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Contents

Introduction

To demonstrate use of business intelligence tools, complete a fictitious business case using tables, graphs, dashboards, or programs, as applicable

Prompt

JetBlue Airways Corporation is a New York-based air carrier which received revenue of $7.7 billion in 2018. However, in recent years, JetBlue has seen its operating income decrease as its operating expenses have increased.

Determine whether JetBlue's competitors have experienced similar effects using the excerpts of income statements below. (See Table 2)

The COO suspects the increased expenses are related to compensation passengers may receive when a flight is delayed. To start, she wishes to better understand delays at the carrier's New York hub.

Date:	12/31/2018	12/31/2017	12/31/2016	12/31/2015
DAL		All numbers in thousands		
Total Revenue	44,438,000	41,138,000	39,450,000	40,704,000
Operating Expenses				
Total Operating Expenses	39,032,000	35,481,000	33,226,000	34,203,000
Operating Income or Loss	5,406,000	5,657,000	6,224,000	6,501,000
UAL		All numbers in thousands		
Total Revenue	41,303,000	37,784,000	36,558,000	37,864,000
Operating Expenses				
Total Operating Expenses	37,524,000	33,937,000	31,469,000	32,372,000
Operating Income or Loss	3,779,000	3,847,000	5,089,000	5,492,000
JBLU		All numbers in thousands		
Total Revenue	7,658,000	7,012,000	6,584,000	6,416,000

Operating Expenses				
Total Operating Expenses	6,935,000	6,019,000	5,324,000	5,221,000
Operating Income or Loss	723,000	993,000	1,260,000	1,195,000
AAL		All numbers in thousands		
Total Revenue	44,541,000	42,622,000	40,142,000	40,990,000
Operating Expenses				
Total Operating Expenses	40,784,000	37,519,000	34,282,000	33,706,000
Operating Income or Loss	3,757,000	5,103,000	5,860,000	7,284,000

Table 1

Analysis

Comparing JetBlue cost growth to competitors

Comparing JetBlue to its competitors is made easier by tidying the table of income statements and adding calculated columns for operational expense and income growth. (See Table 2) In the column labeled, "Opn. expense growth, percent," JetBlue's growth is as large or greater than that of all of its competitors across every year.

Note also how simple touches make everything more readable. Some of these changes include:

- Each year had been a separate column in the source document, but I put all of them in a single column
- Column headings are set apart from the data, are bolded, and are a different color
- Borders around each cell are gone in favor of rows with alternating shading
- The table has a title and white padding surrounds it on each side

Annual growth in operational expenses and income since 2015 for select airlines

Carrier	Year	Opn. expense, millions of USD	Opn. income, millions of USD	Opn. expense growth, percent	Opn. income growth, percent
AAL	2015	33,706	7,284		
	2016	34,282	5,860	2%	-20%
	2017	37,519	5,103	9%	-13%
	2018	40,784	3,757	9%	-26%
DAL	2015	34,203	6,501		
	2016	33,226	6,224	-3%	-4%
	2017	35,481	5,657	7%	-9%
	2018	39,032	5,406	10%	-4%
JBLU	2015	5,221	1,195		
	2016	5,324	1,260	2%	5%
	2017	6,019	993	13%	-21%
	2018	6,935	723	15%	-27%
UAL	2015	32,372	5,492		
	2016	31,469	5,089	-3%	-7%
	2017	33,937	3,847	8%	-24%
	2018	37,524	3,779	11%	-2%

Table 2

I also made a chart in an Excel style. Charts make JetBlue's operational cost growth really stand out. This faceted column chart is no exception. (See Figure 1)

