Bankruptcy by COVID-19: Top Five Airlines Affected

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Introduction

Target Audience:

Public Health Officials,
Governing Officials,
Airline Companies,
Airports,
Travel Agencies,
Travelers

1 **Problem Statement.**

Which airline is more likely to file for bankruptcy from COVID-19?

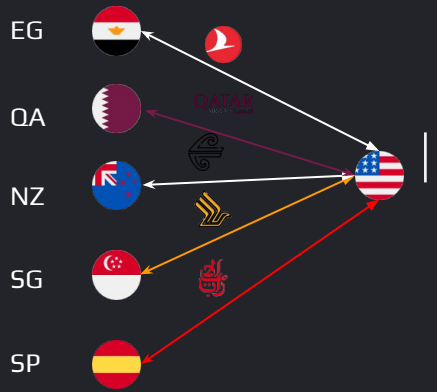
2 **Answering the Problem Statement.**

Creating an SIR model that simulates the interaction between five foreign countries and the United States

3 **Our Metric.**

The number of flights per day over the course of six months

4 **Countries and AIrlines Involved.**



Qatar Airways
Turkish Airlines
Air New Zealand
Singapore Airlines
Emirates Airlines

Average Price Per Trip

Methodology

Primary Focus:

- Tracking airplane gas expense
- Profit gained from ticket sales

		
Gasoline	**International Ticket**	**Per Hour Flying**
$4,000.00-$14,000.00	**$356.51**	**$2,550.00**

Data Sources

- WHO
- BusinessInsider
- Bts.gov
- Worldometers
- Mckinsey
- HowStuffWorks
- Icao.int

Beta/Gamma

Beta - Contact Rate

1/7 infected every 7 days

Gamma - Recovery Rate

1/14 recovered every 2 weeks

Variables/Data Used

- Ticket Price
- Seat Capacity
- Total Income
- Fuel Cost
- Foreign Population
- US Population

Assumptions

- Non-Parallel flights
- Same Beta/Gamma
- Random number of people boarded the airplane
- No passenger recovered on a flight
- At least one infected individual per flight
- One hour flight travel
- Airline reached zero flights, could no longer fly again

Methodology

Methodology - Simulation Overview

1

Setup our system with each countries airline and population data beginning on March 8th, 2020

2

The run simulation function simulates the pandemic for 6 months while calling our update function. This then updates the airline, foreign country, and United States

3

The beta and gamma influence the total infected population, altering the number of passengers and flights

Country Population:

- : 328.2 million - 541 Infected
- : 98.42 million - 1 Infected
- : 46.94 million - 647 Infected
- : 5.639 million - 150 Infected
- : 4.886 million - 5 Infected
- : 2.782 million - 15 Infected

QT (QA) 254 Seats

TA (EG) 337 Seats

ANZ (NZ) 168 Seats

SA (SG) 285 Seats

EA (SP) 517 Seats

Methodology - Flight Simulation

4

Simulate 60 flights per day. Based on the percent infected from both countries, a random amount of seats get filled on the airplane

5

Percent of infected individuals on the flight is determined by the total percent infected from both countries

6

The susceptible and infected population contribute to the destination country's population.

Predictions:

Emirates will go bankrupt

Emirates will be the first to stop flying

Total Infected Percent = US Infected + Foreign Country Infected

↑ Total Infected = ↓ Flights

↑ Total Infected = ↑ Chance of Infected Passengers

Results

Figure (1):

No airline had gone bankruptcy for as long as there were available flights.

Spain had made the most income

Figure (2):

As the number of infected individuals increased, the number of flights decreased

Qatar Airlines was the first airline to terminate operations

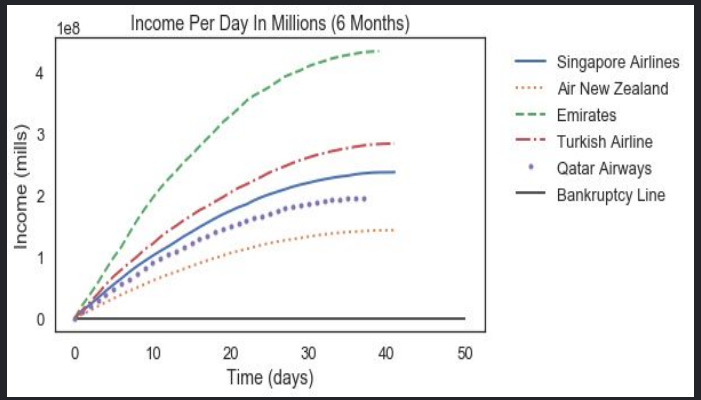


Figure (1)

