Project Report

GitHub URL

https://github.com/Rishaanthan/UCDPA_RishaanthanShanthaSeelan

Abstract

The aviation industry has always been a resilience industry against global economic shocks and with the most recent Covid-19 pandemic, the aviation industry saw a pause in growth and sustainability for two years. As the economy recovers from the Covid-19 pandemic, the aviation industry has seen an up rise in growth passenger and travel demand. This report will analyze of the passenger numbers traveling in and out of Australia, showing the levels pre and post Covid-19 as well as providing a general Load Factor metric which is used by airlines to determine the percentage of available seating capacity that has been filled with passengers.

Introduction

The Australian tourism market has been one of the strongest tourism market in the world and this boost in the tourism sector can be attributed to the strong demand in the aviation. For the past two years, due to the Covid-19 pandemic the whole world had gone into lockdown which meant that there were travel restrictions and bans across the globe. This restrictions and ban impacted airlines and the aviation industry impacting not only the profitability of airlines but the survival of airlines.

In this report, the analysis of the passengers and seat utilization for airlines entering and exiting Australia will be carried out to determine three component which are outlined below:

1) Overall Load Factor – Load Factor is a metric used in the airline industry to measure the percentage of available seating capacity that has been filled by passengers. The Load Factor is a useful metric to determine if the airline has made a loss, breakeven or profit for each flight that they operate and would provide useful insights to future revenue forecasting and operation planning. In this section, an analysis will be carried out on the overall average load factor from all airlines flying in and out of Australian airspace from 1991 to 2022.

2) Qantas Airways Load Factor Analysis – The dataset used in the analysis for this report records the number of passengers entering and exiting Australia by various airlines such as emirates, Qatar Airways, Singapore Airlines etc. and as stated in point (1) the load factor can be used to determine an airlines profitability. In this section, an Analysis will be carried out on Qantas Airways Load Factor to determine the seat utilization capability pre and post Covid-19.

3) Countries with the most flights to Australia in 2022 – Tourism and travel is a major part of a countries GDP and economic growth and diplomatic relationships between countries are strengthen with travel and airspace access. In this section, an analysis will be carried out on the countries that most flights to Australia originated from which would provide indirect insights on the major countries that provide to the growth of Australian’s aviation industry

Dataset

The dataset used for the project analysis is the *International Airlines – Seat utilisation factors* dataset obtained from the Australian Government website. This dataset records the number of passengers and available seats flying in and out of Australia by International Airlines. By analyzing this dataset, a better understanding can be established on the international airline market and demand for travel in and out of Australia. This dataset provides a comprehensive overview of the number of flights, passengers and seats available entering and exiting Australian Airspace to other international countries from 1991 to 2022, providing a range of data to work with which will aid the accuracy of the analysis.

Moreover, since this dataset contains the number of flights and seat utilization of multiple international airlines, an analysis of each airlines passenger load factor can be determine which provides an understanding of the demand for the airlines while the load factor calculation can provide insights to the airline if the route to Australia is profitable or if the airline are required to rethink their strategy for Australian flights. For the purpose of this analysis, the Load Factor for Qantas Airways will be analyzed and an overview will be provided on the load factor pre and post Covid-19, highlighting Qantas airways passenger demand and airline profitability for traveling in and out of Australia.

Lastly, this dataset records the countries that flights to Australia originated from between 1991 to 2022. An analysis can be carried out to determine if which countries had the most flights per year to Australia as this insight would be valuable to Australia to determine and establish diplomatic relationships between these countries. For the purpose of this analysis, the countries with most flights to Australia in 2022 will be determined.

Implementation Process

1) Importing Libraries and Dataset

The first step in carrying out this analysis is to import the relevant libraries that will be used for this analysis which are as below:

```
# Importing Libraries
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
```

The next step is to import the dataset which is available as a flat file (.csv) and the function ***pd.read_csv()*** was used to import the dataset and assign it to ***seat_utilisation_df*** which will store the dataset's imported as a pandas data frame.