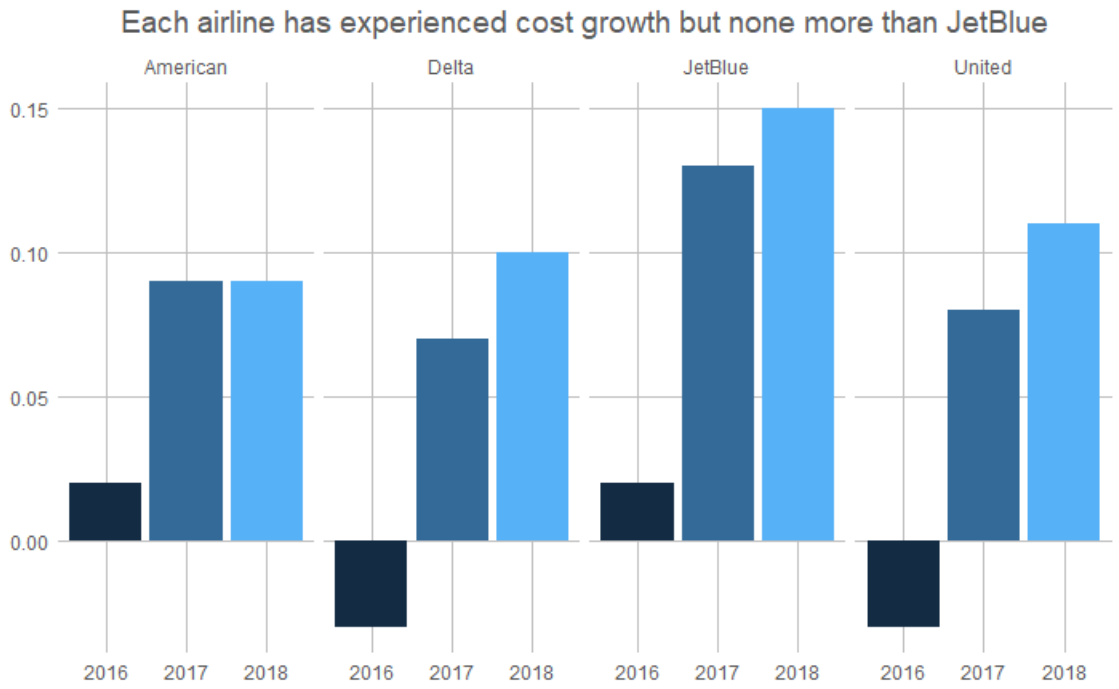

Figure 1

Comparing JetBlue's flight delays

Flight and weather data are publicly available at no cost from the U.S. Bureau of Transportation Services and the U.S. National Weather Service, respectively. This data shows that JetBlue has both the worst on-time ratio at 61 percent and the highest median delay at 30 minutes.

JetBlue is also worse when it comes to delays further out into its extremes. Its interquartile range, the range between it's 25th and 75th percentiles, is 11 to 73 minutes – the highest among its competitors, as can be quickly seen in the following dumbbell chart. (See Figure 2)

