Baggage Fees
A Game Theory Perspective

MBA211: Game Theory: Team Gardè

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10

Table of Contents

1. Introduction

1.1 The Airline Industry

The airline business is notoriously difficult, besieged by volatile fuel costs, fare wars, unpredictable weather, complicated routing logistics, expensive equipment, and even the occasional volcano. The major defining characteristics of this industry are:

- **High fixed costs**: The airline industry is highly capital intensive and therefore requires huge investments periodically. The 12 largest players operated a total of 3512 aircrafts, an average of almost 300 aircrafts.
- **Huge Fuel costs:** Fuel constitutes the single largest expense item for this industry. In 2008, the average fuel expense as a percentage of revenue amounted to 41.71%.
- **Debt intensive:** The industry is also marked by heavy usage of long-term debt, probably because of the huge investments required. The average long-term debt as a percentage of revenue in 2008 was 44.94% and long-term debt as a percentage of assets was 35.27%.

Illustrating the whimsical nature of the industry is its profitability. Profitability in the airline industry has been elusive, with pretax profit margins highly cyclical and well below the U.S. corporate average: [1]
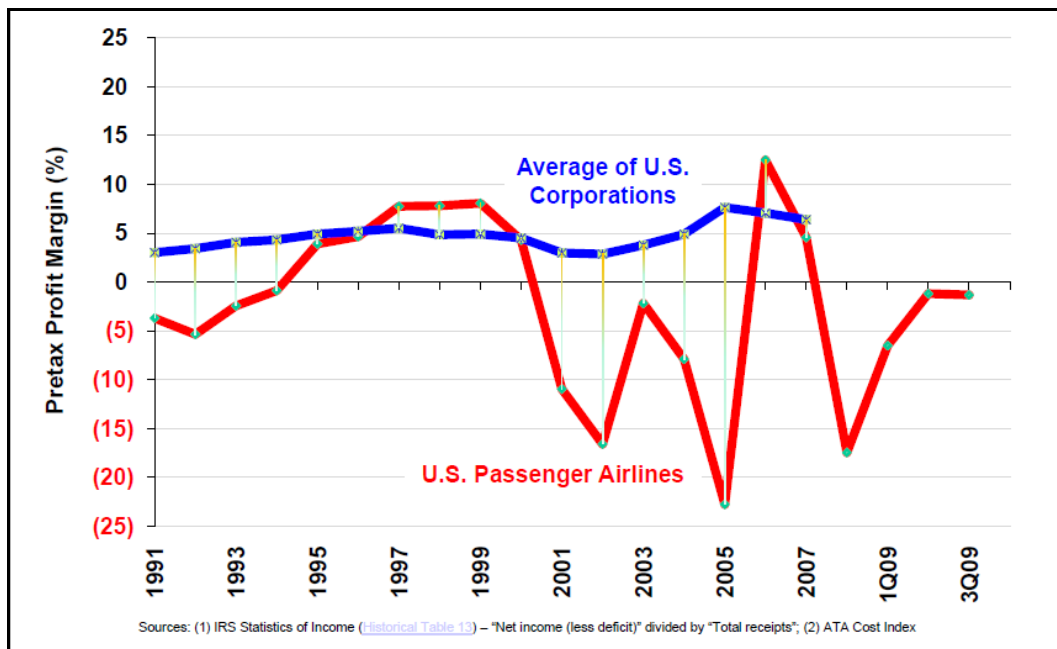
The total U.S. fleet shrank by approximately 700 aircraft from 2000 to 2009: [2]

Below are some startling statistics comparing year 2007 to year 2000 for the 7 largest US Airlines. (American, United, Delta, Continental, Northwest, US Airways and Southwest control 71% of the US market). [3]

- Total Operating Revenue was nearly the same at around $95 billion.
- Capacity measured by Available Seat Miles (ASM's) decreased by 7% (Southwest's ASM increased 66%).
- In the past 7 years, the average one-way passenger fare increased only by $18 (+11%) going from $153 to $171.
- Fuel Expense increased by $15.5 billion (+128%) going from $12.1 billion to $27.6 billion.

- While fuel costs rapidly increased and labor costs and total employment rapidly decreased, the average passenger ratio to airline employee increased by 430 (+36%) going from 1,198 to 1,628.
- During this same time period the average revenue productivity per employee increased by an astounding $107,442 (+52%) going from $206,370 to $313,812.

1.2   The Need for Additional Sources of Revenue

With almost no growth in average ticket prices on the revenue side and sky-rocketing costs of fuel on the cost side, airlines have been forced to look at alternate sources of revenue. This section summarizes the different ways in which airlines have gone about achieving this.

In 2009, the top nine U.S. airlines reported approximately $10 billion in "other revenues". This number may be significantly understated as there is no standard for reporting ancillary fees and many airlines bury some ancillary earnings in general passenger revenues.

Moreover, these numbers keep growing as airlines continue raising fees and invent new ways to extract more money from air travelers. The International Air Transport Association says ancillary fees now account for more than 12% of airline revenues and projects ancillary fees to top $58 billion worldwide in 2010.[4]

Item	Charges
Bags[5]	2008 – American Airlines is the first legacy carrier to break the baggage barrier by imposing a fee for checking a bag ($15 at the time) – others quickly follow (NOTE: Allegiant and Spirit were charging for checked bags as early as 2007) 2010 – Spirit Airlines breaks imposes a carryon bag fee ($20 – $45) 2010 – Only two carriers now have free checked-bags: JetBlue (1 bag), Southwest (2 bags)
Blankets[6]	2008 – In August, JetBlue announces it will charge $7 for a pillow and blanket 2009 – US Airways begins charging for pillows/blankets
Food & Beverage[7]	2001 – After 9/11, many airlines begin dropping meal service 2003 – Delta begins selling of snack boxes on some flights 2005 – United begins selling $5 snack boxes in place of meals 2008 – US Airways begins charging for all drinks (including water, coffee, soda) 2009 – US Airways stops charging for all drinks (because no other airline joined in) 2010 – Continental announces the last "free Coach meal" will be served in the fall
Credit Cards Only*[8]	2005 – Hawaiian Airlines begins accepting credit cards on some flights; by 2006, some routes were "cashless" and a policy of "credit cards only" on all routes was established by 2008 2010 – Twelve U.S. carriers have adopted a "credit cards only" policy – including all legacy carriers

1.3   Baggage Fees

Our topic of analysis "Baggage Fees" has been one of the strongest alternate source revenue earners for airlines. The table below highlights the current (2010) baggage charges being charged by airlines.

