Low Cost Carriers: How Are They Changing the Market Dynamics of the U.S. Airline Industry?

by Erfan Chowdhury

An Honours essay submitted to Carleton University in fulfillment of the requirements for the course ECON 4908, as credit toward the degree of Bachelor of Arts with Honours in Economics.

Department of Economics
Carleton University

Ottawa, Ontario

April 26, 2007

Abstract:

The year 1978 was a landmark year for the airline industry. It was the year the airline deregulation was introduced in the United States. Following the deregulation, many airlines set up operation across the country and started to challenge the dominance of traditional full service carriers (FSC) which translated to better service and lower fares for the consumers. However, the initial success of deregulation was short lived and by the late 1980's most of the newly formed airlines either went out of business or was purchased by their FSC rivals.

In spite of this, by the mid 1990's, a new breed of airlines called low cost carriers (LCC) started to challenge the dominance of full service carriers in the short haul market. The LCCs did not provide any frills such as meals or in-flight-entertainment, but offered ultra low fares on short haul point to point routes.

Today, LCCs have a strong presence in every market segment across the U.S with one third share of the domestic air travel market.. This paper will study how the LCC's are winning the battle against the full service carriers and how the strong presence of LCCs has impacted the U.S. air travel industry.

This paper will consist of two parts. The first will examine the LCC business model and analyze the reasons behind their slow but steady success. In addition, the first part will also analyze how low cost carriers are impacting various areas of airline operation including pricing, efficiency, cost structure and employee compensation.

The second part of this paper will analyze the practice of price decimation in the air travel industry and the impact the growth of low cost carriers have on price discrimination.

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Part One:

Why full service carriers are losing the war against low cost carriers?

An analytical overview.

A brief history of low cost carriers In the United States

In the post World War II period, commercial air travel in the United States was heavily regulated by the federal government. As a result, the nation was reliant on a few leading airline companies. Competition was permitted only within individual states. California and Texas were the only two states that had both the geographical and demographic advantage (in terms of population) to make air travel attractive.

In 1949, Kenny Friedkin leased a war surplus DC-3 and converted it to fly passengers. On its first flight the DC-3 departed San Diego for Oakland with a stopover in Burbank as Pacific Southwest Airlines (PSA). PSA was the world's first low cost carrier, it offered low fare and friendly service on short haul routes within the state of California. (Calder, 2003, p.32) PSA successfully competed with much larger rivals like Western (now part of Delta) and United airlines for decades. However, it was just the first step in a long and difficult journey which established low cost carriers as major players in the air travel industry.

In early 1968, The Texas Aeronautics Commission approved Southwest Airlines application to fly between Dallas, Houston and San Antonio. Its founders studied the business model of PSA and concluded that a similar concept could work well in Texas, which is much bigger than California in terms of size. However, Southwest Airlines had to fight its rivals in a legal battle before they were permitted to fly in Texas. Its competitors (Braniff, Continental and Trans-Texus)

filed lawsuits against Southwest Airlines which forced the Texas Aeronautics Commission to suspend Southwest Airline's "certificate to fly". (Calder, 2003, pp 34) The competitors argued that there was not enough demand to support a new airline in Texas. Southwest Airline had to go all the way to the Federal Supreme Court in Washington to regain its certificate to fly. Finally on June 18th 1971, Southwest Airlines' first flight departed from Dallas Love Field Airport. Today, Southwest Airline is not only the largest domestic airline in the United states, but it is also the world's largest and most profitable low cost carrier.

Even though the LCC's had an early start, their growth has been incredibly slow in the domestic market. Until the deregulation in 1978, there were only three low cost scheduled carriers in the United States - PSA, Air California and Southwest Airlines. After the deregulation, PSA and Air California pursued a rapid expansion policy but they became involved in intense airfare wars with their larger rivals. By 1986, both PSA and Air California (now renamed AirCal) were acquired by the U.S. Airways and American Airlines respectively. On the other hand, Southwest Airlines followed a very cautious expansion plan for the post deregulation period, thus avoiding the calamitous over expansion of many of the new start up carriers of the 1980's.

One of the most successful but short-lived low cost airlines in the post deregulation era was People's Express. People's Express was launched from an abandoned airport terminal in Newark Airport in New Jersey. The airline had a

very simple fare structure. All seats on a given route were offered at the same price, with slight differences between "Peak" and "Off-Peak" fares. Initially the airline was very successful with its one low fare strategy and within two years started flying packed Boeing 747's across the Atlantic. But the airline became a victim of its own growth. In order to finance its growth, the Airline acquired massive debt. In addition, traditional full service carriers introduced computerized yield management systems which enabled them to match People's Express's fares on competing routes. In a desperate attempt to restructure the airline, the management moved away from its original low cost business model and changed the airline into a full service carrier. But the restructuring was a failure. Burdened with high debt load and unable to compete effectively with other full service carriers, People's Express was sold to Texas Air Corp (parent company of Eastern and continental airlines) and its operations were merged into Continental airlines in 1987. (Heppenheimer, 1995)

It was not until the mid 1990's that the LCCs started to see an unprecedented growth rate both in the U.S. and around the world. Following the footsteps of Southwest Airlines, a new generation of well-planned and well financed low cost carriers started to set up large scale operations across the country. The most successful ones are Frontier Airlines in Denver (1994), ValueJet in Atlanta (1996), JetBlue in New-York (2000). Southwest itself undertook a major expansion plan in the early 1990's, spreading into Chicago (1990), Salt Lake City (1993) and Florida (1996). (Ito *&* Lee*,* 2003, April, p.4) According to The

International Air Transport Association(IATA), in 2006 the low cost carriers have a market share of 30% in the United States, compared to 7% in 1990.

The LCC Business Model:

The modern LCC business model was pioneered by Southwest Airlines in the early 1970's. Table 1 gives an overview of the LCC business model. Table 1 gives a comparison of the LCC and FSC business models.

Table1: The Comparison of Low Cost Carrier business model and traditional airlines

	Traditional Airlines	**Low Cost Airlines.**
Product Features		
Fare structure	Multiple fare structures with various restrictions.	Simplified fare structure.
Distribution	Low direct sales, high dependency on travel agents.	High direct sales and low dependency on travel agents.
Route structure	High frequency Hub and Spoke route structure.	High frequency Point to Point route structure.
Seating	Multiple classes with mixed seating density (Economy/Business/First). Pre assigned seating.	Single class high density seating, unreserved seating.
In flight	Hot meals and in-flight entertainment.	No hot meals. Snacks and light beverages only, no in-flight-entertainment
Frequent flyer	Frequent flyer program.	No frequent flyer program
Operating features		
Aircraft	Multiple aircraft types and low utilization of aircraft (9 hours/day)	Single Aircraft type, high utilization rate (12 hours per day)
Trip Length	Medium to long	Short to medium.
Airport	Primary airport with major international connections.	Secondary/uncongested which facilitates fast turnaround of aircraft.
Staff	High wage but low productivity. No profit sharing.	Competitive wage, profit sharing plan and highly productive employees

As shown in Table 1, Southwest Airlines' low cost business model was based on simplicity and high productivity. Everything from fare structure to the seating arrangement was simplified to reduce cost and increase productivity.

However, over the last thirty years, a large number of FSCs have adopted features from the LCC business model. Almost all the full service carriers have eliminated hot meals for flights within continental North America. They have also

simplified their fare structure and implemented profit sharing plan for employees (Delta). Some of the FSCs have introduced their own low cost airline (Ted, Song).

Low cost carriers have also adopted features from the full service carriers in order to differentiate their products including but not limited to: Frequent flyer programs (Southwest); hub and spoke network systems (AirTran); in-flight entertainment (Frontier); and multiple aircraft type (JetBlue).

However, if we analyze the business strategies of full service and low cost carriers, one trend becomes very clear. Most of the full service carriers have borrowed features from the LCC business model to downgrade their product offering (elimination of hot meals) in an effort to reduce cost. Conversely, low cost carriers have introduced features (frequent flyer programs, in-flight entertainment) from full service carriers to upgrade their product offerings. As a result, over the last three decades, the line between low cost carriers and full service carriers has diminished substantially in terms of product offerings. However, low cost carriers still have substantial cost advantages over their full service counterparts while offering very similar products. Although the product offering between the LCCs and FSCs has diminished, the full service carriers have failed to reduce the cost gap with their full service counterparts.

Table 2 compares the operating cost of Boeing 737 aircraft by various U.S. Airlines as of 1999. As shown in Table 2, Southwest Airlines had a much higher aircraft utilization rate and higher seat density per aircraft which gave Southwest Airlines a significant cost advantage (up to 56%).

