

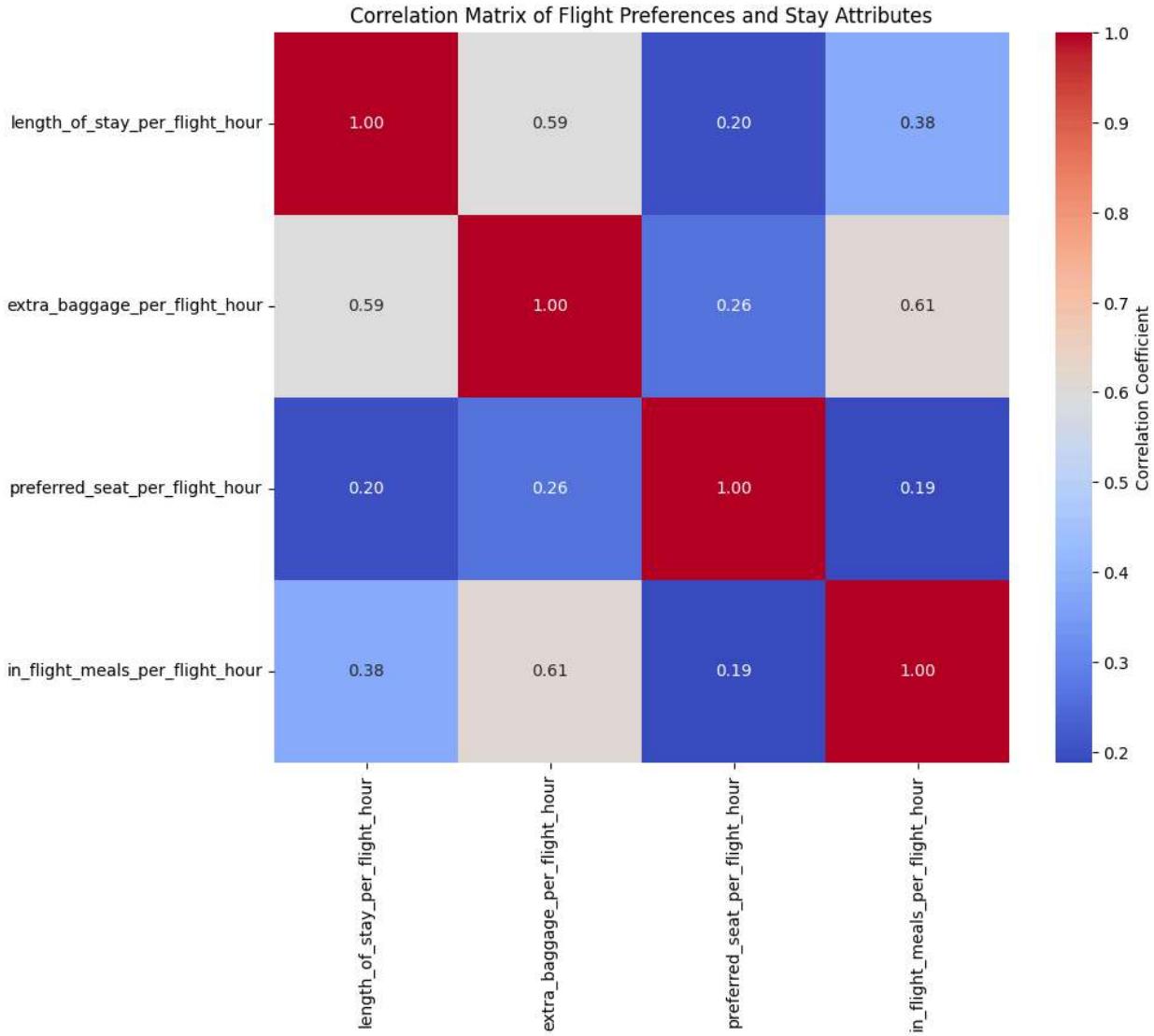
Question 6

Link to Jupyter notebook for additional analysis: [Q6_Additional Analysis.ipynb - Colab](#)

Small section of the output of SQL query for question 6

	sales_channel	route	avgLengthOfStayPerAvgFlightHour	avgExtraBaggagePerAvgFlightHour	avgPreferredSeatPerAvgFlightHour	avgInFlightMealsPerAvgFlightHour
▶	Internet	AKLDEL	3.28421053	0.06315789	0.02105263	0.05789474
	Mobile	AKLDEL	2.50000000	0.00000000	0.00000000	0.00000000
	Internet	AKLGH	5.66666667	0.00000000	0.00000000	0.00000000
	Internet	AKLHND	0.87500000	0.02500000	0.00000000	0.02500000
	Internet	AKLICN	3.63953488	0.09689922	0.02519380	0.07170543
	Mobile	AKLICN	2.80000000	0.04000000	0.00000000	0.04000000
	Internet	AKLKIX	7.76315789	0.05263158	0.01315789	0.02631579
	Internet	AKLKTM	4.11111111	0.13333333	0.00000000	0.02222222
	Mobile	AKLKTM	6.00000000	0.33333333	0.00000000	0.00000000
	Internet	AKLKUL	3.59346827	0.07336044	0.02488068	0.04940781
	Mobile	AKLKUL	3.23387829	0.06948229	0.02179837	0.03860127
	Internet	AKLMRU	5.85416667	0.12500000	0.10416667	0.12500000
	Internet	AKLPEK	1.44736842	0.07894737	0.05263158	0.10526316
	Mobile	AKLPEK	1.82352941	0.00000000	0.05882353	0.05882353
	Internet	AKLPVG	2.40000000	0.10000000	0.00000000	0.03333333
	Internet	AKLTPE	2.66933333	0.06933333	0.00800000	0.02933333
	Mobile	AKLTPE	2.16883117	0.05194805	0.01298701	0.02597403

To calculate the correlation between flight hours, length of stay, and various preferences such as extra baggage, preferred seats, and in-flight meals, a correlation matrix has been made and the variables were calculated by taking the ratio of the average of each variable with the average flight duration. We essentially take this ratio because flight durations can vary a lot between the same two destinations, so it makes sense to consider variables per unit flight hour while computing the correlation between any two variables.



Following are the insights derived from the correlation matrix

1. Length of Stay per Flight Hour:

- **Moderate Positive Correlation with Extra Baggage per Flight Hour (0.594):**
Passengers who stay longer relative to flight hours are moderately more likely to require extra baggage.
- **Weak Positive Correlation with In-flight Meals per Flight Hour (0.382):**
A slight tendency for passengers with longer stays per flight hour to also prefer in-flight meals.

- **Weak Positive Correlation with Preferred Seat per Flight Hour (0.202):**
Longer stays per flight hour are weakly associated with a preference for specific seats.

2. Extra Baggage per Flight Hour:

- **Strong Positive Correlation with In-flight Meals per Flight Hour (0.614):**
Passengers who bring more extra baggage relative to flight hours also strongly prefer in-flight meals.
- **Moderate Positive Correlation with Preferred Seat per Flight Hour (0.263):**
Those who require extra baggage are moderately more likely to prefer specific seats.
- **Moderate Positive Correlation with Length of Stay per Flight Hour (0.594):**
Passengers with a higher stay-to-flight hour ratio also bring more extra baggage.

3. Preferred Seat per Flight Hour:

- **Weak Positive Correlations with Other Preferences:**
Extra baggage per flight hour (0.263) and in-flight meals per flight hour (0.188) show weak correlations.
- **Weak Positive Correlation with Length of Stay per Flight Hour (0.203):**
Specific seat preferences are only weakly influenced by the length of stay relative to flight hours.

4. In-flight Meals per Flight Hour:

- **Strong Positive Correlation with Extra Baggage per Flight Hour (0.614):**
Passengers who opt for in-flight meals are strongly likely to require extra baggage.

- **Weak Positive Correlation with Length of Stay per Flight Hour (0.382):**
Passengers staying longer are somewhat more inclined to select in-flight meals.
- **Weak Positive Correlation with Preferred Seat per Flight Hour (0.188):**
Meal preferences show a weak relationship with seat preferences.

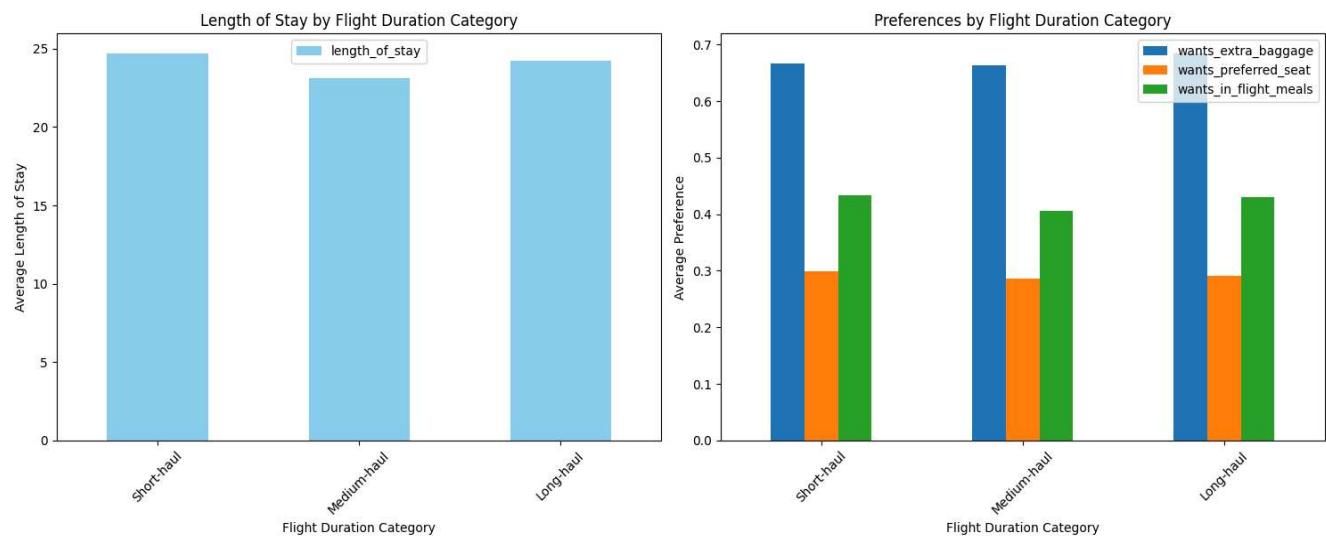
There are clear moderate to strong correlations between preferences like extra baggage and in-flight meals, especially in relation to length of stay and flight hours. However, preferred seat selection is less influenced by these factors, suggesting it may depend on other variables, such as personal habits or class of service.

Let's go deeper into this.

Flight Duration

What are we looking into?