AIRLINE	FIRST CHECKED BAG	SECOND CHECKED BAG	ADDITIONAL BAGS	OVERWEIGHT BAGS	OVERSIZED BAGS
Airtran	$15	$25	$50	51-70 lbs (23-32kgs): $39 71 to 99 lbs: $79	62-70 total linear inches: $39; 71-80 inches: $79
Alaska	$15; $20 for travel on or after June 16	$20	3rd, $20; 4th or more $50 each	51-100 lbs: $50	63-80 inches: $50; 81-115 inches: $75
American	$25 ($15 to/from Canada)	$35 ($25 to/from Canada)	Bags 3-5: $100; 6th or more: $200	51-70 lbs (23-32kgs): $50; 71-100 lbs: $100. (Fees may be higher on international routes)	63 inches and over: $150
Continental	$23 ($2 more if not paid online)	$32 ($3 more if not paid online)	$75 nonstop/$100 connecting	51-70 lbs (23-32kgs): $50 Over 70 lbs not accepted.	63 inches and over: $100
Delta	$23 ($2 more if not paid online)	$32 ($3 more if not paid online) $50 for European travel	Travel within the US & Canada: Third bag: $125; Bags 4 to 10 $200 each; Travel to Europe: no charge for first bag, $50 for second; $200 for 3rd, $350 for 4th and 5th, $600 for bags 6-10).	51-70 lbs (23-32kgs): $90 ($150 for travel outside US) 71 to 100 lbs: $175 ($300 each outside US)	63-80 total linear inches: $150 $175
Frontier	$20	$30	$50	51-100 lbs: $75	63-80 inches: $75
JetBlue	$0	$30	$75	51-70 lbs: $50; 71-99 lbs: $100	63-80 inches: $75
Spirit	Checked bags: $19 paid online ($25 if paid at airport); Carry on bag: $30 online, $45 at airport; $20 for $9 Club members (one "personal item" free)	$25 (online or at airport)	Bags 3-5: $100 (online or at airport)	51-70 lbs: $50 71 to 99 lbs: $100	62-79 inches: $100; 80 inches and over: $150
Southwest	$0	$0	3-9: $50; 10 and more: $110	51 -100 lbs: $50	62-80 inches: $50
United	$25 ($2 discount if paid online)	$35 ($3 discount if paid online)	Bags 1-4: $125; 5th or more: $250	$100	63-115 inches: $125
US Airways	$25 at airport, $23 online	$35 at airport, $32 online, $50, online, to Europe ($55 at airport)	Bags 3-9: $100	51-70 lbs (23-32kgs): $70 71 to 99 lbs: $120	62-80 total linear inches: $100
Virgin America	$25 (up to 70 pounds)	$25 (up to 50 lbs)	Bags 3-10 $25	51-70 lbs $50; 71-100 lbs $100	$50 (63-80 linear inches)

9

1.4   Baggage Fee Collections

Baggage fees usually garner relatively little pushback from customers but are such a huge source of revenue for airlines. According to data from the Bureau of Transportation Statistics, the 10 largest U.S. airlines collected $566.3 million in baggage fees during the first quarter of 2009, and the total for all airlines amounted to $1.5 billion in 2008.[10]

Airlines Ranked by 2nd Quarter 2009 Baggage Fee Revenue

All amounts in Dollar Thousands ('000s)

2Q 2009 Rank	Airline	2nd Quarter 2008	3rd Quarter 2008	4th Quarter 2008	1st Quarter 2009	2nd Quarter 2009	Percent Change 2Q 2008-2Q 2009 (%)
1	American	37,101	94,075	113,856	108,117	118,442	219.2
2	Delta	42,861	47,489	60,542	102,838	118,356	176.1
3	US Airways	17,917	67,928	93,759	94,227	104,138	481.2
4	United	19,721	42,283	58,771	59,102	67,412	241.8
5	Northwest	15,685	32,695	63,578	59,787	67,186	328.3
6	Continental	16,361	21,180	49,287	55,616	63,157	286.0
7	AirTran	6,099	7,867	12,749	30,881	40,535	564.6
8	Spirit	N/A	N/A	N/A	N/A	16,178	N/A
9	Frontier	1,245	2,928	10,018	12,456	13,463	981.4
10	JetBlue	7,275	12,119	11,504	12,603	12,353	69.8
	Industry Total	**178,214**	**350,061**	**498,568**	**566,328**	**669,572**	**275.7**

1.5   Latest Developments

Carry-on baggage: Spirit Airlines, the pioneer for charging for baggage in the US is now planning to charge for carry-on baggage as well later this year in August. Charges will range from $25 - $40.[11]

International flights: Baggage fees used to be restricted to domestic U.S. flights, but recently major U.S. airlines have quietly started charging for baggage on select overseas routes. Most U.S. airlines exempt elite members of their frequent flier programs from the fees, as well as passengers in first and business classes, those with full-fare coach tickets and active U.S. military personnel. Beginning September 2010, American Airlines will impose a $50 fee for the second checked bag on flights between the U.S. and India, the Caribbean, and eight European countries. [12]

1.6   Airline Terminology

Term	Description
ASM	Available Seat Mile. A measure of capacity. ASM's equal the total number of seats available for transporting passengers during a reporting period multiplied by the total number of miles flown during that period.
RPM	Revenue Passenger Mile. One revenue-paying passenger transported one mile. RPM's equal the number of revenue passengers during a reporting period multiplied by the number of miles flown by those passengers during that period, RPM's are also referred to as "traffic".
Yield	The amount of passenger revenue earned per RPM during a reporting period.
RASM	Operating Revenue per ASM. The amount of operating revenue earned per ASM during a reporting period. RASM is also referred to as "unit revenue."
PRASM	Passenger Revenue per ASM. The amount of passenger revenue earned per ASM during a reporting period. Passenger RASM is also referred to as "passenger unit revenue."
CASM	(Operating) Cost per Available Seat Mile. The amount of operating cost incurred per ASM during a reporting period, also referred to as "unit cost".
Load Factor	Passenger Load Factor - A measure of utilized available seating capacity calculated by dividing

	RPMs by ASM's for a reporting period.
Average Fare	Represents the average one-way fare paid per flight segment by a revenue passenger

2. Analysis

Our analysis of the "baggage fee" game is centered around 2008 when most of the airlines went about introducing the baggage fees. Airlines obviously saw "baggage fee" as a possible solution to hedge against rising fuel and operating costs, something they couldn't address by increasing ticket prices, but when faced with the question of how they should go about introducing them, they had to **pre-empt and understand** responses from the two other stakeholders in the game, **Passengers and Competition**.

Given that both passengers & competition would have responses to this action, what choices could an airline make in terms of **when to charge** and **whether to charge** for both bags or only one bag or to not charge at all in view of those responses. We use game theory to analyze and report on such competitive interactions.

For our analysis we have chosen American Airlines (AA), the largest airline in 2008, as our main protagonist. For competitive interactions, we have chosen **Delta Airlines (DL)** and **Southwest Airlines (LUV or SW)** as the other stakeholders who either played along with AA or have since taken an opposing position.

2.1 Data & Assumptions

2.1.1 Airline Data

For our analysis, we used actual data from Airline Financials for year 2008. After obtaining the data, we made some simplifying assumptions on number of passengers & passenger fare that would make our calculations & illustrations easier.