Table 2: Direct operating cost of Boeing 737 aircraft

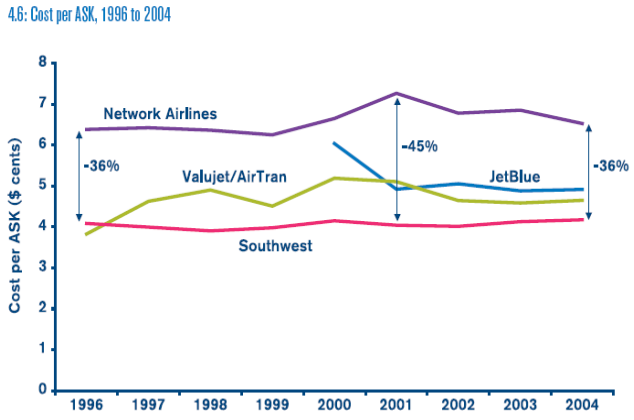
Airline	Cost Per Seat Mile (US$)	Index (Cost)	Average Sector Length	Utilization Hours	Seats Per Aircraft	Seat (Index)
Delta	5.54	100	708	9.8	126	98%
United	5.20	94	660	10.32	128	100%
U.S. Airways	5.04	91	698	10	126	98%
Continental	4.28	77	1007	10.55	129	101%
American West	3.91	71	701	11.85	131	102%
Southwest	3.10	56	468	11.31	137	107%

Direct Operating cost only
(Fuel, labour cost of flying, all maintains costs, aircraft depreciation and rentals.)
Source: Doganis, 2001, p. 131

However, the data used on Table 2 reflected the fact that full service carriers offered Premium service, which had a much higher cost base. After September 11, 2001, almost all the full service carriers substantially reduced their labour costs through restructuring. The International Air Transportation Association (IATA) published a study in July 2006, entitled “Airline Cost Performance”. The study analyzed the cost base of leading full service airlines versus no-frills, low-cost airlines. According to the study, major restructuring among the U.S. full service carriers has caused a reduction in their unit costs by over 10% between 2001 and 2004. Furthermore, there was a 17% reduction in non-fuel operating costs over the same period.

Despite these costs savings, the full service carries were unable to reduce the cost gap with the low cost airlines. In 2004 Southwest Airlines enjoyed a sizeable cost gap of 36% with its' full service counterparts, which was virtually the same as in 1996. Most of these costs savings were attributed to Southwest Airlines' lower fuel costs thanks to its oil hedging strategy which was implemented in 1998. The study also found that JetBlue (25%) and AirTran (29%) have also managed to maintain a significant cost gap with the full service carriers over the last four years without any fuel hedging.

Figure1: The cost gap between LCC's and FSC's after adjusting for average stage lengths and aircraft seat density.



Source: Pearce & Smyth, July, 2006.

LCC business model: The source of savings

Since the low cost carriers have a much lower cost base but offer a product similar to the full service carriers, there have been a few misconceptions about the employee compensation of low cost carriers among the general population and the media. The most common misconceptions are that low cost carriers do not have unionized employees and that Low cost carriers offer substantially lower salaries to their employees compared to their full service counterparts. These misconceptions are far from reality. Most of the major low cost carriers in America are unionized with some exceptions (Jet blue). However, unlike the full service carriers, low cost carriers have a very healthy relationship with their unions.

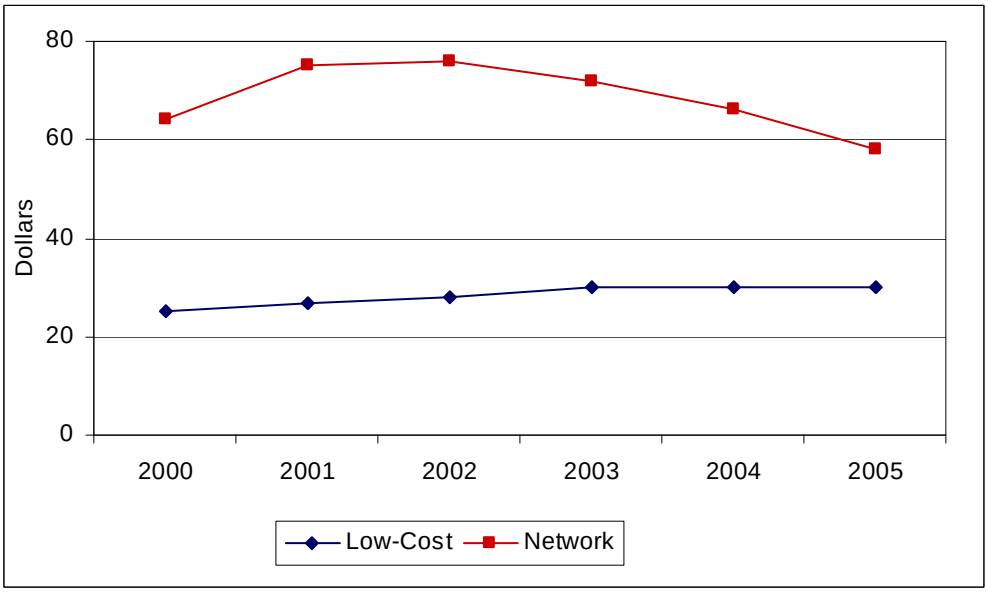
On the salary front, employees of low cost carriers earn almost as much as their full service counterparts. Table 3 compares the hourly salaries of pilots of low cost and full services carriers. As shown in Table 3, the mean salary is almost the same among full service and low cost carriers. American has the highest salary among the full service carriers because they did not go through a restructuring process after 9/11. Overall, Southwest has the highest pay rate among any airline in America.

Table 3: Pilots' compensation (in U.S. dollars) of full service and low cost carriers*.				
		Captain	**Co-Pilot**	**Average**
Full Service Carrier				
	American	150.64	95.36	123
	United	124.73	79.55	102.14
	Continental	137.91	84.27	111.09
	Delta	129.73	85.29	107.51
Average salary for full service carrier pilots				**110.94**
Low Cost Carrier				
	JetBlue	125.82	70.91	98.365
	Southwest	187.18	118	152.59
	Spirit	117.36	65.55	91.455
	AirTran	127.64	72.9	100.27
Average salary for low cost carrier's pilots				**110.67**
*Captains' and co-pilots' salary is the mean hourly salary (pilot's flying domestic narrow body aircraft(130-180seat)). Pilots' compensation varies depending on their experience and flying hours. The range of pilot experience varies between two and twelve years for this data set. **Source:** Airline Pilot Central.				

Other than Southwest Airlines, the base salary of LCC pilots is slightly lower than their full service counterparts. However, if profit sharing and stock options are added to the equation, the LCC pilot compensation would be higher than full service carriers.

Despite having a similar salary structure, the labour cost for each unit of output is lower on LCC's compared to full time carriers. Figure 1.1 provides employee compensation cost per enplanement for both low cost and full service carriers.

Figure 1.1: Average Annual Full-Time Equivalent Employee Compensation Per Enplanement



Source: Bureau of Transportation Statistics, Airline Financial Data.

Data on Table 3 and on Figure 1.1 suggests that employees of LCCs are much more productive than their FSC counterparts. However, since, 2002, the labour FSCs have significantly reduced their labour costs.

If it is not employee compensation, how do the low cost carriers achieve such a low cost base? The answer is efficiency. Low cost carriers are very efficient at using their resources. Table 4 indicates the major operational areas where low cost carriers achieved their savings. Data for this Table was collected from the IATA study “Airline Cost Performance”.

Table 4: Cost Advantage of Low Cost Carriers:			
		Cost saving by LCC's Seat /km(%)	**Cost per Seat kilometer**
Cost per seat km for full Service carrier			**6.96**
Cost per seat km for LCC			
	Higher seat density	0.40 (5.7%)	6.53
	Aircraft ownership/fuel	0.47 (6.8%)	6.06
	Lower salary/expenses	0.20 (2.9%)	5.86
	Infrastructure	0.47 (6.8%)	5.39
	Product distribution/overhead	0.87 (12.5%)	**4.52**
Full service Airline: American, United, Delta. Low Cost Airline: Southwest, Airtran and JetBlue. **Source**: Pearce & Smyth, 2006.			

As shown in Table 4, distribution, passenger service and other related costs account for the largest share of the cost gap (12.5%). These savings are achieved by increasing direct sales, efficient design of route network (point-to-point service) and through a reduction in overhead cost.

The second biggest cost saving is achieved in the area of aircraft ownership and fuel costs (6.8%). The LCCs have a lower average fleet age (fuel efficient aircraft) and higher rates of aircraft utilization (in terms of hours flown per day) than the average for the full service airlines. LCCs use only one type of aircraft, which also reduces operational, maintenance and training costs.

Infrastructure is as important a source of cost saving. ownership/fuel (6.8%). Most of the saving in this area is achieved by utilizing secondary airports with lower landing fees. Some saving is also achieved by increasing seat density (5.7%). The lowest savings is achieved in the area of salary/expenses(2.9%).

This largely reflects differences in labour productivity rather than basic wage rates.

Cost advantage achieved in one area through operational efficiency may amplify savings in other areas. For example, eliminating hot meals only saves about $15 or so per passenger, per flight. However, this also facilitates faster turnaround of aircraft, replacement of aircraft kitchen with revenue-earning seats and a reduction of number of flight attendants. When all these changes are implemented, not only is cost per seat mile is reduced substantially but revenue also increases.

The Response of full service carriers to counter the threat of LCCs

After the deregulation, existing low cost carriers have become a major threat to full service carriers. Almost all the existing and newly established carriers (except Southwest Airlines) started to grow rapidly and became a major threat to full service carriers. To counter the threat of LCC's, the full service carriers designed sophisticated revenue management software to separate leisure passengers from business travelers which enabled them to optimize revenue from every passenger. American Airlines was the first full service airline to implement revenue management systems which was soon replicated by every other full service carriers (Smith, Leimkuhler & Darrow, 1992). This strategy of price discrimination became a very effective tool in the fight against the LCCs. By 1987, most of the major low cost carriers were bought up by the full service carriers (PSA, AirCal, People's Express).