- Do passengers on longer flights prefer extra baggage or in-flight meals more?
- Are short-haul passengers less likely to prefer specific seats?



Observations:

1. Extra Baggage:

- Long-haul passengers have the highest preference for extra baggage (0.685), followed closely by Short-haul (0.667) and Medium-haul (0.663) passengers.
- Long-haul passengers seem to be the most likely to want extra baggage

2. Preferred Seat:

- The preference for a preferred seat is highest among Short-haul passengers (0.299), followed by Long-haul (0.291) and Medium-haul (0.286) passengers.
- Short-haul passengers are slightly more likely to prefer specific seats compared to passengers on longer flights.

3. In-flight Meals:

- Short-haul passengers have the highest preference for in-flight meals (0.433), with Long-haul passengers closely following (0.430).
- Medium-haul passengers have the lowest preference for in-flight meals (0.405).

Therefore:

1. Do passengers on longer flights prefer extra baggage or in-flight meals more?

- Long-haul passengers show a higher preference for extra baggage (0.685) than for in-flight meals (0.430).
- In comparison, Short-haul passengers show a higher preference for in-flight meals (0.433) than extra baggage (0.667).

Conclusion: Passengers on longer flights (Long-haul) tend to prefer extra baggage more than in-flight meals, while Short-haul passengers have a stronger preference for in-flight meals than for extra baggage.

2. Are short-haul passengers less likely to prefer specific seats?

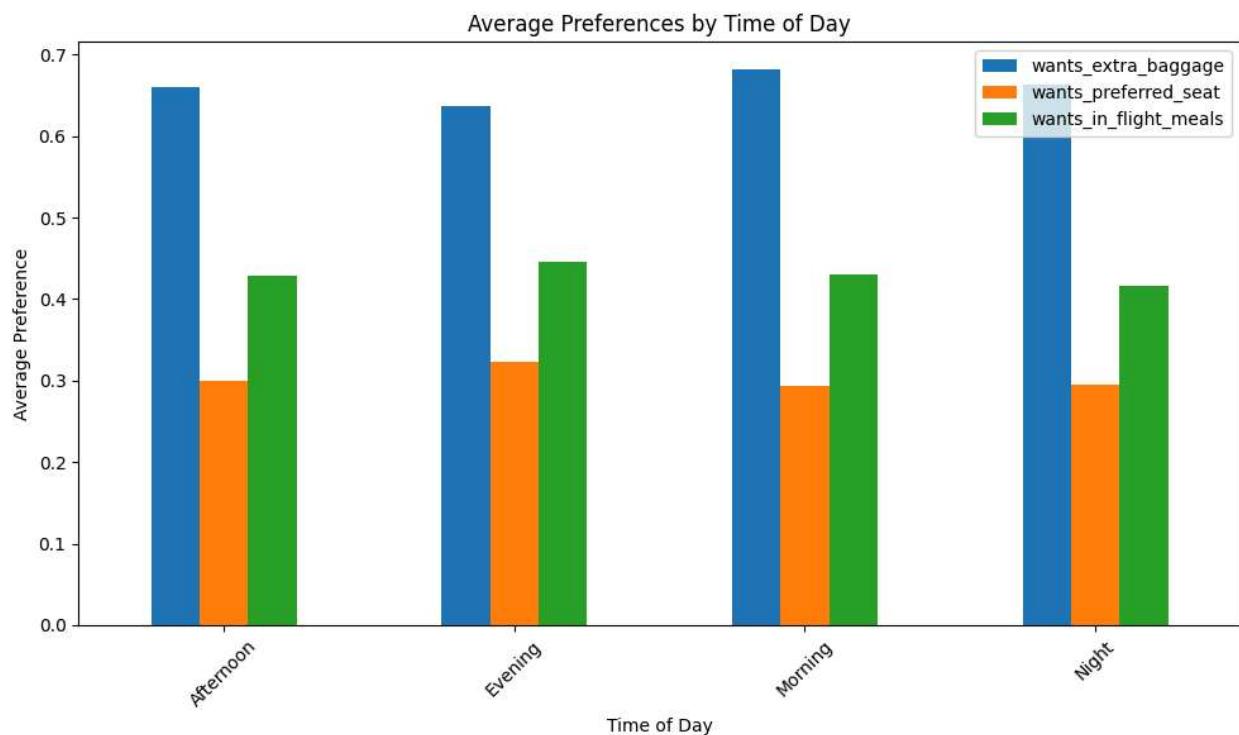
- Short-haul passengers have the highest preference for preferred seats (0.299), compared to both Medium-haul (0.286) and Long-haul (0.291) passengers.

Conclusion: Short-haul passengers are not less likely to prefer specific seats. In fact, they show a slightly higher preference for specific seats compared to passengers on longer flights.

Time of Flight

Here's what we'll be looking into:

- Do morning flights have lower demands for in-flight meals compared to evening flights?
- Are specific seat preferences more common for late-night or red-eye flights?



Observations:

1. Extra Baggage:

- Morning flights have the highest preference for extra baggage (0.681398).
- Evening flights show the lowest preference for extra baggage (0.637714).
- The preference for extra baggage is slightly higher during morning and night flights, suggesting that early and late travellers might require more baggage for longer trips or overnight stays.

2. Preferred Seat:

- Evening flights exhibit the highest preference for specific seats (0.322537).
- Night flights have the lowest preference for specific seats (0.294952).
- There is a notable, albeit small, variation across times of the day, with evening flights standing out as the period where passengers prioritise seating arrangements, likely for comfort or convenience during peak travel hours.

3. In-flight Meals:

- Evening flights show the highest preference for in-flight meals (0.446019), followed by morning flights (0.429434).
- Night flights have the lowest preference for in-flight meals (0.415959).
- Meal preferences peak during evening flights, possibly due to passengers seeking additional comfort during end-of-day travel. Night flights, often shorter or red-eye flights, exhibit the lowest meal preference.

Therefore:

1. Do passengers on longer flights prefer extra baggage or in-flight meals more?

- Extra baggage: Long-haul passengers have a slightly higher preference for extra baggage (0.685) compared to short-haul (0.667) and medium-haul (0.663) passengers.
- In-flight meals: Short-haul passengers show a slightly higher preference for meals (0.433) than long-haul (0.430), although the difference is not large.

Conclusion: Passengers on longer flights tend to prefer extra baggage slightly more than in-flight meals, though meal preferences remain relatively consistent across all flight durations.

2. Are short-haul passengers less likely to prefer specific seats?

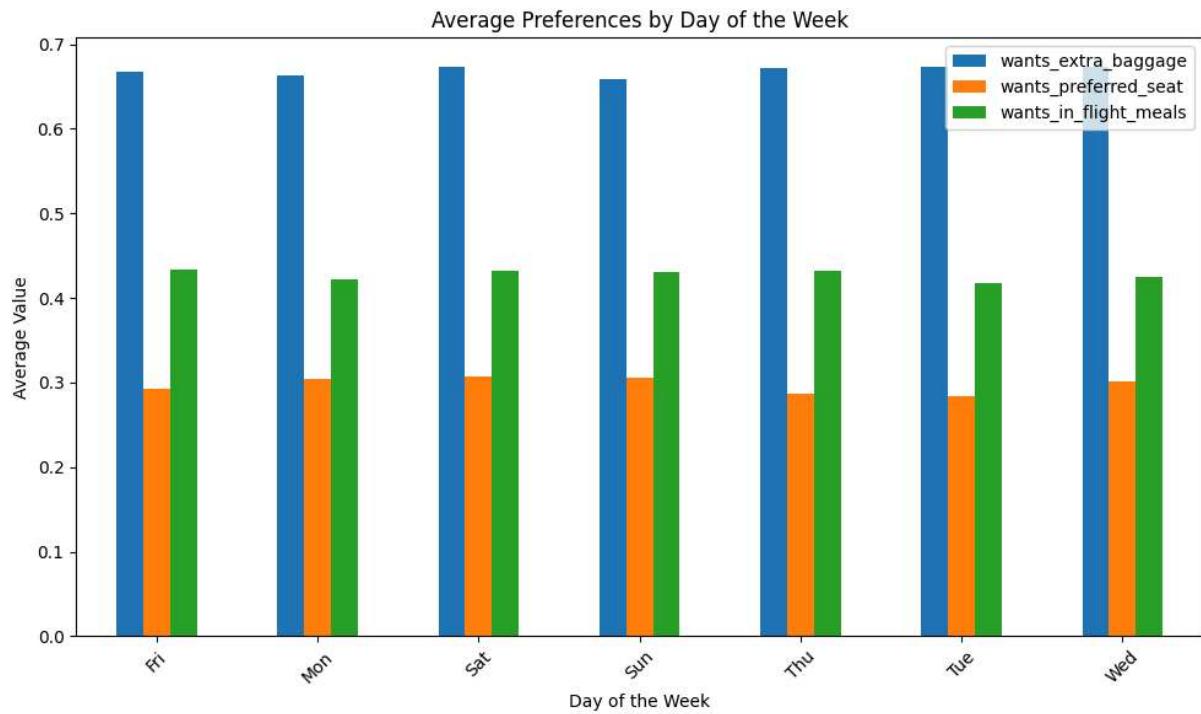
- Preferred seats: Short-haul passengers have a slightly higher preference (0.299) for specific seats than both medium-haul (0.286) and long-haul (0.291) passengers.

Conclusion: Short-haul passengers are not less likely to prefer specific seats. In fact, they show a slightly higher preference compared to other flight durations, though the difference is minor.

Days of the Week

What we'll look at:

- Are there specific days when passengers are more likely to want extra baggage, preferred seats, or in-flight meals?
- Do preferences for in-flight meals or baggage increase or decrease on weekends (e.g., Friday vs. Monday)?
- Is there any day of the week when passengers consistently prefer seats more or less than on other days?



Observations:

1. Extra Baggage:

- Saturday (0.674) and Tuesday (0.674) have the highest preference for extra baggage.
- Sunday has the lowest preference for extra baggage (0.659).
- There is a slight fluctuation across the days, but Saturday and Tuesday seem to consistently show a slightly higher preference for extra baggage.

2. Preferred Seat:

- Monday (0.304) shows the highest preference for specific seats, followed closely by Saturday (0.307) and Sunday (0.306).
- Thursday (0.287) shows the lowest preference for specific seats, indicating that seat preferences are lower on Thursdays.

- There is noticeable variability in seat preferences, with Monday standing out as the day passengers are most likely to request a specific seat.

3. In-flight Meals:

- Friday (0.434) shows the highest preference for in-flight meals, slightly ahead of Saturday (0.433).
- Tuesday (0.417) shows the lowest preference for in-flight meals, followed by Monday (0.422).
- Meal preferences are generally consistent across the days, with a slight peak on Friday and Saturday, and a slight dip earlier in the week (Monday and Tuesday).