Airline	Actual				Assumptions		
	# of passengers	Avg. passenger fare	Profits	Load Factor	# of passengers	Avg. passenger fare	% Market share
Source	*(Wikipedia)*	*(Airline financials)*	*(Airline financials)*	*(Airline financials)*	*Approx.*	*Approx.*	*Based on approx. values*
Southwest (LUV/SW)	101,921,000	$119.16	$1	71%	**100,000,000**	**$120**	**19%**
American (AA)	92,772,000	$196.55	($10)	82%	**95,000,000**	**$200**	**18%**
Delta (DL)	71,615,000	$191.93	($1)	82%	**70,000,000**	**$190**	**13%**

Northwest (NW)	48,772,000	$174.5	($25)	82%	**50,000,000**	**$175**	**9%**
United (UA)	63,071,000	$242.87	($26)	82%	**65,000,000**	**$240**	**12%**
US (US)	54,776,000	$150	($17)	82%	**55,000,000**	**$150**	**10%**
Continental (CON)	71,728,000	$233.80	$6	82%	**70,000,000**	**$230**	**13%**
JetBlue (JB)	21,824,000	$140	$5	80.40%	**22,000,000**	**$140**	**4%**
TOTAL	**551,628,000**	**$175**			**527,000,000**		**100%**

Table 1

In addition to the general data on the airlines, our research indicates that prior to introduction of baggage fees, on an average 40% of passengers check-in 1 bag and 10% passengers check in the 2nd bag.

2.1.2 Assumptions

The airline business is extremely complicated and it is obviously true that with passengers switching airlines, several outcomes (Revenues, Yield, Load Factor) and inputs (Cost, Operations) change for each airline. However, for our analysis and illustrations, we have made the following trade-offs and assumptions:

1. The 8 airlines in Table 1 add to 100% of the market share. If passengers were to switch, only these 8 options would be available to them.

2. If passengers switch, the probability of switching to a particular airline is equal to the airlines' market share.

3. Since airlines are a high fixed-cost industry, when passengers switch, we have considered that the only impact on airlines would be gained and lost revenues. There would be no impact on cost.

4. The revenue gain or loss will equal the number of passengers that switched multiplied by the average ticket price of that airline.

5. The decision to introduce baggage fee for the 2nd checked in bag affects 10% of the passengers and the decision to introduce a fee for the first bag affects 40% of the passengers.

2.2 Airlines vs. Passengers

2.2.1 Overview

Having decided that they would charge for baggage fees, American Airlines (AA) were first faced with

a) How these charges would need to be presented to passengers, and

b) What would passengers' reaction be to such fees.

The easiest way to introduce such fees was to make some assumptions around baggage handling costs and spread the cost among all the passengers by increasing the ticket prices. However, this would lead to two problematic issues. One, AA would not be able to differentiate between passengers that would have check-in bags and those that didn't and two, their ticket prices would rise immediately, and with a competitive market, passengers would immediately switch to a competing airline leading to lost revenues.

The following sub-sections analyze these interactions in more detail.

2.2.2   Numerical Assumptions

Let us assume that a potential passenger is buying a ticket on a comparison shopping website, and he/she is usually used to seeing AA charging a $200 ticket for that travel. $200 is the lowest price and the next price being offered is $201 by a competing airline.

The airline has decided to charge $15 as baggage fee for the 2nd checked-in bag. In order to deter discount passengers from cancelling tickets, airlines had decided to charge $100 as the cancellation fee per ticket.
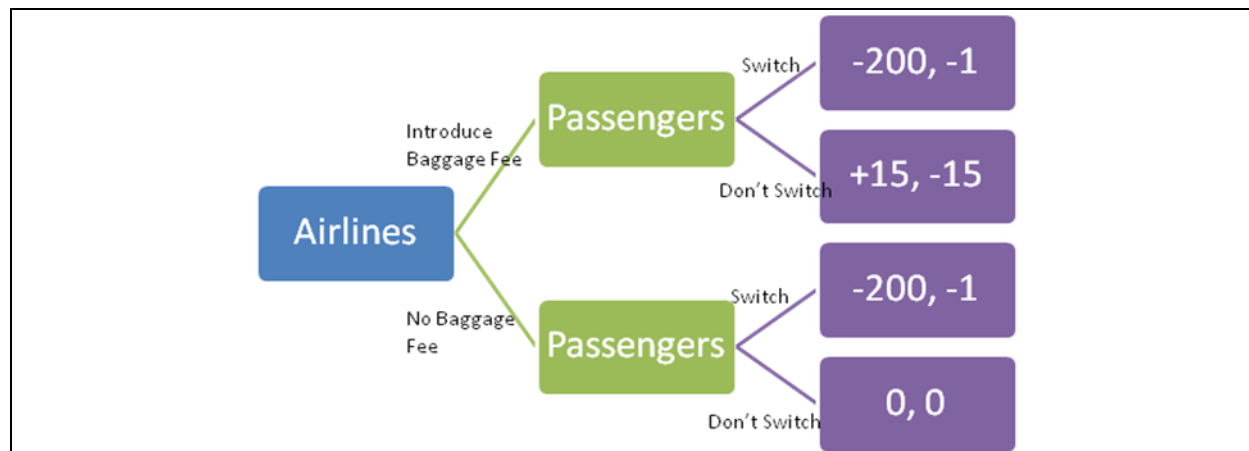
2.2.3   Look Forward Reason-Back Analysis

Figure 1: LFRB Airlines vs. Passengers

Error! Reference source not found. highlights the game tree when airlines decides between introducing baggage fee in the ticket price and not introducing it in the ticket price and passengers response to such an action.

Given that AA was faced with such a situation, it saw that if it included baggage fee in the ticket, the passenger would immediately switch and it would result in a payoff of (-200,-1). -200 because the airline would have lost the ticket revenue, and -1 because passenger would have to pay $201 instead of $200 for his/her ticket. Passenger would never choose (+15, -15) because his/her payoff is lower than what he/she would be able to achieve by switching.

Since AA would invariably lose a passenger if it included baggage fee in ticket price, it purposely chose not to do so thus retaining the passenger with a payoff of (0,0).

However, instead of not charging the passenger at all, AA broke down this game into a 2 staged game. In the 1st stage, it enticed passengers into buying tickets by offering the lowest price. In the 2nd stage, it forced them to pay

for the baggage fee by creating a pay-off structure where paying the baggage fee had the best payoff among all others.

2.2.4   The 2-Staged Game

2.2.4.1 Stage 1

		Passenger	
		Buys from AA	**Switches to another airline**
American Airlines (AA)	Include Baggage fee in Flight Fare	+15, -15	-200, -1
	Exclude Baggage fee from Flight Fare	0,0	-200,-1

Figure 2: Stage 1

Figure 2 is a normal form representation of analysis done in Section 2.2.3. Airlines purposely choose a **Dominated strategy**, that of not including baggage fee in Flight Fare to get Passengers to buy tickets such that the payoff from Stage 1 is (0,0).