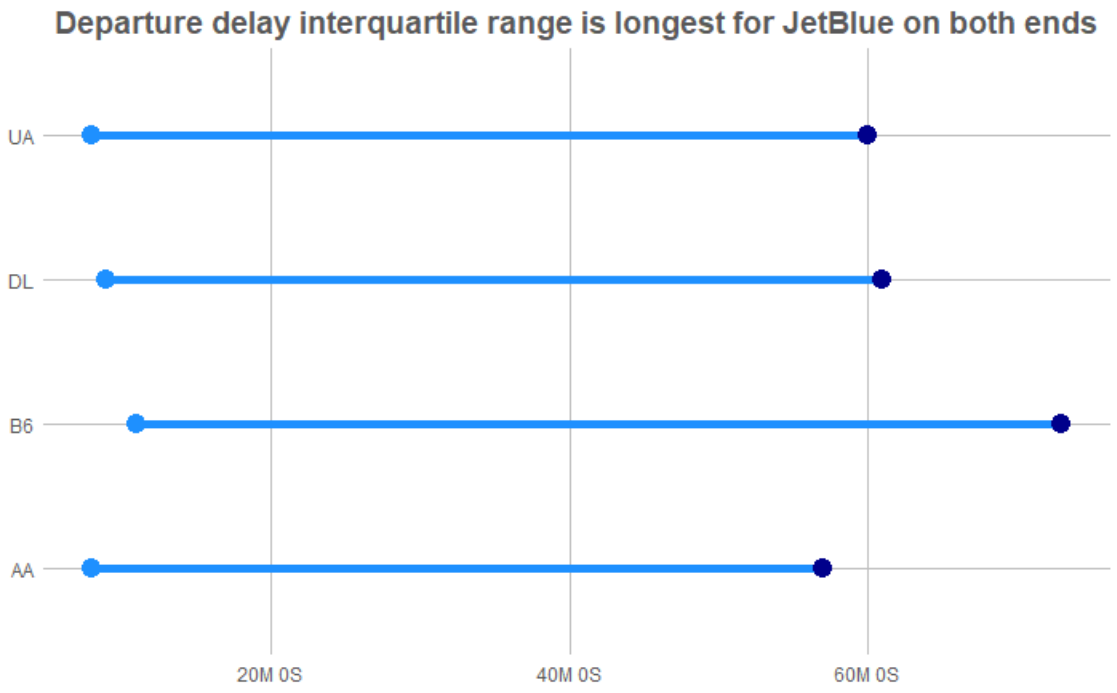

Figure 2

What's more, JetBlue's tardiness is not confined to a few bad days, but rather JetBlue's poor performance relative to its competitors is spread across the year. Here is an area chart, itself a specialized ribbon chart, that shows this. (See Figure 3)

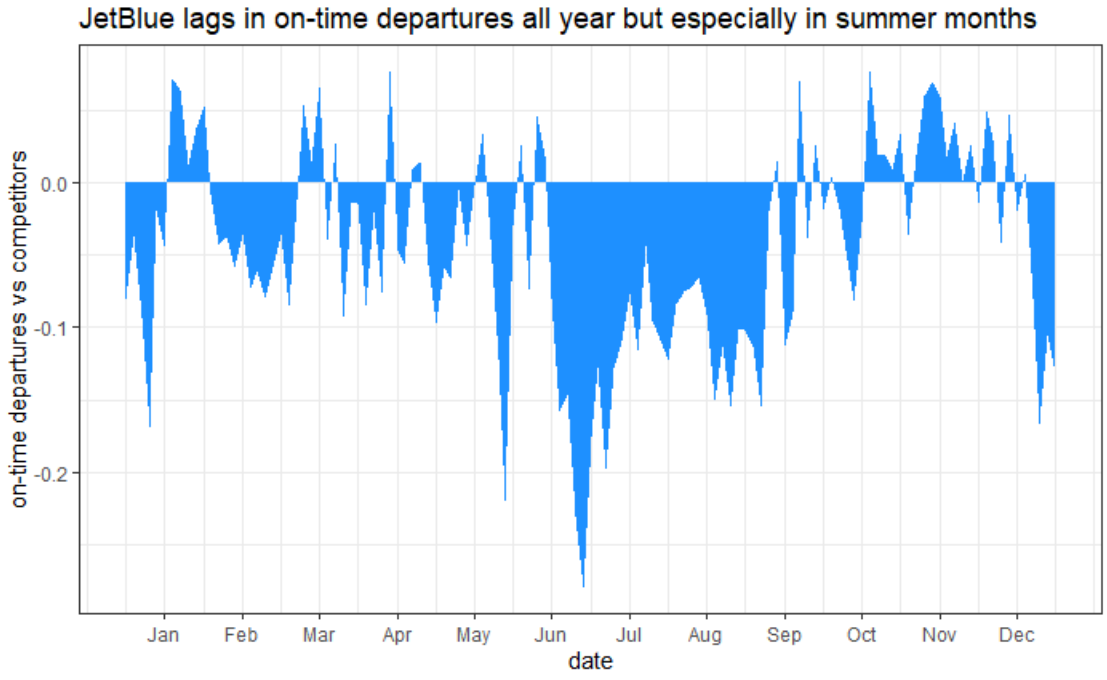

Figure 3

JetBlue's on-time ratio certainly suffers in the summer months of June, July, and August. It's worth the time to put together a grouped density chart to see if the length of its delays is also worse in those summer months. (See Figure 4)