The dataset can also be sorted using the ***sort_values()*** function to aid in the analysis.

```
#Importing and sorting data set

seat_utilsation_df = pd.read_csv('seat_utilisation.csv', index_col
= 0)
seat_utilsation_df.sort_values('Passengers_In', ascending = False)
seat_utilsation_df.sort_values(['Year','Passengers_In'], ascending
= [True,False])
```

2) Analysis 1: Overall Load Factor of passengers entering and leaving Australia per year

The first analysis that will be carried out is to determine the average load factor of passengers entering and leaving Australia per year from 1991 to 2022. Since the dataset is structured where for each corresponding year, the respective ***'Passengers_In', 'Passengers_Out', 'Seats_In' and 'Seats_Out'*** data can be obtained using the ***groupby ()*** method, the first step for this analysis is to find the average (***mean()***) of '***Passengers_In', 'Passengers_Out', 'Seats_In' and 'Seats_Out'*** for each year using the ***groupby ()*** and assigning it to its respective variable.

The next step is to calculate the average load factor for each year and the load factor calculation is as below:

$$Load\ Factor\ (\%) = \frac{Passenger\ onboard}{Seats\ available} \times 100$$

Using this formula, the load factor was calculated as below:

```
 Calculating the average Load Factor (Load Factor is used to determine
the percentage of available seating capacity that has been filled with
passengers)
LoadFactor_per_year_in = (Passenger_In_per_year/Seats_In_per_year)
*100
LoadFactor_per_year_out = (Passenger_Out_per_year/Seats_Out_per_year)
*100
```

This assigns the average load factor of passengers entering and leaving Australia to ***LoadFactor_per_year_in*** and ***LoadFactor_per_year_out*** which is used to create the plot as shown in the results section (Graph 1 and Graph 2).

3) Analysis 2: Qantas Airways Load Factor Analysis pre and post Covid-19 (Year: 2019, 2020, 2021 and 2022)

Since the dataset used records all international airlines data entering and leaving Australia, an analysis of Qantas airways load factor for the years pre and post Covid-19 was carried out. The first step is to extract all the data relevant to Qantas airways and this can be done by subsetting Qantas Airways data as below:

```
# Airline Analysis
# Subsetting Qantas_Airways data for Analysis
Qantas_Airways = seat_utilsation_df[seat_utilsation_df['Airline'] ==
'Qantas Airways']
```

Once the data for Qantas Airways have been subset the next step is to subset data for each year for 2019, 2020, 2021 and 2022 as these are the years that will be used for the pre and post Covid-19 Analysis. The subsets for the years are as below:

```
Qantas_Airways_2019 = Qantas_Airways[Qantas_Airways['Year'] == 2019]
Qantas_Airways_2020 = Qantas_Airways[Qantas_Airways['Year'] == 2020]
Qantas_Airways_2021 = Qantas_Airways[Qantas_Airways['Year'] == 2021]
Qantas_Airways_2022 = Qantas_Airways[Qantas_Airways['Year'] == 2022]
```

Once Qantas Airways data for each of the following year is extracted, then the method to group ***'Passengers_In', 'Passengers_Out', 'Seats_In' and 'Seats_Out'*** used in Analysis 1 can be done for each year and the Load factor for each year can be calculated as previously accomplished in Analysis 1. This data was then plotted as a bar chart to show the relationship of the Load Factors for Qantas Airways between 2019 to 2022 as show in the results section (Graph 3 and 4).

A pivot table was also created to show the average flights in and out of Australia for each of the four years to highlight the demand for travel to and from Australia during that time.

4) **Analysis 3: Identifying countries with most flights to Australia in 2022**.