Conclusion

In summary, preferences for extra baggage and in-flight meals are moderately to strongly correlated, especially in relation to the length of stay and flight hours. Preferred seat selection appears to be influenced less by these factors and may depend more on individual preferences or travel circumstances. Furthermore, there are clear patterns in passenger preferences based on flight duration, time of flight, and day of the week as well.

Understanding these insights allows airlines to better cater to passenger needs by tailoring services accordingly. By aligning offerings with passenger tendencies, airlines can enhance customer satisfaction and potentially increase ancillary revenues.

Question 7

Key Findings

Airline	Class	Seasonality	Avg_SeatComfort	Avg_FoodnBeverages	Avg_InflightEntertainment	Avg_ValueForMoney	Avg_OverallRating
Qatar Airways	Business Class	Non-Seasonal	4.1139	4.0696	4.2911	3.7532	7.2911
Qatar Airways	Business Class	Seasonal	4.0704	3.8592	4.1268	3.7183	7.5211
Qatar Airways	Economy Class	Non-Seasonal	3.9841	4.2024	4.2659	3.8492	7.2738
Qatar Airways	Economy Class	Seasonal	3.9153	3.9266	4.1977	3.4802	6.6158
Qatar Airways	First Class	Non-Seasonal	4.0000	4.0000	4.1111	3.8889	9.3333
Qatar Airways	First Class	Seasonal	4.0000	2.5000	4.5000	3.2500	6.7500
Qatar Airways	Premium Economy	Non-Seasonal	3.7500	4.0000	3.5000	5.0000	10.0000
Qatar Airways	Premium Economy	Seasonal	4.0000	5.0000	2.0000	5.0000	10.0000
Singapore Airlines	Business Class	Non-Seasonal	3.6531	3.6122	4.0136	3.5986	7.0612
Singapore Airlines	Business Class	Seasonal	3.5714	3.4048	3.7500	3.8929	7.5595
Singapore Airlines	Economy Class	Non-Seasonal	3.7324	3.5523	3.9100	3.4234	6.3747
Singapore Airlines	Economy Class	Seasonal	3.6242	3.4970	3.8000	3.4970	6.6364
Singapore Airlines	First Class	Non-Seasonal	3.7273	3.5455	4.4545	4.5455	9.2727
Singapore Airlines	First Class	Seasonal	4.0000	4.0000	2.5000	5.0000	10.0000
Singapore Airlines	Premium Economy	Non-Seasonal	3.6140	3.4386	3.8070	2.9298	5.6667
Singapore Airlines	Premium Economy	Seasonal	3.5385	3.6154	4.2308	2.8846	6.0000

1. Seasonal vs. Non-Seasonal Ratings Overview:

- **Qatar Airways:**
 - Ratings for all classes show significant improvement during seasonal periods, particularly in OverallRating and ValueForMoney.
 - Seasonal ratings for **First Class** are exceptional, achieving perfect scores (10.000) for OverallRating and ValueForMoney.
 - **Premium Economy** exhibits better consistency, with similar performance across seasonal and non-seasonal periods.
- **Singapore Airlines:**
 - Seasonal improvements are observed across all classes, particularly in SeatComfort and InflightEntertainment.
 - Premium Economy during non-seasonal periods has the lowest ratings, notably in ValueForMoney (2.8846) and OverallRating (5.6667).
 - Business Class and Economy Class have more balanced scores between periods but remain below Qatar Airways in overall metrics.

2. Metric-Specific Observations:

- **SeatComfort:**
 - Qatar Airways consistently scores high, especially in non-seasonal Business Class (4.1139).
 - Singapore Airlines trails behind in Premium Economy for both periods.
- **FoodnBeverages:**

- This metric has the lowest scores across both airlines and all classes, highlighting a shared weakness.
- Qatar Airways seasonal improvements are minor, while Singapore Airlines shows negligible change.
- **InflightEntertainment:**
 - Both airlines perform well, with Qatar Airways leading slightly in First Class seasonal ratings (4.5000).
- **ValueForMoney:**
 - Qatar Airways achieves standout scores in Seasonal Premium Economy and First Class.
 - Singapore Airlines underperforms significantly in non-seasonal periods, particularly in Premium Economy.
- **OverallRating:**
 - Qatar Airways consistently outperforms Singapore Airlines, with seasonal ratings peaking in First Class (10.000).

3. Insights from the Historical Trends (Graph):

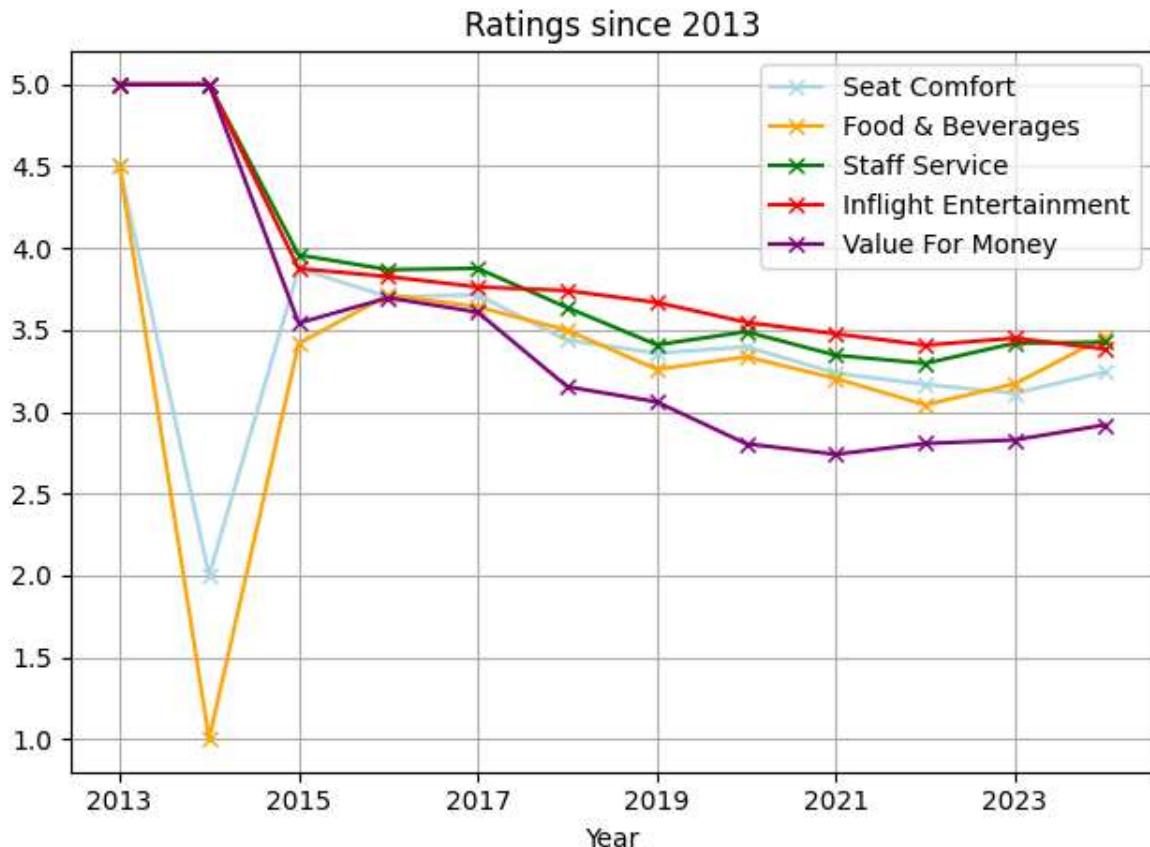


Figure: Graphical trend of airline ratings since 2013

- The graph illustrates a sharp decline in ratings around 2015, possibly due to operational or market disruptions.
- Ratings stabilize post-2017 but show a slight dip during global disruptions (e.g., COVID-19 pandemic in 2020).
- Despite the recovery, 'FoodnBeverages' remains the weakest metric over time, consistently scoring below other categories.

Insights from Class-Specific Analysis

1. Qatar Airways:

- **First Class:**
 - Dominates across metrics, with perfect seasonal scores in key categories.
 - Maintains high standards even during non-seasonal periods, reflecting consistent quality.
- **Economy Class:**
 - Seasonal ratings highlight slight improvements in customer satisfaction, particularly in InflightEntertainment.
- **Premium Economy:**
 - Balanced performance across periods but lacks the excellence of First Class.

2. Singapore Airlines:

- **First Class:**
 - Shows significant seasonal improvements but lags behind Qatar Airways in ValueForMoney.
- **Business Class:**
 - Averages are consistent but fall short in seasonal competitiveness.
- **Premium Economy:**
 - Struggles with low non-seasonal ratings, especially in ValueForMoney and OverallRating.

Recommendations:

1. Enhance Food and Beverage Offerings:

- Both airlines should prioritize improvements in this metric by introducing special seasonal menus, premium dining options, or regional cuisines.
- Conduct customer feedback surveys to understand specific preferences and pain points.

2. Focus on Premium Economy Value:

- Singapore Airlines should address customer dissatisfaction in ValueForMoney by offering additional perks (e.g., free Wi-Fi, complimentary lounge access) during non-seasonal periods.
- Qatar Airways can leverage its high scores to market Premium Economy as a competitive edge.

3. Consistency in Quality Across Periods:

- Seasonal excellence in Qatar Airways First Class should serve as a benchmark for other classes and airlines.
- Singapore Airlines should work on reducing variability between seasonal and non-seasonal ratings, especially in Premium Economy.

4. Leverage Inflight Entertainment:

- Both airlines should capitalize on their strong ratings in this metric by curating region-specific content, integrating new technologies, or offering exclusive content during long-haul flights.

5. Customer-Centric Innovations:

- Personalized offerings based on customer demographics and preferences can boost satisfaction in lagging metrics like 'FoodnBeverages' and 'ValueForMoney'.

6. Long-Term Focus on Sustained Quality:

- Address historical dips in performance (e.g., 2015 and 2020 disruptions) by improving operational resilience and customer engagement during challenging times.

