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1100 Data Science and Visualization

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Tarmac Wait Times

Problem Formulation

In 2010, the Department of Transportation passed new passenger protection rules which require airlines to reduce the time passengers spend waiting in the aircraft but are sitting on the tarmac or runway. This allows the Government to fine airlines up to $27,500 per passenger if the passengers sit aboard a plane on the ground for more than three hours (Moreno). This all stemmed from “a series of high-profile tarmac delays in 2008, in which planeloads of passengers spent hours trapped on aircraft without water or food, few air travelers were screaming for laws that would force flight crews to return to the gate” (Elliot). Although this may seem like a good resolution to the problem, research suggests that it is doing more harm than good. “The American Aviation Institute, a Washington think tank, combed through data and concluded that the three-hour rule, by prompting airlines to preemptively cancel flights, affect half a million air travelers and cost them $3 billion in lost productivity last year” (Elliot). We want to know if these new rules have affected the waiting times on the tarmac for passengers. This presents several questions: Is an economic incentive of having to pay $27,500 per passenger enough to make airlines reduce tarmac times? Does it depend on the airport? Does it depend on the month or year? Or other factors?

Data Collection, Storage, Cleaning, and Analysis

Data Collection

To answer the questions regarding if the tarmac times were reduced due to the new government rule, I collected tarmac time data from the Bureau of Transportation Statistics (Bureau of Transportation Statistics). I chose to use this website because the Bureau of Transportation Statistics is part of the Department of Transportation and is the most reliable source for the public to understand statistics on transportation. From this website, I collected data from the top ten busiest airports in the US which are ORD, EWR, DFW, PHL, IAH, ATL, LGA, JFK, IAD, and BOS. I obtained yearly data for the years 2005-2015 for each of the airports by using the year filter and the month filter from January to December. I obtained monthly data for the year 2010 for each of the airports by using the year filter for 2010 and the month filter for each month.

Data Storage & Cleaning

The data that I collected was stored in an excel spreadsheet. Within the spreadsheet, I created two different workbooks, one for yearly tarmac times and the other for monthly tarmac times. Since I only took the data that I needed, there wasn't any cleaning that needed to be done. There was an instance where the month of October 2010 didn't show any data, meaning there weren't any tarmac times, so I had to account for that in the spreadsheet, making those entries 0.

Data Analysis

Although the data that I collected didn't need any further aggregation, I calculated the average tarmac times for each airport before 2010 and after 2010. When I first wanted to display the information without taking the average, the graph was a bit complicated and hard to read. Once I took the average for before and after 2010, the data was more compiled and easier to read

and understand. To get the average tarmac time before 2010, I took the values in rows 3 through 7 and used the average function in row 14 of the workbook titled Yearly Tarmac Times. To get the average tarmac time after 2010, I took the values in rows 9 through 13 and used the average function in row 15 of the workbook titled Yearly Tarmac times. I did both aggregations above for each of the airports. In the second workbook titled Monthly Tarmac Times, I took the average as well to make the information more concise. Since the new government rule began in April of 2010, I took the average tarmac time for each airport from January through March and then April through December.

Data Visualizations

I created multiple visualizations to answer the questions formed above. The first visualization that I created was a bar chart that contains the tarmac times for each year from 2005-2015 for the top ten busiest airports in the US. I chose to do a bar chart because it is not a time series so a line graph wouldn't represent the data as good. *Figure 1* is the bar chart.