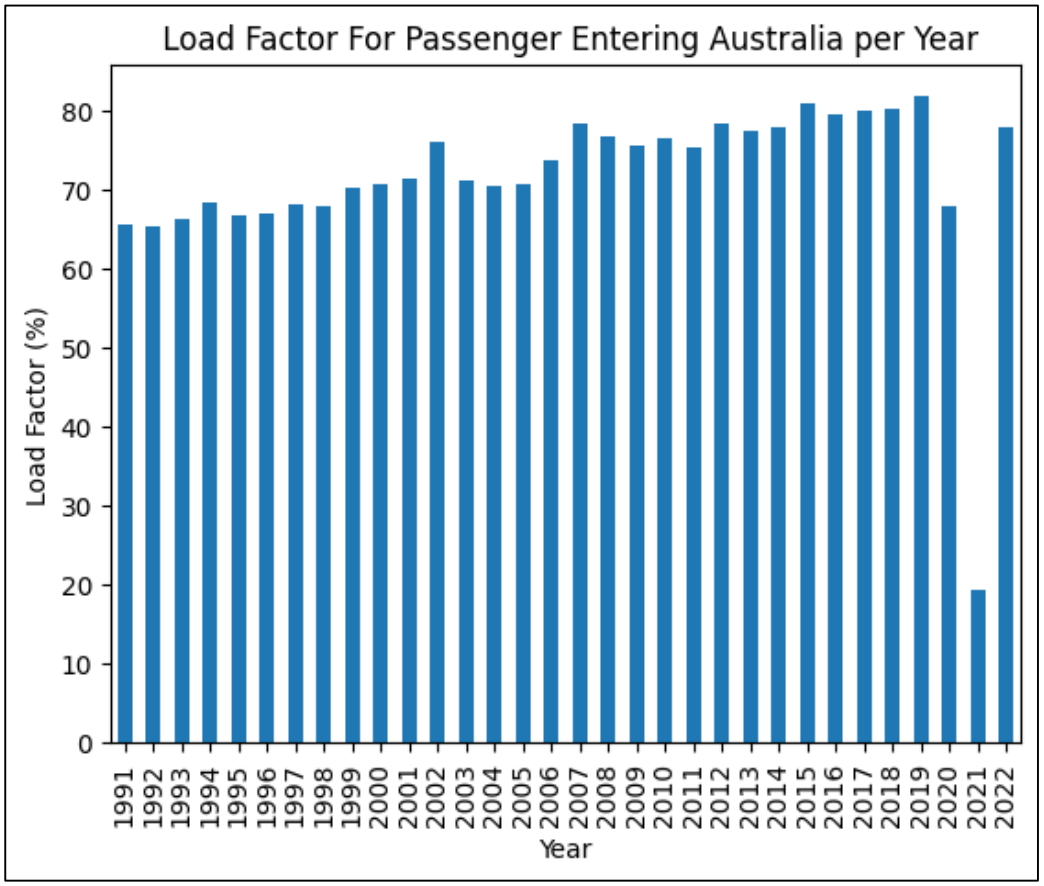
The final analysis carried out was to determine the countries with the most flights to Australia in 2022. The first step is to extract all the 2022 data from the seat utilisation dataset and this was done by subsetting as below:

```
# Subsetting 2022 data
Year_2022 = seat_utilsation_df[seat_utilsation_df['Year'] == 2022]
```

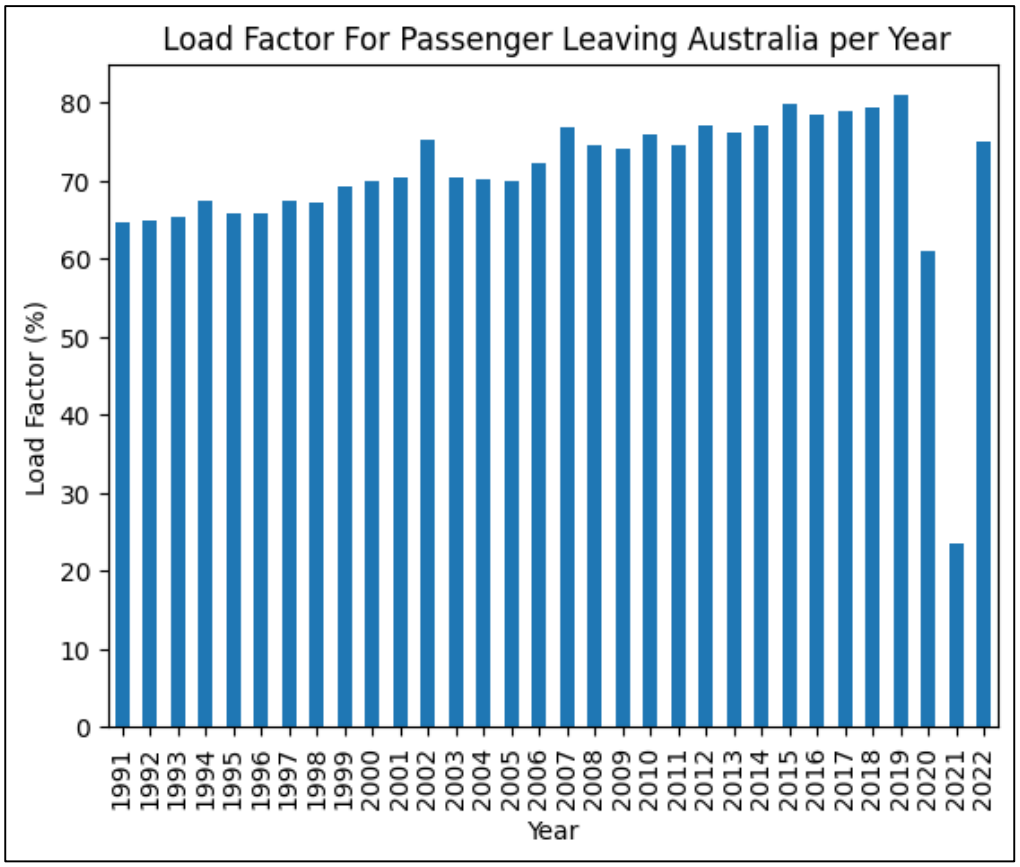
Once the data is extracted the next step is to group all the *service_Country* against the *Flights_In* data and assign it to a variable *Countries_Flights_In*. The next step is to create a data frame for the data extracted and this is done by ***pd.DataFrame ()***. The dataset was also sorted in ascending order and a bar chart was created to show the countries with the most flights to Australia as shown on graph 5 in the results section.