2.2.4.2 Stage 2

		Passenger		
		Travel	**Cancel**	**Don't Fly**
American Airlines (AA)	**Charge Baggage Fees**	+15, -15	+100,-100	+200,-200
	Don't Charge Baggage Fees	0,0	+100,-100	+200,-200

Figure 3: Stage 2

Having enticed passengers into buying tickets, AA then forced passengers into paying for baggage fees by making the costs of not flying higher. Passengers are faced with the payoff matrix in Figure 3 where if airlines chose to charge for baggage fees, the best option was pay for the baggage fee rather than cancel the ticket or not fly at all.

Again, this is a sequential move game which we've represented in the normal form.

2.2.5 Key Take-aways

By creating this 2 staged game, AA (and other airlines) were quite successful in making the outcomes fuzzy enough to coax passengers into flying with them even though they were charging for bags. While the smart passenger who was incredibly well planned and meticulous and knew exactly how much he/she would carry would look forward reason back and switch airline, majority of the passengers did fall prey to the fuzzy outcome and ended up continuing flying with AA. The many behavioral finance influenced techniques used by airlines (loyalty programs, bundling air with hotel, advance purchase programs etc) were successful in helping airlines win Stage 1 of the game, thus ensuring their continued victory in Stage 2.

We also learnt that it was impossible for airlines to charge/include baggage fee in the ticket prices. Given that a majority of ticket booking is moving online and passengers are easily able to compare and shop, including baggage fees and increasing ticket prices would lead to a revenue disaster for an airline. However, by creating the 2 staged game, airlines gave themselves the chance of at least grabbing the naïve passengers.

For the smarter passengers, airlines would need to play a larger game – that of co-ordination with competition which we address in the subsequent sections.

2.3 Airlines vs. Competition

2.3.1 Overview

Having looked at the game between AA and passengers, we now turn our attention to AA vs. Competition. AA's primary competition comes from the other airlines large airlines which have been mentioned in Table 1. Our analysis will be based on payoff in the form of revenues that an airlines generates by charging baggage fees vs. revenues that it loses when passengers defect and switch airlines.

2.3.2 Defection Rate Analysis

Before analyzing competitive interactions between AA and UA, we must first analyze behavior by the 3rd stake-holder, the passengers when baggage rates are introduced.

2.3.2.1 Addressable Passenger size
When introducing baggage fees, we know that airlines are primarily targeting the 40% passengers that check-in one bag and 10% passengers that check-in the 2nd bag. Based on data sources[13], we are aware that with the introduction of the fees, there is an automatic reduction of passengers checking-in bags by 25% for passengers checking in 1st bag and by 50% for passengers checking in the 2nd bag, leading to an addressable passenger size of about 30% and 5% passengers. The passengers that we have just eliminated are passengers who could have done without checking in bags but were doing so because it was free.

2.3.2.2 Break-even calculations

The second step is to determine the break-even # of passengers where baggage revenue gained from passengers just equals the ticket revenue lost from passengers that defect. The table below highlights the break-even requirements for each of the 8 airlines.

Airline	# of passengers (Million)	Avg. ticket price	% 1st bag	% 2nd bag	# of passengers @$15/2nd bag to breakeven	% of total passengers	# of passengers @$25/2nd bag to breakeven	% of total passengers	# of passengers @$15/1st bag to breakeven	% of total passengers
Southwest (LUV/SW)	100	$120	30%	5%	4.44	4.44%	4.14	4.14%	26.67	27%
American (AA)	95	$200	30%	5%	4.42	4.65%	4.22	4.44%	26.51	28%
Delta (DL)	70	$190	30%	5%	3.24	4.63%	3.09	4.42%	19.46	28%
Northwest (NW)	50	$175	30%	5%	2.30	4.61%	2.19	4.38%	13.82	28%
United (UA)	65	$240	30%	5%	3.06	4.71%	2.94	4.53%	18.35	28%
US (US)	55	$150	30%	5%	2.50	4.55%	2.36	4.29%	15.00	27%
Continental (CON)	70	$230	30%	5%	3.29	4.69%	3.16	4.51%	19.71	28%
JetBlue (JB)	22	$140	30%	5%	0.99	4.52%	0.93	4.24%	5.96	27%

As we can see, of the 5% passengers that'll continue to check-in 2nd bag, airlines need to retain approx. 90% of those passengers if they were to charge $15 for the 2nd bag, and approx. 85% if they were to charge $25.

Similarly, if airlines charge $15 for the first checked-in bag, they would need to retain approx. 90% of the addressable passengers checking in 1 bag.

As is evident from this analysis, by charging only $15 for the 2nd checked in bag, airlines would have a difficult time breaking even. But by charging $25 for the 2nd checked in bag, they improve their chances of breaking even and this was the amount the airlines with which they began the entire baggage fee strategy.

2.3.2.3 Defection

The third step is analyzing defection rates. From Section 2.2, we know that airlines are able to retain some naïve passengers. We estimate that airlines will be able to retain at least 25% of the passengers checking in 2nd bags and 50% of the passengers checking in their first bags. The defection rate (which is variable) will be applicable to the remaining passengers.

We anticipate that the defection rate will be directly proportional to the number of other airlines that are charging or not charging baggage fees. For eg. if our protagonist, AA charges, and none of the other airlines charge, we anticipate that all of the remaining addressable passengers will defect. Wheras, if 7(including AA) of the 8 airlines charge and only 1 doesn't' charge, then only 1/8th of the addressable passengers will defect. While we have assumed a linear relationship between airlines not charging for baggages and passengers defecting, this relationship could be non-linear as well.

Following tables highlight anticipated defection rates among passengers.

Option for passenger	Probability	Remark
Stop checking in 2nd bag	50%	Data sources point that about 50% of passengers check-in their second bag just because it was free and could easily stop doing so by stuffing more in the first bag or travelling lighter.

Not travel at all	0.001%	Although passengers have this option, we anticipate that this will be exercised by very few passengers
Continue with current airline	25% + passengers that do not switch.	We anticipate that airlines will be able to retain at least 25% of the existing passengers through various means.
Switch to an airline that doesn't charge	Variable	We anticipate this option to vary. This would be directly proportional to the number of other airlines that also charge. For eg. if no other airline charges, all 25% of the remaining passengers would switch to another airline. If all airlines charge no passengers will switch. And if 7 out of 8 airlines charge 1/8*25% will switch.

Table 2: Passengers checking in 2nd bag (10% of overall passengers)

Option	Probability	Remark
Stop checking in 1st bag	25%	Data sources point that about 25% of passengers check-in their first bag just because it was free and could easily stop doing by travelling lighter or carrying more in their cabin bags.
Not travel at all	0.001%	Although passengers have this option, we anticipate that this will be exercised by very few passengers
Continue with current airline	50% + passengers that do not switch.	We anticipate that airlines will be able to retain at least 50% of the existing passengers.
Switch to an airline that doesn't charge	Variable	We anticipate this option to vary. This would be directly proportional to the number of other airlines that also charge. For eg. if no other airline charges, 25% of the remaining passengers would switch to another airline. If all airlines charge no passengers will switch. And if 7 out of 8 airlines charge 1/8*25% will switch.