However, in the 1990's, the full service carriers adopted a more aggressive strategy to compete with new market entries. Almost all the full service carriers designed a hub and spoke route systems. Dozens of hub airports were developed across the U.S. Each hub airport was dominated by one or more full service carriers. FSCs vigorously defended the market share of their respective hubs. If a new entrant started to operate from a full service carrier's hub, the dominating carrier responded by matching fares offered by the new entrant carrier on a large portion of its seats. In addition, the dominating carriers often added additional flight frequencies or used larger aircraft on routes entered by

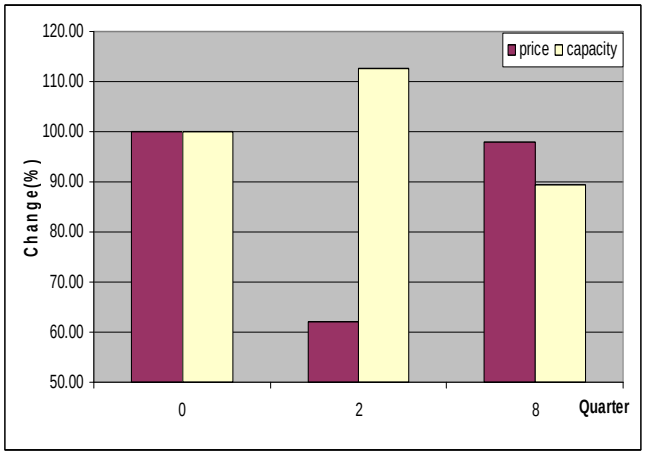
low cost carriers to keep the load factor of the new entrant at an unattainable level. (OsterJr. & Strong, 2001)

A paper commissioned for the Transportation Research Board entitled “Entry and Competition in the U.S. Airline Industry”, examined patterns of market entry and exit by various airlines. The report examined twelve occasions in which a new entrant established operations in a hub airport dominated by one or more full service carriers during the period between 1994 and 1996. The report found that if a new entrant started to operate from a full service carrier’s hub, the full service carrier responded by reducing their fares by an average of 62% and increased their capacity by 13% in competing routes. In six out of twelve cases examined, new entrant exited the market within two years of starting operation.

After the exit of the entrant, dominating carrier have increased their fare by 69% and reduced capacity by 10%. (Shown in Figure 2)

This practice by full service carriers made it very difficult for new carriers to establish operation on hub airports across the country.

Figure2: Price and capacity adjustment of full service carriers in response to a new entrant’s entry to their dominating hub.



“0” quarter shows benchmark fare & capacity of dominating carrier one quarter before competition’s market entry.
“2” quarter shows fare & capacity adjustmet of the dominating carrier two quarter after competition’s market entry.
“8” quarter shows fare & capacity adjustment of dominating carrier if the new entrant exited the market within two years of entry.
Source: Meyer, 1999, p. 90-91

According to the Department of Transport, between 1989 and 1996, 70 carriers applied to get an air carrier's license for scheduled passenger service in the United States, an average of 8.75 per year during a time when the U.S aviation industry lost record amount of money. However, during the period of the aviation boom (1997-2000) there were only 17 applications with an average of 4.25 per year. The decline in entry applications may, in part, be due to the perceptions of both investors and prospective new entrants about the nature of likely entry responses from the dominant full service carriers. It is important to note that the applications appear to resume in 1999, following the announcement that Department of Transportation was in the process of reviewing competitive practices in the industry and the filing of an antitrust suit by the Department of Justice against a network carrier's alleged predatory conduct. (Oster & Strong , 2001, p.16)

As shown in Figure 2, the practice of fare reduction and capacity expansion in response to competition from new entrant airline was fairly common among the FSCs in United States in the 1990's. Even though this practice may be considered as anti-competitive, the Department of Justice was not very active against this kind of practice until the late 1990's. In 1998 the Department of justice filed a complaint against American Airlines for anti-competitive behavior at its Dallas Forth Worth hub. However, the department of Justice lost the case

against American Airlines implying that the courts did not agree that responses of FSCs to new entry were predatory or anti-competitive.

In response to full service carriers' aggressive responses to restrict entry at their respective hub airports, a new generation of well planned and well financed LCCs started to set up large scale operations across the country. Among them were Frontier Airlines (1994), ValueJet/Airtran (1993) and JetBlue (2000). All of them grew very rapidly. In addition, existing low cost carriers such as Southwest Airlines started to execute very aggressive growth strategy. As a result, traditional strategy practiced by full service carriers to prevent LCC's market entry (fare reduction /capacity expansion) became ineffective. In response, the full service carriers concentrated on reducing their cost structure in order to be competitive. Unfortunately, the aviation market in the U.S. entered a positive business cycle, and most of the full service carriers returned to profitability by the mid 1990's and this prevented the unions from give any wage concessions. Unable to cut their overall cost structure, the full service airlines responded by starting their own low cost subsidiaries.

United Airlines was the first full service carrier to try this strategy when it started United Shuttle in October 1994. United shuttle was designed to compete with Southwest Airlines in California as well as to provide feeder service in United Airline's three western hubs: Denver, San Francisco, and Los Angeles.

In October 1996, Delta established low cost subsidiary Delta Express. Delta Express provided point to point service between Florida and Northeast by passing its hub in Atlanta. Delta Express was launched to counter the threat from Valuejet/Airtran.

Metro Jet was the low cost subsidiary of U.S. Airways, which started operations in 1998. The goal of Metrojet has been to help U.S. Airways compete against Southwest Airlines, which had entered many U.S. Airways markets on the east coast.

These subsidiaries were a defensive response by full service carriers to counter the threat of LCCs. They operated a single fleet type, offered low cost point to point service and utilized secondary airports. Almost all the subsidiaries flew primarily hub over-flight routes to predominately lower-yield, leisure markets, where the full service carriers were particularly vulnerable to entry by low-cost carriers. These low cost subsidiaries reduced the market penetration and profit potential for low-cost, low-fare, new-entrant airlines. By avoiding service to the dominant hubs, the subsidiaries could contain the threat while having minimal impact on full service carrier's ability to use their market power in these hubs. (OsterJr. & Strong, 2001, p.16)

However, the subsidiaries had some major limitations. Union contracts limited the growth of subsidiaries. Even though the cost base of subsidiaries was lower than

full service carriers, they were still considerably higher than traditional LCCs. Metro Jet and United Shuttle closed their operation soon after September 11, 2001, where Delta Express was replaced by Song in 2003.

Despite best efforts by full service carriers to limit the growth of LCC carriers, the LCC's have grown their market shares substantially during the 1990's. Between 1990 and 2002, low cost carriers in the United States not only maintained their profitability, but also increased their domestic market share from 7% to almost 23.7%. Table 5 provides detailed data on LCC market share in the U.S.

Table 5: The growth of LCC carrier in the 1990's.

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
AirTran†				0.0	0.6	1.4	1.0	0.9	1.2	1.3	1.5	1.6	1.9
ATA	0.1	0.1	0.1	0.4	0.7	1.0	0.9	0.8	1.1	1.2	1.3	1.6	1.9
Frontier					0.0	0.2	0.3	0.3	0.3	0.5	0.6	0.6	0.8
JetBlue											0.3	0.8	1.3
Southwest	7.0	8.2	9.6	11.3	12.7	13.6	14.1	13.8	13.8	14.3	14.9	16.2	15.8
Other LCCs			0.2	1.9	2.4	2.3	2.8	2.4	2.2	2.2	2.0	2.1	2.0
Total LCCs	7.0	8.3	10.0	13.7	16.3	18.4	19.0	18.2	18.5	19.4	20.6	22.9	23.7
Alaska	1.8	1.9	1.9	2.0	2.6	2.9	3.1	3.0	3.1	3.0	2.9	3.0	3.2
America West	3.8	4.3	3.6	3.4	3.3	3.4	3.3	3.3	3.2	3.2	3.4	3.6	3.8
American	14.8	15.3	16.2	14.7	12.7	11.5	11.0	10.7	10.8	10.4	10.9	10.8	14.1
Continental	6.8	7.4	7.4	7.3	8.3	7.2	6.5	6.6	7.0	6.9	6.7	6.9	6.8
Delta	12.6	15.0	15.5	15.0	14.8	13.4	14.8	15.7	16.2	15.9	16.1	15.2	16.0
Northwest	7.1	7.3	7.5	7.3	7.1	7.4	7.5	7.6	7.0	7.6	7.6	7.6	7.6
TWA*	3.9	3.8	4.1	3.6	3.6	3.6	3.5	3.6	3.9	3.8	3.8	3.2	
United	11.5	12.8	12.7	11.8	11.2	11.9	11.9	12.1	13.2	12.7	11.7	11.0	10.2
US Airways	14.0	13.1	12.4	11.8	12.3	10.7	10.1	10.7	10.7	10.2	10.4	10.3	9.6
Other Carriers	16.6	10.8	8.8	9.5	7.7	9.7	9.2	8.7	6.6	6.9	5.9	5.6	5.1
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

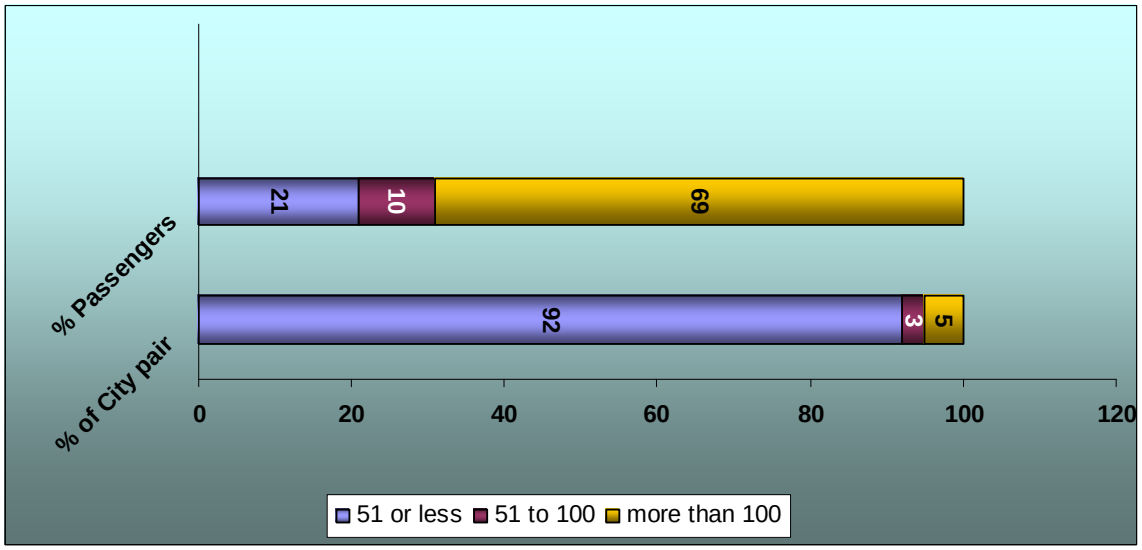
*Acquired by AMR Corporation in 2001. †Data for AirTran and ValuJet combined.

