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No Frills = No Thrills? An Econometric Study of the Effects of Airline Baggage Fee Charges

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I. Introduction

The airline industry in the United States, especially during the Golden Age of Flying between the 1950s and 1960s, was once an equivalent term for the exclusive access to Pan Am's or TWA's most glamorous and expensive flying experience 30,000 feet above ground that only a few were fortunate enough to enjoy.[1] Air travel, however, has come down from its elusive and prestigious crown since the *Airline Deregulation Act of 1978*[2] and today almost anyone can afford to travel by air in the United States. Behind this increasing popularity and affordability of air travel also hides the fact that the intense competition between airlines has driven down not only ticket price but also service quality due to the changed business models airlines have adopted in the face of a new era of air travel.

Instead of providing a full set of luxurious services that is included in a single ticket price, most airlines have decided to separately charge other non-ticket related costs. Out of these non-ticket related charges, baggage fee has become one of the most important and lucrative ancillary revenue sources for most airlines. Since 2008, when American Airlines, the first major carrier in the US, began to charge a stand-alone baggage fee from its customers[3], most major airlines and low cost carriers in the US has followed suit except Southwest and JetBlue

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[1] John Brownlee, "What It Was Really Like To Fly During The Golden Age Of Travel," *Co. Design*, last modified December 05, 2013, http://www.fastcodesign.com/3022215/terminal-velocity/what-it-was-really-like-to-fly-during-the-golden-age-of-travel

[2] Howard Cannon, "S.2493 - Airline Deregulation Act," C*ongress.gov*, https://www.congress.gov/bill/95th-congress/senate-bill/2493

[3] Micheline Maynard, "Like American, More Airlines Add Fees for Checking Luggage," *The New York Times*, last modified June 13, 2008, http://www.nytimes.com/2008/06/13/business/13bags.html

(although JetBlue ended its free checked baggage program in June 2015, leaving Southwest the only remaining airline in the US with a free checked baggage policy). In 2014 alone, U.S. airlines collectively gained over $3.5 billion extra revenues from charging air travelers baggage fees[4]. Considering that ancillary revenues like baggage fees have become a significant revenue component for most airlines, it is therefore worth some systematic probing as to whether the decision to continue to provide free checked baggage service to customers is economically sustainable for Southwest in the long run. More interestingly, we want to find out whether there exists empirical evidence to support the claim that the Dallas-based, world's largest low-cost carrier, Southwest, will eventually start to charge its customers baggage fees under "peer pressure,"[5] especially when its newly acquired subsidiary company AirTran Airways does not follow Southwest's free baggage policy and therefore has reaped significant financial benefits from charging baggage fees.[6]

The rest of this paper is organized in the following fashion: Section II will provide an overview of some relevant previous research and literature references. Section III will explain the methodology of my econometric model and the variables and data used in the model.

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[4] "Baggage Fees by Airline 2014," Bureau of Transportation Statistics, last modified May 04, 2015, https://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/subject_areas/airline_information/baggage_fees/html/2014.html

[5] Robert Siegel, "The Economics of Airline Baggage Check; To Pay or Not To Pay." *NPR*. July 01, 2015. Accessed April 29, 2016. http://www.npr.org/2015/07/01/419218276/the-economics-of-airline-baggage-check-to-pay-or-not-to-pay.

[6] Sheryl Jean, "Southwest Airlines sees fivefold jump in revenue from baggage fees, thanks to AirTran," *The Dallas Morning News*, last modified May 14, 2013, http://www.dallasnews.com/business/airline-industry/20130514-southwest-airlines-sees-fivefold-jump-in-revenue-from-baggage-fees-thanks-to-airtran.ece

Section IV will present the regression results and interpretation of the results while Section V will summarize the findings of this paper and suggest further research possibilities.

II. Literature Review

There are several previous studies focusing specifically on the effects of airlines' differentiation of their services by unbundling their products and charging separate fees for checked baggage, on board food and beverages, and advanced seating assignments, etc. Out of all types of service unbundling, the effects of checked baggage fees have been studied most thoroughly. For example, Garrow, Hotle and Mumbower (2012) suggest that although both low cost carriers and network carriers stress the importance of ancillary revenues like baggage fees, the unbundling trends in the US airline industry will only be broadly adopted by low cost carriers in the future. For major network carriers, they anticipate that ancillary fees will be eventually eliminated as airline will realize that these fees hinder their system performance more than the revenues generated.[7]

Similarly, Nicolae et al. (2013) analyze whether baggage fees improve the overall operational performance of airlines. Since travelers are more likely to bring less baggage when faced with an extra fee, airlines might experience a systematic relief from handling more baggage and thus improve their operational performance when imposing a checked baggage fee. They use the on-time performance of airlines as their main research metric and have

[7] Garrow, Laurie A., Susan Hotle, and Stacey Mumbower. "Assessment of Product Debundling Trends in the US Airline Industry: Customer Service and Public Policy Implications." *Transportation Research Part A: Policy and Practice* 46, no. 2 (2012): 255-68. doi:10.1016/j.tra.2011.09.009.

identified a differential impact of checked baggage fees. Their research find that a significant on-time departure performance improvement is present in the airlines that start charging a checked baggage fee in the 35-day period afterwards.[8]

Besides these scholarly scrutiny in the effects of baggage fees on airline operational and system performance, other researchers have also looked at baggage fees' impact on other factors such as air ticket prices, airlines stock prices, etc. For instance, Henrickson and Scott (2012) examine what impact the introduction of baggage fees have had on ticket prices by using spatial autoregressive model. They conclude that baggage fees actually reduce ticket prices, but they also find that "Southwest Airlines has increased their ticket prices on routes in which they compete with fee charging firms, leveraging their 'Bags Fly Free' product differentiation to increase their revenues."[9]

