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# DATA-DRIVEN INSIGHTS: ASSESSMENT OF AIRLINE ANCILLARY SERVICES

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## ABSTRACT

Airlines increasingly rely on ancillary service fees for revenue generation. As a result, many ancillary services have been conceived and implemented. However, each customer does not desire to purchase every ancillary service. This research examines the heterogeneity among U.S. international airline passengers and their willingness to pay for assorted ancillary services. Antecedents to purchase intention and actual purchase behavior were evaluated using Amazon Mechanical Turk for data collection. Our results show that there are differences in airline passenger preferences when purchasing ancillary services on international flights. The number of times a passenger flies in a year and the reason for travel are found to be consistently significant. Occasionally, age and income are found to be significant. These findings will be very useful to airline marketing executives and could help to assure consumers receive the services they want at the price levels they are willing to pay.

## INTRODUCTION

Many organizations collected reams of data long before big data and data analytics became all the rage. Airlines for example, have amassed enormous amounts of data. We could assume that these vast amounts of data might lead company executives to manage organizations better, attract more customers, or increase revenue. However, a common theme appears. Executive's state that they have plenty of data, though they acknowledge that they do not know what to do with it all. Proponents of data analytics suggest that insights garnered from vast amounts of data lead to better decision-making, though if it is difficult to know how to use the data, then collecting vast amounts of data becomes counterproductive.

Even though airlines collect very large amounts of data about their customers and their ancillary purchases, it cannot be assumed that they are collecting the most useful data or that they are using the data to their benefit. Airlines may be missing opportunities to improve financial and operational performance from the use of their data.

Ancillary service fees for example, have become a popular revenue stream for airlines. After all, baggage fees alone brought in more than $3.1 billion for U.S. airlines in 2016 (USDOT Bureau of Transportation Statistics, 2017). Ancillary service revenue are "revenues beyond the sale of tickets and are indirectly seen as part of the travel experience" (Wittmer, Gerber and Boksberger, 2012). These fees are considered non-ticket revenues and are only paid when passengers choose the service. Even though airlines have collected large amounts of customer and ancillary service purchase data, could these data bring more value to the organization?

Ancillary services bring two areas of concern for airlines. One, when airlines implement new ancillary services, considerable amounts of resources are allocated and two, passengers might not purchase them. Therefore, airlines may be missing revenue maximization opportunities and optimal resource allocation by not providing appropriate ancillary services or developing marketing and sales strategies to account for the complexity of customer choice drivers (Teichert, Shehu and von Wartburg, 2008). Consequently, it is important for airline management to understand which ancillary services

passengers are likely to purchase and which passengers will purchase them. It is also important to consumers that airlines price these services appropriately and data can help airlines achieve this goal as well.

We explore using passenger ancillary service choice behaviors in a U.S. international network setting to identify whether a better approach to implementing and selling ancillary services can be identified. Accordingly, we set out to answer two research questions:

- RQ1. Which ancillary services should airlines sell and to whom should they sell on U.S. international flights?

- RQ2. Can airlines use *intention* to purchase to predict if customers will purchase ancillary services on U.S. international flights?

The remainder of this paper is organized as follows: literature review, research methodology, data analysis and results, and discussion and conclusion.

## LITERATURE REVIEW

Despite the prevalence and growing importance of ancillary service fees, few academic studies have examined the factors that lead to customers purchasing ancillary services and their willingness to pay fees for such services (Mumbower, Garrow and Newman, 2015). Ancillary services are a relatively undeveloped academic research area and more research in this area could be done (Espino, Martiìn and Romaìn, 2008; Ødegaard and Wilson, 2016).

Stated choice experiments have been a popular research methodology for a majority of the previously conducted airline ancillary service studies (Espino, Martiìn and Romaìn, 2008; Martin, Romaìn and Espino, 2008; Balcombe, Fraser and Harris, 2009; Chen and Wu, 2009; Correia, PimpaÞo and TaÞo, 2012; Wittmer and Rowley, 2014). While these studies provide insight into how customers may behave in actual purchase situations, these studies have some limitations. One, they limit the number of attributes and levels in the experiment because increasing them greatly increases the size of the experimental design. Consequently, they limit the number of insights that can be found surrounding passenger heterogeneity. Two, stated choice experiments ask passengers at the time of booking travel, which airline would they choose given a set of attributes. However, a key component that is not identified is whether a passenger would purchase or intends to purchase a particular ancillary service. Fourth, these studies omit actual purchase behavior of ancillary services. Fifth, each of these studies was narrowly focused on a particular route, specific region, or type of airline and did not include the U.S. airlines. Thus, generalizability of their results could be a concern.

Two other ancillary service studies examined airline seating. Lee and Luengo-Prado (2004) compared business and leisure travelers and their willingness to pay for additional legroom on two U.S. legacy airlines and Mumbower, Garrow and Newman (2015) investigated influential factors that led airline customers' purchase of premium coach seats at JetBlue Airlines.