Source: Ito & Lee, 2003, April, p 4.

As shown on Table 5, by the late 90's LCCs had captured one fifth of the domestic market, which gave them critical mass they needed wage full fledge war against the full service carriers. Full service carriers were forced in to defensive mode in the battle against the low cost carriers.

According to a recent research paper (Deimler & Koehler, 2006) among the 50,000 city pairs in the United states, only 8 percent generate enough traffic between them to warrant point-to-point flights. The remaining 92 percent are served by connecting flights through hub-and-spoke networks. However, the traffic of the 8 percent portion of the city pairs accounts for nearly 80 percent of all airline traffic. The LCC's formulated this information into their route planning strategy and developed a very efficient point-to-point route network. In 2000, about 48% of all passengers could choose to fly on an LCC on a given route. By 2007, that number is expected to reach nearly 80 percent.

Figure 3: Market dynamics of U.S. air travel industry



- **Only 5% of the City pairs generate enough traffic (more than 100 per day) to served by narrow body jets. These city pairs accounts for 69% of the total domestic market share.**
- **About 3% of the city pairs generate enough traffic (between 51 and 100) to served by regional jets or turboprop aircraft.**
- **92% of the city pairs do not have sufficient traffic (51 or less per day) for direct service, and requires connecting flight though hub.**

Source: Deimler & Koehler, 2006

The impact of September eleven on low cost carriers:

There is no debate that the events of September 11, 2001 forced the U.S. Airline industry into a deep recession. After 9/11, instead of fighting low cost competition, full service carriers threw in the towel and aggressively cut their domestic operations in order to cut losses and reduce their cost base. However, in the process, they have made some strategic errors that the low cost carriers skillfully used to their advantage.

Most of the low cost carriers emerged from 9/11 as strong and resilient, whereas most of the full service carriers came out as weak and even confronted bankruptcy. The airlines in United States cut their flights by an average of 20 percent and laid off an average of 16 percent of their workforce in the weeks following the attacks of September eleven. These layoffs can have negative implications for organizational performance. Most organizations, for example, experience deteriorating profitability, product and service quality, innovation, and organizational climate after downsizing. Continental and American Airlines had the least layoff rates among the major full service carriers, and their actual layoffs were much lower than their original announcement following September 11. On the other hand, U.S. Airways laid off 20% of its workforce, which was highest in the industry. (Cameron, Gittell & Lim, 2005). The negative correlation between layoffs and organizational performance is quite clear in the post 9/11 airline industry. Continental and American airlines were the only two major full service carriers that did not have to go through bankruptcy in the post 9/11 era. On the other hand, after implementing those layoffs, U.S. Airways had to go thought

bankruptcy twice before being bought up by low cost carrier America West in 2006. Southwest Airlines is the only airline in the U.S. which made an operating profit during 2001 and it is also one of the few airlines that did not lay off any employees in response to 9/11.

In addition to layoffs, most of the full service carriers were forced to withdraw aircraft from their active fleet and put them into temporary storage as well as deferred delivery of new aircraft. As a result, the cost of owning/leasing aircraft was reduced substantially. The low cost carriers took advantage of this price reduction and placed massive orders for new aircraft (JetBlue, AirTran).

Various large airports in the United States implemented major expansion plans in the 1990's (Denver, San Francisco) to meet the projected demand for air travel. However, as the full service carriers reduced their capacity to cut losses, financially strong LCC's quickly moved in and took over various airport assets (terminal buildings, gates, hangers) in larger hub airports. this enabled the LCCs to break the monopoly of dominant carriers at various hub airports across the country. (JetBlue at JFK, Frontier at Denver)

According to the (U.S)Bureau of Transportation Statistics, the cost of aviation fuel in the U.S. increased two and half times from 77 cents a gallon to 193 cents a gallon between 2001 and 2006. Airlines across the world introduced fuel surcharges to cover the extra cost of fuel. In order to reduce the exposure to fuel

price fluctuations, Southwest started to heavily hedge its fuel cost in 1998 when prices were very low. Thanks to its fuel hedging strategy, Southwest stared to

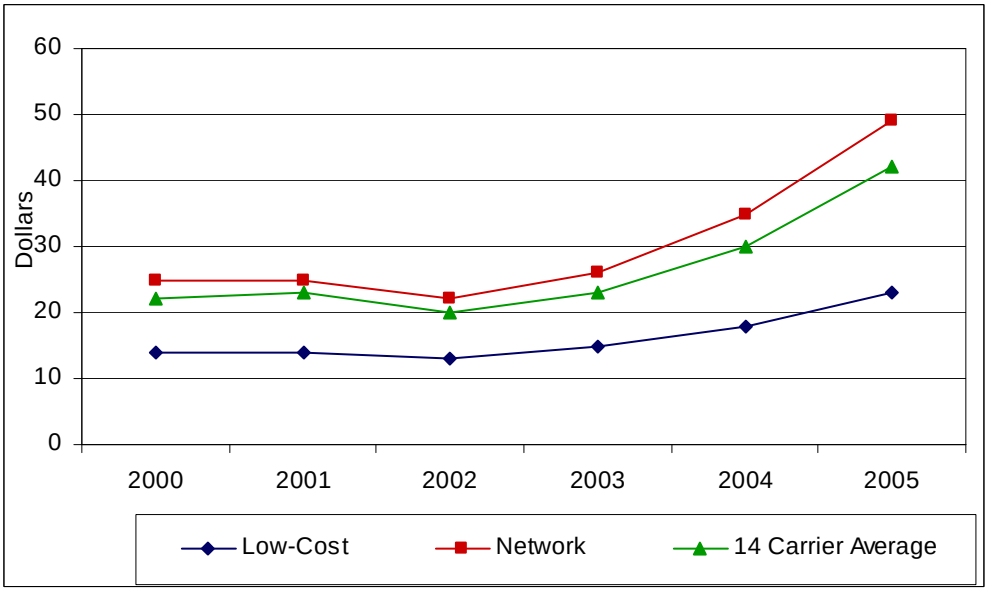
Figure 3.1: Percentage of fuel costs hedged for 2004

Airline	Q2	Q3	Q4
AirTran	25%	10%	10%
Alaska	40%	30%	31%
American	16%	6%	6%
America West	35%	20%	10%
Continental	80%	45%	45%
Delta	0%	0%	0%
JetBlue	44%	40%	40%
Northwest	0%	0%	0%
Southwest	80%	80%	80%

Source: Marsh, 2004, p. 50

save substantial amount of money in its fuel bill compared to any other airlines when the fuel started to raise in 2003 (Marsh, 2004). Southwest passed on these saving to their customers in the form of lower ticket price. Almost all the carriers (both FSCs and LCCs) were forced to reduce or match their fare on routers where they competed with Southwest Airlines. This had a ripple effect on the entire industry and U.S. domestic airfare went down about 4.5% in the first quarter of 2005 compared to the same period in 2004, while fuel cost rose by 43% (Bureau of Transportation Statistics).

Figure 4: Fuel Cost per Enplanement



Source: Bureau of Transportation Statistics, Form 41 Airline Financial Data and T-100 Segment Data

The low cost carriers (other than Southwest) and full service carriers (network carriers) paid similar price for fuel. But since Southwest's fuel costs were much lower and it much bigger in size than any other low cost carrier, it brought down the total LCC fuel cost.

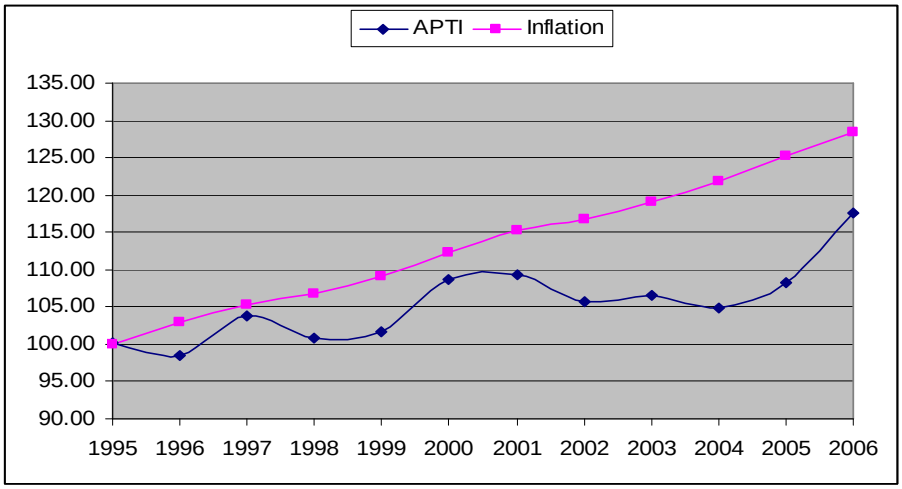
As a result, most of the carriers in the U.S had an operating loss which included low cost carriers like JetBlue and Frontier airlines. This made the recovery process for full service carriers very difficult and left them with very weak balance sheets.