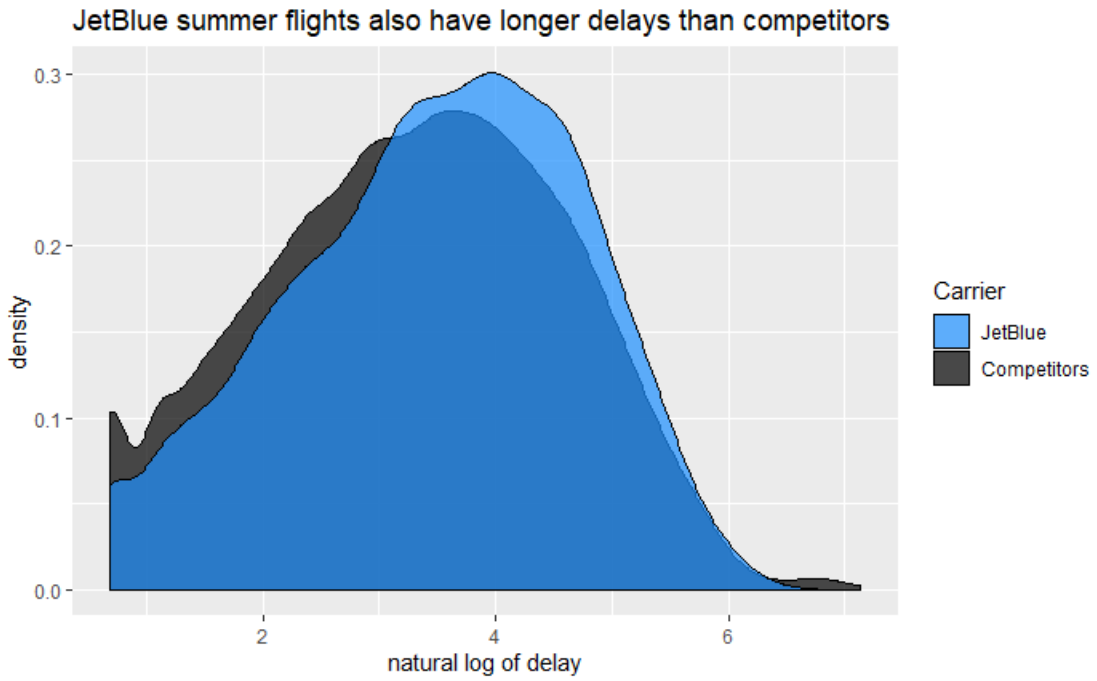

Figure 4

Explore potential causes of JetBlue's flight delays

Indicators that could lead JetBlue to experience flight delays are near endless. Even if only considering details about the weather and the flight, there are dozens of possibilities. A good starting point is to compare correlations across the data that hint at a causal relationship. This is easy to visualize using a correlogram. (See Figure 5)

