel	0	-0.018	-0.011	0.099	0.008	-0.018	-0.033	-0.023	-0.011	-0.04	-0.009	-0.012	
p-value	0.997	0.729	0.829	0.055	0.884	0.728	0.528	0.663	0.839	0.438	0.868	0.818	
Hub	0.092	0.406	0.381	0.299	0.22	0.62	0.374	0.474	0.387	0.132	0.012	0.202	-0.015
p-value	0.075	0	0	0	0	0	0	0	0	0.01	0.809	0	0.771
3QTR	-0.059	-0.121	0.045	0.207	-0.001	0.015	-0.044	-0.094	-0.014	-0.055	-0.055	-0.041	0.428
p-value	0.255	0.019	0.385	0	0.985	0.765	0.395	0.068	0.79	0.289	0.284	0.434	0

Table 4. Correlation analysis of Variables considered for the Average Fare Model

D. Regression Analysis

Initially regression models were developed to explain the differences between market passenger demand and average fares for third quarter 2007 and 2008. Later first quarter 2007 and fourth quarter 2008 were added to determine any seasonal effects from the third quarter.

Stepwise regression for passenger demand for third quarter 2007 and 2008 gave the results shown in table 5. This model explained over 86% of the variation of passenger demand between markets served by La Guardia airport.

Step	1	2	3	4	5	6
Constant	-12588	-67975	-40697	-77092	-54490	-53711
DailyAverageFrequency	7306	6828	7642	7663	7646	7740
T-Value	24.24	26.97	27.04	28.21	28.32	28.01
P-Value	0	0	0	0	0	0
avgsz		721	604	501	521	510
T-Value		9.72	8.29	6.75	6.99	6.82
P-Value		0	0	0	0	0
No_Carriers			-2604	-2687	-2537	-2540
T-Value			-5.31	-5.69	-5.33	-5.36
P-Value			0	0	0	0
AverageLf				68391	77342	75418
T-Value				4.14	4.53	4.42
P-Value				0	0	0
P					-32696	-29823
T-Value					-1.9	-1.73
P-Value					0.059	0.086
SHUTTLE						-11699
T-Value						-1.5
P-Value						0.134
S	56033	46179	43291	41614	41338	41204
R-Sq	74.8	82.97	85.11	86.31	86.56	86.72
R-Sq(adj)	74.68	82.8	84.88	86.03	86.22	86.31
Mallows Cp	165.7	50.5	21.8	6.5	4.9	4.7

Table 5. Stepwise regression for 3QTR 2007 and 2008 Passenger Demand

Stepwise regression for passenger demand for all four quarters gave the results shown in table 6. This model explained over 86% of the variation of passenger demand between markets served by La Guardia airport.

Step	1	2	3	4	5	6	7	8
Constant	-14208	-72225	-48651	-80655	-58968	-58175	-62067	-71305
DailyAverageFrequency	6957	6344	7109	7160	7144	7223	7301	7262
T-Value	31.54	34.91	34.95	36.37	36.45	36.21	36.09	35.68
P-Value	0	0	0	0	0	0	0	0
avgsiz		786	705	574	587	578	665	665
T-Value		14.27	13.26	10	10.23	10.06	9.28	9.29
P-Value		0	0	0	0	0	0	0
No_Carriers			-2497	-2629	-2514	-2525	-2240	-2029
T-Value			-6.93	-7.53	-7.16	-7.21	-5.96	-5.08
P-Value			0	0	0	0	0	0
AverageLf				69219	75634	73346	72605	74640
T-Value				5.12	5.49	5.33	5.3	5.43
P-Value				0	0	0	0	0
P					-28740	-25786	-26353	-27303
T-Value					-2.16	-1.94	-1.99	-2.06
P-Value					0.031	0.054	0.048	0.04
SHUTTLE						-10557	-11104	-12694
T-Value						-1.93	-2.04	-2.3
P-Value						0.054	0.042	0.022
Hub							-12899	-14366
T-Value							-2.03	-2.24
P-Value							0.044	0.026
avgfare								57
T-Value								1.53
P-Value								0.128
S	56425	45157	42467	41048	40839	40683	40507	40431
R-Sq	73.37	82.99	85	86.02	86.2	86.35	86.5	86.59
R-Sq(adj)	73.29	82.9	84.87	85.87	86.01	86.12	86.24	86.29
Mallows Cp	339.3	89	38.4	13.5	10.8	9	6.9	6.6

Table 6. Stepwise regression for La Guardia Passenger Demand

Stepwise regression for average fare for third quarter 2007 and 2008 gave the results shown in table 7. This model explained over 80% of the variation of average fare between markets served by La Guardia airport.