Due to these strategic errors made by full service carriers, 9/11 benefited most of the low cost carriers. LCC carriers as a group have increased their market share by 2% a year in the five years following 9/11. The rate market share growth was only about 1% a year in the previous decade (Bureau of Transportation Statistics). Full service carriers have made little progress in reducing the cost gap with their LCC counterparts despite receiving huge concessions on wage rates

from their unions. The overall price decrease in 2005 reinforced the fact that low cost carriers have the market penetration to influence overall pricing.

The effect of LCC's growth on the domestic air travel industry:
The low cost carriers have affected every aspect of the air travel industry from wage rates to aircraft configuration. However, the strongest effect is in the area of pricing. The low cost carriers have significantly reduced the price of plane ticket.

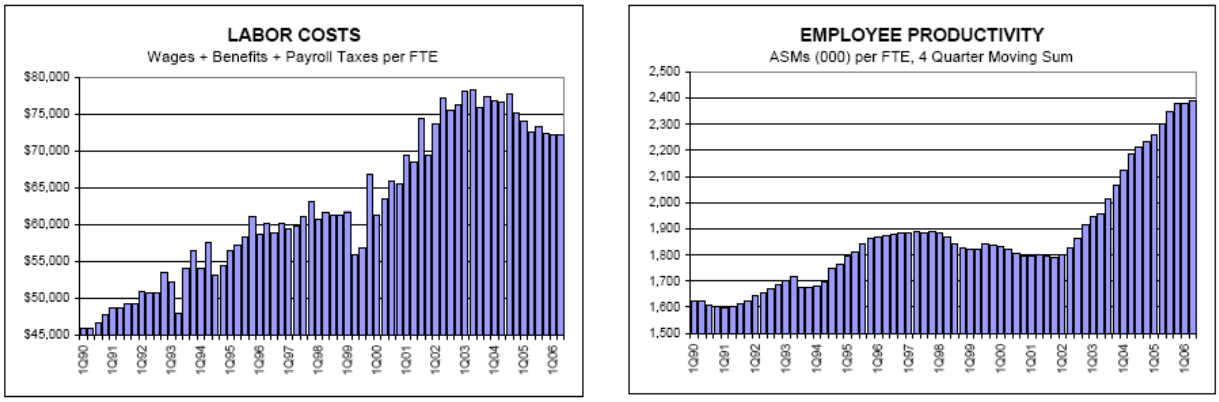
Figure 5: U.S. Inflation and Air travel price index(APTI).



1995 is the base year (100%) for both inflation rate and APTI.
Source: Air Travel Price Index (APTI) data collected form Bureau of Transportation Statistics.
Inflation rate is calculated from the Consumer Price Index data collected form Bureau of Labour Statistics.

As shown on Figure 5, over the last decade the cost of air travel actually declined in real terms. According to the Bureau of Trasnsporation Statistics, the cost of air travel has gone down about 17% in real terms between 1995 and 2006 while demand for air travel (revenue ton miles) have increased by 42.3% during the same period. The reduced cost of air travel has significantly helped stimulate demand. In addition to reducing fares, low cost carriers have also increased the overall efficiency of the airline industry.

Figure 6: Labor cost and Employee Productivity of Large U.S. Airlines



FTE: Full time employee.
Source: Air Transportation Association, 2006.

As shown in Figure 6, between 2003 and 2005, employee compensation has declined significantly while there was a major improvement in employee productivity. In addition, the adoption of various cost limiting measures of the LCC business model by full service carriers, including elimination of meals form short and medium haul flights, increasing ticket sales through the internet and outsourcing of maintains and IT operations has greatly improved the overall efficiency of the industry.

Conclusion:

According to the findings of this paper, the success of LCCs can be attributed to two factors: simplicity of their business plan and the efficiency of their operations. Both of these factors have helped them to significantly reduce their cost structure without compromising the quality of their product. The full service carriers have unsuccessfully tired to compete with the low cost carriers using financial strength and market power for decades. Events like the September 11 incident forced the full service carriers to reduce their own cost structure in order to be more competitive. In the past six years, the FSCs have significantly reduced their cost structure by improving efficiency in all aspects of their operations. However, even after considerable improvement in efficiency and aggressive cost cutting measures, the full service carriers are still finding it extremely difficult to compete with low cost carriers in the U.S. domestic air travel market. After six years of continued losses, the full service carriers as a whole returned to profitability in the 2nd quarter of 2006. This is however, largely due to increased demand. As well, in recent years employee compensation of full service carriers has gone down substantially. In 2006, fuel prices fell significantly, domestic passenger load factor was a record high (79.5%), and domestic airfare increased by 12% (Bureau of Transportation Statistics). Full service carriers have very little room to maneuver as any upward pressure on cost structure or any downward pressure on pricing would force their profit margins into negative territory. Despite the recent upturn, it seems like low cost carriers continue to enjoy competitive advantage over their full service counterparts. Can the full time carriers catch up with the low cost

carriers in the near future, it’s very unlikely in the short turn, but anything can happen in the long run.

Part 2:Price discrimination

How the Low cost carriers are affecting the practice of price discrimination in the domestic air travel market: a statistical analysis.

Background:

Price discrimination is the practice of charging unequal prices to different buyers or groups of buyers for products that are essentially identical, when such pricing does not correspond to differences in supply cost. Generally, price discrimination is employed to extract as much consumer surplus as possible from each group of consumers, given their utility functions and income. The air transportation marketplace provides ample opportunity for the airlines to use price discrimination as a tool to increase revenue and competitiveness. Barriers to entry arising from sunk costs, scale economies, and hub-and-spoke systems give large carriers market power even on relatively competitive routes. Airlines differentiate among themselves by occupying different slots in flight schedules, and by offering different route networks. Carriers can successfully discriminate in terms of price between different consumer groups only if the difference in demand elasticity is significant. (Stavins, 2001). Conveniently for the airlines, in general, the air travel market consists of two types of consumers, business and leisure travelers. Since business travelers are required to travel for professional needs, they have a much lower price elasticity of demand compared to leisure travelers. In order to maximize their utility from flying, consumers choose between various price-restriction packages, such as low price-high inconvenience and high price-no restrictions combinations. The choice depends on the consumer's elasticity of demand with respect to convenience, time or money. (Stavins, 2001). In order to extract maximum consumer surplus (higher revenue) from business travelers, the full service carriers(FSC) have attacted

various restrictions on their low fair tickets specially designed to limit their sale to business travelers. These forms of price discrimination have been a standard practice in the U.S air travel industry since the 1960's. Price discrimination has intensified with the introduction of various electronic revenue management packages in the 1980's.

The original low cost carrier (LCC) business model developed in the 1950's used only one single class fare designed to attract low yield leisure travelers; however, over the years the LCCs have modified their product offerings and marketing strategy to attract high yield business travelers. Nevertheless, since the domestic market share of low cost carriers was very low in the past, the large full service carriers were able to ignore the threat of LCCs. It enabled the FSCs to extract healthy revenues from the business travelers by utilizing various revenue management strategies. Systematic use of Yield Management enabled American Airlines to generate 1.4 billion dollars in additional revenue between 1989 and 1991.(Smith, Leimkuhler & Darrow, 1992). Table 2.1 provides a typical example of price discrimination strategies employed by full service airlines in the late 1990's. As shown on Table 2.1 airlines employed three types of restrictions

Table 2.1 Coach/Economy Fares on United Airlines Flight 1956, January/February 2001.

One Way Fare	Advanced Purchase	Minimum Stay	Maximum Stay	Change Fee	Fare Code
$ 1,045.00	No	No	No	None	BUA
$ 945.00	Yes (3 days)	No	No	None	BA3
$ 940.50	No	No	No	None	BUA/SD10
$ 850.50	Yes (3 days)	No	No	None	BA3/SD10
$ 567.00	Yes (14 days)	Sunday	30 Days	$ 75.00	QE14NR
$ 483.29	Yes (14 days)	Sunday	30 Days	$ 75.00	QE14NR/SD10

Source: OsterJr. & Strong, 2001, p.23

to each fare class, which are refundability, time of purchase (advance purchase) and minimum/maximum stay over requirements on round trip fares. In her paper titled "Price Discrimination in the Airline Market: The Effect of Market Concentration" Joanna Stavins tested all three of these parameters on twelve domestic routes and eleven airlines during 1995. Her study concluded that airlines discriminate on all three of the categories shown above. In addition, Stavins found that the cost of one way ticket is significantly higher compared to round trip tickets. This paper will analyze these four types of price discrimination practices in current market conditions: refundability, The time of purchase(advance purchase requirement), the effect of a Saturday night stay over requirement on round trip fares and difference between one way and round trip fares.