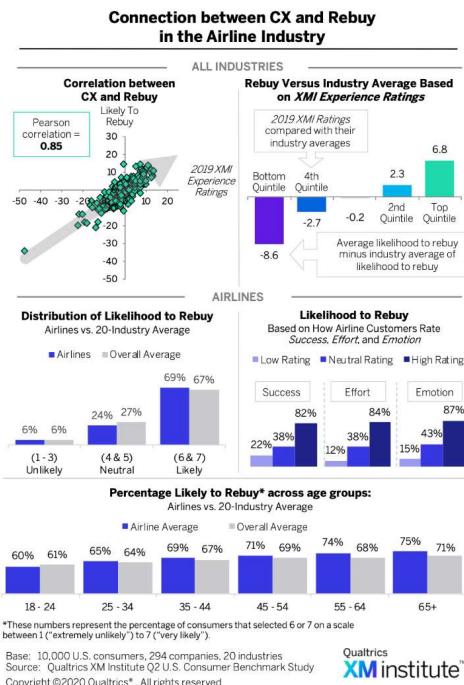
Conclusion

The analysis reveals that Qatar Airways leads in overall customer satisfaction, particularly in First Class and Premium Economy, during seasonal periods. Singapore Airlines struggles to match this performance, especially in non-seasonal Premium Economy. To remain competitive,

airlines must address weaknesses in Food & Beverages and Value for Money, while leveraging strengths like Inflight Entertainment to differentiate their offerings. By focusing on customer-centric innovations and maintaining consistent quality, both airlines can enhance their reputation and retain customer loyalty across all periods.

Question 8

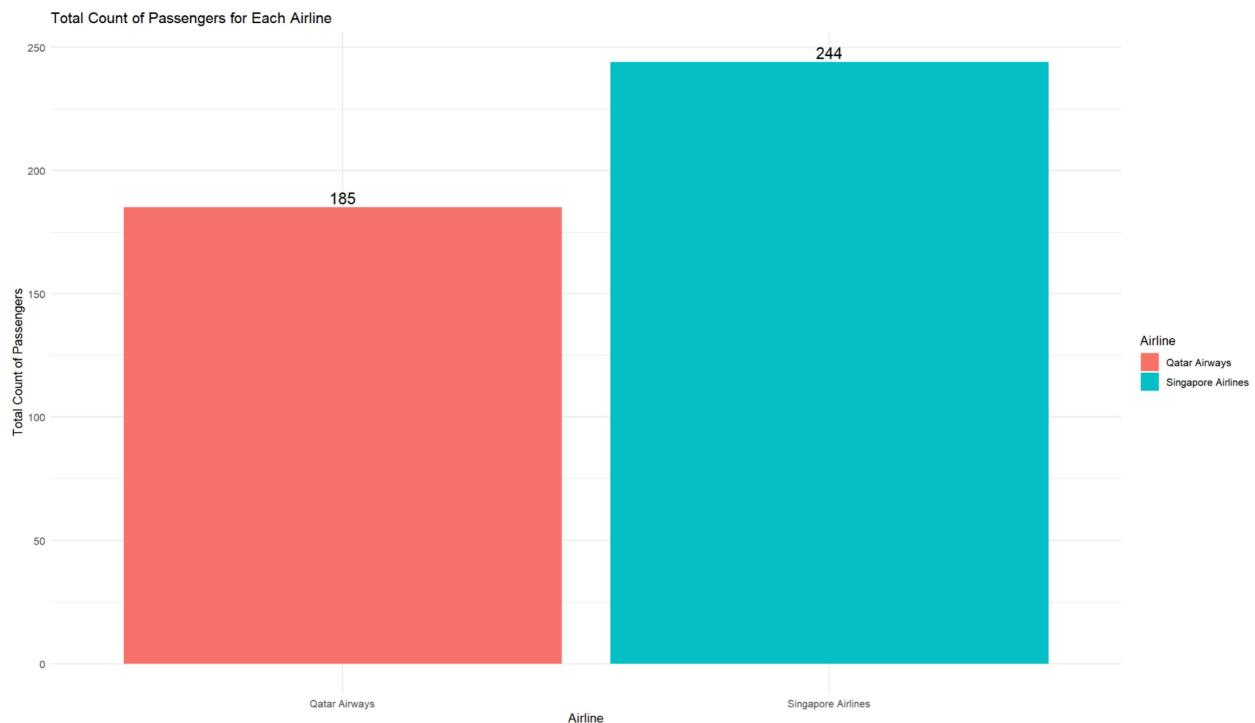
To evaluate the current state of customer experience, the XM Institute surveyed 10,000 customers about their experiences with companies across different industries, including the airline industry. The survey highlighted a significant correlation between customer experience and their likelihood to rebuy from a company, where 86% of customers who gave an airline a high score for emotion say that they are likely to recommend the airline to others (*Customer Experience in the Airline Industry | XM Institute, 2022*). Moreover, 9% of customers who interacted with an airline over the previous 6 months reported having a bad experience (*Customer Experience in the Airline Industry | XM Institute, 2022*). Of those who endured a poor experience, more than half reduced or stopped their spending entirely with the airline after that one bad interaction. Hence, we assume that customers who complain will most likely not recommend the airline to others. Thus, we only use passenger's review when it is verified to be true and that they would not recommend the airline to others, i.e. Verified = "TRUE" and Recommended = "no".



Correlation between Customer Experience and Likelihood to Rebuy

After filtering reviews that are true and reviews that would not recommend the airline to others, there are a total of 429 bad reviews. Out of these 429 reviews, Singapore Airline customers

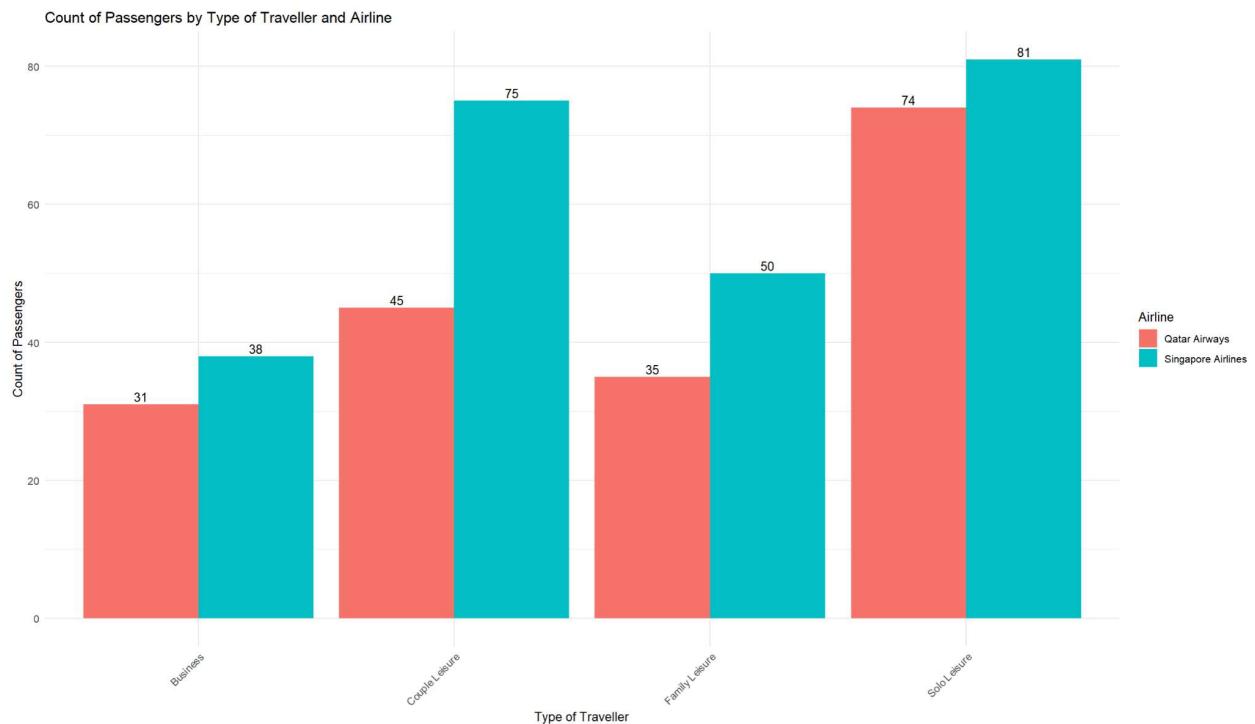
make up approximately 50% of the bad reviews. Additionally, we also broke down the number of bad reviews for each Airline and TypeofTraveller.



Total Passengers for Each Airline

Airline	TypeofTraveller	CountOfPassengers
Singapore Airlines	Solo Leisure	81
Singapore Airlines	Business	38
Singapore Airlines	Couple Leisure	75
Singapore Airlines	Family Leisure	50
Qatar Airways	Couple Leisure	45
Qatar Airways	Business	31
Qatar Airways	Solo Leisure	74
Qatar Airways	Family Leisure	35

CountOfPassengers	Airline	TypeOfTraveller
81	Singapore Airlines	Solo Leisure
45	Qatar Airways	Couple Leisure
38	Singapore Airlines	Business
50	Singapore Airlines	Family Leisure
31	Qatar Airways	Business
74	Qatar Airways	Solo Leisure
35	Qatar Airways	Family Leisure
75	Singapore Airlines	Couple Leisure



Count of Passengers by Traveller Type and Airline

The airlines_reviews dataset captures detailed feedback regarding customer's experience with the specific airline that they flew with. Specifically, the dataset contains columns where customers are able to rate different components of their experience with the airline, providing comprehensive insights into their satisfaction levels. For specific components, customers are able to rate it out of 5 stars, while for the Overall Rating they are able to rate it out of 10 stars.

10/10

"a pleasure to fly with"3 reviews  M Tennant (South Korea) 15th November 2024

Trip Verified | A pleasure to fly with Singapore Airlines. Newer airplanes, best services, perfect entertainment system with plenty of choices, newest cabin. Flight crew the most professional and adorable.