At the same time, Barone, Henrickson and Voy (2012) study the impact of announcements of baggage fees on the stock prices of airlines with event study methodology. They discover that initial announcements drove down stock prices of both announcing airlines and competing airlines as baggage fee was interpreted as a sign of industry weakness. But

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[8] Nicolae, Mariana, Mazhar Arıkan, Vinayak Deshpande, and Mark Ferguson. *Do Bags Fly Free? An Empirical Analysis of the Operational Implications of Airline Baggage Fees*. David Eccles School of Business, University of Utah. March 2013. Accessed April 25, 2016. https://www.business.utah.edu/sites/default/files/media/bagfee_paper_-_version_submitted_to_ms.pdf.

[9] Henrickson, Kevin E., and John Scott. "Chapter 8 Baggage Fees and Changes in Airline Ticket Prices." *Advances in Airline Economics Pricing Behavior and Non-Price Characteristics in the Airline Industry*, 2012, 177-92. doi:10.1108/s2212-1609(2011)0000003010.

subsequent increases in baggage fees was seen as positive impact on airlines' financial performance and thus had brought positive returns on stocks.[10]

However, very few scholarly research have tried to focus exclusively on examining the relationship between passenger volume and the imposition of checked baggage fees. The importance in studying this relationship cannot be overlooked because as airlines start to charge baggage fees, passengers, especially those who are very price-sensitive, will react rationally to these charges by choosing whether or not to fly with certain fee charging airlines. Therefore, passengers' behavior in reaction to baggage fees can provide us with another unique perspective when investigating the economic indication and significance of airline checked baggage fees. Scotti and Dresner (2015) is one of the most recent and rare reports on the relationship between passenger demand and airline-imposed baggage fees. They adopt a three-stage least squares (3SLS) method to test whether baggage fees have impact on airfare and passenger demand. Their results show that "on an average route, a $1 increase in baggage fee leads to a loss of 0.7 passengers and is associated with a $0.11 reduction in fare levels" while "an equivalent increase of $1 in fares results in a much greater decline in passengers (eight times greater)."[11] Thus their research seems to indicate that "substituting additional baggage fees for higher fares may be a beneficial strategy for carriers in terms of generating revenues

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[10] Barone, Gerhard J., Kevin E. Henrickson and Annie Voy. "Baggage Fees and Airline Stock Performance: A Case Study of Initial Investor Misperception." *Journal of the Transportation Research Forum 51*, no. 1 (2012). http://journals.oregondigital.org/trforum/article/view/2796.

[11] Scotti, Davide, and Martin Dresner. "The Impact of Baggage Fees on Passenger Demand on US Air Routes." *Transport Policy* 43 (2015): 4-10. doi:10.1016/j.tranpol.2015.05.017.

and maintaining market share."[12] This conclusion, coupled with the evidence found in Coy and Chiang (2012), which states that Southwest charges higher fares (Southwest, on average, charges $27.10 more per ticket compared to airlines charging an explicit baggage fee) in lieu of imposing a baggage fee,[13] prompts us to ask if Southwest's "high fare but free baggage" business strategy hurts its ability to draw in passengers, especially when compared to other similar low cost carriers in the U.S. domestic market with a "low fare but extra baggage fee" business model.

III. Methodology and Empirical Framework

A. Conceptual Development of Research Goal

Preliminarily, based on the findings of Scotti and Dresner (2015) and Coy and Chiang (2012), we can illustrate a rough comparison between the two different business strategies' net effect on passenger volume. As shown below (Table 3.1 – a & b), assuming that on all routes Southwest charges $25 more on its average fare but $0 on its baggage fees compared to other airlines serving the same routes that charges an average fare but $25 on baggage fees, we expect Southwest to lose significantly more passengers (who are assumed to bring only one checked baggage for the purpose of simplicity) due to its "high fare, free baggage" strategy.

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[12] Ibid.

[13] Coy, Jeffrey M., and Eric P. Chiang. "Are Explicit Baggage Fees The Answer To Rising Airline Operating Costs?" *European Journal of Business Research* 12, no. 1 (2012): 162-67.

$1 increase in baggage fees

- **0.7 passengers loss**
- **$0.11 fare decrease**

$1 increase in fare

- **5.6 passengers loss**
- **$1 baggage fees decrease**

Table 3.1a

Airlines / Loss of Passengers	Southwest Airlines	Other Fee-Charging Airlines
Loss	25*5.6 = 140	25*0.7 = 17.5
Gain	25*0.7 = 17.5	0.11*25*5.6 = 15.4
Net Loss	140-17.5 = 122.5	17.5-15.4 = 2.1

Table 3.1b

It is therefore the primary goal of this paper to examine empirically whether Southwest and JetBlue are actually losing more passengers compared to other baggage fee charging airlines in the domestic market in the U.S. during 2014 (the most recent year with available data) across a set of selected domestic airline origination-destination (O&D) routes. In addition, because some low cost carriers (i.e. Frontier Airlines and Sprit Airlines) have implemented in recent years a carry-on baggage fee as well and as a result, we will also examine how this further unbundling of service from Frontier and Spirit Airlines within their baggage fees affects the passenger volume on their airline routes.

B. Econometric Model and Variables Specification

For the purpose of this paper, we choose 25 distinct airports from 20 cities of various population and locations within the continental US (some cities have multiple airports) to form city pairs and the airports details are included in Table 3.2.1 in Appendix A. Subject to data availability, we are able to retrieve data for 252 distinct domestic non-stop airline routes from the city pairs formed combinatorically out of all the city pairs generated by the 25 airports.