As the first part of this paper demonstrates, since 2001, the LCC's have gained significant market share in the U.S. domestic air travel industry. Since most of the LCC's revenue (seat/mile basis) is much lower compared to full-service carriers,, significant market penetration by low cost carriers should reduce a full service airline's ability to extract high fares from consumers. Therefore, the results of this

analysis should indicate that the overall level of price discrimination has gone down in the last decade.

Data collection & Methodology:

For this study, the top five domestic city pairs (by number of passengers) between February 2006 and January 2007 were selected to be analyzed. All these city pairs are highly competitive routes, with a large number of airlines (both LCC's and FSC's) providing high frequency service. In addition, most of these city pairs are served by more than one airport on each end. Table 2.2 proves detail information on each of the five routes selected for this study.

Table 2.2: Information of the selected five Routes.

City Pair	Passengers/Year (In million)	Number of Airports*	
		Origin	Destination
New York, NY - Chicago, IL	3.16	4	2
Los Angeles, CA – Chicago, IL	2.80	2	2
Fort Lauderdale, FL – New York, NY	2.78	1	4
Atlanta, GA – New York, NY	2.66	1	3
Washington, DC – Chicago, IL	2.62	3	2

* see Appendix A for list of airports.
Source: Bureau of Transportation Statistics. Intermodel Transportation Database.

Pricing data on economy class fares (one way and return) were collected on all the five routes on a specific travel day. Table 2.3 provides detailed information on travel dates.

Table 2.3: Actual travel and ticket purchase dates.		
Fare type	**Departure date**	**Return date**
One day (Type I)	Thursday March 8th, 2007	n/a
Return (Type II)	Thursday March 8th, 2007	Friday March 9th, 2007
Return(Sat. stayover) (Type III)	Thursday March 8th, 2007	Monday, March 12th, 2007
Ticket purchase dates: February 15th, February 22nd, March 1st and March 7th 2007.		

These dates were chosen to avoid summer, Christmas and March break peaks. Selecting a single day eliminates price differences due to travel on different days of the week. The purchase price includes fares offered for sale at various times before the scheduled travel date. The earliest data include fares offered at 21 days prior to departure, 14 days prior to departure, 7 days prior to departure and finally 1 day prior to departure. For simplicity, One way fares are classified as Type I fares, next day round trip fares are classified as Type II fares and finally round trip fares with Saturday stayover are classified as Type III fares.

Almost all the airlines analyzed in the study offered more than two fare classes for the same level of service (economy class). The study found only two fare class common across all the airlines and selected them to investigate further. The fare classes are lowest economy fare and lowest refundable fare. Since various surcharges and government taxes vary across airport/route/airline, the fare included all related fees and government taxes. All these fares are actual advertised fares at the time of purchase with no modifications with the exception of JetBlue Airways. This New York based LCC has only one class of fare across its network and does not offer refundable fares. But, for a flat fee of thirty dollars,

the price of the ticket can be converted to a credit towards a future reservation which has to be used within one year. Therefore, a fee of thirty dollars was added to convert JetBlue's non-refundable fares to refundable fares.

The pricing information on each of the two fare classes was collected from respected airline's website. This information was then cross checked with multiple online travel agents' websites(see Appendix A). The fare includes both round-trip and one-way fares, but round-trip tickets were divided by two to convert them to one way fares. In total, there were 937 individual observations collected from eleven airlines. Each observation contains specific information on a single ticket: the ticket price, the number of days prior to departure, whether the fare was for a one-way, round-trip(next day) or roundtrip with Saturday stay over, distance, refundability, and the name and type (LCC/FSC) of the airline.

The Regression models:

The following regression model was used as a base model to analyze the level of price discrimination.

$$Y_{ijk} = \beta_0 + \beta_1 X_0 + \beta_2 X_1 + \beta_3 X_2 + \beta_4 X_3 + \beta_5 X_4, \quad \textbf{--------(A)}$$

where,

Y=fare(in cents/mile)

i= airline

j=route

k=time of purchase.

X_0 = number of days before departure.

X_1 = 1 If the fare is for a return ticket, 0 otherwise (dummy variable)

X_2 = 1 If the fare is for return ticket with a Saturday stay over, 0 otherwise (dummy variable)

X_3 =1 if the airline is a low cost carrier, 0 otherwise(dummy variable)

X_4 =1 if the fare is refundable, zero otherwise (dummy variable)

This model examines all the four type of ticket restrictions across all the routes and airlines in a single regression, Regressions B and C are derived from the original model to analyze each of the two fare classs: non-refundable and refundable

$$\textbf{Y}_{\textbf{ijk}}\text{(Non-refundable only)} = \beta_0 + \beta_1 X_0 + \beta_2 X_1 + \beta_3 X_2 + \beta_4 X_3 \textbf{----------(B)}$$

$$\textbf{Y}_{\textbf{ijk}}\text{(Refundable only)} = \beta_0 + \beta_1 X_0 + \beta_2 X_1 + \beta_3 X_2 + \beta_4 X_3 \textbf{. ----------(C)}$$

The following two regression models are used to analyze how refundable and non-refundable fares change with respect to the time of purchase.

$$D_{ijk}\textbf{(refundable)= } \beta_0 + \beta_1 Z_0 + \beta_2 Z_1 + \beta 3 Z_2 \textbf{----------(D)}$$

$$D_{ijk}\textbf{(non-refundable)= } \beta_0 + \beta_1 Z_0 + \beta_2 Z_1 + \beta 3 Z_2 \textbf{---------(E)}$$

where,

D=Ticket price (in dollars)
i= airline
j=route
k=time of purchase
Z_0= 1 if ticket is purchased two weeks before departure, 0 otherwise(dummy variable)
Z_1= 1 if ticket is purchased one weeks before departure, 0 otherwise(dummy variable)
Z_2= 1 if ticket is purchased one day before departure, 0 otherwise(dummy variable)

Results:

The results of the regressions A, B and C are shown in the Table 2.4. For comparability and simplicity, all fares are converted into cents per mile for all the regression models. The R square value for the regression A and B were in the mid 30's, which is within the margin of tolerance. However, the R square value and most of the variables of the regression C were statistically insignificant, which means the overall regression is not statistically significant.

Table 2.4: Results of Regression A, B and C.

		Intercept	# of days Before dept.	If Round trip	If Round trip (Saturday.)	If LCC	If Refundable	R^2
A)	All	26.6	-0.44	-00.95*	-2.4*	-7.0	21.07	0.37
B)	Non-refundable	27.8	-0.71	-0.1*	-2.3	-2.3	n/a	0.35
C)	Refundable	46.4	-0.14*	-1.9*	-2.6*	-11.5	n/a	0.08

* Statistically insignificant.

As for interpreting the results, there seems to be no significant price discrimination between one way, round trip and round trip with Saturday stay over fare for both refundable and non-refundable fare type. However, price for non-refundable Type III tickets seems to be marginally lower than non-refundable Type I or Type II tickets. Data provided on Table 2.6, also support that fact that non-refundable Type III fares are marginally lower that Type II or Type I fares.

Table 2.5: Mean Type I, Type II and Type III fares(cents/mile).

Fare type	**OneWay** Type I	**Return(next day)** Type II	**Retrun(Sat)** TypeIII
Non-refundable	19.3	19.2	17.0
Refundable	41.0	39.2	38.5

Marginally lower fares for Type III fares can be explained by the fact that the actual travel date for the second half (return leg) of the journey for Type III tickets are four days after the first half of the journey. However, since all three types of the fares were purchased on the same day, it translates to a two day discrepancy between ticket purchase date and actual travel date among Type I and Type III fares. As a result, the average Type III fare should be marginally lower than Type I fares to compensate for that discrepancy. Therefore, based on the results on shown in Table 2.4 and 2.5, we can conclude there is no price discrimination between Type I, Type II and Type III fares.

The results of regression A shows that there is a significant price difference between refundable and non-refundable tickets. The intercept for refundable fare is about 1.7 times higher compared to the intercept for non-refundable fares. However, Regression C reveals no other forms of discrimination on refundable fares as only the low cost carrier coefficient is statistically significant. The LCC's seems to offer refundable fares at a much lower price compared to FSCs. Data presented Table 2.6 backs up the results of regression C, which shows that refundable tickets on full service carriers are much more expensive (25%) compared to refundable tickets on low cost carriers. By comparison, the fare difference on non-refundable fares between the two groups of carriers is quite low.

Table 2.6: Mean refundable and non-refundable fares. (cents/mile)		
Carrier type	**Non Refundable**	**Refundable**
Low cost	17.8	31.9
Full Service	19.1	50.5

Regression B provides additional data on non-refundable fares, according to which, both group of carriers discriminate heavily on non-refundable fares based on time of purchase. As the departure dates nears, the carriers gradually withdraws cheaper class of fares form the market. For example, consumers can save 18% on non-refundable fares by purchasing their ticket one week in advance, controlling for other ticket attributes. In order to further analyze discrimination policies of LCCs and FSCs, variable X_3 was removed from regression D and E, and the modified regression was applied to each of the two carrier groups. The results of these regressions are shown on Table 2.6.1.

Table: 2.6.1: Comparison of Price Discrimination between LCC's and FSC's.				
	Intercept	#Day before dept	Two way	Two Way (S)
Non Refundable				
LCC	24.48	-0.67	0.57*	-1.44*
FSC	26.72	-0.60	0.36*	-2.77*
Refundable				
LCC	34.43	-0.23*	0.14*	-0.48*
FSC	46.76	-0.11*	-2.87*	-3.49*
*Statistically insignificant				

Table 2.6.1 shows the both groups of carriers (LCC/FSC) have almost identical fare level and discrimination policies on non refundable fares but refundable fares on low cost carriers are substantially lower compared to full service

carriers. But there seems to be no other forms of discrimination on refundable fares.