Lastly, two studies took a descriptive approach of examining ancillary revenue. Garrow, Hotle and Mumbower (2012) provide a review of product unbundling trends that have occurred in the U.S. airline industry, whereas O'Connell and Warnock-Smith (2013) provided an account of international passengers' acceptance of ancillary fees. Though these studies are important and provide insights into ancillary services, they do not seek to understand antecedents to passengers' intent to purchase or actual purchase behavior.

While there appears to be a need to add to the airline ancillary services stream of research, this paper strives to make several research contributions. First, we provide a comprehensive analysis of which ancillary services customers are willing to purchase by exploring U.S. international airline passenger heterogeneity and purchase intentions. Second, we add to the limited ancillary service research in the United States market. Third, our research is not narrowly restricted to leisure or business travelers, low cost or legacy carriers, or to

a particular route or airline. Thus, our results are generalizable. Last, and most importantly, we provide an illustration of how data insights can lead to better operations and financial performance for airline organizations.

## RESEARCH METHODOLOGY

This research includes three separate analyses as shown in Figure 1. We follow the approach by Leon and Uddin (2017). In their study, they examined ancillary services in the U.S. domestic airline industry. This study extends their work to the international sector.

Model 1 and 2 are used to answer RQ1, which ancillary services should airlines sell and to whom should they sell on U.S. international flights? Model 3 helps to answer RQ2, can airlines use *intention* to purchase to predict if customers will in fact purchase ancillary services on U.S. international flights.

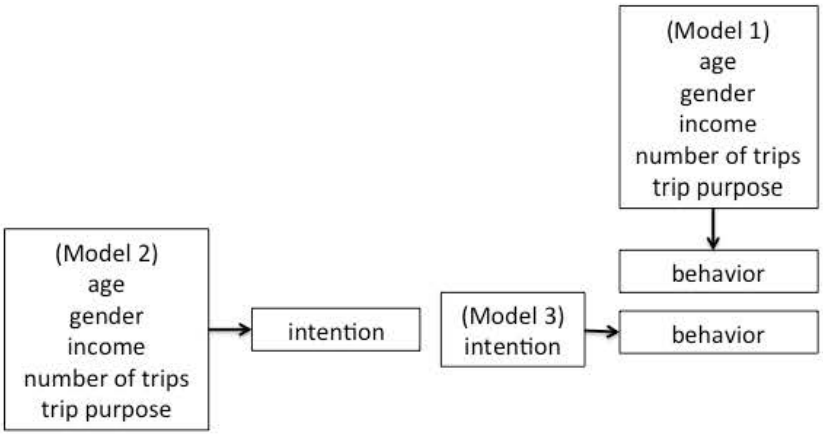
Model 3 is guided in part by the Theory of Planned Behavior (TPB). Fishbein and Ajzen (1975) suggest behavior can be predicted based on the intention to perform the behavior. TPB views behavioral intention as the immediate source of behavior. The stronger the intention, the more likely the behavior will be performed. Further, TPB has been used previously to explain behavior in the transportation domain (Bamberg, Ajzen and Schmidt, 2003; Chaney, Bernard and Wilson, 2013; Schniederjans and Starkey, 2014; Chen et al., 2016). If *intention* to purchase can predict if customers will purchase ancillary services, then airlines do not need to rely on actual purchase data, providing airlines the freedom to collect intention data from various sources.

### Data Collection Instrument

An online survey was developed using items from previous research articles. Non-substantive changes were made to the survey after it was pretested on several subjects who would be typical survey respondents.

The categorical independent variables used for Model 1 and 2 are shown in Table 1. Usage frequency and number of trips have been widely used in previous studies (Harris and Uncles, 2007; Balcombe, Fraser and Harris, 2009; Leon and Uddin, 2017). The respondents were asked, on average, how many times they fly on domestic flights (DF) per year. Categories included 0, 1-2, 3-5, and more than 5 times. The reference category is more than 5 times. Respondents were also asked, on average, how many times they fly on international flights (IF) per year. Categories included 0, 1-2, and more than 2 times. The reference category is more than 2 times.

**FIGURE 1**
**OVERVIEW OF RESEARCH**



Trip purpose, age, gender, and total annual household income were included in previous studies and were included in this study as well (Harris and Uncles, 2007; Balcombe, Fraser and Harris, 2009; Leon and Uddin, 2017). Survey respondents were asked to select one: On most occasions, I am a *(business or leisure)* traveler (TP_B and TP_L). Leisure traveler is the reference category. Age was divided into two categories: born in 1981 (AGE_B) and earlier, and born in 1982 and later (AGE_A) (Pew Research Center 2011). The split in years was done to group Generation Y/Millennials into one group and to group earlier generations into another one. Since there is great interest in understanding Millennial behavior, this split was deemed most appropriate. The reference category is 1981 and earlier. The reference category for gender (GEN) is male. Total annual household income (INC) contains five categories, whereas more than $120,000 is the reference category.