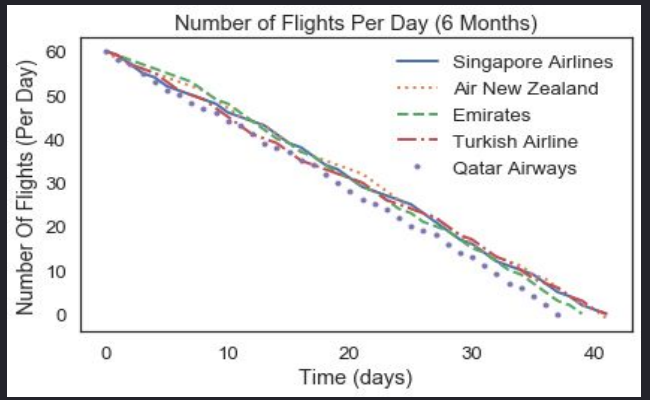


Figure (2)

Results

Figure (3):

Spike increases are additional infected individuals added to a country

Countries with largest population had the smallest marginal affected

Figure (4):

Changing the beta values did not produce a significant difference

Air New Zealand was the first airline to terminate operations

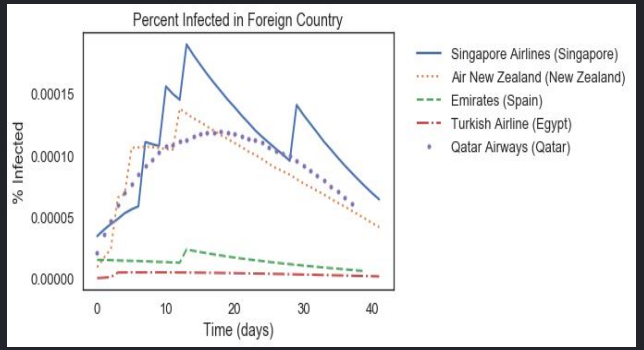


Figure (3)

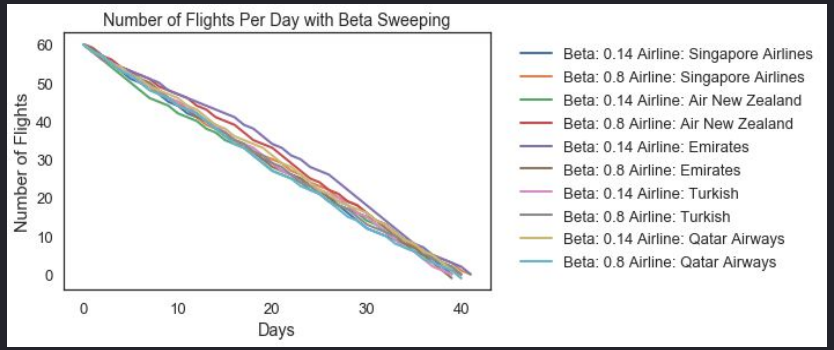


Figure (4)

Analysis

Large population **does not always equate** to an airline stopping operations first

Difficult to produce the same outcome because the model is **highly dependent** on probability and randomness

Limitations

Values Dependent on Probability:

Number of airplane seats taken

Number of passengers

Number of infected passengers

Insufficient Data:

Relies only on income from ticket sales

Only expense tracked is gasoline

Neglects countries containing the same airline

Lacking sweeping data

Precise Beta and Gamma values for COVID-19

Improvements

Sources and Computation:

Accurate Beta and Gamma values for COVID-19

Updated susceptibility and infected population

Average number of passengers on board

Larger variety of expenses

Computers with faster processing speed

Analysis

Accuracy

We believe our model to not be entirely accurate .

Relies on too much probability

Random amount of passengers

Assumed beta and gamma values

Various quantities of airline seats

Precision and Robustness

We believe our model to not be entirely precise and robust.

Too many assumptions

Inconsistent results

Fruitfulness

We believe our model to be fruitful.

Assumptions made are relevant

Justifiable probabilities
Legible results

Generality

We believe our model to not be entirely general.

Versatile with many countries

Versatile with many airlines

Conclusion

Real-life Applications

- Government officials can apply quicker temporary regulations as to whether or not airline activity should be increased or decreased
- Airline companies will lose money regardless and should come up with a travel package plan to mitigate the money lost

Future Research

- More research is needed to find legitimate COVID-19 beta and gamma values to understand the true impact the virus had on each foreign country and the United States
- Various airline expenditures should be included to find a true net income value for airlines

Takeaways

- Airline companies situated in countries with lower populations should be prepared to close down operations sooner than countries with higher populations
- Maintaining an airline is very expensive. Selling tickets alone is not enough to keep an airline company from going bankrupt.