Data presented on Table 2.6.2 shows that price discrimination based on time of purchase for non refundable fares is almost identical for both type of carriers.

Table 2.6.2: Price discrimination based on time of purchase*(Cents/mile)				
Carrier type	Number of days before departure			
	21 days	**14 days**	**7 days**	**1 day**
LCC	11.1	12.6	20.5	23.5
FSC	12.3	15.6	22.7	26.4

*Non-Refundable fares only.

In order to further examine refundable and non-refundable fares, regression models D and E were applied to each of the two fare classes. Based on the results of these regressions, the mean ticket price of each of the two fare classes is calculated for twenty one days before departure. As shown on Table 2.7, non-refundable fares increase significantly as the gap between departure date and ticket purchase date decreases. However, the in the change in refundable fare is statistically insignificant, small and inconsistent.

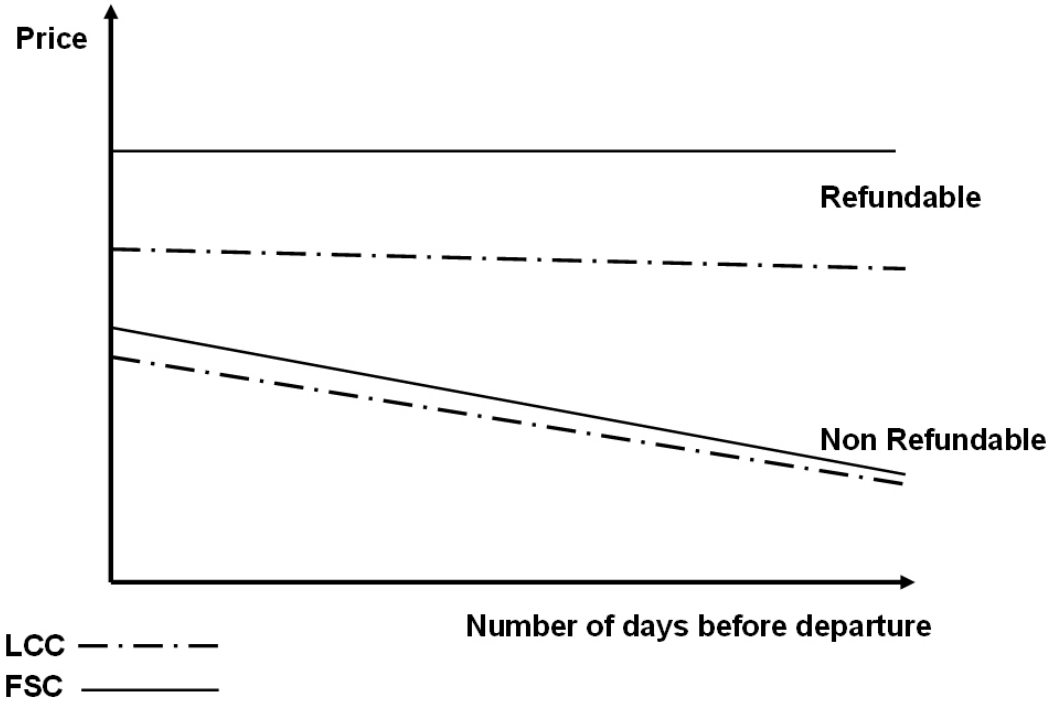
Table 2.7: Price discrimination based on time of purchase (All carriers).				
	Time before departure			
Fare type	21 days (base fare)	14 days (Δ from base fare)	7days (Δ from base fare)	1 day (Δ from base fare)
Refundable	339.31	18.75*	10.05*	31.30*
Non-refundable	110.25	27.23	88.61	119.99

* Statistically insignificant
Δ= (current fare-base fare)

Based on the results presented in this section, we can conclude that there is no price discrimination between one way and return fares. In addition, there is no

price difference between Type II and Type III return fares. However, there is a significant price difference between refundable and non-refundable fares. Within the refundable fare category, there are no additional discounts for advance purchases on either of the two carrier groups(LCC/FCC). However, the price of refundable fares is much lower on LCCs compared to FSCs. There is significant advance purchase discount on non-refundable fares. Figure 2.1 summarizes the overall macro picture of the current form of price discrimination in the domestic air travel industry.

Figure 2.1: Price discrimination in the U.S airline industry.*



*Not Scaled. Derived from data presented on Table 2.6.1

Figure 2.1 suggests that the spread of price discrimination (difference between highest and lowest fare) is lower on LCCs compared to FSCs. I

Table 2.8 compares the findings of this study with the findings of previous study done by Stavins in 1995.

Table 2.8: Price Discrimination 2007 vs.1995				
Year	Refundability	Time of purchase	Saturday stayover Restrictions	Higher price for one way fares
1995	Yes	Yes	Yes	Yes
2007	Yes	Yes	No	No

As shown on Table 2.8, two out of four types of priced discrimination techniques have been withdrawn from the market place in recent times. The two remaining discrimination techniques are refundability and time of purchase. Both groups of carriers (LCCs/FSCs) have been using these two techniques as part of their current revenue management strategy. Based on the data provided on Table 2.8, it can be concluded the number of discrimination margins has been reduced over the last decade, which supports the initial hypothesis of this paper. However, there is not enough evidence to prove that overall level of price discrimination has been during the last decade.

Over the last decade, LCC's have developed and implemented various creative revenue management and marketing techniques, which have reduced the effectiveness of traditional revenue management techniques used by FSC's. Popular LCC products such as internet only, discounted one-way non-refundable tickets made it difficult for FSCs to put restrictions on return tickets. Data presented on Table 2.8 also reinforces this argument, which shows that restrictions from two way fares have been virtually eliminated from the marketplace. Even though both the LCCs and FSCs discriminates on time of

purchase in similar fashion, full service carriers are still able to charge a premium on their refundable fares because of some strategic advantage they enjoy which includes higher frequency of flights, access to lounges at airports and upgrades to higher class of service(business class). Nevertheless, the study concludes that over the last decade, the low cost carriers have gained sufficient market power to not only reduce average fares but also affected price discrimination policies of full service carriers.

Additional Findings:

In addition to the results presented in the previous section, this paper investigated several other aspects of price discrimination. In recent times, LCCs have developed various new forms of price discrimination like pre-assigned seating (AirTran), method of purchase (Southwest). The study also found that, in general, LCCs maintain more fare classes compared to FSCs. The discrimination methods also vary between low cost carriers and full service carriers. As the departure date approaches, the low cost carriers simply suspend selling their cheaper fare class tickets, but continue to sell higher fare class tickets, which forces people to pay substantially higher price for the same class of service. For example, a day before departure, AirTran withdraws internet only special fares and discounted coach fares from most of its routes, but continues to sell regular priced non-refundable coach class tickets. In contrast, full service carriers like American Airlines continue to sell their discounted non-refundable fares until the very last moment; but the amount of the "discount" gradually decreases as the departure date nears. Table 2.9 provides a summary of price discrimination strategies of various low cost and full service carriers.

Table 2.9: Price discrimination strategy of various airlines.	
Name of carrier (#of fare class)	**Discrimination method**
Carrier Type: LCC	
Air-Tran(6)	Purchase method, Pre-assigned seating, Time of purchase.
Southwest(6)	Purchase method, Time of purchase, Refundability.
Jet Blue(1)	Time of Purchase.
Carrier Type: FSC	
American Airlines(3)	Refundability, Change in travel itinerary, Reward points, and Time of purchase.
Delta Airlines(4)	Refundability, Upgrade opportunity, Reward points, Time of purchase.
United airlines (2)	Refundablility, Time of purchase.
*Economy class only.	

The data presented in Table 2.9 suggests that most low cost carriers discriminate more compared to full service carriers. However, the spread of price discrimination (measured by calculating the difference between highest price and lowest price) is much lower on LCCs compared to FSCs.

Table 2.10 provides data on mean fares on the largest LCCs and FCCs

Table 2.10: Mean fare on selected airlines.(cents/mile)		
	Refundable	**Non-refundable**
South West	16.49	25.44
AirTran	21.23	53.08
JetBlue	15.57	17.22
American	19.03	40.01
United	19.26	53.84
Delta	19.07	57.61

Within the non-refundable fare class, JetBlue's average fare was the lowest and AirTran's average fare was the highest. For the refundable class, Southwest offered the lowest average fare while Delta's average fare was the highest . The data on Table 2.9 suggest that, in general, the cost of flying on low cost carriers is lower compared to full service carriers.

Table 2.11 provides data on actual highest and lowest ticket price on all the routes examined. Full service carriers do offer lower fares on some of the routes examined for the study, but their average fare was higher than low cost carriers.

Table 2.11: Highest and lowest fare on each route.

Route	Lowest fare (Airline)	Highest fare (Airline)
New York, NY - Chicago, IL	$49.40 (SW)	$501.40 (AA, UA)
Fort Lauderdale, FL - New York, NY	$88.3 (US)	$557.3 (AA)
Los Angeles, CA – Chicago, IL	$109.8 (FR)	$742.8 (AA)
Washington, DC – Chicago, IL	$59,4 (AA, SW, UA)	$734.805(DL)
Atlanta, GA – New York, NY	$120.30 (US)	$674.00 (US)

SW: Southwest, **US:** U.S airways, **AA:** American , **UA:** United, **FR:** Frontier, **DL:** Delta,

Limitations of the study:

As with most academic studies, this study had some limitations. Only five routes were analyzed for the study. Increasing the number of routes could have produced better results. A number of variables which can strongly influence pricing like market share of a particular airline, slot restrictions on airports, size and average income of travelers, percent of business travelers on a particular route etc which were not analyzed in the study. There was a one week gap for each data collection period and there was a significant price difference between various flights within the same day, which was ignored. However, the purpose of this study was to examine the overall macro environment of price discrimination for which the study has succeeded despite these limitations.