Step	1	2	3	4	5	6	7
Constant	35.65	48.18	40.34	63.59	50.72	53.37	59.15
sqrt_dist	4.65	6.03	6.06	5.97	5.95	5.76	5.8
T-Value	18.83	22.92	25.34	25.74	26	23.46	23.55
P-Value	0	0	0	0	0	0	0
avgsz		-0.537	-0.525	-0.445	-0.455	-0.451	-0.474
T-Value		-8.79	-9.47	-7.76	-8.04	-8.02	-8.14
P-Value		0	0	0	0	0	0
SHUTTLE			34.6	34	30.2	30.4	29.6
T-Value			6.68	6.8	5.88	5.96	5.8
P-Value			0	0	0	0	0
AverageLf				-42	-47	-48	-46
T-Value				-3.9	-4.33	-4.46	-4.29
P-Value				0	0	0	0
log_demand					1.96	2.9	2
T-Value					2.61	3.3	1.96
P-Value					0.01	0.001	0.052
No_Carriers						-0.66	-0.78
T-Value						-2.04	-2.36
P-Value						0.043	0.019
DailyAverageFrequency							0.32
T-Value							1.47
P-Value							0.142
S	37.1	31.7	28.8	27.8	27.4	27.2	27.1
R-Sq	63.25	73.32	78.11	79.64	80.3	80.7	80.91
R-Sq(adj)	63.07	73.06	77.79	79.24	79.81	80.12	80.24
Mallows Cp	181.2	77.7	29.5	15.4	10.5	8.3	8.1

Table 7. Stepwise regression for 3QTR 2007 and 2008 Average Fare

Stepwise regression for average fare for all four quarters gave the results shown in table 8. This model explained over 86% of the variation of average fare between markets served by La Guardia airport.

Step	1	2	3	4	5	6	7	8	9
Constant	36.64	49.98	43.4	68.49	69.96	75.5	78.63	69.66	60.31
sqrt_dist	4.83	6.25	6.26	6.28	6.3	6.18	6.14	5.99	6.01
T-Value	21.49	26.5	27.79	28.78	28.96	27.44	27.56	25.36	25.46
P-Value	0	0	0	0	0	0	0	0	0
avgsz		-0.554	-0.542	-0.442	-0.453	-0.446	-0.487	-0.477	-0.475
T-Value		-10.85	-11.13	-8.6	-8.81	-8.68	-9.33	-9.11	-9.09
P-Value		0	0	0	0	0	0	0	0
SHUTTLE			27.4	26.3	25.9	27	24.3	23.5	23.5
T-Value			6.13	6.04	5.97	6.2	5.56	5.36	5.36
P-Value			0	0	0	0	0	0	0
AverageLf				-54	-49	-46	-46	-50	-51
T-Value				-4.95	-4.39	-4.18	-4.19	-4.49	-4.53
P-Value				0	0	0	0	0	0
3QTR					-7.4	-7.7	-6.8	-5.8	-8.3
T-Value					-2.06	-2.16	-1.91	-1.61	-2.12
P-Value					0.04	0.032	0.057	0.107	0.034
No_Carriers						-0.48	-0.98	-1.14	-1.11
T-Value						-1.93	-3.4	-3.79	-3.7
P-Value						0.055	0.001	0	0
DailyAverageFrequency							0.53	0.35	0.35
T-Value							3.3	1.86	1.85
P-Value							0.001	0.064	0.065
log_demand								1.9	1.8
T-Value								1.82	1.74
P-Value								0.069	0.083
fuel									4.4
T-Value									1.56
P-Value									0.119
S	41.8	36.5	34.8	33.7	33.6	33.5	33	32.9	32.9
R-Sq	55.31	66.06	69.18	71.1	71.42	71.71	72.52	72.77	72.95
R-Sq(adj)	55.19	65.88	68.93	70.78	71.04	71.25	72	72.17	72.28
Mallows Cp	231.5	88.6	48.5	24.7	22.3	20.4	11.5	10.1	9.7

Table 8. Stepwise regression for La Guardia Average Fare

E. Goodness of Fit Analysis

The goodness of fit analysis of the Passenger Demand Models for La Guardia are shown in figures 11 and 12. The passenger demand for the shuttle markets Washington (DCA) and Boston (BOS) are predicted high, while the shuttle markets Atlanta (ATL) and Chicago (ORD) are predicted low.

