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# Navigating Through Crisis: The Turbulence and Triumphs of the “Big Four” Airlines in the Wake of 9/11

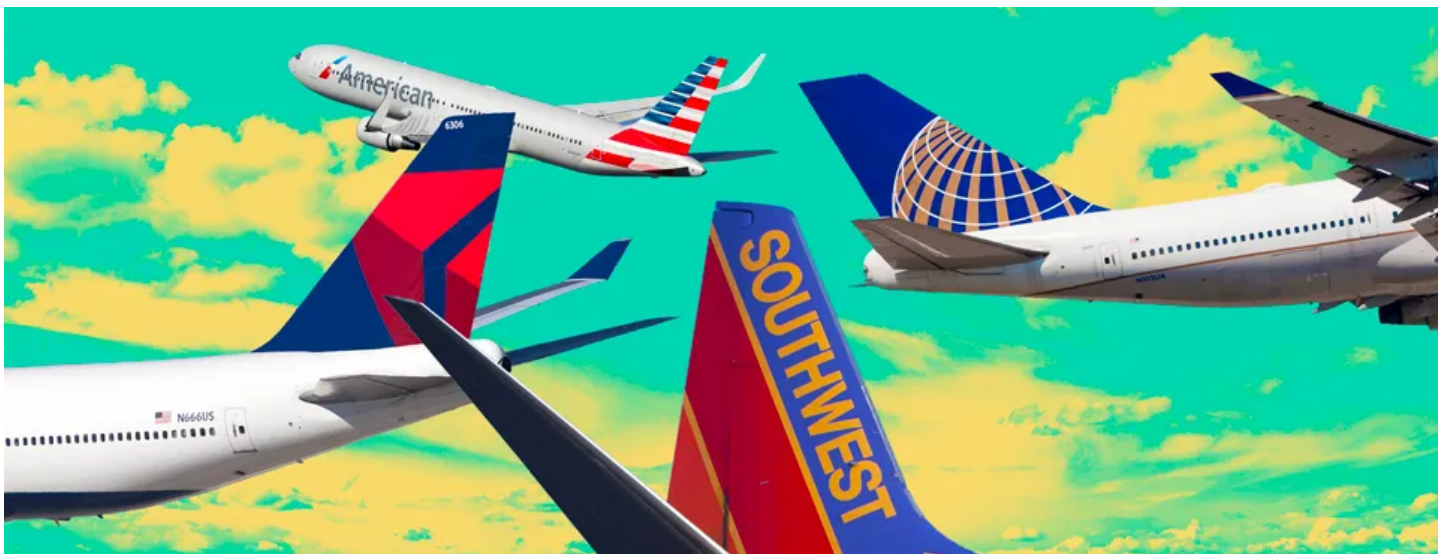


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*In the aftermath of the September 11 attacks, the airline industry faced unprecedented challenges. Dominating the U.S. aviation sector with a combined 74% market share, the “Big Four” airlines — United, American, Delta, and Southwest — each responded in unique ways that have since shaped their operations and market strategies. This blog post delves into the analytical journey undertaken by Fly Girls Analytics to understand the enduring impacts of 9/11 on these major carriers.*

Our project was propelled by a key question: Can we quantify the impact of the 9/11 attacks on the airline industry? With this goal in mind, we embarked on a comprehensive investigation to analyze the implications of 9/11 on the US airline industry. Our research was divided into two main areas of focus: quantitative analysis to assess changes in market fares, revenue per mile (RPM), and passenger volume, and qualitative analysis to discern shifts in language and sentiment. This dual approach allowed us to paint a detailed picture of the industry’s dynamics in response to the attacks and gain insights into the resilience and adaptability of the “Big Four” airlines. To deepen our analysis, we specifically compared United and American Airlines — both of which were directly involved in the 9/11 attacks — against Delta and Southwest Airlines, which were not, to better understand how direct involvement in the crisis influenced airline operations and communication.

## **Methodology and Data Sources**

We performed exploratory data analysis using consumer airfare data sourced from the U.S. Department of Transportation. We focused on key metrics such as market fares, passenger volumes, and RPM to quantify the impact on these measures, with a particular focus on flights operating in

and out of New York. We opted for year-level analysis due to discrepancies and missing data points in the quarter-level data for NY-based flights over several years. This aggregation by year allowed for a more consistent and reliable dataset, ensuring the robustness of our findings in assessing the impacts of the 9/11 attacks on the airline industry.

Additionally, we conducted textual and sentiment analysis on each airline's 10K annual reports from 1999 to 2003, focusing on the frequency of keywords related to safety and security. We specifically chose to examine 10K annual reports as these documents provide a comprehensive overview of the companies' operational and financial statuses. Analyzing these reports captures the strategic language and sentiments that reflect their annual performance and challenges, effectively supplementing our quantitative analysis by adding depth and context to the numerical data, thus providing a more holistic understanding of the impacts of the 9/11 attacks on the airline industry.

## **The Impact of 9/11: A Two-Pronged Analysis**

### **Exploratory Data Analysis**

Using the consumer airfare data, we filtered for flights operated by United and American Airlines from before and after the 9/11 attacks. We created dummy variables for flights based on whether either their departure or arrival was in New York (NY-based), and whether they are pre/post 9/11. We also calculated a new variable, RPM, by multiplying Passenger Volume with Flight Distance, which was measured using geographic coordinates.

Market fare faced a stark dip for NY-based flights as compared to non-NY-based flights between 2000 and 2001, and then a slight increase from 2001 to 2002, as opposed to non-NY-based flights.