Results

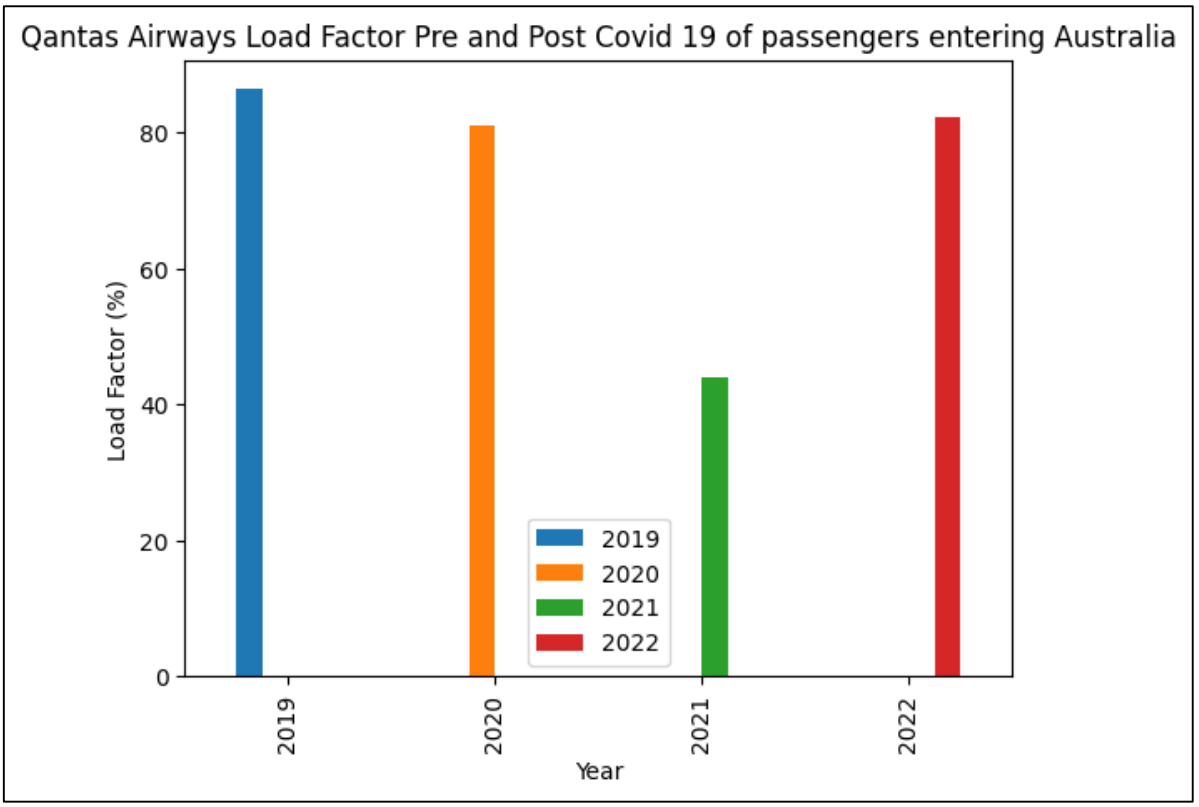
Graph 1: Average Load Factor of passengers entering Australia from Analysis 1