Since we would like to study what effects checked baggage fees and carry-on fees have on passenger volume for airline routes, we choose natural logarithmic of passenger

enplanements on a certain, bidirectional O&D routes *i* between a city pair as our dependent variable.

In terms of independent variables that might explain the passenger enplanement volume, we look into previous scholarly works. For example, Bhadra (2003) adopts a bottom-up econometric estimation model to forecast air travel demand. By using maximum likelihood estimation method, Bhadra concludes that local area income, demographic population, large hub status, high market share all positively affect travel demand while high average fare puts a negative influence on passenger volume.[14] We will adopt this conclusion and include the aggregate sum of a city pair's population and per capital income in our econometric model. Additionally, we also add the hub status of both ends of a city pair, a city pair's average airfare level, a cubic functional modelling for passenger volume and distance, the history of the operating airline and its average aircraft age into our model. These 10 independent variables will be the very core factors we consider throughout our research process and the detailed variables specifications are included in Table 3.2.2 in Appendix B. The preliminary econometric model is expressed as follows:

$$ln(Pax_{ij}) = \beta_0 + \beta_1 Distance_i + \beta_2 Distance^2 + \beta_3 Distance^3 + \beta_4 ln(Population_i) + \beta_5 PPIncome_i + \beta_6 airline\_history_j + \delta_1 city1\_hub_j + \delta_2 city2\_hub_j + \beta_7 avg\_age_j + \beta_8 avg\_fare_i + \varphi + \varepsilon_{ij} \quad (1)$$

Due to our keen interests in whether checked baggage fees and carry-on fees would affect passengers' choice of flying with fee charging airlines, we naturally incorporate first checked

[14] Bhadra, Dipasis. "Demand for Air Travel in the United States: Bottom-Up Econometric Estimation and Implications for Forcasts by Origin and Destination Pairs." *Journal of Air Transportation* 8, no. 2 (2003): 19-56.

baggage fee and carry-on fee dummy variables within our model as we test different scenarios in the above model, and we will manipulate the φ component in the model to create two different scenarios as listed below in Table 3.2.3 Part I to examine various effects baggage and carry-on fees have on passenger volume across all of our sampled airlines and selected sub-group (i.e. all of low cost carriers) of our sampled airlines:

	φ
Part I: Two Scenarios	
Scenario 1: effect of baggage fee, carry-on fee and low cost carriers across all sampled airlines	$\varphi = \delta_3 bagfee_j + \delta_4 LCC_j + \delta_5 carryfee_j$
Scenario 2: effect of baggage fee, carry-on fee across sampled low cost carriers	$\varphi = \delta_6 bagfee_j + \delta_7 carryfee_j$ $\boldsymbol{given\ LCC == 1}$
Part II: One Experiment	
Scenario 3: effect on passenger volume of *Coy and Chiang (2012)*'s higher airfare assumption regarding Southwest Airlines	$\varphi = \delta_8 bagfee_j + \delta_9 LCC_j + \delta_{10} carryfee_j$ $\boldsymbol{given\ Southwest\ airfare\ is\ \$27.10\ more\ across\ all\ of\ its\ O\&D\ routes}$ (the adjusted avg_fare_i is called new_fare_i): $\beta_8 avg\_fare_i \rightarrow \beta_8' new\_fare_i$

Table 3.2.3

In addition, because we are also fascinated by the claim made by Coy and Chiang (2012) that Southwest charges, on average, $27.10 more on its air tickets compared to other baggage fee charging airlines operating the same routes, we would conduct a controlled experiment in which we assume simplistically that Southwest charges $27.10 more dollars on all of its routes. Therefore, we generate a new set of data for independent variable avg_fare_i where all average fares sum between any O&D route *i* for Southwest are $27.10 more than other airlines (except JetBlue, which we exclude from this experiment). And by excluding JetBlue, Southwest

becomes the only airline not charging first checked baggage fees and its airfare is higher than other airlines by $27.10. Thus, we can test whether passenger volume for Southwest decreases significantly like we have hypothesized in Table 3.1 a & b if the result in Coy and Chiang (2012) were true.

C. Data

For dependent variable, passenger enplanement, we use the annual (January to December in 2014) total enplanement passenger count in an O&D route *i* with airline *j*. For independent variables, we take the Great Circle Route distance for an O&D route *i* and assume each airline *j* serving the same O&D route *i* have the same distance. For city pair population (or per capita income) for any given O&D route, we take the sum of each city's population (or per capita income) count in 2014 from the Metropolitan Statistical Area (MSA) it belongs to. For airline history, we subtract the year airline *j* was founded under its current name from 2014 to get its history. For the status of both ends of an O&D route, we assign 1 to the variable if it is a hub for airline *j* and 0 otherwise. For average aircraft age for airline *j*, we use the average airliners age across its entire fleet. For average fare level, we take the sum of the average airport fare level in 2014 from both ends of an O&D route. Lastly, for the four different scenarios in φ, we assign 1 to the dummy variable if certain fee is imposed and 0 otherwise. And although dummy variable *LCC* does not enter our model directly, we do establish it in order to create and restrict different analysis scenarios outlined above. The sources for all the variables (independent and dependent) are listed in Table 3.3.1 in Appendix C.