The dependent variables are displayed in Table 2. For Model 1, respondents were asked to answer 13 behavior items related to actual purchases of various ancillary services on international flights. Behavior is a categorical dependent variable. An example of one of the 13 behavior items in the survey is, "On a past international flight, I have paid extra airline fees for an aisle seat. Yes, No, Not an Option." Each of the 13 behavior items is listed in Appendix A - Table A.1.

**TABLE 1**
**SUMMARY OF INDEPENDENT CATEGORICAL VARIABLES**

| Categorical Variable | Variable Code | Model 1 and 3 Behavior Frequency (%) | Model 2 Intention Frequency (%) |
|---|---|---|---|
| Age | | | |
| 1981 and before [a] | AGE_B | 88 (29.33) | 123 (32.71%) |
| 1982-1998 | AGE_A | 212 (70.67) | 253 (67.29%) |
| Gender | | | |
| Female | GEN_F | 134 (44.67) | 168 (44.68%) |
| Male [a] | GEN_M | 166 (55.33) | 208 (55.32%) |
| Income | | | |
| Less than $25,000 | INC_0 | 67 (22.33) | 69 (18.35%) |
| $25,000 - $45,000 | INC_1 | 68 (22.67) | 93 (24.73%) |
| $45,001 - $75,000 | INC_2 | 84 (28.00) | 112 (29.79%) |
| $75,001 - $120,000 | INC_3 | 56 (18.67) | 74 (19.68%) |
| More than $120,000 [a] | INC_4 | 25 (8.33) | 28 (7.45%) |
| Domestic Flights Flown | | | |
| 0 | DF_0 | 14 (4.67) | |
| 1-2 | DF_1 | 141 (47.00) | 193 (51.33%) |
| 3-5 | DF_3 | 102 (34.00) | 131 (34.84%) |
| More than 5 [a] | DF_5 | 43 (14.33) | 52 (13.83%) |
| International Flights Flown | | | |
| 1-2 | IF_1 | 227 (75.67) | 285 (75.80%) |
| More than 2 [a] | IF_2 | 73 (24.33) | 91 (24.20%) |
| Trip Purpose | | | |
| Business | TP_B | 96 (32.00) | 119 (31.65%) |
| Leisure [a] | TP_L | 204 (68.00) | 257 (68.35%) |
| n = | | 300 | 376 |

*Note:* a = reference category.

TABLE 2
SUMMARY OF INTENTION AND BEHAVIOR DEPENDENT VARIABLES

| Ancillary Service | Behavior Model 1 and 3 | | | Intention Model 2 |
|---|---|---|---|---|
| | Yes Frequency (%) | No Frequency (%) | Not an Option Frequency (%) | Mean (Std. Dev.) |
| Aisle Seat | 83 (21.50) | 217 (56.22) | 86 (22.28) | 2.81 (1.44) |
| Extra Legroom | 113 (29.27) | 193 (50.00) | 80 (20.73) | 3.47 (1.35) |
| Window Seat | 104 (26.94) | 201 (52.07) | 81 (20.98) | 3.13 (1.47) |
| Seat Front of Airplane | 77 (19.95) | 227 (58.81) | 82 (21.24) | 2.65 (1.38) |
| Priority Boarding | 111 (28.76) | 205 (53.11) | 70 (18.13) | 2.69 (1.43) |
| Priority Deplaning | 62 (16.06) | 226 (58.55) | 98 (25.39) | 2.65 (1.42) |
| Reserved Seat | 135 (34.97) | 182 (47.15) | 69 (17.88) | 3.26 (1.44) |
| Reserved Overhead Space | 81 (20.98) | 199 (51.55) | 106 (27.46) | 2.88 (1.45) |
| Onboard Meals | 157 (40.67) | 167 (43.26) | 62 (16.06) | 3.61 (1.35) |
| Onboard Movies | 124 (32.12) | 200 (51.81) | 62 (16.06) | 3.25 (1.41) |
| Onboard TV | 95 (24.61) | 218 (56.48) | 73 (18.91) | 3.10 (1.45) |
| Onboard WiFi | 123 (31.87) | 186 (48.19) | 77 (19.95) | 3.61 (1.35) |
| Mobile Tablets Provided by Airline | 71 (18.39) | 161 (41.71) | 154 (39.90) | 2.75 (1.52) |

*Note:* Intention – Behavior (model 3) uses intention data as the independent metric variable.

Respondents were also asked to answer 13 intention items related to their intention to purchase various ancillary services on international flights. Intention is a metric dependent variable for Model 2. Intention is used again as an independent metric variable for Model 3. An example of one of the 13 intention items in the survey is, respondents were asked using a five-point Likert scale anchored by 1 = Definitely Would Not and 5 = Definitely Would, "When I travel by air, I would pay extra fees for—an aisle seat." Each of the 13 intention items is listed in Appendix A Table A.1.