Conclusion and summary

The purpose of this study is to examine how the market penetration of low cost carriers has affected price discrimination strategies of the domestic air travel market. Four variables and their effects on price discrimination were analyzed for that purpose: time of purchase, refutability, two way fares, and two way fares with weekend stay requirements. The study found strong evidence of price discrimination based on time of purchase on non-refundable fares. The study also found significant price difference between refundable and non-refundable fares. The data suggested that there is no difference between one way and return fare (with or without any minimum stay requirements). In addition, the results also suggested that the number of margins used by the airlines to discriminate has been reduced since 1995. There is no significant difference on fare and discrimination level between low cost and full service carriers on the non-refundable fares. However, the refundable fares are substantially cheaper on low cost carriers compared to full service carriers. In the last decade low cost carriers have gained enough market power to impact the ability of full service carriers to extract consumer surplus from business travelers by using price discrimination as a tool.

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APPENDIX - A: AIRLINE AND AIRPORT DATA

AIRLINE DATA

FULL SERVICE CARRIER		
	AMERICAN AIRLINES.	www. aa.com
	DELTA AIRLINES	www.delta.com
	UNITED AIRLINES.	www.unted.com
	CONTINENTAL AIRLINES	www.continental.com
	NORTHWEST AIRLINES.	www.nwa.com
	U.S. AIRWAYS.	www.usairways.com
LOW COST CARRIER		
	JETBLUE AIRWAYS.	www.jetblue.com
	FORNTIER AIRLINES	www.frontierairlines.com
	SOUTH WEST AIRLINES.	www.southwest.com
	AIR-TRAN AIRWAYS	www.airtran.com
ONLINE BOOKING AGENT		
	EXPEDIA	www.expedia.com
	ITA SOFTWARE	www.itasoftware.com

LIST OF AIRPORTS:

NEW YORK CITY, NY
JOHN F. KENNEDY AIRPORT. (JFK) NEWARK INTERNATIONAL AIRPORT(EWR) LONG ISLAND MACARTHUR AIRPORT (ISP) LA GUARDIA AIRPORT(LGW)
WASHINGTON, D.C.
REAGAN WASHINGTON NATIONAL AIRPORT (DCA) DULLES INTERNATIONAL AIRPORT(IAD) BALTIMORE WASHINGTON INTERNATIONAL AIRPORT(BWI)
CHICAGO, IL
CHICAGO O'HARE INTERNATIONAL AIRPORT(ORD) CHICAGO MIDWAY AIRPORT(MDW)
LOS ANGELES, CA
L.A. INTERTIONAL AIRPORT(LAX) LONG BEACH AIRPORT(LGB)
FORT LAUDERDALE, FL
HOLLYWOOD INTERNATIONAL AIRPORT(FLL)
ATLANTA, GA
HARTSFIELD ATLANTA INTERNATIONAL AIRPORT (ATL)

APPENDIX – B: REGRESSION DATA

Summary output: regression A.

Regression Statistics	
Multiple R	0.606438
R Square	0.367768
Adjusted R Square	0.364369
Standard Error	0.151945
Observations	936

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	5	12.48975	2.497951	108.1956	4.34E-90
Residual	930	21.47124	0.023087		
Total	935	33.961			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*
Intercept	0.266101	0.012717	20.92446	5.66E-80	0.241144
DAYS before dept.	-0.00435	0.000663	-6.57152	8.28E-11	-0.00565
Two Way	-0.00953	0.012165	-0.78347	0.433549	-0.03341
Two Way (S)	-0.024	0.012165	-1.97258	0.04884	-0.04787
Refundable	0.210739	0.009933	21.21611	8.76E-82	0.191245
LCC	-0.06967	0.010536	-6.61241	6.37E-11	-0.09034

Summary output: regression B.

Regression Statistics	
Multiple R	0.590698
R Square	0.348924
Adjusted R Square	0.343299
Standard Error	0.076779
Observations	468

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	4	1.46272	0.36568	62.03262	5.87E-42
Residual	463	2.729368	0.005895		
Total	467	4.192088			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*
Intercept	0.277602	0.008366	33.1814	1.8E-124	0.261161
DAYS before dept.	-0.00717	0.000473	-15.1458	2.22E-42	-0.0081
Two Way	-0.00051	0.008693	-0.05828	0.953554	-0.01759
Two Way (S)	-0.02324	0.008693	-2.67296	0.007784	-0.04032
LCC	-0.0231	0.007529	-3.06814	0.00228	-0.03789

Summary output: regression B (LCC only, no X_3)

Regression Statistics	
Multiple R	0.635422
R Square	0.403761
Adjusted R Square	0.391993
Standard Error	0.063047
Observations	156

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	0.40915	0.136383	34.31042	5.42E-17
Residual	152	0.604197	0.003975		
Total	155	1.013347			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*
Intercept	0.244826	0.011351	21.56836	4.16E-48	0.222399
DAYS before dept	-0.00674	0.000673	-10.0067	2.01E-18	-0.00807
Two Way	0.005702	0.012365	0.461123	0.64537	-0.01873
Two Way (S)	-0.01436	0.012365	-1.16152	0.24725	-0.03879

Summary output: regression B (FSC only, no X_3)

Regression Statistics	
Multiple R	0.56691
R Square	0.321387
Adjusted R Square	0.314777
Standard Error	0.082954
Observations	312

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	1.003772	0.334591	48.62232	9.41E-26
Residual	308	2.119477	0.006881		
Total	311	3.123249			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*
Intercept	0.28244	0.010561	26.74418	2.72E-82	0.261659
Intercept	-0.00739	0.000627	-11.7909	9.85E-27	-0.00862
DAYS before dept	-0.00361	0.011504	-0.31388	0.753828	-0.02625
Two Way	-0.02768	0.011504	-2.40575	0.016728	-0.05031

Summary output Regression C

Regression Statistics	
Multiple R	0.277953
R Square	0.077258
Adjusted R Square	0.069303
Standard Error	0.196505
Observations	469

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	4	1.500124	0.375031	9.712275	1.5E-07
Residual	464	17.91696	0.038614		
Total	468	19.41708			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*
Intercept	0.464118	0.021389	21.69858	1.38E-72	0.422086
DAYS before dept.	-0.00145	0.00121	-1.19652	0.232105	-0.00382
Two Way	-0.01856	0.02225	-0.83398	0.404722	-0.06228
Two Way (S)	-0.02631	0.022214	-1.18421	0.236935	-0.06996
LCC	-0.11546	0.019259	-5.995	4.09E-09	-0.1533

Summary output: regression C (LCC only, no X_3)

Regression Statistics	
Multiple R	0.104777
R Square	0.010978
Adjusted R Square	-0.00854
Standard Error	0.169784
Observations	156

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	0.048637	0.016212	0.562406	0.640626
Residual	152	4.381631	0.028827		
Total	155	4.430268			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*
Intercept	0.34431	0.030657	11.23092	1.09E-21	0.28374
DAYS	-0.00232	0.001804	-1.28445	0.200938	-0.00588
TW	0.001391	0.033298	0.041779	0.966729	-0.0644
TWS	-0.00484	0.033298	-0.14532	0.884654	-0.07063

Summary output: regression C (FSC only, no X_3)

Regression Statistics	
Multiple R	0.083268
R Square	0.006934
Adjusted R Square	-0.00274
Standard Error	0.208952
Observations	312

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	0.09389	0.031297	0.716812	0.542576
Residual	308	13.44759	0.043661		
Total	311	13.54148			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*
Intercept	0.467576	0.026601	17.57712	2.21E-48	0.415232
DAYS	-0.00112	0.001578	-0.70794	0.479521	-0.00422
TW	-0.02869	0.028976	-0.98995	0.322975	-0.0857
TWS	-0.03487	0.028976	-1.20346	0.229724	-0.09189

Summary output: regression D.

Regression Statistics	
Multiple R	0.076055
R Square	0.005784
Adjusted R Square	-0.00064
Standard Error	151.4653
Observations	468

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	61932.32	20644.10537	0.89984951	0.441141927
Residual	464	10644963	22941.73097		
Total	467	10706895			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*
Intercept	339.3096	14.00297	24.23126049	1.99412E-84	311.7925101
14 days	18.75137	19.80319	0.946886201	0.344189622	-20.163696
7days	10.04906	19.80319	0.507446514	0.612082657	-28.86600369
1 day	31.30197	19.80319	1.580652689	0.114638872	-7.613097709

Summary output: regression E.

Regression Statistics	
Multiple R	0.593871811
R Square	0.352683727
Adjusted R Square	0.348498493
Standard Error	64.84736981
Observations	468

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	1063093.86	354364.6201	84.26857	1.55E-43
Residual	464	1951204.156	4205.181372		
Total	467	3014298.017			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*
Intercept	110.2457692	5.99514146	18.38918564	3.96E-57	98.46477
14 days	27.23192308	8.478410361	3.211913781	0.00141	10.57108
7days	88.60807692	8.478410361	10.4510248	4.22E-23	71.94723
1 day	119.9871368	8.478410361	14.15207942	4.71E-38	103.3263