IV. Empirical Results

A. Pre-Regression Predictions

For airline routes, travelers might prefer to drive instead of flying if the travel distance is short, but as distance becomes longer, travelers will prefer to travel by plane. However, when the travel distance becomes so long that it is physically uncomfortable anymore, the demand for air travel will go down. Therefore we predict there exists a cubic functional form between travel distance and passenger demand for air travel. Also, intuitively, if a city pair's population is large, then air travel demand might go up as population increases. Similarly, if the income level (i.e. per capita income) between a city pair is high, then the travel activities might go up as more income allows more consumer spending. Further, if an airline has a long history or the city pairs are hubs, then demand might go up because of brand effect and hub effect (connecting flights). On the contrary, if the airfare for the route is high or the average aircraft age on the route is old, travelers might feel less inclined to travel by air for financial or safety concerns. Then for variables in φ, the effects of baggage fee and carry-on fee are ambiguous. And variable low cost carriers (LCC) has an ambiguous effects as well since high-end travelers might prefer network airlines while budget travelers might prefer LCC.

The summary statistics of all variables are presented below in Table 4.1:

Variable	Obs	Mean	Std. Dev.	Min	Max
ln_Pax	478	12.60897	.8281682	10.21979	14.48389
Distance	478	1198.822	676.6684	90	2724
Distance_sq	478	1894097	1937021	8100	7420176
Distance_cubic	478	3.54e+09	4.95e+09	729000	2.02e+10
ln_Population	478	16.29691	.5011821	15.01594	17.32272
PPIncome	478	65281.55	7185.236	50916	86424
Airline_History	478	58.87657	27.80502	7	85
City1_Hub	478	.4644351	.499256	0	1
City2_Hub	478	.4205021	.4941568	0	1

Avg_Fare	478	796.6892	73.3156	578.44	984.8
Avg_Age	478	11.92092	3.497633	5	16.9
firstbagfee	478	.7824268	.4130278	0	1
LCC	478	.4037657	.4911656	0	1
CarryFee	478	.1004184	.300872	0	1

Table 4.1

B. OLS Regression Results

The OLS regression results are presented below in Table 4.2:

	Scenario 1 (robust)	**Scenario 2**	**Scenario 3 (robust)**
	ln_Pax	*ln_Pax*	*ln_Pax*
Distance	0.000957	0.000905	0.000800
	(0.000690)	(0.000684)	(0.000766)
Distance_sq	-0.00000110*	-0.00000128*	-0.000000910
	(0.000000547)	(0.000000554)	(0.000000606)
Distance_cubic	2.88e-10*	3.62e-10**	2.30e-10
	(1.28e-10)	(1.31e-10)	(1.42e-10)
ln_Population	0.112	0.382***	0.138
	(0.0726)	(0.0862)	(0.0754)
PPIncome	-0.00000227	0.0000139*	-0.000000839
	(0.00000510)	(0.00000584)	(0.00000515)
Airline_History	0.00756	0.0156	-0.0379**
	(0.00719)	(0.00798)	(0.0127)
City1_Hub	0.418***	0.422**	0.449***
	(0.0997)	(0.151)	(0.104)
City2_Hub	0.660***	0.268*	0.761***
	(0.105)	(0.128)	(0.115)
Avg_Age	-0.00522	-0.0446	0.0688*
	(0.0292)	(0.0385)	(0.0343)
Avg_Fare	-0.00146**	-0.00470***	
	(0.000559)	(0.000663)	

bagfee	-0.592***	-0.334*	-1.775***
	(0.169)	(0.157)	(0.279)
CarryFee	0.105	-0.0423	0.584**
	(0.155)	(0.168)	(0.177)
LCC	-0.152		-2.646***
	(0.375)		(0.678)
new_fare			-0.00112*
			(0.000564)
_cons	11.67***	8.817***	14.62***
	(1.280)	(1.364)	(1.551)
Observations	478	193	447
R^2	0.255	0.398	0.289
F	.	9.897	.

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4.2

Scenario 1 and 2

From the empirical results, we can conclude that the cubic functional form for passengers' volume and travel distance is statistically significant at better than 5% for scenario 1 & 2 (*Distance* term is not significant, however). Thus after calculation, we find that travel distance around 2546 miles/2357 miles will produce a lowest point (contrary to our prediction) for passenger volume in scenario 1 and scenario 2 respectively. The coefficients for population and income variables are only found to be significant for scenario 2, which means as population of a city pair increases by 1%, there is on average a 38.2% increase in passenger volume if the operating airline on the route is a low cost carrier. For network airlines (i.e. non LCC), income and population do not have significant effect on passenger volume. Although the coefficient for income variable in scenario 2 is also significant, but since it is not practically large, we cannot

conclude that it has much effect on passenger volume for even low cost carriers. The effect of average aircraft age and the history of an airline are found to be not significant both among all airlines sampled and among low cost carriers sampled.

However, the hub effect is obviously present in both scenarios as the coefficients for the hub variables are significant at better than 5% level. On average, if one of the city end of an O&D city pair is a hub of the airline operating on this route, then the passenger volume are expected to increase by roughly 20 – 60%. For average airfare variable, we find that at 1% significance level, if airfare increases by $1, passenger volume are expected to go down by 0.15% and 0.47% for scenario 1 and 2 respectively. Similarly, when other factors are controlled, if an airline charges baggage fee, passenger volume will decrease by 59.2% among all airlines sampled and 33.4% among all LCCs sampled (significant at 5%). We do not, however, find significant evidence to support that carry-on fee and low cost carrier status will decrease passenger volume.

From the R-squared value, we see that the model as a whole can explain about 25.5% of variations for scenario 1 and 39.8% for scenario 2. In scenario 1, there is heteroskedasticity problem, thus we use a robust regression. The large F-statistics for scenario 2 indicates the model as a whole is valid.