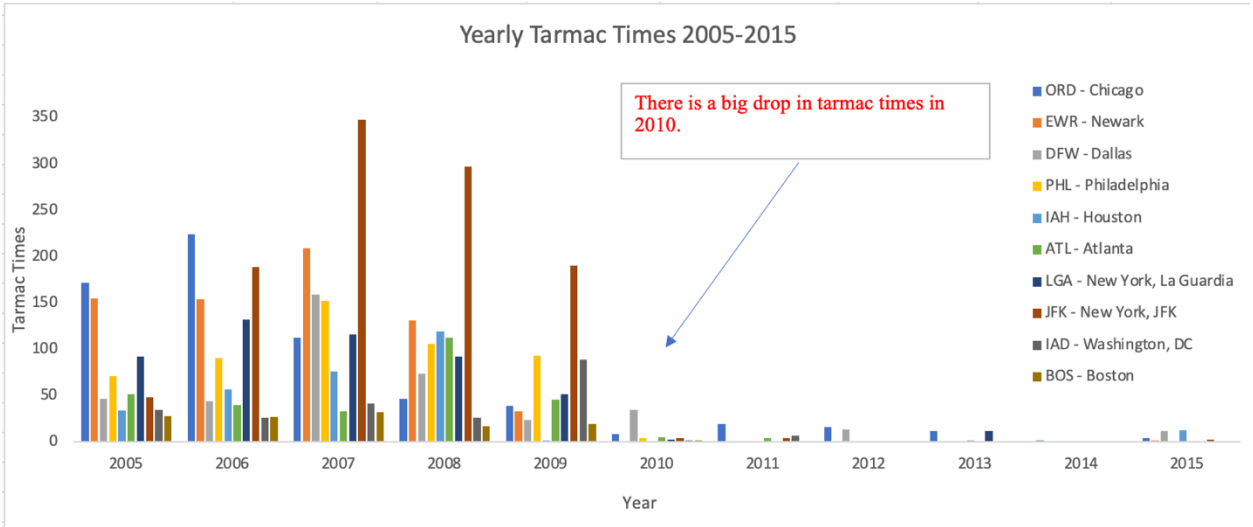

Figure 1: Yearly Tarmac Times

This bar graph shows us the tarmac time data for each year. From this chart, this is a noticeable drop in tarmac times beginning in 2010. I decided to include an annotation on this because it is

an important part of answering the questions. This drop is compatible with the government rule which was initialized in 2010. Since the rule was enforced in 2010, it makes sense why the tarmac times had a dramatic drop. I also created another visualization from the yearly data. This visualization compiles the data in *Figure 1* to help with understanding. I also used a bar chart for this because it's not a time series and I am doing a comparison. I used the average before and after 2010 for each airport to get a better visual of the comparison of before the new rule was put into place and after. Below is *Figure 1a*.