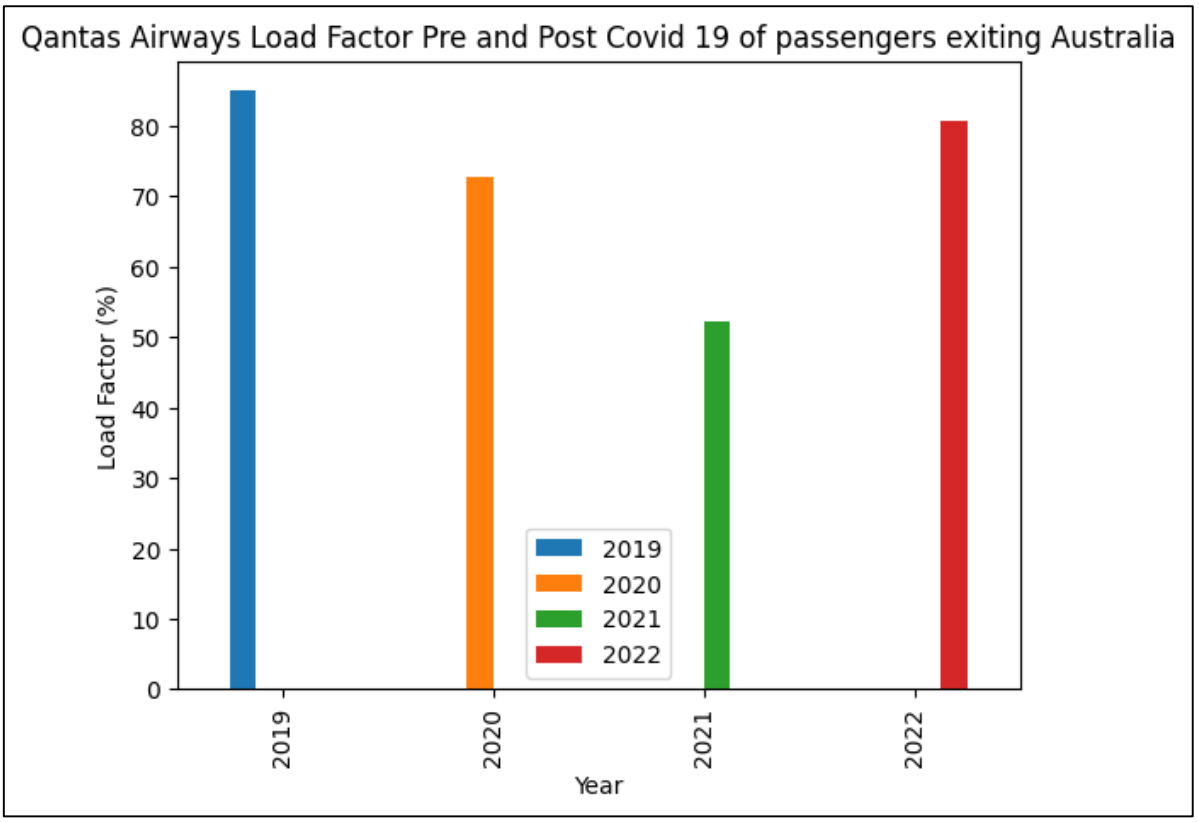
Graph 2: Average Load Factor of passengers leaving Australia from Analysis 1