Table 3: Passengers checking in 1st bag (40% of overall passengers)

2.3.2.4 Passenger Gain

On the opposite side of defection is passenger gain. If an airline doesn't charge baggage fees, it has the potential to win over passengers from the other airlines that charges baggage fees. We estimated that passenger gain would be in the proportion of the airlines overall market share. For example, if an airlines enjoys 17% market share and 1m passengers want to switch airlines, this airline would only be able to accommodate 170,000 of those passengers, not all 1M of them. We had to build this limitation because not all airlines fly to all destinations.

2.3.3 Sequence of events

Before we get into the actual analysis of payoffs, we need to mention the sequence of announcements regarding baggage fees.

All major airlines except SW and AA had gone ahead and announced in early 2008 that they would be charging $25 for the 2nd checked in bag. In the sequence of events that followed, SW stayed out of the race throughout, but AA announced that it would charge for 2nd checked-in bags in May, and within a month it announced that it would charge for all checked-in bags. Through the next few sections, we analyze these decisions through game theory viewpoint.

2.3.4 Look Forward Reason-Back Analysis

2.3.5 Charging for the 2nd checked in bag

In order to simplify the analysis, we observe the interactions between AA and DL (Delta), the two largest airlines (other than SW).

When AA was observing the baggage fee situation in early May, all airlines but SW and itself were planning to charge for 2nd checked in bags. Given that other airlines had already decided to charge, AA could make 3 possible decisions, 1) Continue not charging and hope that defecting passengers from DL and other airlines would join them, 2) Charge for one bag and 3) Charge for both bags.

The next section describes how payoffs were calculated for various combinations.

2.3.5.1 Payoff Calculations

Payoffs for DL and AA were calculated as follows:

1. DL Charges and AA doesn't charge

Airline	Revenue Gained from Baggage Fees (A)	Revenue lost from Defection (B)	Revenues lost from passengers deciding not to fly ©	Net Payoffs
DL (worst case)	Rev / Bag=$25 # airline charging fees = 6 %passengers checking in 2nd bag = 10% % of passengers continuing with DL = 25% of 10% + 6/8*25% = 43.75% ⇨ 70M*10%*43.75%*$25= $77M	% Defecting = 50% - % staying = 50% - 43.75% = 6.25% ⇨ 70M*10%*6.25%*$190 ⇨ -$83M	% passengers deciding not to fly = 0.1% ⇨ 70M*10%*0.1%*$190 ⇨ -$1	-$7M
DL (Best	70M*10%*50%*$25= $87.5M	$0	-$1	$86.5

case)				

The best case arises when there is no defection. The worst case arises when passengers defect based on our prediction and this changes with the number of airlines charging/not charging for baggages. In the example above, we have quoted that 6 out of 8 airlines charge for baggage fees.

AA's payoffs, if it doesn't charge any baggage fees, arise from what it gains from DL. Its gain when passengers defect from DL will be as follows:

1. Passengers gained = AA market share * # passengers defecting from DL = 18% * 0.44M = 0.0792M

2. Revenues from passengers = Passengers gained * Avg. ticket price = 0.0792M * $200 = $16M

At the same time, for DL's best case scenario, i.e. no defection, payoff to AA would be 0M.

Similar model is used for calculating payoffs for other situations with an additional change that the number of airlines charging for baggage increases to 7 from 6.

2.3.5.2 AA Observations
Based on the decision tree and our assumptions about defection and passenger gain rates, AA observed the following game trees:
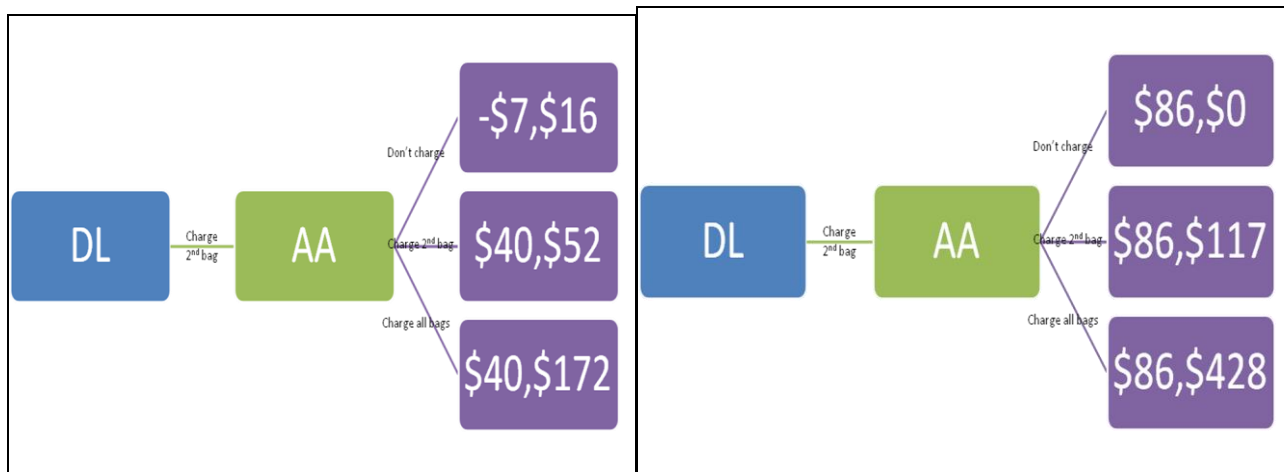

Figure 4: Worst Case and Best Case Payoff Scenarios

AA observed that its payoffs when charging for the 2nd checked in bags were higher than its payoff for not charging at all. This is true for both the best and worst case scenarios. Therefore the revenue that it would gain by charging baggage fee exceeded the revenue it would gain from passengers that switch from other airlines.

AA also observed that its payoffs from charging for all bags were even higher, but given that the trees were only prediction models and actual passenger response was unknown, it was too much of a risk to charge for all bags straight away.

With the above observations in mind, AA also joined the 6 other airlines and became the 7th airline to charge for the 2nd checked in bags.

2.3.6   Charging for 2 bags

Once 7 out of the 8 major airlines started charging for the 2nd checked in bag and results turned out to be favorable and payoffs were in between the situations highlighted in Figure 4, airlines immediately set sights on the next milestone, that of charging for all bags.

AA took the initiative this time and was the first one to announce the decision to charge for the 2nd bags. A domino effect followed and the rest of the airlines followed suit. The only exception was SW which continued not to charge for any checked in bags.

2.3.6.1 Payoffs
The following figures highlight the payoff diagrams for the best and worst case scenarios. Given that both AA and DL are charging for the 2nd bag, they either have the option of continuing charging for that one piece or charging for all pieces or for not charging for any baggage at all.