### Data Collection Process

Sample data were collected from Amazon MTurk in October of 2015 over a four-day period. Amazon MTurk has been shown to be a viable data collection source used to obtain high-quality data economically and quickly, and where data obtained are at least as reliable as those obtained through traditional methods (Buhrmester, Kwang and Gosling, 2011; Germine et al., 2012; Holden, Dennie and Hicks, 2013). Researchers from diverse domains such as health (Boynton and Richman, 2014), retail (Munzel, 2016), transportation (Krupa et al., 2014; Winter et al., 2017) and tourism (Dedeke, 2016) have used this approach for collecting data. To ensure completion of the survey and lessen the likelihood of duplicates, $.20 was offered to respondents who completed the survey in full and to assure that surveys from the same IP address would not be counted.

## DATA ANALYSIS AND RESULTS

The original survey collected data for two studies, one study concentrated on domestic flights of U.S. airlines and the second study concentrated on international flights of U.S. airlines. This study was aimed at airline passengers who have flown at least one international flight that had either departed or arrived in the United States. The original sample size consisted of 525 responses. Eight responses had identical IP addresses and were removed from the analysis. Eliminating these responses reduced the possibility of duplicate responses or responses that were intentionally altered to collect the cash reward. Incomplete surveys were also removed from the analysis. Further, if the respondent did not fly at least one international flight, their responses were removed from the analysis. In addition, if respondents answered that they did not have an

option to purchase ancillary services on their flights; their responses were removed from the behavior model analysis. The net sample size resulted in 300 useable responses available for behavior data analysis (Models 1 and 3) and 376 useable responses available for intention data analysis (Model 2).

Tables 2 and 3 summarize the responses and the variable coding. Table 2 indicates that airline passengers show a higher intention score to purchase onboard Wi-Fi, onboard meals, and extra legroom though these scores are not particularly high. Other ancillary service intention scores are even lower. This would suggest that ancillary services are not widely popular among passengers. This is corroborated by airline passengers actual purchase behavior of ancillary services.

The intention survey items show good reliability with a Cronbach's alpha reliability coefficient of 0.92 (Nunnally, 1978). Since independent and dependent variables were collected from the same survey instrument, a number of steps were taken to minimize the occurrence of common method variance. The survey was developed and administered in accordance with the recommendations from Podsakoff et al. (2003). Careful attention was given to the order and position of the survey items to create temporal distance. In addition, the independent and dependent items were displayed in different formats, using five-point Likert scales and dichotomous rating scales. Harman's single-factor procedure was also conducted and it was found that a single factor accounts for less than the majority of the variance at 39.67% (Podsakoff et al., 2003). Using separation, scale differences, and statistical methods provides added confidence in our research findings.

**Model 1 Behavior Results**

The dependent variable behavior represents the choice between "Yes, I bought the ancillary service," and "No, I have not bought the ancillary service." This is modeled using logistic regression, which is an acceptable method of analysis when modeling discrete choice behavior and is commonly employed when studying choice behavior. It facilitates the understanding of individual purchases, provides predictions, and includes characteristics of consumers and their behaviors (Harris and Uncles, 2007). We use the same approach as Leon and Uddin (2016) and Leon and Uddin (2017) did in previous studies that modeled behavior antecedents directly using logistic regression.

We find the probability of selecting "Yes, I bought the ancillary service," using the general formulation (1), where K is the number of independent variables in the equation.

(1) $$P(B) = \frac{e^{\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_k X_k}}{1 + e^{\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_k X_k}}$$

Thirteen (13) binary logistic regressions, one for each ancillary service, were conducted with the results shown in the Appendix - Table A.2. The column labeled Reciprocal of Odds Ratio exists to show the reciprocal of the Odds Ratio when the Odds Ratio is less than one. This helps to show which variables are most prominent and provides a more intuitive meaning of the results with less room for misinterpretation.

Age, the number of times a traveler flies domestic and international flights in a year, type of travel, and to a lesser extent, income are found to be significant factors. For example, the odds of fliers who were born in the years 1982-2000 choosing to purchase onboard TV on international flights over not purchasing Onboard TV on international flights is 1.865 times than that of those fliers born in 1981 or earlier. Likewise, the odds for purchasing onboard movies are 1.707 times and the odds for purchasing mobile tablets provided by airline are 2.883 times than that of the older travelers.

The odds of business travelers choosing to purchase an aisle seat on an international flight over not purchasing an aisle seat on an international flight is 2.786 times than that of leisure travelers. Similar results are seen for extra legroom, reserved seats, seat front of airplane, priority deplaning, and reserved overhead space.