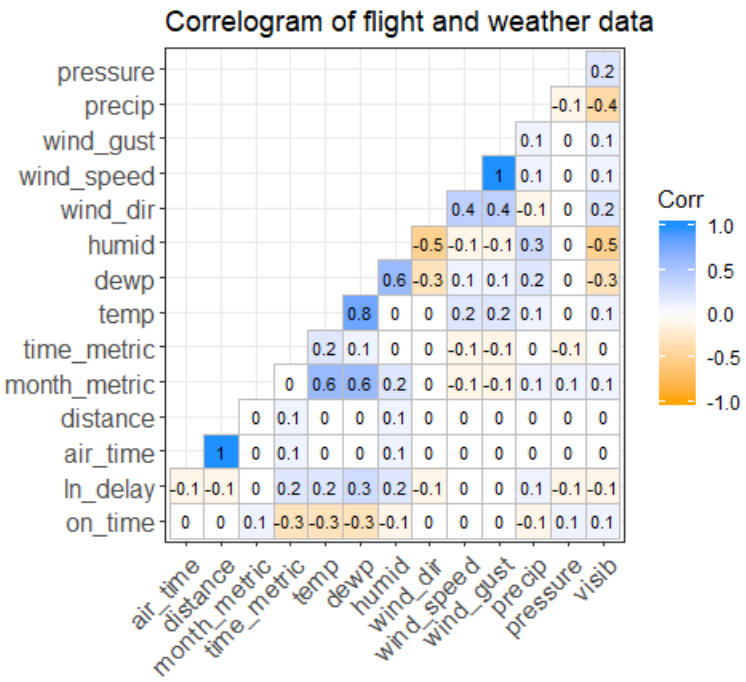

Figure 5

Some independent variables immediately present themselves as good candidates for being correlated with the on-time ratio of flights or the average delay of late flights, including the month of the flight, the departure time of the flight, the temperature at the time of the flight, and the dewpoint at the time of the flight. However, it appears that temperature and dewpoint may also be correlated with each other. Including both variables may tell the same story twice. I can use a count plot, sometimes called a bubble plot, to explore this further. (See Figure 6)

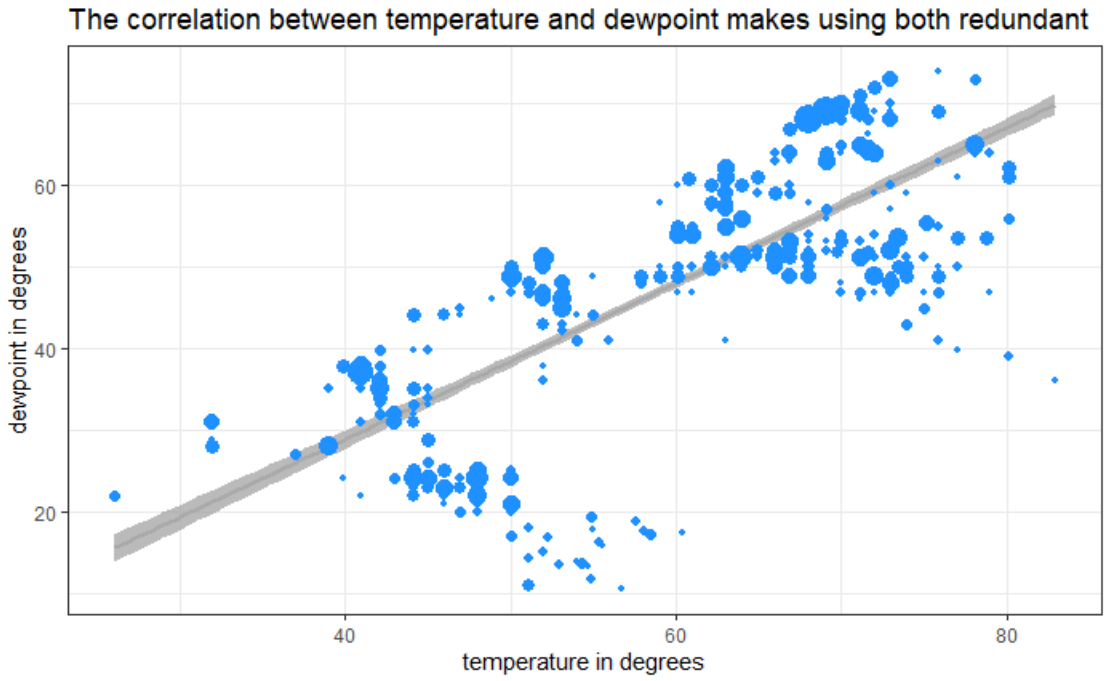

Figure 6

Using flight and weather data to estimate predictive equations

Using the remaining correlated independent variables – month, day of the week, and time of day – we can estimate two equations to predict the likelihood of a future JetBlue flight being delayed and, if delayed, we can predict the range in minutes of its delay.