		Delta (DL)		
		No charges	Charge for 2nd checked-in bag	Charge for all check-in bags
	No Charges			0,401
American Airlines (AA)	Charge for 2nd checked in bag			117,401
	Charge for all check-in bags	545,0	545,86	**545,401**

Figure 5: Best Case (No defection)

		Delta (DL)		
		No charges	Charge for 2nd checked-in bag	Charge for all check-in bags
	No Charges			79, -52
American Airlines (AA)	Charge for 2nd checked in bag			113,-5
	Charge for all check-in bags	-100,75	-23,99	222,175

Figure 6: Worst case (with defection)

The figures above are normal form representations of the sequential moves that each player has. As we can see, the expected payoffs of moving from charging for just the 2nd bag to charging for both bags are higher for both AA and DL and as a result both airlines decided to charge for all bags.

These payoffs however assume that except for SW, all other airlines are also charging for both bags. If the number of airlines charging for bags were less, the defection rates would have been much higher leading to a complete break-down of the payoffs to the airlines.

2.3.7   Key Take-aways

One of the key take-aways from this analysis is how fragile this whole co-ordinated game is. It is heavily reliant on the assumption other players would also co-ordinate and co-operate, thus delivering benefits to all. It must also be noted that the payoff structures are such that the incentives are just enough to co-operate and not defect. The payoffs also such that they would keep players interested and not allow them to defect. Having said that, this whole game is still very fragile and would definitely break-apart should one of the larger airlines (AA/Delta/US) decide to stop charging for baggage altogether. With such a situation, defection rates would rise throwing airlines revenues off balance which in turn would lead each airline to stop charging for baggages to protect passengers from defecting.

The other take-away from this game is how most of the airlines achieved co-operation and co-ordination and synchronized their decisions to charge baggage fees. While government would disallow collusion, airlines achieved some form of co-operation by announcing and committing through various means. The co-operation game continues to this day where one action by an airline immediately leads the other airlines to follow suit. In 2010, baggage fees offer a level playing field with each airline charging exactly the same amount for each bag checked-in. This is akin to the GE-Westinghouse case where each party achieved some form of co-operation by charging a similar price without colluding with each other.

Last but not the least, one take-away that surprised us is that passengers were surprisingly resilient. Upon observing flight schedules and yield and passenger miles over the last two years, we did not see any noticeable shift of passengers from airlines charging baggage fees to airlines not charging baggage fees. This sticky nature of passengers has actually helped airlines a lot because defection rates were considerably less than anticipated.

2.4   Southwest's Strategy

The AA vs. DL scenario would play out exactly the same way if we use any other legacy airline: in every case (and also if we increase the number of airlines considered, or the number of pieces of luggage subjected to fees) the equilibrium situation turns out to be the one in which everybody charges as many fees as possible.

It is therefore interesting to analyze the case of the only major airline that did not follow suit: Southwest Airlines (LUV). The following table highlights payoffs to each of these airlines if they were to choose between charging for the 2nd bags.

As one can see, revenue generated from defection is very little compared to the revenue generated from charging baggage fees.

	LUV - no fee	LUV - fee for 2nd checked in bag
AA - no fee	0 , 0	11 , 78
AA - fee for 2nd checked in bag	50, 7	**117,124**

As expected, for both airlines charging for baggage is a dominant strategy, and so the equilibrium in game is that both airlines charge for the baggage. This definitely makes intuitive sense: if everybody else is doing it, why not charging? In fact:

- Passengers would have no alternative but to pay the fee (everybody is doing it)
- Revenue would increase (and this is always good)
- Easy to mask as a form of "a la carte" pricing (your base price appears to be lower)

But LUV has a couple of differences that put them in the position of making a different choice:

- It is profitable, so the choice of charging for baggage would not be dictated by the need of reducing the losses, but only by the tension to grow revenues. In an industry in which everybody is losing money Southwest's shareholders will probably not push too hard to grow revenues, but eventually the strategy still needs to make economic sense.
- LUV has always been positioned in a very peculiar way, with a clear focus on customer care and on not exploiting the passengers

Therefore, they decided to stay in a position that is apparently not an equilibrium, leveraging their profitability and brand to play a more complex strategy.

First of all, they make sure everybody is aware of the strategy they have chosen:

This makes sense from the point of view of LUV's "brand personality". We believe that it is also part of an interesting strategic bet, and that this will help to avoid any push back from the shareholders in the long term.

This is basically a game of LUV vs. LUV over time, where at each step they must choose whether to start charging baggage fees or not:
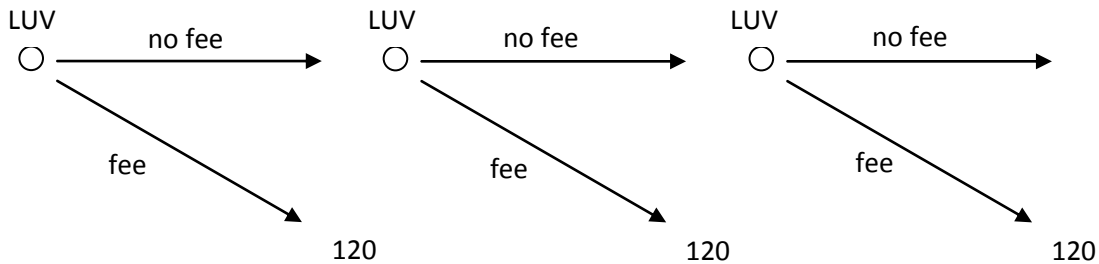
Basically, for every year in which LUV chooses not to introduce the baggage fee, they leave on the table about $120M of incremental revenues just by not charging for the 2nd bag. Not charging fee makes economic sense only if they can in some way collect additional revenues that are in excess of what they are leaving on the table.
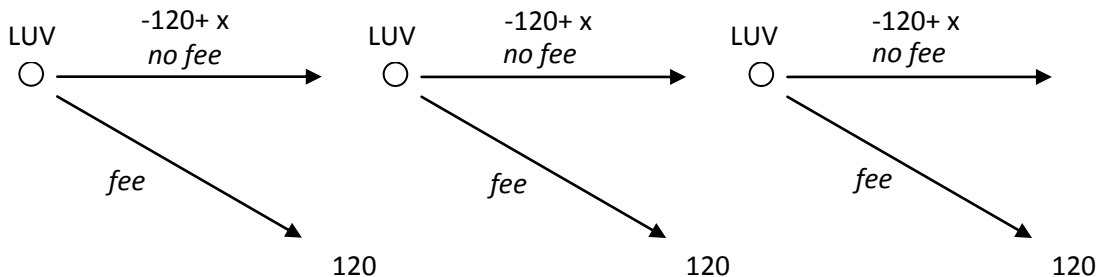
The variable "x" is the additional revenues coming mainly from new passengers that have been lured away from other airlines thanks to the absence of a baggage fee. Now we see clearly what's the objective of the "Bags fly free" campaign. If LUV can convince enough passengers to switch to them from the other airlines _because_ of the absence of a baggage fee, they can increase the relative payoff and make more money than if they had introduced the fee.

Is this strategy working? Apparently yes, LUV has enjoyed an increase in passengers and revenues while all the other companies are still struggling.

Is it sustainable? Probably not. At some point the influx of new passengers will slow down, and the payoffs will revert to those of the original game, with the equilibrium in the "everybody charges a baggage fee" situation. Anyway, if LUV is good enough in retaining at least part of the new passengers that switched in the meantime, they will both amplify the increase in revenues and end up with more customers than at the beginning.