**TABLE 3**
**GLM ANCILLARY SERVICE MODEL 2 RESULTS**

| Ancillary Service | Comparisons of Least Square Means | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | DF1 | DF3 | DF5 | DF1 vs DF3 | DF1 vs DF5 | DF3 vs DF5 | IF0 | IF1 | IF2 | IF0 vs IF1 | IF0 vs IF2 | IF1 vs IF2 | TP_B | TP_L | TP_B vs TP_L |
| Aisle Seat | 2.71 | 3.20 | 3.37 | *** | *** | Ns | | | | | | | 3.35 | 2.83 | *** |
| Extra Legroom | 3.29 | 3.61 | 4.02 | ** | *** | * | | | | | | | | | |
| Window Seat | | | | | | | 3.31 | 2.89 | 3.66 | *** | * | *** | | | |
| Seat Front of Airplane | 2.71 | 3.06 | 3.06 | ** | ns | Ns | 2.70 | 2.70 | 3.44 | ns | *** | *** | 3.14 | 2.75 | *** |
| Priority Boarding | 2.76 | 3.05 | 3.49 | ** | *** | ** | 3.03 | 2.81 | 3.46 | ns | ** | *** | 3.34 | 2.86 | *** |
| Priority Deplaning | | | | | | | 2.68 | 2.57 | 3.33 | ns | *** | *** | 3.05 | 2.67 | ** |
| Reserved Seat | | | | | | | | | | | | | 3.62 | 3.13 | *** |
| Reserved Overhead Space | | | | | | | 2.96 | 2.84 | 3.46 | ns | ** | *** | 3.31 | 2.86 | *** |
| Onboard Meals | | | | | | | | | | | | | | | |
| Onboard Movies | | | | | | | | | | | | | | | |
| Onboard TV | 2.93 | 3.18 | 3.78 | * | *** | *** | | | | | | | | | |
| Onboard WiFi | 3.49 | 3.63 | 4.19 | ns | *** | *** | | | | | | | | | |
| Mobile Tablets Provided by Airline | | | | | | | 2.47 | 2.61 | 3.53 | ns | *** | *** | | | |

*Note:* Numerical values are Least Square Means; *$p < 0.10$; **$p < 0.05\%$; ***$p < 0.001$; ns and empty cells = not significant.

The odds of those travelers with income of less than $25,000 choosing to purchase reserved overhead space on an international flight over not purchasing reserved overhead space on an international flight is 3.176 times than that of those travelers with income levels of more than $120,000. The odds of those travelers with income of less than $25,000 choosing to purchase priority deplaning on an international flight over not purchasing priority deplaning on an international flight is 2.365 times than that of those travelers with income levels of more than $120,000.

**Model 2 Intention Results**

SAS Proc GLM (General Linear Model) was used to identify significant independent variables as they relate to the continuous dependent variable intention to purchase. Since each of the independent variables is categorical, GLM is an appropriate analysis method. GLM has become a popular means of estimating ANOVA and MANOVA models because of its flexibility and simplicity in model design (Hair et al., 2006).

GLM analysis was conducted 13 times, one for each ancillary service. The results of the analysis, including Least Square Means (LSMeans - SAS keyword) and significant differences between air traveler characteristics when the dependent variables are intention to purchase ancillary services are displayed in Table 3.

The number of times a traveler flies on domestic and international flights in a year is significant. When domestic fliers were asked about their intention to purchase ancillary services on international flights, there were differences in fliers purchase intentions of aisle seats, extra legroom, and priority boarding, onboard TV and onboard Wi-Fi. There were no significant differences between domestic flyer purchase intentions on international flights for window seats, priority deplaning, reserved overhead space, meals, movies, and tablets.

When international fliers were asked about their intention to purchase ancillary services on international flights, there were differences in fliers purchase intentions of window seats, seats in the front of the airplane, priority boarding and deplaning, reserved overhead space and mobile tablets provided by the airline.

Trip purpose is also a significant factor. When travelers were asked about their intention to purchase ancillary services on international flights, business travelers were more intent to pay for an aisle seat, seats near the front of the airplane, priority boarding and deplaning, reserved seats, and overhead space than leisure travelers. While there is no difference in the purchasing intention for extra legroom, window seats, meals, movies, TV or Wi-Fi.

Age, gender, and the level of income were not found to be significant factors, thus there is no difference in the purchase intention between fliers from different age or gender groups, or income brackets.

**Model 3 Intention - Behavior Results**

Intention is the single independent metric variable and behavior is the binary dependent variable. This is modeled 13 times, one for each ancillary service, using logistic regression (Ajzen, 1991; Ajzen and Driver, 1992)

These models seek to understand whether or not the choice behavior of purchasing ancillary services for international flights can be predicted by a respondent's stated intention to purchase the ancillary services. Thirteen binomial logistic regressions were conducted with behavior representing the choice of "*Yes*, I bought the ancillary service," or "*No*, I have not bought the ancillary service."

From the previous equation (1), we reduce K to equal one (1) independent variable $X$ , where is the intention score. Given the intention score, we are determining the probability of selecting "*Yes*, that a passenger will purchase the ancillary service" using the general formulation in equation (2).

(2) $$P(B) = \frac{e^{\beta_0 + \beta_1 X_1}}{1 + e^{\beta_0 + \beta_1 X_1}}$$

The results of the 13 binary logistic regressions are shown in Table 4 and indicate that intention may indeed predict behavior.