Scenario 3

Scenario 3 is a very extreme and simplistic experiment used to see whether Coy and Chiang (2012)'s claim that Southwest leverages its free baggage policy to charge a higher fare has empirical support. We would like to know that if this claim is indeed true, then besides the

revenue benefits, what effects it will have on Southwest's passenger volume. Therefore, we are primarily interested in baggage fee and newly adjusted airfare variables. From the OLS results, we can conclude that both coefficients are significant at at least 5% level. Interestingly, the coefficient is negative for baggage fee variable while positive for carry-on fee variable. This might suggest that with all other factors held constant (including airfare, where we suppose other airlines also charge $25 more on all of their routes like Southwest), then if an airline charges for an additional baggage fee, passenger volume will decrease by 177.5%. When compared to scenario 1 and 2 (decrease by 59.2% & 33.4%), baggage fee effect is significantly magnified under the "higher fare" assumption in Coy and Chiang (2012). Coupled with the fact that when we compare the (adjusted) new fare variable with the (unadjusted) average fare variable, both of which have roughly same magnitude and signs (-0.00146 vs. -0.00112), it means that airlines other than Southwest who charge lower airfare and an additional baggage fee actually unbundled their baggage services and thus allow passengers to select the services they need by offering a lower price for base airfare and an additional charge for extra services. In turn, this increases demand from price-sensitive passengers and therefore their passenger volume decreases at a slower pace compared to "higher fare but no baggage fee" airlines.

V. Conclusion

With the rise and regional dominance of low cost carriers both within the United States and around the globe (especially in Europe), it has become quite a popular phenomenon in the airline industry to further disintegrate the services airlines provide and unbundle the services in order to cater to travelers with different travel needs. My paper examines primarily the effect

this unbundling of services might have on passenger volume. Through regression analysis, I find that travel distance, hub status, average fare level, and baggage fee charges have statistically significant effect on passenger volume both across all airlines sampled and across the low cost carriers sampled. Specifically, passengers aboard low cost carriers are more sensitive to average fare level and less to baggage fee charges while passengers flying with all airlines (without restriction within LCC samples) react more to baggage fee than to average fare level.

This interesting result connects naturally to the discovery noted in Coy and Chiang (2012). They assert that Southwest Airlines charges a higher fare in order to provide free baggage services. By setting up a somewhat exaggerated data set to be used by my econometric model, I discover that if the claim in Coy and Chiang (2012) is true, then the *ceteris paribus* effect of charging baggage fee is much larger compared to using unmodified data. It also shows that the *ceteris paribus* effect of average fare level is about the same between adjusted and unadjusted data. This indicates that if the claim in Coy and Chiang (2012) holds value, then Southwest's decision to provide "free checked baggage" policy is helping Southwest in drawing in price-sensitive passengers and hurting other airlines who have an extra baggage fee charges, which is contrary to the "peer pressure" statement we hypothesized in the introduction.

However, the econometric model used in this paper is by no means sufficient and exhaustive in capturing all the variables that might affect the passenger volume. Besides, due to the unavailability of some of the data in the city pairs I have examined, the data set only paints a partial picture of the air travel market. For example, I used the average airports fare level

instead of individual route fare level due to data unavailability. Further studies can be conducted more precisely if all the data needed for this study become available.

Appendix A

IATA Airport Code	Airport Name	City and State	Multiple Airport System (MAS)
ATL	Hartsfield–Jackson Atlanta International Airport	Atlanta, GA	No
BOS	Logan International Airport	Boston, MA	No
BWI	Baltimore–Washington International Airport	Baltimore, MD	No*
CLT	Charlotte Douglas International Airport	Charlotte, NC	No
DCA	Ronald Reagan Washington National Airport	Washington, D.C., DC	Yes
DEN	Denver International Airport	Denver, CO	No
DFW	Dallas/Fort Worth International Airport	Dallas/Fort Worth, TX	No**
DTW	Detroit Metropolitan Airport	Detroit, MI	No
EWR	Newark Liberty International Airport	Newark/New York, NJ	Yes
HOU	William P. Hobby Airport	Houston, TX	Yes
IAH	George Bush Intercontinental Airport	Houston, TX	Yes
IAD	Washington Dulles International Airport	Washington, D.C., DC	Yes
JFK	John F. Kennedy International Airport	New York, NY	Yes
LAS	McCarran International Airport	Las Vegas, NV	No
LAX	Los Angeles International Airport	Los Angeles, CA	No
LGA	LaGuardia Airport	New York, NY	Yes
MCO	Orlando International Airport	Orlando, FL	No
MDW	Midway International Airport	Chicago, IL	Yes
MIA	Miami International Airport	Miami, FL	No
MSP	Minneapolis–Saint Paul International Airport	Minneapolis/St. Paul, MN	No
MSY	Louis Armstrong New Orleans International Airport	New Orleans, LA	No
ORD	O'Hare International Airport	Chicago, IL	Yes
PHL	Philadelphia International Airport	Philadelphia, PA	No
SEA	Seattle–Tacoma International Airport	Seatle, WA	No
SFO	San Francisco International Airport	San Francisco, CA	No
Notes:			
	* Although BWI is often considered an airport serving both Baltimore and Washington D.C. metropolitan area, we treat BWI as a separate airport from the Washington D.C. city as we use two separate Metropolitan Statistical Area data between BWI and DCA, IAD.		
	** Because Dallas Love Field Airport (DAL) has become a hub mainly for Southwest Airlines with very few other airlines operating frequent routes out of DAL, therefore we do not consider DAL in our research.		