3. Conclusion

Baggage fees introduced by airlines provides for an interesting game theoretic analysis between the various stakeholders. Based on ones goals, each airlines choose certain actions and decides whether to go along with a competitor and play the game or to stay out and follow a different strategy.

While majority of the airlines are benefiting from baggage fees, the success of that initiative is critically dependent on co-operation among the major airlines. If one airline pulls out, the whole program will fall like a house of cards. So far co-operation has been sustained and everyone has been benefiting.

While Southwest has for now decided to stay out of the game, we feel that it is perhaps worse off by not co-operating with others. While it is playing the game of wooing away passengers from other airlines, and only time will tell on how much longer it'll be able to continue forgoing money that is readily available. Or will it be able to pull off a fast one where passengers actually defect reversing the benefits that the other airlines are currently enjoying. How this game plays out remains to be seen, but the odds are stacked against Southwest because they only control about 15% of the market share, not enough to disrupt the entire airline coalition.

4. References

4.1.1   Baggage Handling Operations

Some of the items reflected in the cost of hauling baggage:[14]

- Aircraft fuel used to carry the bag

- Cost of the baggage tags and the scales to weight them

- Ticket agents that have to transfer and route the bags correctly

- Upkeep on the conveyor belt system to transfer it to the cart

- Cost of the baggage cart and the tug to pull it

- Ramp serviceman to load it on the cart

- Tug driver to drive it to the airplane

- The gas, oil, tires and upkeep on the tug

- Ramp servicemen to transfer the bags to the aircraft

- Baggage loading equipment to put the bags in the aircraft

- Insurance to cover lost baggage

4.1.2 2008 Summary Financials (Table A):15

FINANCIAL (millions except stock price)	AA	UAL	DAL	CAL	LUV	NWA	LCC	JBLU	ALK	AAI	FRNT	ALGT
Operating revenue [1]	$21,210	$17,139	$15,529	$12,886	$11,023	$10,903	$9,239	$3,388	$2,921	$2,552	$1,253	$504
Passenger revenue	$18,234	$15,337	$13,767	$11,382	$10,549	$9,386	$8,183	$3,056	$2,644	$2,414	$1,199	$383
Total operating expense [2]	$22,140	$18,766	$15,587	$12,598	$10,574	$12,237	$10,171	$3,279	$2,976	$2,639	$1,392	$448
Operating expense less fuel	$13,986	$11,044	$9,260	$7,693	$6,861	$6,986	$6,553	$1,927	$1,814	$1,444	$827	$219
Wage & benefit total expense (SEC)	$6,044	$4,312	$4,802	$2,850	$3,340	$2,702	$2,231	$694	$759	$475	$279	$72
Wage/salary expense W2 (BTS)	$4,318	$2,991	$2,662	$2,209	$2,502	$1,888	$1,759	$554	$572	$388	$210	$52
Management salaries (general) (BTS)	$68	$18	$43	$87	$169	$101	$33	$18	$10	$23	$15	$5
Pilot wage/salary expense (BTS)[3]	$1,153	$757	$803	$624	$965	$525	$482	$193	$181	$157	$69	$17
Flt Attendant wage/salary exp (BTS) [3]	$795	$530	$435	$432	$408	$262	$282	$65	$81	$58	$29	$10
Fuel & oil	$8,154	$7,722	$6,327	$4,905	$3,713	$5,251	$3,618	$1,352	$1,162	$1,195	$564	$230
Cash & equivalent (unrestricted)	$3,107	$2,039	$2,220	$2,643	$1,803	$2,264	$1,241	$571	$1,077	$335	$69	$175
Total assets	$22,518	$19,461	$28,021	$12,686	$14,308	$20,024	$7,214	$6,023	$4,836	$2,063	$919	$424
Long-term Debt [4]	$6,684	$7,199	$9,461	$5,371	$3,498	$6,769	$3,634	$2,883	$1,596	$957	bk	$39
Operating income (loss) [5]	($930)	($1,627)	($58)	$288	$449	($1,333)	($932)	$109	($56)	($87)	($138)	$56
Operating margin [9] [c]	-4.40%	-9.50%	-0.40%	2.20%	4.10%	-12.20%	-10.10%	3.20%	-1.90%	-3.40%	-11.00%	11.10%
Net profit (loss) (per SEC) [6]	($2,071)	($5,348)	($8,433)	($585)	$178	($5,987)	($2,210)	($76.00)	($136)	($274)	bk	$35
Median stock price [7]	$10.30	$22.10	$11.50	$18.60	$11.90	-	$9.00	$11.50	$19.90	$5.20	bk	$40.10
OPERATIONAL												
ASM's (total)(million)	163,532	135,861	128,976	102,527	103,271	84,450	74,151	32,442	24,218	23,809	11,978	4,442
International ASM's (million)	61,675	58,153	56,341	51,093	-	38,840	16,067	-	-	-	-	-
International % of ASM capacity [c]	37.70%	42.80%	43.70%	49.80%	-	46.00%	21.70%	-	-	-	-	-
RPM's (million)	131,757	110,061	105,698	82,806	73,492	71,646	60,570	26,071	18,712	18,956	9,837	3,863
Load factor	80.60%	81.00%	82.00%	80.80%	71.20%	84.80%	81.70%	80.40%	77.30%	79.60%	82.10%	87.00%
Yield (cents)	13.84	13.89	13.02	13.75	14.35	13.1	13.51	11.72	14.13	12.73	12.19	9.47
PRASM (passenger) (cents)	11.15	11.29	10.67	11.1	10.21	11.11	11.04	9.42	10.92	10.14	10.01	8.63
RASM (operating)(cents) [c]	12.97	12.58	12.04	12.51	10.67	12.91	12.46	10.44	12.06	10.72	10.46	11.35
CASM (cents)	13.87	13.26	12.09	12.29	10.24	14.49	13.72	9.87	12.54	11.02	11.62	10.09
RASM-CASM differential (cents) [c]	-0.9	-0.68	-0.05	0.22	0.43	-1.58	-1.26	0.57	-0.48	-0.3	-1.16	1.26
Passengers boarded (million)	92.771	63.149	71.728	48.682	88.529	53.68	54.82	21.92	16.809	24.619	10.622	4.299
Employees (mainline) BTS [8]	70,923	51,536	47,420	40,630	34,680	29,124	32,683	10,177	9,628	8,259	4,939	1,330
Flight Attendants (mainline) BTS [8]	15,962	13,214	11,742	8,808	7,692	7,298	7,099	1,980	2,329	1,958	916	339
Pilots (mainline) BTS [8]	8,306	6,337	6,391	4,578	5,588	4,345	4,234	1,724	1,361	1,559	641	269
General managers mainline) BTS [13]	53	51	258	48	1,937	42	212	35	12	258	54	10
RPM's per passenger (average one way) [c]	1,420	1,743	1,474	1,701	830	1,335	1,105	1,189	1,113	770	926	899
Aircraft block hours (daily average) (BTS)	6,365	4,772	4,797	3,950	5,853	3,205	3,538	1,694	1,206	1,505	-	212
Aircraft departures (daily average) (BTS)	2,016	1,398	1,455	1,065	3,267	1,119	1,359	563	465	713	277	90
Operating aircraft (SEC)	625	409	434	350	537	319	354	142	110	136	58	38
% of wide body aircraft (2 aisles)	23.30%	27.90%	20.40%	9.40%	-	17.10%	11.80%	-	-	-	-	-
Fleet Age (average mainline in years)	15	13	-	9.4	10.1	-	11.8	3.6	7.3	5.6	4.5	-