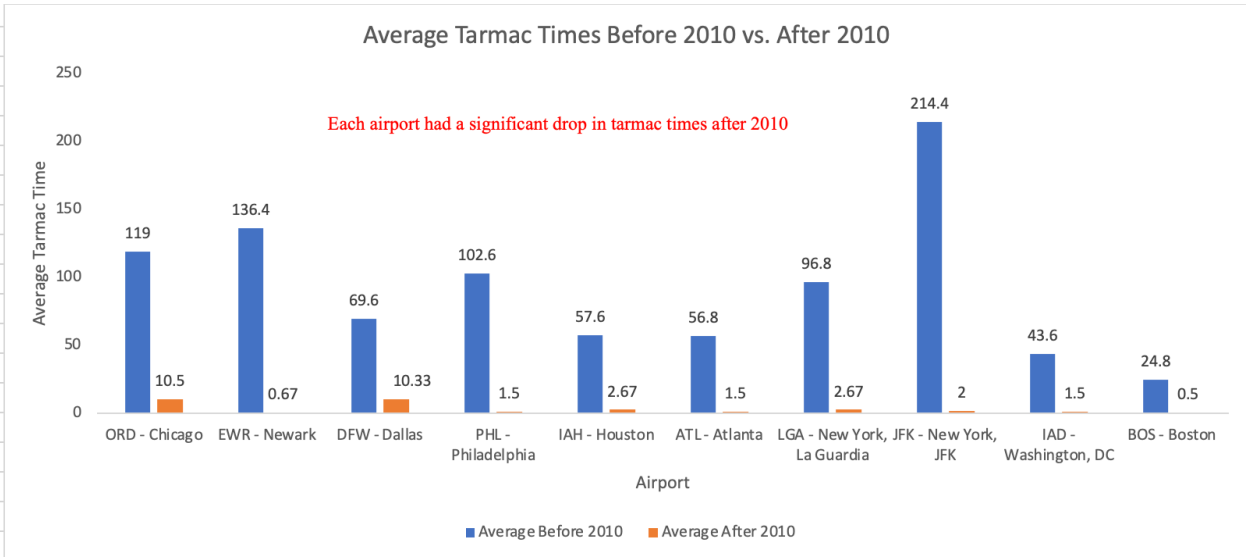

Figure 1a: Average Tarmac Times Before and After 2010

This bar graph gives a better visual than *Figure 1*. It shows a better comparison of the year before 2010 and the years after. *Figure 1a* clearly shows that after the new government rule was put into place, tarmac times decreased dramatically. For the monthly data for 2010 that I gathered, I created another bar chart, which is *Figure 2* below. I decided to create a bar chart because it is the same type of data that is in *Figure 1* and a line graph wouldn't make sense.

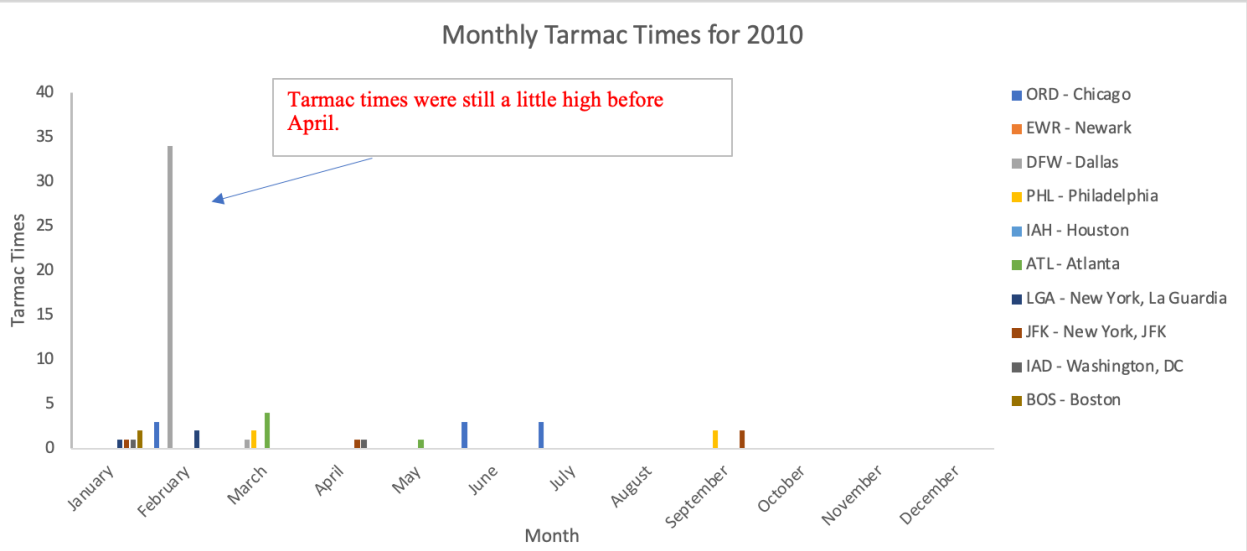

Figure 2: Monthly Tarmac Times

This bar graph shows up the monthly tarmac times for each airport. Since the rule was applied in April of 2010, seeing a slight drop in tarmac times during and after April isn't surprising. After April, most of the tarmac times for each of the airports were close to none. I also created another visualization that helps with understanding this bar graph a little more. Below is *Figure 2a.*