For each of the 13 international ancillary service models, intention is significant, thus as the intention score increases, fliers tend to purchase the respective ancillary services. For example, one-unit increase in a flier's intention to purchase an aisle seat on an international flight will increase the odds of choosing to purchase an aisle seat over not purchasing an aisle seat by approximately 143% (odds ratio = 2.425).

**Model Validation** We tested the prediction accuracy of Intention – Behavior probability model (Model 3) by comparing the predicted outcome with the actual outcome using the Brier score. The Brier score is a measure of the deviation from a perfect model fit (Bukszar, 2003).

The Brier score in equation (3) is the mean squared error of the probability forecast and is a measure of forecast accuracy. It was first introduced by Brier (1950) and is frequently used to examine forecast accuracy (Bukszar, 2003; Brozyna, Mentel and Pisula, 2016).

(3) Brier Score = [2] $\frac{1}{N}\sum_{t=1}^{N}(P(B)_t - B_t)$

Where {\displaystyle f_{t}}*P(B)* is the probability that was forecast, *B* is the actual behavioral outcome of the event at instance *t* and N is the number of forecasting instances. The score is reported between and including 0 and 1, where a lower score is better. Zero implies a perfect prediction.

Using the general probability equation (2) a determination of the probability of "*Yes*, that a passenger will purchase the ancillary service" is made. is , where *B* is behavior and is either 0 or 1, are coefficient estimates derived from the sample data, and *X* is the intention score. The Brier score results, displayed in Table 4, are low implying that the prediction models developed using the sample data are reliable.

## DISCUSSION AND CONCLUSION

This study comprehensively examined a number of airline ancillary services and factors that may influence the purchase of them on international flights to or from the United States. In the investigation of ancillary services, we answered: 1) which ancillary services should airlines sell and to whom should they sell on U.S. international flights, and 2) can airlines use *intention* to purchase to predict if customers will purchase ancillary services on U.S. international flights.

**TABLE 4**
**INTENTION-BEHAVIOR MODEL 3 AND VALIDATION RESULTS**

| Dependent Variable | Intercept | Coefficient | Std. Error | Wald Chi-square | Significance | Odds Ratio | Brier Score |
|---|---|---|---|---|---|---|---|
| Aisle Seat | -3.9348 | 0.8858 | 0.1339 | 43.7354 | <.0001 | 2.425 | 0.16 |
| Extra Legroom | -3.9032 | 0.903 | 0.1392 | 42.0731 | <.0001 | 2.467 | 0.19 |
| Window Seat | -4.0927 | 0.979 | 0.1316 | 55.2982 | <.0001 | 2.662 | 0.17 |
| Seat Front of Airplane | -3.9885 | 0.8984 | 0.1274 | 49.7058 | <.0001 | 2.456 | 0.15 |
| Priority Boarding | -3.826 | 1.0573 | 0.1201 | 77.5375 | <.0001 | 2.879 | 0.15 |
| Priority Deplaning | -4.2211 | 0.9171 | 0.1391 | 43.4902 | <.0001 | 2.502 | 0.13 |
| Reserved Seat | -2.9835 | 0.777 | 0.1068 | 52.921 | <.0001 | 2.175 | 0.19 |
| Reserved Overhead Space | -3.8623 | 0.8794 | 0.1303 | 45.5271 | <.0001 | 2.409 | 0.16 |
| Onboard Meals | -2.406 | 0.6135 | 0.1068 | 32.972 | <.0001 | 1.847 | 0.22 |
| Onboard Movies | -3.465 | 0.8375 | 0.1157 | 52.3922 | <.0001 | 2.311 | 0.19 |
| Onboard TV | -3.883 | 0.8575 | 0.126 | 46.3264 | <.0001 | 2.357 | 0.17 |
| Onboard WiFi | -3.902 | 0.9004 | 0.1381 | 42.5159 | <.0001 | 2.460 | 0.19 |
| Mobile Tablets Provided by Airline | -3.299 | 0.7435 | 0.1253 | 35.1881 | <.0001 | 2.103 | 0.16 |

As with the finding in Leon and Uddin (2017), answering these questions has several managerial applications. First, the findings can assist airline management in developing current and prospective ancillary services. Second, the findings can assist in developing associated sales, marketing, and training strategies, leading to increases in revenue. Taking a keen approach to sales and marketing efforts toward customers who are most likely to purchase ancillary services, airlines can increase revenue and reduce the risk of new ancillary service implementation.

Such a pointed approach enables a better understanding of the passengers' traits that lead to ancillary purchases, and which ancillary services customers are willing to purchase. Generally though, passengers are not fond of purchasing ancillary services in the first place. However, compared to the U.S. domestic airline study by Leon and Uddin (2017), this study found that passengers on international flights have higher intention scores. Thus, international passengers are more likely to purchase ancillary services on longer flights. This study also found that the number of domestic and international flights a passenger flies in a year and trip purpose were significant factors when examining intention to purchase ancillary services. Moreover, the significance of these factors change based on the ancillary service in question. Thus, some passengers show a clear preference for certain ancillary services.