Figure 11. Goodness of Fit for 3QTR 2007 and 2008 Passenger Demand Model

Figure 12. Goodness of Fit for La Guardia Passenger Demand Model

The goodness of fit analysis of the Average Fare Models for La Guardia are shown in figures 13 and 14. The average fare for the airport in Fayetteville Arkansas predicted lower fares.

Figure 13. Goodness of Fit for 3QTR 2007 and 2008 Average Fare Model

Figure 14. Goodness of Fit for La Guardia Average Fare Model

V. Summary and Future Analysis

A. Summary

The summary of this regression analysis is shown in table 9.

Variable	Description	Source	Market Diff	Quarterly Diff	PAX Coeff	Fare Coeff
Avgfare	Average Fare	BTS DB1B	X	X	57	
PAX	Passenger Demand	BTS T100	X	X		
Log_demand	Log of Passenger Demand	BTS T100	X	X		1.8
Distance	distance to market	BTS T100	X	X		
Sqrt_Dist	sqrt of distance	BTS T100	X	X		6.01
AverageLf	avg load factor (pax/seats)	BTS T100	X	X	74640	-51
Avgsize	avg plane size (seats)	BTS T100	X	X	665	-0.475
DailyAvgFreq	avg daily arrivals & departures	ASPM	X	X	7262	0.35
No_Carriers	Number of carriers serving market	ASPM	X	X	-2029	-1.11
Avgschedblk	Avg scheduled gate to gate time	ASPM	X	X		
Avgactblk	Avg actual gate to gate time	ASPM	X	X		
Avgactair	Avg actual air time	ASPM	X	X		
CLI	Cost of living index compared to NY	www.bestplaces.net	X			
Population	2000 Census Population for city	Census Bureau	X			
Fuel	Avg fuel price	BTS P52		X		4.4
Dummy Variables	Description	Source	Market Diff	Quarterly Diff	PAX Coeff	Fare Coeff
Map_B	big city	Census Bureau	X			
P	primary airport	ACAIS 2008	X		-27303	
Hub	large or medium hub	ACAIS 2008	X		-14366	
Shuttle	Multi-modal price elasticity curve	BTS DB1B	X		-12694	23.5
3QTR	Third Quarter data			X		-8.3
Adj R square					86.29	72.28

Table 9. Summary of regression analysis for La Guardia Average Fares and Passenger Demand

This analysis shows that average load factors, average plane size, daily frequency of flights, number of carriers and whether the market is a shuttle market or not is common variables for both models. This analysis also shows the dependency of average fare on passenger demand and vice versa.

This analysis shows as load factors, average plane size, frequency of flights and average fare increase, so does passenger demand. Also as the number of carriers (competition) increases the passenger demand decreases. Lastly, this analysis shows a negative effect on passenger demand if the market is a primary airport, hub, or shuttle market.

This analysis shows as passenger demand, distance, frequency of flights, and fuel increase so does the average fare. As the load factor, average plane size, and number of carriers (competition) increases the average fare decreases. Lastly, this analysis shows a negative effect on average fare for the third quarter (seasonality) and an increase in fares for shuttle markets.

B. Future Analysis

Continuing this analysis for more quarters of data and for more airports in the New York and San Francisco Metroplexes may produce more robust models to represent passenger demand and average fare differences between markets. Additionally, this analysis will show the effect of slot controls on passenger demand and average fare.

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Abdul Qadar Kara is a PhD student at GMU working on the management of Congestion at NY metroplex airports. He has completed his Bachelors from Pakistan at Mohammad Ali Jinnah University and Masters from Germany at Max Planck Institute. He has over 6 years experience of programming and problem solving.