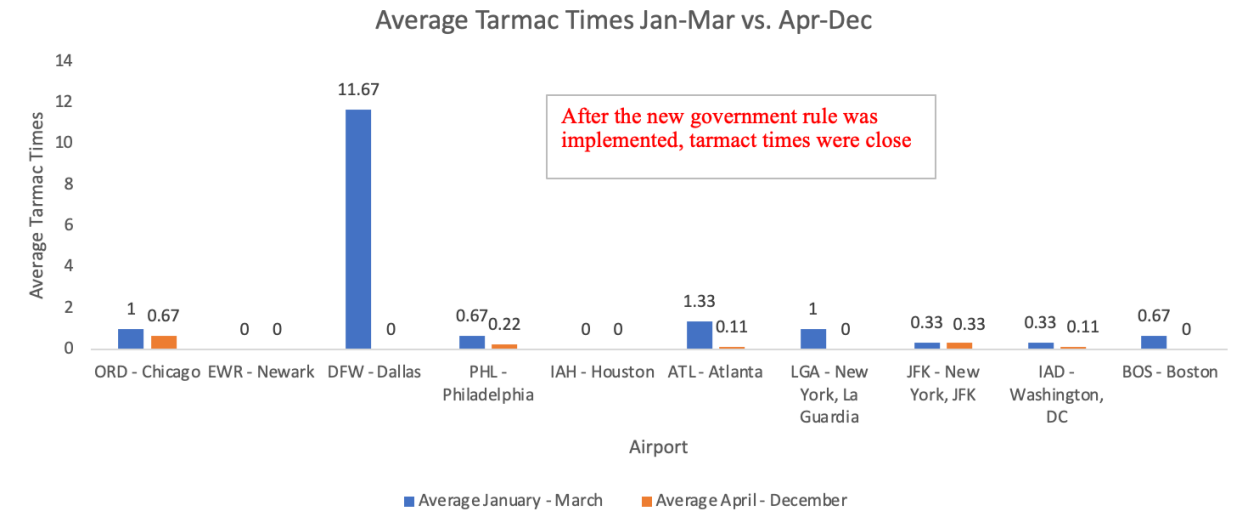

Figure 2a: Average Tarmac Times Jan-Mar vs. Apr-Dec

I decided to create this bar graph because Figure 2's information wasn't as compiled, and it was hard to make a comparison between before April and after April. This bar chart makes it easier to see the effects of the new government rule being implemented. For each airport, after April, there

was a drop in tarmac times. Although tarmac times were already on a decrease compared to years before, after April most of them were close to 0.

Conclusions

After analyzing the data, I can answer the questions that were formed when looking at this data. Both the yearly data and the monthly data show that the economic incentive of having to pay $27,500 per passenger was enough to make airlines reduce tarmac times. In *Figures 1* and *1a*, you can see the drop from 2009 to 2010 had a significant effect on tarmac times for each of the airports. With the question of whether it depends on the airport, I don't think it doesn't because all of them show a significant decrease in tarmac times. Although it doesn't depend on the airport, I think it depends on the year because, in Figure 1, you can see as soon as 2010 came, the tarmac times decreased, which is not as clear with the monthly data. Since the tarmac times were already decreased when 2010 hit, the monthly data values are mostly steady and low. This shows that airports could have been decreasing the time passengers wait on the tarmac, but since they would have to pay money, they made a change.

For the next steps or future work with this data, I would say to collect data after 2015 as well to see if the new government rule is still affecting airports. Also maybe include more airports. There were limitations for me in collecting the data. When exploring the data for October 2010, it came up that there wasn't any data, meaning that the tarmac times for all the airports were 0. The website retained this information so when I tried to search for November and December, it was saying the same thing, which wasn't true for December. Also, after I collected my data, the next data when I tried to access the website again, it said the website couldn't be found so I wasn't able to go back in and analyze more of the data.

Works Cited

Bureau of Transportation Statistics. “Tarmac Times.” *Bureau of Transportation Statistics*, www.bts.gov/topics/tarmac-times-2008-present.

Elliott, Christopher. “The Navigator: Should Tarmac-Delay Rules Become Law?” *The Washington Post*, WP Company, 20 May 2011, www.washingtonpost.com/lifestyle/travel/the-navigator-should-tarmac-delay-rules-become-law/2011/05/17/AFTqHy7G_story.html.

Moreno, Jenalia. “New Rules for Tarmac Delays Take Effect Today.” *Chron*, Houston Chronicle, 3 Aug. 2011, www.chron.com/news/houston-texas/article/New-rules-for-tarmac-delays-take-effect-today-1711501.php.