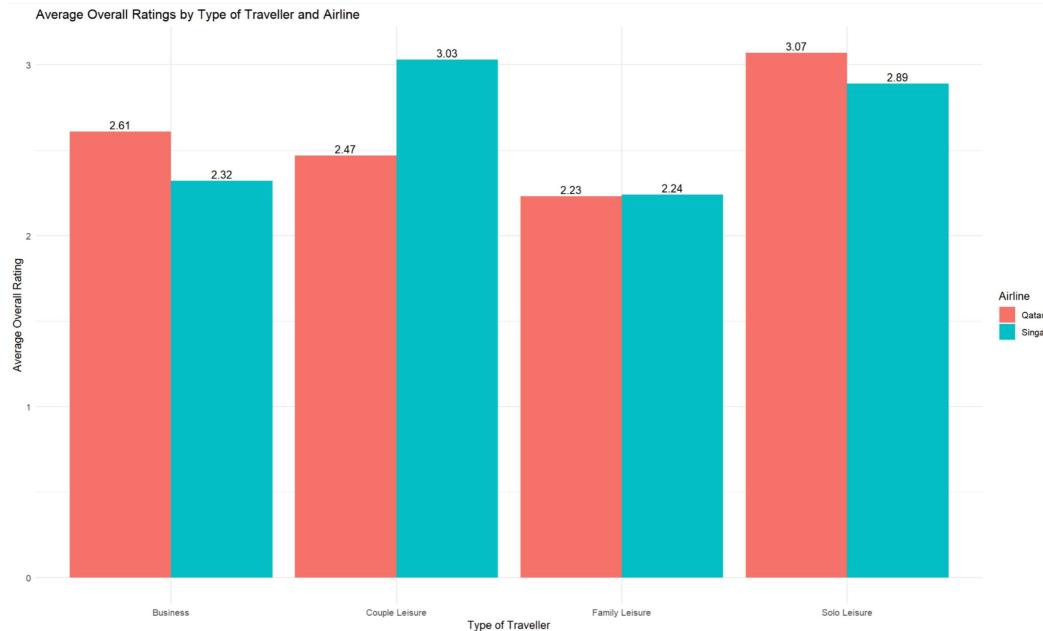
Aircraft	B787-10
Type Of Traveller	Business
Seat Type	Business Class
Route	Singapore to Seoul
Date Flown	November 2024
Seat Comfort	
Cabin Staff Service	
Food & Beverages	
Inflight Entertainment	
Ground Service	
Wifi & Connectivity	
Value For Money	
Recommended	✓

An example of a review taken from the linked Kaggle dataset

To find out the common complaints that airline customers have, we first looked at the average overall rating, as well as the average rating for the different rating components for each Airline and TypeofTraveller. For average overall rating, we observe that Solo Leisure Travellers had the highest average, while Family Leisure Travellers had the lowest average for Qatar Airways. On the other hand, Couple Leisure Travellers had the highest average, while Business Travellers had the lowest average for Singapore Airlines. In general, Qatar Airways had a higher average across Business and Solo Leisure Travellers, while Singapore Airlines has a higher average across Couple Leisure and Family Leisure Travellers, as seen from the comparison chart. This reveals that airline customers that leave a negative review generally had a poor experience with the airline. Given that the average overall ratings are below 5 on a scale of 10, this can significantly impact the airline's image on customers and influence their decision to repurchase air tickets from the airline again.

Airline	TypeofTraveller	AvgOverallRating
Singapore Airlines	Solo Leisure	2.8889
Singapore Airlines	Business	2.3158
Singapore Airlines	Couple Leisure	3.0267
Singapore Airlines	Family Leisure	2.2400
Qatar Airways	Couple Leisure	2.4667
Qatar Airways	Business	2.6129
Qatar Airways	Solo Leisure	3.0676
Qatar Airways	Family Leisure	2.2286

Airline	TypeofTraveller	AvgOverallRating
Singapore Airlines	Couple Leisure	3.0267
Qatar Airways	Family Leisure	2.2286
Qatar Airways	Solo Leisure	3.0676
Qatar Airways	Business	2.6129
Singapore Airlines	Business	2.3158
Singapore Airlines	Family Leisure	2.24
Qatar Airways	Couple Leisure	2.4667
Singapore Airlines	Solo Leisure	2.8889



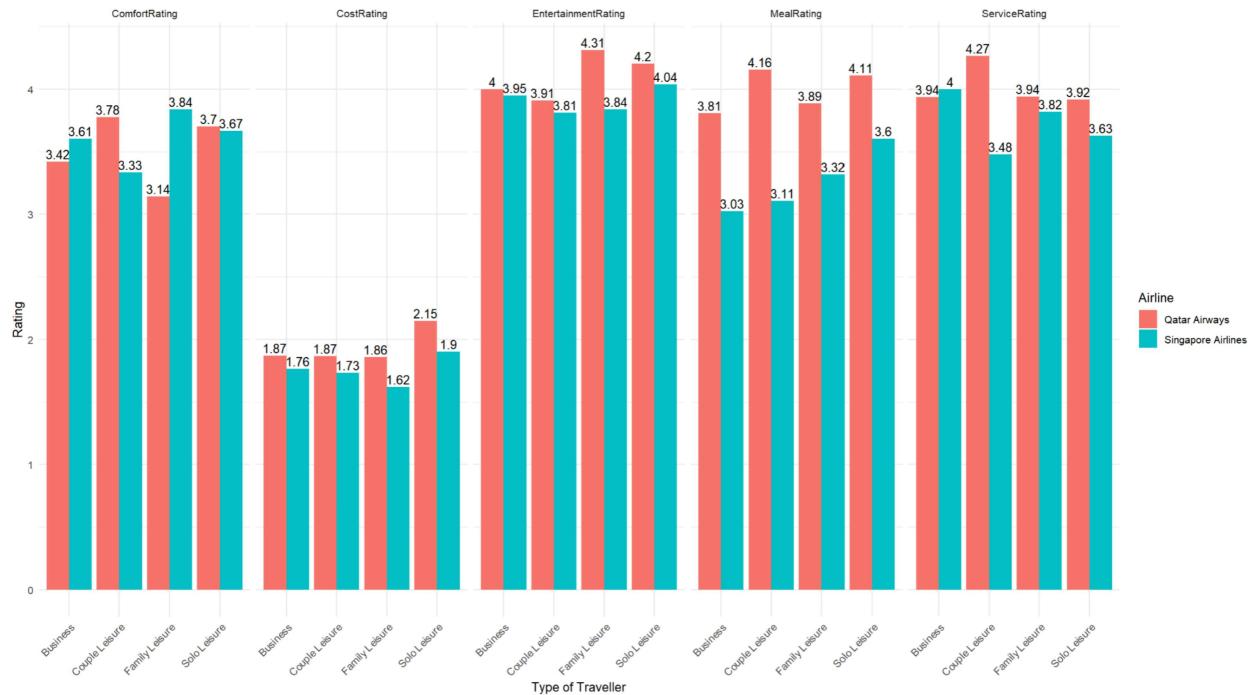
Average Overall Rating for Each Airline and TypeofTraveller

For the average rating for the various rating components, Cost Rating has one of the lowest average across all types of travellers as well as airlines. This suggests that most customers find it costly and that the experience or journey they had was not value for money. Meanwhile, in-flight entertainment had one of the highest average in general, suggesting that customers were satisfied with the in-flight entertainment that both airlines had. Overall, Qatar Airways has a higher average rating across all traveller types and rating components in comparison with Singapore Airlines. Moreover, Couple Leisure and Solo Leisure travellers are the most satisfied for both airlines. In contrast, Business Leisure travellers tend to have lower ratings, especially for Singapore Airlines.

Airline	TypeofTraveller	ComfortRating	ServiceRating	MealRating	EntertainmentRating	CostRating
Singapore Airlines	Solo Leisure	3.6667	3.6296	3.6049	4.0370	1.9012
Singapore Airlines	Business	3.6053	4.0000	3.0263	3.9474	1.7632
Singapore Airlines	Couple Leisure	3.3333	3.4800	3.1067	3.8133	1.7333
Singapore Airlines	Family Leisure	3.8400	3.8200	3.3200	3.8400	1.6200
Qatar Airways	Couple Leisure	3.7778	4.2667	4.1556	3.9111	1.8667
Qatar Airways	Business	3.4194	3.9355	3.8065	4.0000	1.8710
Qatar Airways	Solo Leisure	3.7027	3.9189	4.1081	4.2027	2.1486
Qatar Airways	Family Leisure	3.1429	3.9429	3.8857	4.3143	1.8571

Airline	TypeofTraveller	AvgSeatComfort	AvgStaffService	AvgFoodBeverages	AvgInflightEntertainment	AvgValueForMoney
Qatar Airways	Couple Leisure	3.7778	4.2667	4.1556	3.9111	1.8667
Singapore Airlines	Solo Leisure	3.6667	3.6296	3.6049	4.037	1.9012
Qatar Airways	Solo Leisure	3.7027	3.9189	4.1081	4.2027	2.1486
Qatar Airways	Business	3.4194	3.9355	3.8065	4.0	1.871
Singapore Airlines	Family Leisure	3.84	3.82	3.32	3.84	1.62
Singapore Airlines	Business	3.6053	4.0	3.0263	3.9474	1.7632
Singapore Airlines	Couple Leisure	3.3333	3.48	3.1067	3.8133	1.7333
Qatar Airways	Family Leisure	3.1429	3.9429	3.8857	4.3143	1.8571

Airline Ratings by Type of Traveller and Rating Category



Average Rating for Each Rating Component for Each Airline and TypeofTraveller

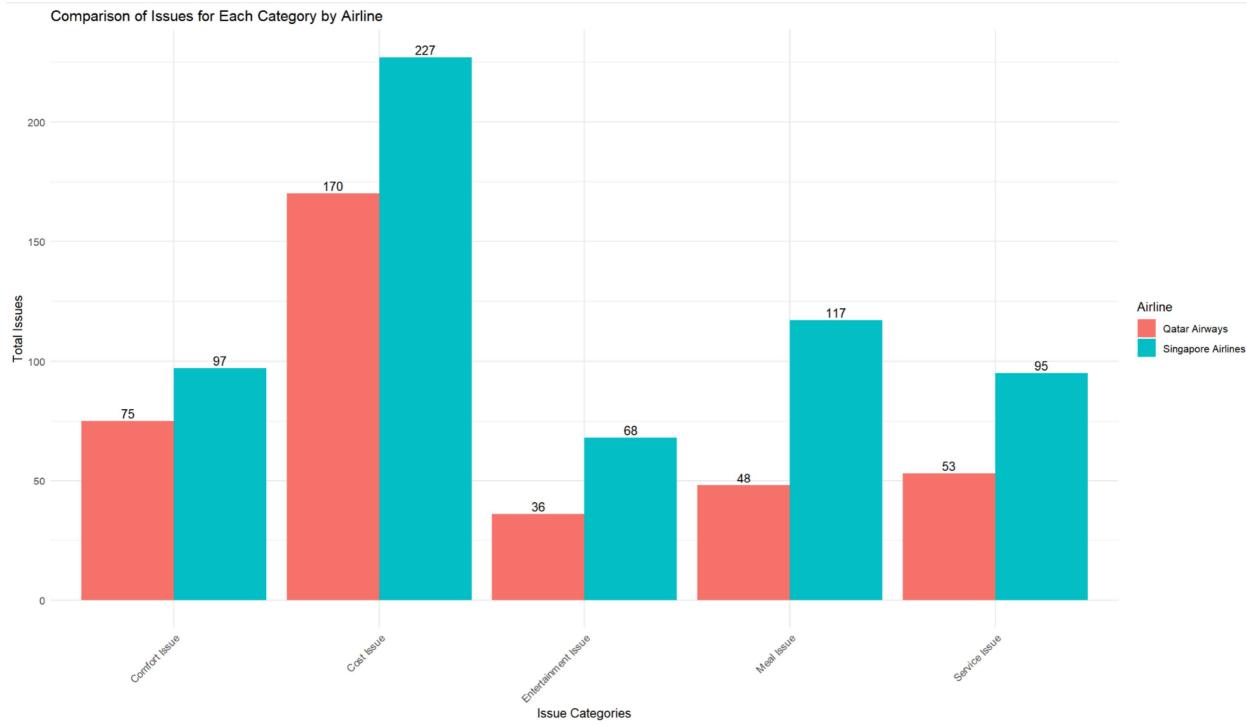
Given that the ratings are out of 5 for these categories, we decide to look at the number of customers that gave a poor rating of 3 and below, to deduce the common complaints or

dissatisfaction that they possibly might have. From the graph below, we observe that overall there is higher dissatisfaction among Singapore Airlines customers compared to Qatar Airways. The number of Singapore Airlines customers who rated 3 and below for each of the category is significantly higher. Moreover, both airlines receive the most complaints in the Cost and Comfort category, which aligns with their lower average ratings. This suggests that customer dissatisfaction with these aspects could be one of the common complaints.