We can use a linear regression to predict the length of delay of a delayed flight – but only by taking the natural logarithm of the delay such that its distribution better approximates a normal distribution. This function is built into Excel. We can use a logistic regression to predict the probability of an on-time flight. This is not built into Excel but can be accomplished with some manual work and the Solver module.

The equation to predict whether a flight will be on-time is below. (See Equation 1)

$$p(on-time) = \frac{1}{1 + e^{-(-0.87 + 0.13\times|sched.\ dep.\ time - 21{:}27| - 0.094\times|flight\ date - May\ 10| + 0.31\times Sat + 0.32\times Sun + 015\times Mon + 0.27\times Tues + 0.32\times Wed + 0.098\times Thur)}}$$

Equation 1

The equation to predict the length of delay, given a delayed flight is below. (See Equation 2)

$$p(delay \mid delayed\ flight) = e^{3.85 - 0.064\times|sched.\ dep.\ time - 21{:}27| - 0.054\times|flight\ date - May\ 10| - 0.13\times Sat - 0.17\times Sun - 0.062\times Mon - 0.045\times Tues - 0.17\times Wed - 0.11\times Thur}$$

Equation 2

Using a mobile app to predict future delays

Rather than re-copy the two equations and substituting new data each time, the COO may instead access an application that does this automatically by surfing to mariobonifacio.shinyapps.io/JetBlue_app on a mobile device. A preview of the mobile UI is below. (See Figure 7)

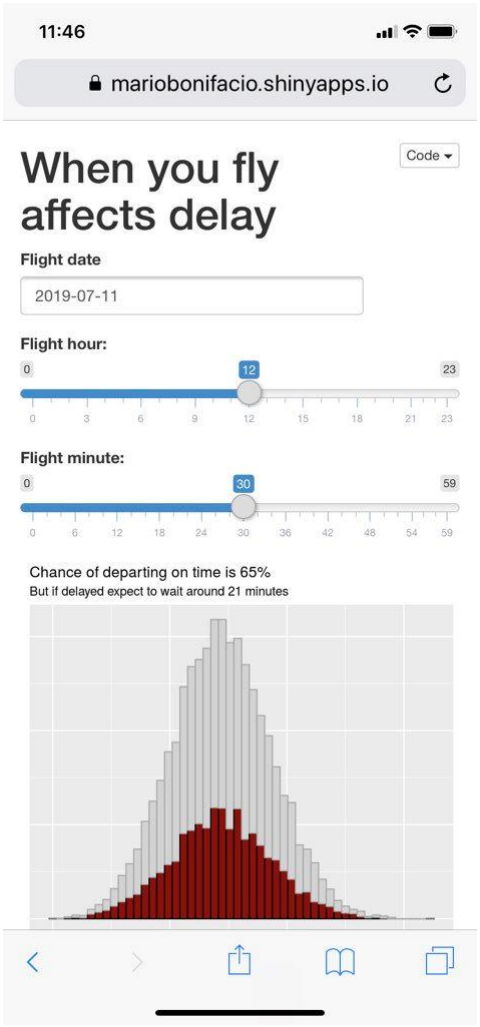

Figure 7

Tableau dashboard

Finally, because the situation with operational expenses, profits, and flight delays is always changing, the COO could benefit greatly from a dynamically updated dashboard in Tableau. (See Figure 8) Starting from the upper left corner and proceeding clockwise, the three modules are:

1. A map that counts how many JetBlue flights have departed for each destination in the current year, keeps a running tally of both operational revenue by adjusting the size of each bubble and operational profit by changing the fill color of each bubble, and providing more detailed information by hovering over each destination airport;
2. The mean departure delay for the 10 flight destinations associated with the highest total revenue so far in the year, plus the profit or loss so far by changing color; and
3. The mean departure delay of all completed months