When actual ancillary service purchase behavior was investigated, this study found that, the number of domestic and international flights a passenger flies in a year, trip purpose, and to a lesser extent income levels and age, were significant factors. Our results show that gender is not a significant factor in predicting intent to purchase or the actual purchase of ancillary services. In their daily lives, Generation Y/Millennial behave differently than older generations in many ways. However, we found that this is not true in the case of purchasing airline services.

If passengers are grouped together and asked which ancillary services they have purchased or are likely to purchase, onboard meals, onboard Wi-Fi, and extra legroom rank higher than others. However, without taking the analysis further we lose some of the heterogeneity among passengers, and airlines might be leaving money on the table. For example, passengers who have flown more than five domestic flights in a year are more likely to purchase extra legroom and Wi-Fi than those who have flown fewer flights. Moreover, while paying extra for aisle seats, seats in front of the airplane, and reserved overhead space does not appear high on the list of ancillary purchases, passengers who have flown three or more domestic flights or two or more international flights are more likely to purchase these ancillary services.

Given these insights, airlines now have a path to increasing revenue per passenger by narrowly focusing on which passengers are most likely to purchase a specific ancillary service. Airlines can provide information and training to front line employees such as gate and reservation agents, and flight attendants in the identification of more likely buyers, and sales techniques where they can offer the most relevant ancillary services, at the appropriate time, and to the most appropriate customers.

This study also supports the belief that intent to purchase ancillary services predicts actual purchases behavior of ancillary services. This is important because it provides an opportunity to reduce the risk of implementing new ancillary services. If airlines survey customers and non-customers about their intention to purchase certain ancillary services, the airline gains valuable information about whether passengers will purchase the ancillary service, prior to any significant investment or asset allocation.

This study followed the same approach as Donald, Cooper and Conchie (2014), Stran et al. (2016), and Leon and Uddin (2017) where intention and behavior were measured at the same time. However, a longitudinal study could reaffirm our results. Additionally, potential studies could include other factors that might influence ancillary purchases such as traveling in groups or families, or whether passengers are frequent fliers or not.

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## APPENDIX 1

**TABLE A.1: ANCILLARY SERVICE SURVEY ITEMS**

| Intention | Ancillary Service | Behavior | Ancillary Service |
|---|---|---|---|
| When I travel by air, I would pay extra fees for … | Aisle Seat | On a past international flight, I have paid extra fees for… | Aisle Seat |
| | Extra Legroom | | Extra Legroom |
| | Window Seat | | Window Seat |
| | Seat Front of Airplane | | Seat Front of Airplane |
| | Priority Boarding | | Priority Boarding |
| | Priority Deplaning | | Priority Deplaning |
| | Reserved Seat | | Reserved Seat |
| | Reserved Overhead Space | | Reserved Overhead Space |
| | Onboard Meals | | Onboard Meals |
| | Onboard Movies | | Onboard Movies |
| | Onboard TV | | Onboard TV |
| | Onboard WiFi | | Onboard WiFi |
| | Mobile Tablets Provided by Airline | | Mobile Tablets Provided by Airline |