Airline	TypeofTraveller	SeatIssue	ServiceIssue	MealIssue	EntertainmentIssue	CostIssue
Singapore Airlines	Solo Leisure	27	33	30	21	73
Singapore Airlines	Business	15	12	22	10	36
Singapore Airlines	Couple Leisure	39	32	39	21	71
Singapore Airlines	Family Leisure	16	18	26	16	47
Qatar Airways	Couple Leisure	14	9	10	13	40
Qatar Airways	Business	14	9	11	4	29
Qatar Airways	Solo Leisure	26	24	16	14	68
Qatar Airways	Family Leisure	21	11	11	5	33

SeatIssue	ServiceIssue	MealIssue	EntertainmentIssue	CostIssue	Airline	TypeofTraveller
26	24	16	14	68	Qatar Airways	Solo Leisure
14	9	10	13	40	Qatar Airways	Couple Leisure
27	33	30	21	73	Singapore Airlines	Solo Leisure
14	9	11	4	29	Qatar Airways	Business
21	11	11	5	33	Qatar Airways	Family Leisure
39	32	39	21	71	Singapore Airlines	Couple Leisure
15	12	22	10	36	Singapore Airlines	Business
16	18	26	16	47	Singapore Airlines	Family Leisure

Number of Complaints for Each Category Across Airline and Type of Traveller



Total Number of Complaints for Each Category

Based on research, we have shortlisted some common airline customer complaints and created a list of associated words that frequently appear in customers' reviews, as seen in the table below (*Top Airline Customer Complaints, 2015*).

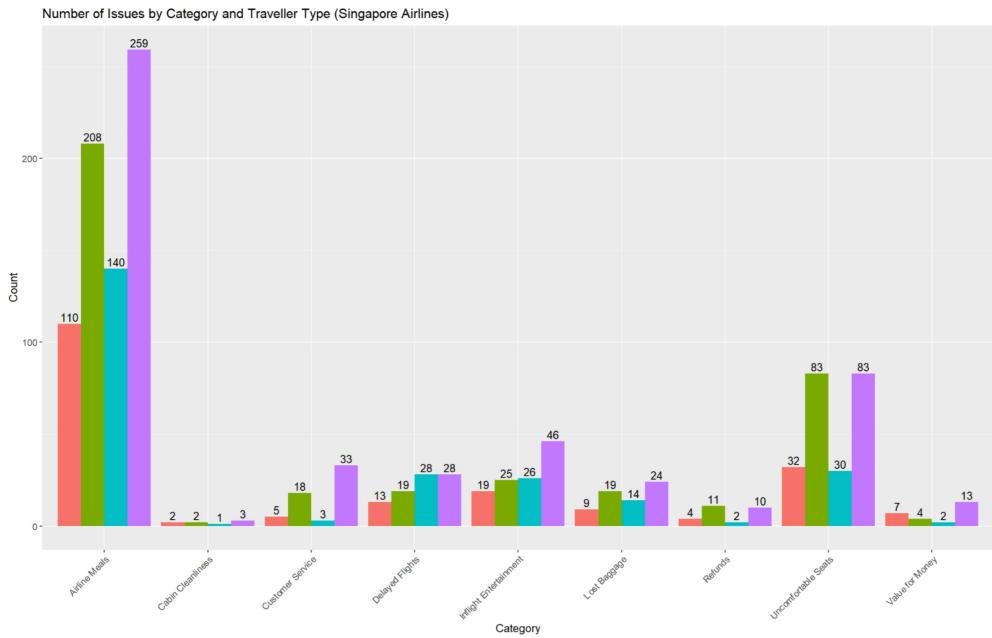
Common customer complaints	List of associated words	Why this complaint is important?
Lost baggage	Lost, baggage	Passengers expect their baggage to arrive safely and on time. If baggage is lost or delayed, it can lead to significant inconvenience and frustration for them.
Delayed flights	Delay	Delays can disrupt travel plans, cause missed connecting flights and lead to additional expenses for passengers.
Uncomfortable seats	Uncomfortable, legroom, small, leg room	Seat comfort is a critical factor in overall flight experience. Complaints often highlight issues such as lack of legroom, narrow seats and general discomfort.
Customer service	Curt, rude, unfriendly	The airline industry is service-facing, meaning its staff are the face of the

		airline. The demeanor and responsiveness of airline staff play a role in customer satisfaction. Negative reviews often mention experiences with rude or unfriendly staff.
Cabin cleanliness	Dirty	Cleanliness is a fundamental expectation for travellers. Complaints about dirty cabins can tarnish an airline's reputation and deter future bookings.
Refunds	Refunds	The process of obtaining refunds can be a pain point for customers. If they are unable to obtain their refunds efficiently, it may affect their decision to repurchase from the same airline.
Airline meals	Meal, food	Inflight meals are common topics in customer feedback. Issues may include poor taste, limited options and inadequate food portions.
Inflight entertainment	Wifi, wi-fi, tv, console	Inflight entertainment options are important to keep passengers entertained during flights, especially long haul flights. Complaints often mention issues with wi-fi connectivity, television screens and entertainment consoles.
Value for money	Expensive, costly	Perception of value for money is a critical factor influencing customer satisfaction. Complaints often refer to the high cost of tickets relative to the quality of service offered by airline staff.

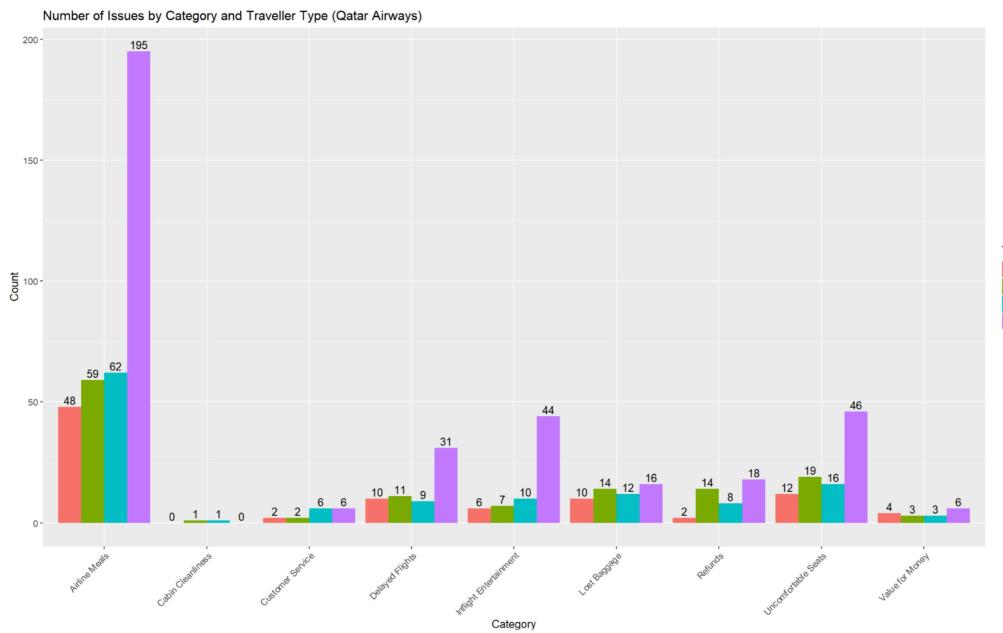
To identify the common complaints by airline customers, we looked at the frequency of specific complaint-related keywords in customer reviews. We counted the occurrence of each associated word in the customer reviews, allowing us to quantify how often each issue was mentioned. After which, we summed the frequencies of all associated words for each complaint category. By comparing the frequencies, we can identify the top 5 most common complaints faced by airline customers.

As seen from the graphical representation of the number of complaints for each category based on their associated words for each airline, airline meals is the most frequent complaint across all

traveller types, and especially for Solo Leisure Travellers. This indicates that there is a significant dissatisfaction with the quality or variety of meals provided. Uncomfortable seats is the second most frequent complaint across all traveller types, indicating customers' discomfort with the seat design and legroom. In addition, we can see that both delayed flights and inflight entertainment remain one of the top 5 common complaints across all traveller types and both airlines.



Comparison of the Frequency of Associated Words for Each Category and Traveller Type for Singapore Airlines



Comparison of the Frequency of Associated Words for Each Category and Traveller Type for Qatar Airways

Airline	Type of Traveller	Top 5 common issues
Singapore Airlines	Business	<ol style="list-style-type: none"> 1. Airline Meals 2. Uncomfortable Seats 3. Inflight Entertainment 4. Delayed Flights 5. Value For Money
	Couple Leisure	<ol style="list-style-type: none"> 1. Airline Meals 2. Uncomfortable Seats 3. Inflight Entertainment 4. Delayed Flights 5. Customer Service
	Family Leisure	<ol style="list-style-type: none"> 1. Airline Meals 2. Uncomfortable Seats 3. Delayed Flights 4. Inflight Entertainment 5. Lost Baggage
	Solo Leisure	<ol style="list-style-type: none"> 1. Airline Meals 2. Uncomfortable Seats 3. Inflight Entertainment 4. Delayed Flights 5. Lost Baggage

Qatar Airways	Business	<ol style="list-style-type: none"> 1. Airline Meals 2. Uncomfortable Seats 3. Lost Baggage 4. Delayed Flights 5. Inflight Entertainment
	Couple Leisure	<ol style="list-style-type: none"> 1. Airline Meals 2. Uncomfortable Seats 3. Refunds 4. Lost Baggage 5. Delayed Flights
	Family Leisure	<ol style="list-style-type: none"> 1. Airline Meals 2. Uncomfortable Seats 3. Lost Baggage 4. Inflight Entertainment 5. Delayed Flights
	Solo Leisure	<ol style="list-style-type: none"> 1. Airline Meals 2. Uncomfortable Seats 3. Inflight Entertainment 4. Delayed Flights 5. Refunds