Table 3.2.1

Appendix B

VARIABLES	**EXPLANATIONS**
$ln(Pax_{ij})$	the logarithm of the annual passenger enplanements on route *i* for airline *j*[15]
$Distance_i$	Distance in miles between the airports for a city pair *i*[16]
$Distance^2$	the square of *Distance* variable
$Distance^3$	the cube of *Distance* variable
$ln(Population_i)$	the logarithm of the total population sum between a city pairs' Metropolitan Statistical Area in 2014[17]
$PPIncome_i$	total per capita income sum between a city pairs' Metropolitan Statistical Area in 2014[18]
$airline\_history_j$	airline history in years for an airline *j* as of 2014
$city1\_hub_j$	the hub status for an airline *j* at its starting end of an O&D route *i* as of 2014
$city2\_hub_j$	the hub status for an airline *j* at its finishing end of an O&D route *i* as of 2014
avg_age_j	the average aircraft age in years for airline *j* by June, 2014[19]
avg_fare_i	the average airfare level in dollars between a city pair in 2014
$bagfee_j$	whether or not an airline *j* charges an additional baggage fee
$carryfee_j$	whether or not an airline *j* charges an additional carry-on fee
LCC_j	whether or not an airline *j* is defined as a low cost carrier
ε_{ij}	error term; difference between actual logarithm passenger enplanements and predicted logarithm passenger enplanement;

Table 3.2.2

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Research Process

This paper was originally written for *ECN 214 Introduction to Econometrics with Lab* for Dr. Leo Kahane during Spring 2016 semester. The paper served as an end-of-semester capstone research project allowing students to apply econometrics techniques covered in class to real life situations and problems. Focused on detailed research in previous economics literature, this paper requires that students choose an original research topic after extensive literature review in the scholarly works of econometricians. In addition, to bridge the theoretical economic hypothesis with quantitative data sets, the paper itself is also an empirical research project that demands scientific methods that are sophisticated and precise. To ensure that my paper meets all above requirements, I developed a research process containing five major phases:

(1) research topic selection – brainstorm possible research topics that are both relevant and achievable within the framework of this paper;
(2) literature review – conduct extensive and meticulous research in the past economic literature in the area of the selected research topic;
(3) research model specification – develop a feasible, hypothesized econometric model based on the literature research in the previous research phase and additional mathematical and statistical references;
(4) data collection – decide which sets of data to collect and gather data from credible and reliable sources;
(5) empirical analysis and research – refine and synthesize all the data sets collected and then conducting empirical analysis using statistical/econometric software *Stata 13*;

For the first research phase, I consulted some well-known online economic websites like *The Economists*, *The New York Times* and *The Wall Street Journal* to identify interesting economic phenomena that might be suitable for further research. During this process, I heavily relied upon the rich resources the HELIN catalogue had to offer. For example, I used the "Gale NewsVault" to access old *The Economists* articles, "Historical Wall Street Journal" to access the WSJ articles and "Historical New York Times" to access the NYT articles, all of these three

sources were found through the Phillips Memorial Library's *Database by Subject* under the "Newspaper" category.

For the next phase, I utilized some online, electronic Economics and Econometrics journals to conduct literature review on the selected research topic (i.e. Economics of Airline Baggage Fee). For example, by using keyword search in journals like *JStor*, *Journal of Applied Econometrics* and *Journal of Econometrics* (*JAE* and *JE* are both available and accessible electronically on Elsevier), I was able to find multiple scholarly articles on the economics of airline baggage fees. The articles ranged from the effects of charging baggage fees on the on-time performance of airlines to the operational efficiency of the airlines. These discoveries not only enabled me to narrow down my research focus but also provided me with valuable research techniques that could be utilized throughout my research.

Inspired by the previous scholarly works on the economics of airline baggage fees, the third phase of my research process included two steps. Initially, I developed a preliminary econometric model based on the previous literature review. Then, I referenced mathematical and statistical texts to ensure the accuracy and relevancy of the empirical model I had developed. In this process, the Ebrary and the Interlibrary Loan program offered through the Phillips Memorial Library proved to be very beneficial to my research. I borrowed a physical copy of Jeffrey M. Wooldridge's *Introductory Econometrics: A Modern Approach*, 4th edition through the ILL system and also referred to multiple electronic textbooks in statistical science in the Ebrary system. All these resources ensured that my econometric model is empirically correct and significant.

For the fourth and fifth research phases, the *EconLit* database (can be found through Phillips Memorial Library's *Database by Subject* under the "Business and Economics" category) hosted by EBSCO was instrumental in helping me locate the data necessary for my research. Again, by using keyword search within this database, I was directed to some econometricians' working papers and their sources of data. In this way, I was able to find several data sets on airline passenger volumes, airline finances, and airline fare levels through the *TranStat's BTS Survey* on the Bureau of Transportation Statistics website. Besides, queries through *Google Scholar* and *Wikipedia* were also extremely helpful for analysis in *Stata 13* software.

After an extensive and exhaustive review of the information uncovered through the above-mentioned research process, which included both physical and electronic database, textbooks, scholarly journals, published and working papers, websites and blogs, online classes, etc., I used *RefWorks* to collect and manage my sources information and *EasyBib* to export the "works cited" page and annotated bibliography.

Annotated Bibliography

"Age of selected airlines' aircraft fleets as of April 2014." *Statista*. Web. Accessed April 29, 2016. http://www.statista.com/statistics/273993/age-of-the-aircraft-fleets-of-selected-airlines/.