**Table A.2: Ancillary Service Behavior Model 1 Results**

| Dependent Variable | Independent Variable | Estimate | Std. Error | Wald Chi-square | Significance | Odds Ratio | Reciprocal of Odds Ratio |
|---|---|---|---|---|---|---|---|
| Aisle Seat | Intercept | -0.5248 | 0.3535 | 2.2041 | 0.1376 | | |
| | DF_1 | -1.0591 | 0.3849 | 7.5719 | 0.0059 | 0.347 | 2.882 |
| | DF_3 | -0.8604 | 0.3899 | 4.8685 | 0.0274 | 0.423 | 2.364 |
| | TP_B | 1.0245 | 0.2867 | 12.7714 | 0.0004 | 2.786 | |
| Extra Legroom | Intercept | 0.1736 | 0.348 | 0.2488 | 0.6179 | | |
| | DF_1 | -1.2659 | 0.3739 | 11.4645 | 0.0007 | 0.282 | 3.546 |
| | DF_3 | -0.8863 | 0.3819 | 5.3859 | 0.0203 | 0.412 | 2.427 |
| | TP_B | 0.7077 | 0.2705 | 6.8446 | 0.0089 | 2.029 | |
| Window Seat | Intercept | 0.2412 | 0.2326 | 1.0748 | 0.2999 | | |
| | IF_1 | -1.2262 | 0.2782 | 19.4288 | <.0001 | 0.293 | 3.413 |
| Seat Front of Airplane | Intercept | -0.6058 | 0.2957 | 4.1986 | 0.0405 | | |
| | IF_1 | -1.0984 | 0.3076 | 12.7546 | 0.0004 | 0.333 | 3.003 |
| | TP_B | 0.8923 | 0.2946 | 9.1757 | 0.0025 | 2.441 | |
| Priority Boarding | Intercept | 1.0669 | 0.3366 | 10.0458 | 0.0015 | | |
| | DF_1 | -1.2662 | 0.3862 | 10.7479 | 0.001 | 0.282 | 3.546 |
| | DF_3 | -0.8351 | 0.3822 | 4.7746 | 0.0289 | 0.434 | 2.304 |
| | IF_1 | -1.0811 | 0.3031 | 12.7205 | 0.0004 | 0.339 | 2.950 |
| Priority Deplaning | Intercept | -0.3769 | 0.6297 | 0.3582 | 0.5495 | | |
| | INC_0 | 0.8607 | 0.6591 | 1.7055 | 0.1916 | 2.365 | |
| | INC_1 | 0.253 | 0.6293 | 0.1617 | 0.6876 | 1.288 | |
| | INC_2 | -0.6922 | 0.6292 | 1.2103 | 0.2713 | 0.5 | 2.000 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | INC_3 | 0.504 | 0.6303 | 0.6395 | 0.4239 | 1.655 | |
| | DF_1 | -1.5057 | 0.4846 | 9.6527 | 0.0019 | 0.222 | 4.505 |
| | DF_3 | -0.4324 | 0.4265 | 1.0282 | 0.3106 | 0.649 | 1.541 |
| | IF_0 | -0.9069 | 0.3613 | 6.3021 | 0.0121 | 0.404 | 2.475 |
| | TP_B | 0.7557 | 0.3337 | 5.1269 | 0.0236 | 2.129 | |
| Reserved Seat | Intercept | 0.0398 | 0.2693 | 0.0218 | 0.8827 | | |
| | IF_1 | -0.66 | 0.2781 | 5.634 | 0.0176 | 0.517 | 1.934 |
| | TP_B | 0.5348 | 0.2607 | 4.2103 | 0.0402 | 1.707 | |
| Reserved Overhead Space | Intercept | -0.3571 | 0.6714 | 0.2829 | 0.5948 | | |
| | INC_0 | 1.1555 | 0.6899 | 2.8053 | 0.094 | 3.176 | |
| | INC_1 | 1.3657 | 0.6754 | 4.0888 | 0.0432 | 3.918 | |
| | INC_2 | 0.3284 | 0.6541 | 0.252 | 0.6156 | 1.389 | |
| | INC_3 | 0.1545 | 0.7006 | 0.0486 | 0.8254 | 1.167 | |
| | DF_1 | -1.3675 | 0.4713 | 8.4193 | 0.0037 | 0.255 | 3.922 |
| | DF_3 | -1.1692 | 0.4421 | 6.9929 | 0.0082 | 0.311 | 3.215 |
| | IF_1 | -0.7722 | 0.3566 | 4.6887 | 0.0304 | 0.462 | 2.165 |
| | TP_B | 0.824 | 0.3126 | 6.9471 | 0.0084 | 2.28 | |
| Onboard Meals | Intercept | 0.5108 | 0.2981 | 2.9355 | 0.0867 | | |
| | DF_1 | -0.9058 | 0.3392 | 7.1322 | 0.0076 | 0.404 | 2.475 |
| | DF_3 | -0.3596 | 0.3561 | 1.0194 | 0.3127 | 0.698 | 1.433 |
| Onboard Movies | Intercept | -0.18 | 0.3311 | 0.2957 | 0.5866 | | |
| | AGE_A | 0.5347 | 0.2627 | 4.1442 | 0.0418 | 1.707 | |
| | DF_1 | -1.1407 | 0.3385 | 11.3557 | 0.0008 | 0.32 | 3.125 |
| | DF_3 | -0.3956 | 0.3471 | 1.2991 | 0.2544 | 0.673 | 1.486 |
| Onboard TV | Intercept | -0.3691 | 0.317 | 1.3553 | 0.2444 | | |
| | AGE_A | 0.6235 | 0.2965 | 4.4203 | 0.0355 | 1.865 | |
| | IF_1 | -1.2643 | 0.2818 | 20.1285 | <.0001 | 0.282 | 3.546 |
| Onboard WiFi | Intercept | 0.3715 | 0.2907 | 1.6338 | 0.2012 | | |
| | DF1 | -1.1872 | 0.3403 | 12.1672 | 0.0005 | 0.305 | 3.279 |
| | DF3 | -0.5502 | 0.3527 | 2.4335 | 0.1188 | 0.577 | 1.733 |
| Mobile Tablets Provided by Airline | Intercept | -0.6311 | 0.4537 | 1.9351 | 0.1642 | | |
| | AGE_A | 1.0588 | 0.3968 | 7.121 | 0.0076 | 2.883 | |
| | DF_1 | -1.317 | 0.4211 | 9.7835 | 0.0018 | 0.268 | 3.731 |
| | DF_3 | -1.0385 | 0.4369 | 5.6498 | 0.0175 | 0.354 | 2.825 |

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