4.1.3   2008 Summary Financials (Table B):[16]

	AA	UAUA	DAL	CAL	LUV	NWA	LCC	JBLU	ALK	AAI	FRNT	ALGT
Wage/benefit % of revenue	28.50%	25.20%	30.90%	22.10%	30.30%	24.80%	24.10%	20.50%	26.00%	18.60%	22.30%	14.30%
Management salaries % of total wage W2	1.60%	0.60%	1.60%	3.90%	6.80%	5.40%	1.80%	3.20%	1.80%	5.90%	7.20%	9.60%
Pilot wage/salary % of total wage W2	26.70%	25.30%	30.20%	28.20%	38.60%	27.80%	27.40%	34.90%	31.60%	40.50%	32.90%	33.60%
FA wage/salary % of total wage W2	18.40%	17.70%	16.30%	19.60%	16.30%	13.90%	16.00%	11.80%	14.20%	15.00%	13.60%	19.90%
Fuel expense % of revenue	38.40%	45.10%	40.70%	38.10%	33.70%	48.20%	39.20%	39.90%	39.80%	46.80%	45.00%	45.60%
Cash & equiv % of revenue	14.60%	11.90%	14.30%	20.50%	16.40%	20.80%	13.40%	16.90%	36.90%	13.10%	5.50%	34.70%
Long-term Debt % of revenue	31.50%	42.00%	60.90%	41.70%	31.70%	62.10%	39.30%	85.10%	54.70%	37.50%	b/k	7.80%
Long-term Debt % of assets [4]	29.70%	37.00%	33.80%	42.30%	24.40%	33.80%	50.40%	47.90%	33.00%	46.40%	b/k	9.30%
Revenue per aircraft (x 100,000)	$339.40	$419.00	$357.80	$368.20	$205.30	$341.80	$261.00	$238.60	$265.50	$187.70	$216.10	$132.60
Revenue per employee (x 1,000)	$299.10	$332.60	$327.50	$317.20	$317.80	374.4	$282.70	$332.90	$303.30	$309.10	$253.70	$379.00
Revenue/flight attendant (x 10,000)	$132.90	$129.70	$132.30	$146.30	$143.30	149.4	$130.10	$171.10	$125.40	$130.40	$136.80	$148.70
Revenue per pilot (x 10,000)	$255.40	$270.50	$243.00	$281.50	$197.30	250.9	$218.20	$196.50	$214.60	$163.70	$195.50	$187.40
ASM's per aircraft (million)	261.7	332.2	297.2	292.9	192.3	264.7	209.5	228.5	220.2	175.1	206.5	116.9
ASM's per employee (x 10,000)	230.6	263.6	272	252.3	297.8	290	226.9	318.8	251.5	288.3	242.5	334
ASM's per flight attendant (x 100,000)	102.5	102.8	109.8	116.4	134.3	115.7	104.5	163.8	104	121.6	130.8	131
ASM's per pilot (x 100,000)	196.9	214.4	201.8	224	184.8	194.4	175.1	188.2	177.9	152.7	186.9	165.1
Employees per aircraft (x 10)	11.3	12.6	10.9	11.6	6.5	9.1	9.2	7.2	8.8	6.1	8.5	3.5
Flight attendants per aircraft	25.5	32.3	27.1	25.2	14.3	22.9	20.1	13.9	21.2	14.4	15.8	8.9
Pilots per aircraft	13.3	15.5	14.7	13.1	10.4	13.6	12	12.1	12.4	11.5	11.1	7.1
Fuel expense per ASM (cents)	4.99	5.68	4.91	4.78	3.6	6.22	4.88	4.17	4.8	5.02	4.71	5.17
Salary/benefits per employee (average)	$85,219	$83,670	$101,265	$70,145	$96,309	$92,778	$68,262	$68,193	$78,781	$57,500	$56,480	$54,141
Employee wage/salary (average)	$60,884	$58,044	$56,138	$54,362	$72,132	$64,842	$53,811	$54,411	$59,364	$47,014	$42,438	$39,105
Employee benefit percentage (average)	40.00%	44.10%	80.40%	29.00%	33.50%	43.10%	26.90%	25.30%	32.70%	22.30%	33.10%	38.50%
Flight attendant % of employees	22.50%	25.60%	24.80%	21.70%	22.20%	25.10%	21.70%	19.50%	24.20%	23.70%	18.50%	25.50%
Pilot % of employees	11.70%	12.30%	13.50%	11.30%	16.10%	14.90%	13.00%	16.90%	14.10%	18.90%	13.00%	20.20%
Passengers per employee (average)	1,308	1,225	1,513	1,198	2,553	1,843	1,677	2,154	1,746	2,981	2,151	3,232
Passengers per flight attendant (x 10)(average)	581	478	611	553	1,151	736	772	1,107	722	1,257	1,160	1,268
Passenger fare (average one way)[10]	$196.55	$242.87	$191.93	$233.80	$119.16	$174.85	$149.27	$139.42	$157.28	$98.04	$112.86	$89.21
Operating expense per pass less labor & fuel	$85.61	$106.61	$62.16	$99.48	$39.77	$79.80	$78.84	$56.25	$62.78	$39.38	$51.61	$34.08
Fuel expense per passenger (o/w)	$87.89	$122.28	$88.20	$100.76	$41.94	$97.83	$66.00	$61.68	$69.15	$48.54	$53.13	$53.42
Labor cost per passenger (o/w)	$65.15	$68.28	$66.95	$58.54	$37.73	$50.34	$40.70	$31.66	$45.12	$19.29	$26.26	$16.75
Management salary % of average o/w fare	0.38%	0.12%	0.31%	0.76%	1.60%	1.08%	0.40%	0.58%	0.38%	0.95%	1.26%	1.31%
Pilot wage/salary % of average o/w fare	6.30%	4.90%	5.80%	5.50%	9.20%	5.60%	5.90%	6.30%	6.80%	6.50%	5.80%	4.60%
FA wage/salary % average o/w fare	4.40%	3.50%	3.20%	3.80%	3.90%	2.80%	3.40%	2.10%	3.10%	2.40%	2.40%	2.70%
Operating income (loss) per pass (avg o/w) [11]	($10.02)	($25.76)	($0.81)	$5.92	$5.07	($24.84)	($17.00)	$4.97	($3.31)	($3.53)	($13.03)	$12.99

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