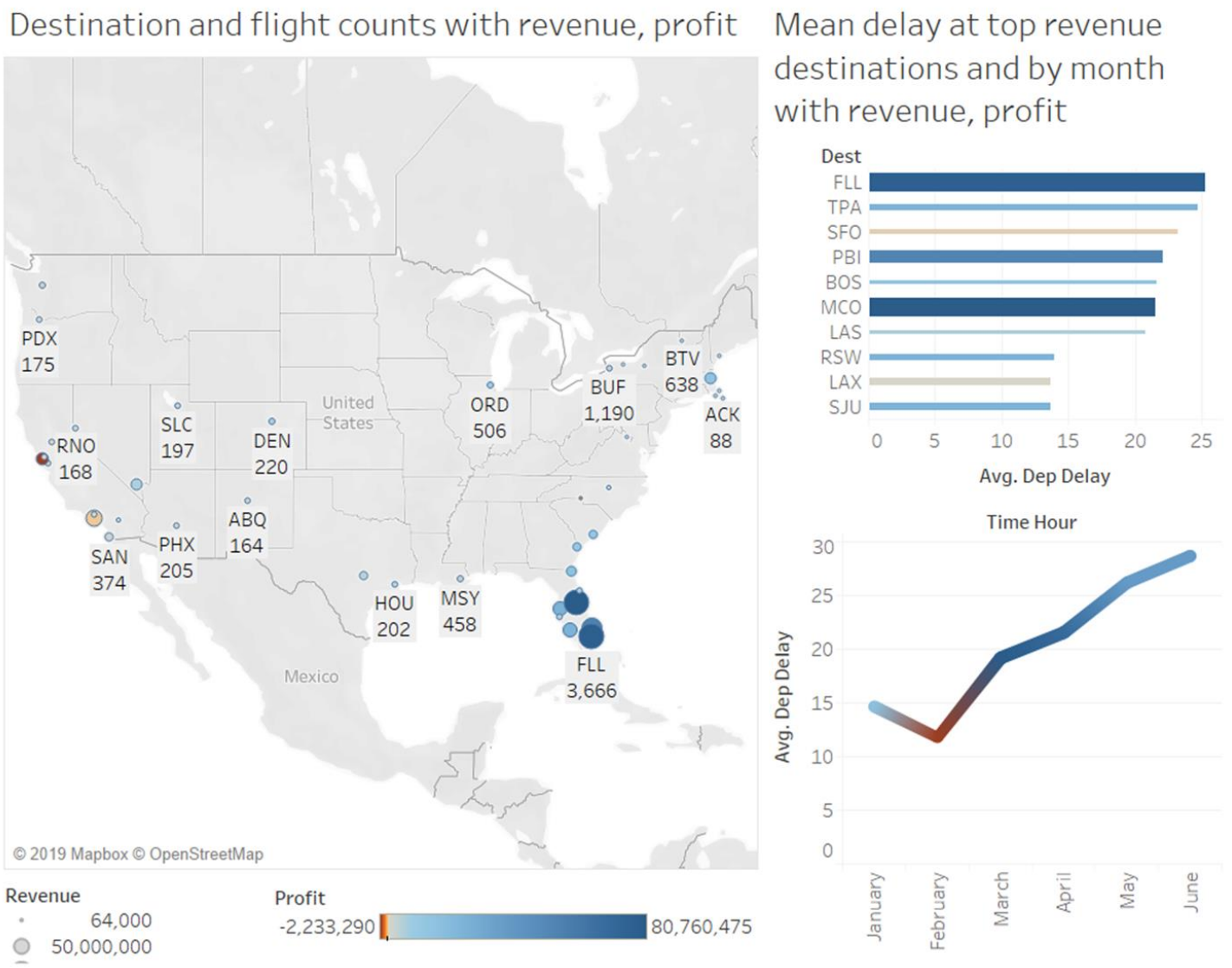

Figure 8