Top 5 Common Issues by Traveller Types for Each Airline

Question 9

- (a) Are there any systematic differences in customer preferences/complaints pre- and post- COVID specific to Singapore Airlines?**

[airlines_reviews] Dataset

Covid-19 started to spread across the world at the beginning of 2020. (News-Medical, 2021)

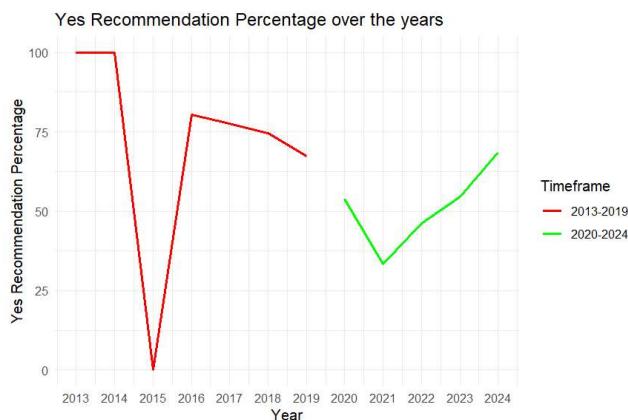
Hence, the data was analysed by comparing 2 time frames, 2013 to 2019 and 2020 to 2024, representing pre-COVID and post-COVID respectively. In order to do that, the dataset was categorised into years using the MonthFlown column. Customer preferences and complaints were assessed through ratings and recommendations. Each row with the respective year contains the total number of reviews, number of “Yes” and “No” for Recommendation, percentage of the “Yes” and “No”, average overall rating, average seat comfort rating, average staff service rating, average food and beverages rating, average entertainment rating and average value for money rating in that year.

Results:

Year	TotalReviews	YesCount	NoCount	YesPercent	NoPercent	AvgOverallRating	AvgSeatComfortRating	AvgStaffServiceRating	AvgFoodBeveragesRating	AvgEntertainmentRating	AvgValueformoneyRating
13	1	1	0	100.00	0.00	10.0000	5.0000	5.0000	4.0000	5.0000	5.0000
14	1	1	0	100.00	0.00	9.0000	2.0000	5.0000	1.0000	5.0000	5.0000
15	1	0	1	0.00	100.00	1.0000	4.0000	5.0000	5.0000	4.0000	1.0000
16	56	45	11	80.36	19.64	7.5179	4.0000	4.2143	3.8929	4.0000	3.9643
17	80	62	18	77.50	22.50	7.5000	3.6750	3.8125	3.6375	3.6375	3.8875
18	134	100	34	74.63	25.37	7.2015	3.8582	4.1269	3.8955	4.0075	3.7015
19	181	122	59	67.40	32.60	6.6022	3.5470	3.7790	3.4365	3.9503	3.4862
20	39	21	18	53.85	46.15	6.0769	4.0513	4.0256	3.3590	4.0513	3.2821
21	15	5	10	33.33	66.67	4.0667	3.5333	3.4000	3.8000	3.7333	2.4000
22	89	41	48	46.07	53.93	5.2472	3.3146	3.4944	2.8202	3.6517	2.8202
23	86	47	39	54.65	45.35	6.0698	3.4535	4.0465	3.3605	3.9186	3.2442
24	19	13	6	68.42	31.58	7.2105	3.7368	4.0526	4.0526	4.0000	3.6842

Analysis

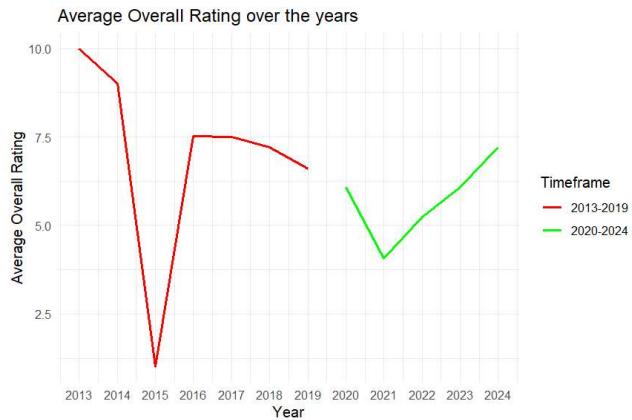
Yes Recommendation Percentage:



Yes Recommendation Percentage over the years

Between 2013 and 2019, the "Yes" recommendation percentage declined, indicating a drop in customer satisfaction or willingness to recommend Singapore Airlines during the pre-COVID period. However, from 2020 to 2024, there is a noticeable recovery, suggesting an improvement in customer satisfaction following the initial decline in 2020, likely due to the COVID-19 pandemic's impact.

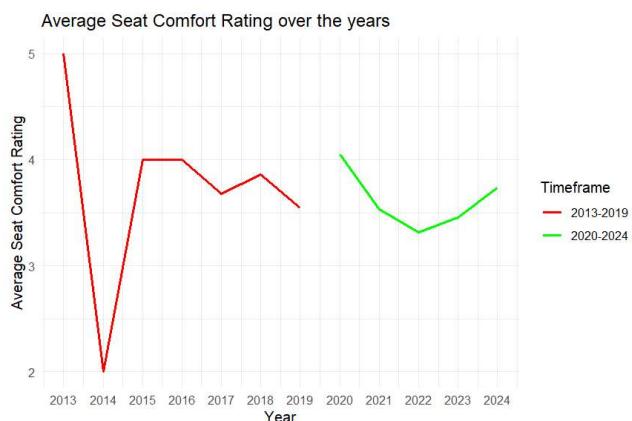
Average Overall Rating:



Average Overall Rating over the years

The average overall rating consistently dropped between 2013 and 2019, reflecting a decline in customer satisfaction. After 2020, the ratings began to recover, showing signs of regain customer confidence in the airline after the challenges of the pandemic.

Average Seat Comfort Rating:

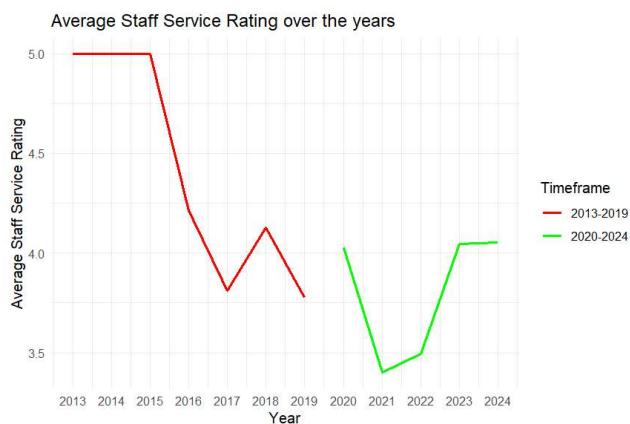


Average Seat Comfort Rating over the years

The seat comfort ratings also declined from 2013 to 2019, with some fluctuations, suggesting growing dissatisfaction with seating comfort. However, from 2020 to 2024, the ratings have

shown improvement. This recovery can likely be attributed to Singapore Airlines' investment of \$1.1 billion in upgrading its Airbus A350 fleet with newly designed cabin products. (Yufeng, 2024) It is also collaborating with National University of Singapore in a S\$45 million SIA-NUS Digital Aviation Corporate Lab to create a cabin simulator to reproduce temperature, humidity, oxygen levels and lighting to maximise seat comfort. (Singapore Airlines Champions Innovation, 2023) This shows a strong commitment to enhance passenger experience and regain customer trust.

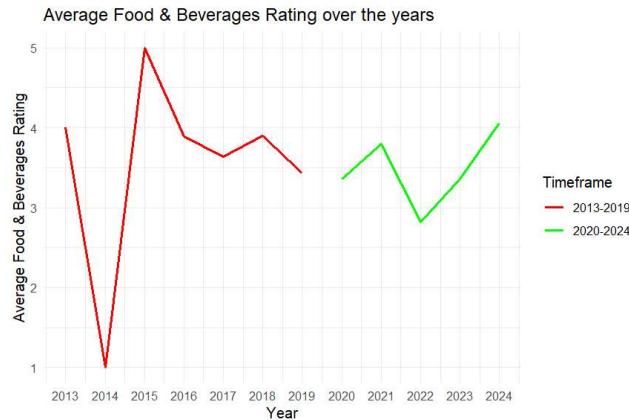
Average Staff Service Rating:



Average Staff Service Rating over the years

Staff service ratings showed a similar trend, declining between 2013 and 2019 but recovering from 2020 onward. This improvement highlights Singapore Airlines' dedication to maintain high service standards. For example, during the pandemic, when many flights were grounded, the airline sent 17,500 of its staff for skills upgrading, ensuring their capabilities were up-to-date to meet evolving customer needs. (SIA, SIA Engg, Scoot and SATS to Send 17,500 Staff for Skills Upgrading, 2020)

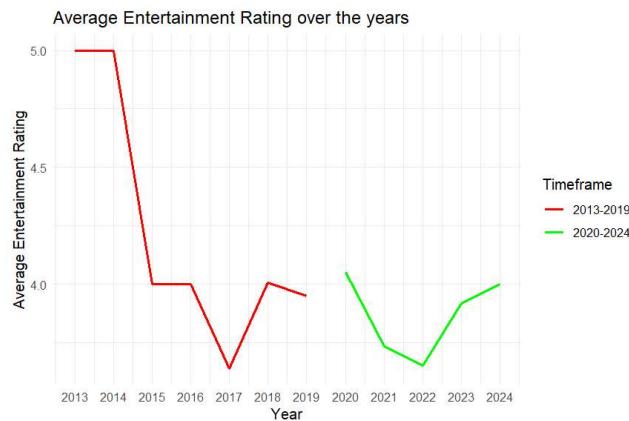
Average Food and Beverages Rating:



Average Food and Beverages Rating over the years

The food and beverage ratings dropped between 2013 and 2019, suggesting dissatisfaction with in-flight dining during this period. However, after 2020, the ratings were rebounded. Singapore Airlines' efforts to enhance its dining experience, such as improving premium economy meals (Loi, 2024), reintroducing appetisers for economy class (Shiying, 2023), and abandoning its paper box meal plan after customer feedback (Yeoh, 2023), have likely contributed to this recovery.

Average Entertainment Rating:



Average Entertainment Rating over the years

From 2013 to 2019, entertainment ratings declined, signalling dissatisfaction with the airline's in-flight entertainment options. However, there has been a recovery since 2020. Singapore Airlines introduced measures such as free unlimited Wi-Fi for economy and premium economy passengers (Yeoh, 2023b) and enhanced its KrisWorld feature, allowing customers access to

online shopping, games, live TV, and more, improving customer satisfaction. (Inflight Entertainment Highlights | Singapore Airlines, n.d.)