As a key independent variable in my econometric model, the average age of aircrafts of each airlines sampled in the research is very important in determining whether the age of an airline's fleets has some significant effects on passenger volume for an airline. Because my research examines the airline data in the year of 2014, it is necessary to obtain some form of average age of airlines' fleets as of 2014, and the aircraft age data from Statista happens to end at April 2014, which fits my research needs perfectly.

"Air Carriers: T-100 Domestic Segment (U.S. Carriers)." *U.S. Department of Transportation (US DOT)| Transtats*. Web. Accessed April 29, 2016. http://www.transtats.bts.gov/Fields.asp?Table_ID=259/.

To obtain all passenger volume data for the entire sampled airline O&D routes (252 distinct O&D U.S. domestic routes), I need a uniform, standardized data sets that can provide me with accurate and reliable statistics on each sampled airline's passenger volume on each studied airline routes during the entire time period in 2014. The U.S. Department of Transportation provides open access to such data and thus I was able to extract from its uniformed and well-documented data sets the data points needed for the entire 2014 time period. Also, because the data are readily available in Excel spreadsheet customizable by users, the Excel data set was used conveniently later by *Stata 13* software directly when analyzing the data within the econometric model.

"Baggage Fees by Airline 2014." *Bureau of Transportation Statistics*. Last modified May 04, 2015. Accessed April 29, 2016. https://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/subject_areas/airline_information/baggage_fees/html/2014.html/.

To give readers a rough idea of how baggage fees have factored into the finances of airline industry with a sizable magnitude, I wanted to borrow some direct statistics from trusted sources to realize this goal at the start of my paper. The Bureau of Transportation Statistics has compiled a detailed and exhaustive list of airline baggage fee information dating back to as early as 2007, and therefore by using this source, I was able to present to my readers the importance of economics of airline baggage fees and thus to draw attention of readers to the meaningfulness of my paper.

Barone, Gerhard J., Kevin E. Henrickson and Annie Voy. "Baggage Fees and Airline Stock Performance: A Case Study of Initial Investor Misperception." *Journal of the Transportation Research Forum 51*, no. 1 (2012). http://journals.oregondigital.org/trforum/article/view/2796/.

As an integral part of my literature review, the economic impact of airlines' decision to charge travelers an extra baggage fees can provide significant insights on the baggage fees effect on airlines' financial performance. Gerhard, et al. studied the baggage fees effect on an airline's stock performance using event study methodology. They discovered that initial announcements drove down stock prices of both announcing airlines and competing airlines as baggage fee was interpreted as a sign of industry weakness. But subsequent increases in baggage fees was seen as positive impact on airlines' financial performance and thus had brought positive returns on stocks. Their research serves as a possible research method reference as I began my research.

Bhadra, Dipasis. "Demand for Air Travel in the United States: Bottom-Up Econometric Estimation and Implications for Forcasts by Origin and Destination Pairs." *Journal of Air Transportation* 8, no. 2 (2003): 19-56.

Bhadra adopts a bottom-up econometric estimation model to forecast air travel demand. By using maximum likelihood estimation method, Bhadra concludes that local area income, demographic population, large hub status, high market share all positively affect travel demand while high average fare puts a negative influence on passenger volume. The conclusions found in Bhadra's paper provideed me with a solid and relevant method of constructing my own econometric model in analyzing the economics of airline baggage fees. I decided to partially adopt Bhadra's proven model and build and extend my model from there on.

Brownlee, John. "What It Was Really like to fly during the Golden Age of Travel". *Co. Design*. Last modified December 05, 2013. http://www.fastcodesign.com/3022215/terminal-velocity/what-it-was-really-like-to-fly-during-the-golden-age-of-travel/.

In order to explain to readers how air travel within the continental U.S. has drastically changed in the past 50 years, I wanted to locate an interesting yet reliable source to present a pictorial and historical overview of air traveling in the United States. Co. Design's article is a mesmerizing and sophisticated recap of the past air travel experience, especially the period known as "the Golden Age of Air Traveling" in the 1950s and 1960s. This piece enabled me to begin my paper with a grabbing story that not only excites readers' curiosity but also provides readers with ample background information.

Cannon, Howard. "S.2493 - Airline Deregulation Act." C*ongress.gov*. https://www.congress.gov/bill/95th-congress/senate-bill/2493/.

Because the *Airline Deregulation Act of 1978* was a watershed event in the U.S. airline industry, it is very important to introduce the basic concept of the Act and explain how it has affected the managerial decisions of every airline company ever since. The U.S. Congress website has transcribed the entire Act into electronic version and thus is a very reliable source in examining the details of the deregulation act.

Coy, Jeffrey M., and Eric P. Chiang. "Are Explicit Baggage Fees The Answer To Rising Airline Operating Costs?" *European Journal of Business Research* 12, no. 1 (2012): 162-67.

Through their research, Coy and Chiang asserts that Southwest, an airline without an extra baggage fee charge, actually charges higher fares (Southwest, on average, charges $27.10 more per ticket compared to airlines charging an explicit baggage fee) in lieu of imposing a baggage fee. This discovery is very important in that it asks hypothetically, using the Southwest Airlines example, whether an airline can truly be financially sustainable without charging an explicit baggage fee. Their research prompts me to conduct my research in response to the hypothesis raised in their research. Thus, the research of Coy and Chiang was an instrumental and crucial source in determining my research interests.

Garrow, Laurie A., Susan Hotle, and Stacey Mumbower. "Assessment of Product Debundling Trends in the US Airline Industry: Customer Service and Public Policy Implications." *Transportation Research Part A: Policy and Practice* 46, no. 2 (2012): 255-68. doi:10.1016/j.tra.2011.09.009.