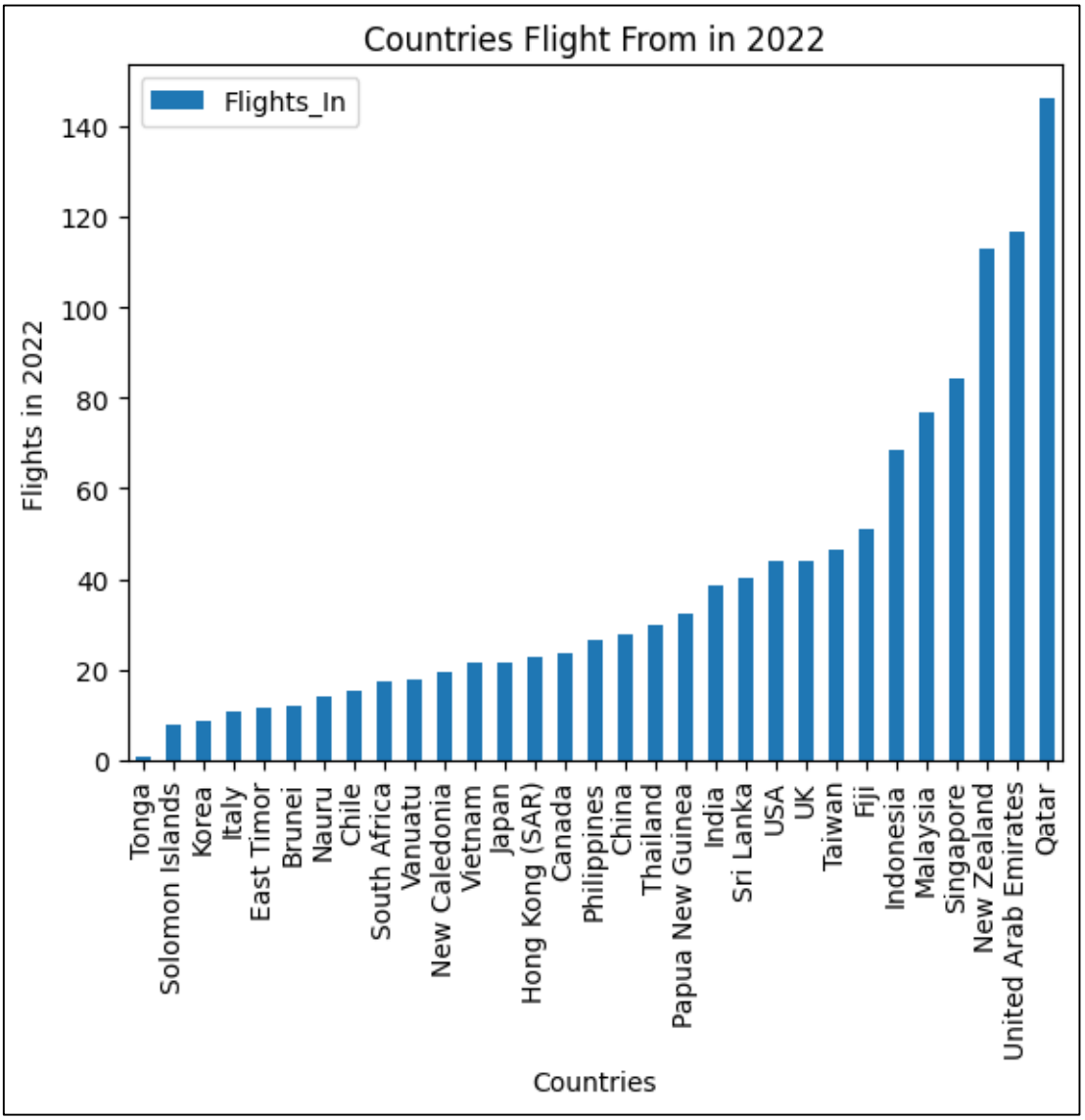
Graph 3: Qantas Airways Load Factor Analysis of passengers entering Australia pre and post Covid-19 from Analysis 2.



Graph 4: *Qantas Airways Load Factor Analysis of passengers exiting Australia pre and post Covid-19 from Analysis 2.*



Graph 5: Countries with the most Flights to Australia from Analysis 3.



Insights

Based on the analysis carried out, a few insights can be derived and they are as below:

- From Analysis 1, it can be seen that the passenger load factor entering and leaving Australia is identical which indicates that the demand for passenger entering Australia is cancelled by the demand for passengers leaving Australia.
- From Analysis 1, it can be seen that in the 90's the load factor was not more that 70% while in the 2000's the load factor has increased pass the 70% mark indicating airlines sold more seats in the 2000's than the 90's.
- From Analysis 2, it can be seen that even though 2020 was considered a Covid-19 year, Qantas Airways still managed to sell 70% of their available seats but this number has dropped in 2021 as expected due to lockdowns and restrictions. The demand for 2022 has also seen pre Covid-19 level load factors.
- From Analysis 2, during 2021 Qantas Airways had a higher load factor for passengers leaving Australia than passengers arriving to Australia which shows that more people leaving Australia during the pandemic.
- From Analysis 3, it can be seen that most flights to Australia originated from Qatar and second from UAE which validates the fact that middle east is the connection hub for all international travel.

References

1) *International Airlines - Seat utilisation factors (2022) Search. Available at: https://data.gov.au/dataset/ds-dga-ca63a1d5-7f01-4ff0-9e11-ef52ac9f5780/details.*
2) *Beers, B. (2022) How does load factor impact airline profitability?, Investopedia. Available at: https://www.investopedia.com/ask/answers/041515/how-can-i-use-load-factor-indicator-profitability-airline-industry.asp#:~:text=The%20load%20factor%20is%20a,over%20a%20low%20load%20factor.*