On the other hand, NY-based flights saw a decline in RPM from 2000 to 2001 without full recovery, while non-NY-based flights initially dropped sharply but began to recover by 2003.

When it came to passenger volume, both NY-based and non-NY-based flights experienced a decrease in passenger volume prior to 9/11, indicating a parallel trend. However, the data shows a sharp divergence post-9/11. While passenger volume for non-NY-based flights continued to decline into 2002, NY-based flights saw a significant rebound in passenger numbers after the initial drop in 2001.

Since the parallel trends assumption was satisfied, we used a Difference-in-Differences approach to compare passenger volumes on NY-based flights (treatment group) versus non-NY-based flights (control group) before and after 9/11. The data shows that while both groups experienced a decline in passenger volume post-9/11, the decrease was more pronounced for non-NY-based flights. Notably, the overall passenger volume increased by 2,399 units post-9/11 for NY-based flights relative to non-NY-based ones, suggesting that despite the attacks, passenger trust in flying to or from NY did not diminish significantly.

## **Textual Analysis**

We processed data from the 10K annual reports of the top four airlines from 1999 to 2002 data by converting text to lowercase, removing stop words and special characters. Our text analysis focused on observing the frequency of specific keywords such as “attacks,” “terrorist,” “terrorism,” “death,” “safety,” “security,” and “hijacking,” and comparing total word counts between airlines.

We found that there was a significant increase in the use of these keywords post-9/11 in 2001, especially in reports from United and American Airlines, which were directly affected by the attacks. This shift underscores the heightened emphasis on security measures and crisis response by the directly affected airlines in the wake of the tragedy.

The chart below shows that United consistently placed a greater emphasis on specific keywords compared to American from 1999 to 2002. This pattern is especially pronounced in the year 2001, where United Airlines' keyword frequency surged dramatically, far surpassing that of American Airlines. This trend suggests that United Airlines may have prioritized certain topics or issues more heavily in their communications, which could be indicative of their strategic focus. Even in the years following 2001, United Airlines continued to maintain a higher level of keyword usage than American Airlines, reinforcing the pattern of greater emphasis in their annual report narratives.

The slide shows word clouds comparing the focus of communication from United and American Airlines versus Delta and Southwest Airlines. The dominant words in United and American Airlines' cloud such as "financial," "securities," and "trust" suggest a concentration on financial stability and trust building, possibly reflecting the impacts of the 9/11 attacks on financial health and trust in air travel. In contrast, Delta and Southwest's cloud, with words like "passenger," "service," and "result," indicates a focus on customer service. These differences signify varied strategic responses to the 9/11 attacks, with the directly affected airlines emphasizing trust and the indirectly affected airlines prioritizing customer service quality.

## **Sentiment Analysis**

To conduct sentiment analysis, we focused on only the 'Business',



‘Management’s Discussion and Analysis of Financial Condition and Results of Operations’ and ‘Letter to Stakeholders’ sections of each airline’s 10K annual reports from 2001 to 2003. We applied stemming after the same data preprocessing steps as mentioned above, and we used the NRC sentiment dictionary to extract emotions and sentiments. The NRC sentiment dictionary categorizes words by emotions (such as anger, joy, and trust) and sentiments (positive or negative), allowing for each word to be associated with multiple emotions. This approach provides a more comprehensive and nuanced understanding of emotional expressions in language than other packages. We then compared emotional distributions between American and United Airlines versus Delta and Southwest Airlines.

This analysis painted a picture of resilience, with “trust” and “anticipation” being the most prevalent emotions across the reports of all four airlines. Negative emotions such as “Fear” and “Sadness” accounted for about one fifth of all emotions, likely to manage expectations realistically with stakeholders and to humanize the airlines, fostering stronger emotional connections with its audiences.

Notably, United and American Airlines demonstrated a higher level of positive sentiment in the aftermath of 9/11 compared to Delta and Southwest, suggesting a strategic communication effort to reassure stakeholders of their forward-looking and robust recovery plans.

## **Conclusion: Lessons Learned and Future Directions**

The airlines demonstrated remarkable resilience in the wake of the tragedy. Notably, those directly affected by the events of 9/11, such as United and American Airlines, showed a significant increase in the usage of keywords related to safety and reassurance in their communications, indicating a concerted effort to address public concerns and enhance transparency, thereby rebuilding trust. The prevalence of positive emotions over negative ones, particularly seen in United and American Airlines, highlighted a

forward-looking stance and an increase in trust and anticipation from 2001 to 2003. This shift underscores the airlines' strong commitment to maintaining consumer confidence even in times of crisis.

Our findings also shed light on the economic impacts of 9/11, with dummy variables including pre/post-9/11 status and NY-based flight routes emerging as significant predictors of market fares and passenger volumes. Interestingly, the immediate post-9/11 period saw a slight rise in market fares and passenger volumes for NY routes, suggesting sustained consumer loyalty and demand despite the attacks. This resilience in passenger behavior points to a robust recovery strategy employed by the airlines, which managed to retain and even grow their customer base during a period of widespread uncertainty.

As such, the “Big Four” airlines, through their strategic responses, have set a precedent for managing adversity and understanding consumer behavior to sustain operations in even the most challenging circumstances, which is essential for long-term recovery and stability.

## **Engage with Us**

We invite readers to explore the full scope of our findings and consider the broader implications for the airline industry and beyond. For further discussion or inquiries about our methodologies and data analysis, please feel free to contact Fly Girls Analytics.

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