Garrow, et al. presents the readers with a very strong counter-argument in arguing against the importance of baggage fees in the financial well-being of airlines, stating that charging an extra baggage fee hinders the operational efficiency of airlines and predicts that such debundling of services will eventually disappear due to its inefficiency. This source is a crucial piece in my paper since it offers readers a very diverging view on my research and thus diversify the paper by making readers think about the possible arguments against my research findings.

Henrickson, Kevin E., and John Scott. "Chapter 8 Baggage Fees and Changes in Airline Ticket Prices." *Advances in Airline Economics Pricing Behavior and Non-Price Characteristics in the Airline Industry*, 2012, 177-92. doi:10.1108/s2212-1609(2011)0000003010.

Henrickson and Scott examine what impact the introduction of baggage fees have had on ticket prices by using spatial autoregressive model. They conclude that baggage fees actually reduce ticket prices, but they also find that “Southwest Airlines has increased their ticket prices on routes in which they compete with fee charging firms, leveraging their ‘Bags Fly Free’ product differentiation to increase their revenues. This source coincides with the source from Coy and Chiang (2012), and therefore both sources can be used together as sportive evidence when I developed my hypothesis that Southwest Airlines, by not charging baggage fees but a higher airfare, is actually losing more passengers when compared to other baggage fee charging airlines.

Maynard, Micheline. “Like American, More Airlines Add Fees for Checking Luggage.” *The New York Times*. Last modified June 13, 2008. http://www.nytimes.com/2008/06/13/business/13bags.html

This article piece provides a very detailed timeline of most U.S. airlines' decision to start charging a separate baggage fee.

Nicolae, Mariana, Mazhar Arıkan, Vinayak Deshpande, and Mark Ferguson. *Do Bags Fly Free? An Empirical Analysis of the Operational Implications of Airline Baggage Fees*. David Eccles School of Business, University of Utah. March 2013. Accessed April 25, 2016. https://www.business.utah.edu/sites/default/files/media/bagfee_paper_-_version_submitted_to_ms.pdf/.

Nicolae, et al. analyze whether baggage fees improve the overall operational performance of airlines. This source explains the following economic intuition: since travelers are more likely to bring less baggage when faced with an extra fee, airlines might experience a systematic relief from handling more baggage and thus improve their operational performance when imposing a checked baggage fee. Nicolae, et al. set out to use the on-time performance of airlines as their main research metric and have identified a differential impact of checked baggage fees. Their research find that a significant on-time departure performance improvement is present in the airlines that start charging a checked baggage fee in the 35-day period afterwards. Thus, this source provides another very important perspective on the beneficial effect of charging a separate baggage fee, namely, in its alleviation on the baggage handling pressure put on airlines.

"Per Capita Income in the Past 12 Months (IN 2014 INFLATION-ADJUSTED DOLLARS)." *American FactFinder | United States Census Bureau*. Web. 29 Apr. 2016.

As an important independent variable, the per capita income of each city pair examined in my research might have some significant effect on the increase or decrease of passenger volume on a particular O&D air route. The United States Census Bureau makes available the 5-year estimate of per capita income in inflation-adjusted dollars for every metropolitan statistical area (MSA) in the United States and it is a very reliable source in gathering the per capita income for my research since it considers the inflation effect and gives instead the real (not nominal) per capita income.

Robert Siegel, "The Economics of Airline Baggage Check; To Pay or Not To Pay." *NPR*. July 01, 2015. Accessed April 29, 2016. http://www.npr.org/2015/07/01/419218276/the-economics-of-airline-baggage-check-to-pay-or-not-to-pay.

This NPR interview of Robert Siegel on Rick Seaney offers the readers a light-hearted and relaxed conversational piece that speculates the future operational decisions regarding Southwest's baggage fee policy. Although short, this piece succinctly captures some subtle changes in Southwest's advertising strategies as of lately and convincingly argues that Southwest may change their free baggage fee policy pretty soon.

Scotti, Davide, and Martin Dresner. "The Impact of Baggage Fees on Passenger Demand on US Air Routes." *Transport Policy* 43 (2015): 4-10. doi:10.1016/j.tranpol.2015.05.017.

Scotti and Dresner has conducted very recently a rare study on the relationship between passenger demand and airline-imposed baggage fees. They adopt a three-stage least squares (3SLS) method to test whether baggage fees have impact on airfare and passenger demand. Their results show that "on an average route, a $1 increase in baggage fee leads to a loss of 0.7 passengers and is associated with a $0.11 reduction in fare levels" while "an equivalent increase of $1 in fares results in a much greater decline in passengers (eight times greater)." Again, this research agrees with the findings in Coy and Chiang (2012) and Henrickson and Scott (2012). Therefore, I intended to use this source as an evidential support to argue that ancillary fees and service debundling in the airline industry might be beneficial to airlines as it might be shown through the econometric examination of passenger volume.

Sheryl Jean, "Southwest Airlines sees fivefold jump in revenue from baggage fees, thanks to AirTran." *The Dallas Morning News*. Last modified May 14, 2013. http://www.dallasnews.com/business/airline-industry/20130514-southwest-airlines-sees-fivefold-jump-in-revenue-from-baggage-fees-thanks-to-airtran.ece/.

This news article shows that AirTran, an airline acquired by Southwest in 2014, has gained significant financial benefits by not following its parent company Southwest's free baggage policy. Thus, it resonates with several other sources in claiming that Southwest might initiate a revision on its baggage fee policy.