Average Value for Money Rating:



Figure XX: Average Value for Money Rating over the years

Value-for-money ratings experienced a significant drop between 2013 and 2019, indicating growing customer dissatisfaction with the perceived value of Singapore Airlines' offerings. Since 2020, however, the ratings have improved, reflecting an enhanced perception of the airline's value proposition as it adapted its services to better meet customer expectations post-pandemic.

Evaluation

As the datasets demonstrate a clear recovery in customer satisfaction post-COVID, external research supports that by showing how Singapore Airlines took sufficient steps to address these issues.

The airline introduced a dedicated "Customer Experience" section in its annual report 2022 onwards, showing its commitment to improve customer satisfaction after COVID. (Annual Report and Sustainability Report | Singapore Airlines, n.d.)



“Customer Experience” section in 2022-2023 Annual Report

There were many post-COVID improvements implemented in the customer journey by Singapore Airlines, such as enhanced cleaning, upgraded lounges and improved on-board experience, to rebuild customer trust. (Andrew, 2020) Moreover, Singapore Airlines actively incorporated customer feedback into decision-making processes, such as revising food packaging based on customer opinions. (Thomaselli, 2023) These in turn improved the overall customer satisfaction for Singapore Airlines, allowing it to maintain its position in the market.

(b) Singapore Airlines hands out 8 months' bonus following record annual profit

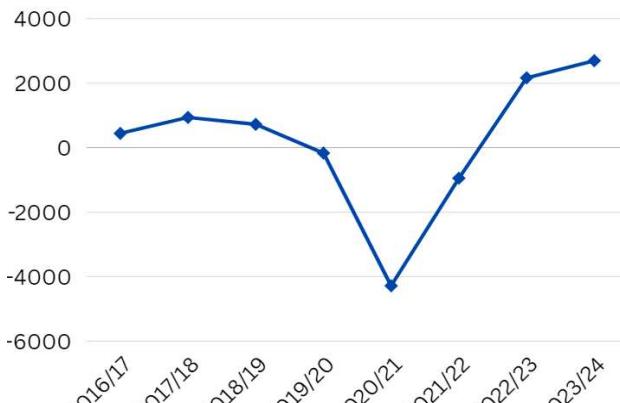
<https://www.channelnewsasia.com/business/singapore-airlines-scoot-employees-get-nearly-8-months-bonus-4340801>

In addition to customer satisfaction, what do you think contributed to the strong performance of Singapore Airlines in recent periods?

Article Insights

The annual reports of Singapore Airlines revealed a sharp drop in profits during the Covid-19 pandemic period in 2020/21. However, this was immediately followed by a remarkable increase and recovery, achieving record-breaking profits. (Annual Report and Sustainability Report | Singapore Airlines, n.d.)

Profits of Singapore Airlines over the years



Profits of Singapore Airlines over the years

This recovery was driven by increased cargo and e-commerce demand, as highlighted in the article given. The surge in profits not only surpassed expectations but also resulted in employee bonuses, reflecting the airline's strong rebound. Initially, there was scepticism about Singapore Airlines' ability to recover, given the dramatic profit losses during the pandemic. (Sen, 2020) However, the airline's subsequent performance proved them wrong and showed its resilience. Supporting this financial success, our analysis also indicated that their customer satisfaction recovered after the pandemic, contributing to the airline's profitability alongside other factors.

Factors contributing to strong performance

Technological Advancements and Innovation:

Singapore Airlines' commitment to innovation is evident through initiatives like KrisLab, its digital innovation hub that encourages employees to pitch ideas and collaborate with startups. This forward-thinking approach led to groundbreaking products such as myKrisWorld, a personalised inflight entertainment system that allows passengers to customise their watchlists and resume movies on future flights. Singapore Airlines also offers live e-shopping and the Makan+ app, enhancing the overall passenger experience. Inflight-dining has also been revamped with sustainable practices, reducing single-use plastics by 80%. These innovations not only improve customer satisfaction but also help differentiate Singapore Airlines in a competitive market. (Singapore Airlines Champions Innovation, 2023) By prioritising technology and innovation, Singapore Airlines has positioned itself as a leader in the industry, directly contributing to its financial success and sustained profitability.

Cost-effectiveness:

By blending rigorous service design with profit-consciousness, Singapore Airlines provides premium service at competitive costs. This balance ensures customer satisfaction without overextending resources. Additionally, Singapore Airlines' operational philosophy emphasises on cost-awareness across all employees, supported by a rewards system linked to profitability. (Heracleous et al., 2004) These efforts sustain SIA's leadership in an industry prone to high costs and fluctuating profits.

Strategic Partnerships:

Singapore Airlines' 5-year collaboration with the National University of Singapore through the S\$45 million SIA-NUS Digital Aviation Corporate Lab shows that it focuses on cutting-edge research to improve passenger comfort and wellness through partnerships. Additionally, SIA's alliances with esteemed wellness brands, such as Golden Door and COMO Shambhala, integrate health and wellness into the travel journey, further elevating its service standards. (Singapore Airlines Champions Innovation, 2023) Beyond innovation, SIA's partnership with Riyadh Air is set to broaden its global reach. By exploring codeshare agreements and reciprocal loyalty benefits, SIA enhances network connectivity and offers greater travel options. (Zhu, 2024) These collaborations not only reinforce SIA's reputation for service excellence but also reduce costs, attract customers, and boost revenue, securing its position as a leading global airline.

Marketing Strategies:

Singapore Airlines uses the "Singapore Girl" logo, a symbol of Asian heritage and hospitality, representing warmth, attentiveness, and professionalism. This differentiates itself from competitors by reinforcing its brand promise of exceptional service and evoking trust and familiarity among passengers. (TheBigMarketing.com, 2024) By incorporating the logo into its campaigns, Singapore Airlines establishes strong emotional ties, building customer loyalty. Its KrisFlyer loyalty program rewards regular customers with benefits like priority check-in, lounge access, and bonus miles, incentivising repeat travel and cultivating long-term relationships with customers. (Singapore Airlines Marketing Strategy: A Commitment to Service Excellence, n.d.) These ensure that Singapore Airlines consistently attracts and retains customers and increases profitability.

Future Outlook and Planning:

This could be seen by Singapore Airlines' ambitious plans for 2024 onwards. It wanted to focus on enhancing connectivity across 13 countries on 4 continents, not by adding new routes but by increasing flight frequencies and deploying higher-capacity aircraft. In Australia, strategic upgrades, such as the shift to Airbus A350-900 aircraft for the Cairns route and additional flights to Perth and Melbourne, maximise efficiency and capacity. Similarly, increased flight frequencies to major Asian hubs like Shanghai, Beijing, and Hong Kong reflect Singapore Airlines' responsiveness to growing regional demand. The airline's plans to reintroduce the Airbus A380 on the Frankfurt route and boost services to Copenhagen and Seattle highlight its focus on high-demand destinations. (Cole, 2023) This capacity planning aligns with evolving travel trends and reinforces Singapore Airlines' market leadership and financial performance.

Question 10

Context (Exceptional Circumstances)

In May 2023, Singapore Airlines flight SQ321 encountered severe turbulence, leading to one passenger losing their life, and numerous others being injured. Following this distressing event, Singapore Airlines offered compensation to affected passengers, though they clarified that they were not legally obligated to do so for the turbulence itself, as it was deemed an "unavoidable event." This case raises important questions about airline responsibility and the role of customer service in mitigating the impact of such incidents. Furthermore, it presents an opportunity to explore how a customer service chatbot could be designed to assist passengers in exceptional circumstances like severe turbulence, ensuring safety, emotional support, and clarity in compensation processes.

Identifying Relevant Issues (airline_reviews analysis)

General Statistics

Average Ratings (out of 5):

- Seat Comfort: 3.6495
- Staff Service: 3.8989
- Food and Beverages: 3.5157
- In Flight Entertainment: 3.8932
- Value for Money: 3.4687

Overall Rating: 6.6.5883/10

Recommended ratio: 65.242%

- Would Recommend: 458
- Wouldn't Recommend: 244

Relevant Reviews

To identify reviews that highlight the key issues faced by Singapore Airlines customers—issues that could potentially be addressed by a customer service chatbot—we conducted a query to extract reviews containing keywords like "safety," "turbulence," and "compensation." We focused

specifically on reviews with an overall rating below a certain threshold, as these are more likely to indicate areas where customer dissatisfaction can be improved. These reviews were then analysed to uncover recurring themes and challenges, which can guide the development of chatbot features aimed at resolving customer pain points.

Relevant Issues Identified from Customer Reviews:

1. Safety Concerns During Turbulence

Example: Passengers reported safety risks, such as children running in the aisles during turbulence.

Solution: The chatbot can remind passengers of safety protocols, such as the importance of keeping seatbelts fastened during turbulence, and provide real-time alerts when turbulence is expected.

2. Compensation for Delays and Lack of Information

Example: Delays were often exacerbated by poor communication, leaving passengers uncertain about next steps.

Solution: The chatbot can offer proactive updates about flight delays, inform passengers about their rights to compensation, and provide timely reminders on how to request reimbursement or file complaints.

3. Inadequate Information Dissemination and Compensation Denials

Example: Passengers expressed frustration over insufficient or confusing information about compensation processes.

Solution: The chatbot can provide clear, step-by-step guidance on pre-flight, in-flight, and post-flight procedures, including compensation claims, to ensure passengers are well-informed and know how to resolve any issues promptly.

4. Lack of Apologies and Acknowledgement of Damages

Example: Customers felt the airline did not acknowledge the inconvenience or damage caused by issues like lost luggage or poor service.

Solution: The chatbot can incorporate empathetic language, offering personalised apologies and expressing understanding of the impact of the situation, while also guiding passengers through the claims process for damaged property or other grievances.

5. Inaccessibility for Disabled Travelers (e.g., Deafblind Passengers)

Example: Deafblind travellers reported being ignored and unable to access crucial information, such as safety instructions and in-flight services.

Solution: The chatbot can be equipped with accessibility features, including an audio option for visually impaired travellers and tailored information for those with hearing impairments, ensuring that all passengers can access important safety and service updates.

By addressing these key issues, the chatbot can improve the customer experience, providing assistance and reassurance during stressful situations, and helping Singapore Airlines better meet the needs of its diverse passenger base.

Functional Design of the Customer Service Chatbot

1. Pre-Flight Information & Safety Protocol Reminders

- **Functionality:** The chatbot will provide passengers with essential information prior to their flight, including safety protocols, in-flight services, and the airline's policies regarding turbulence and other disruptions.
- **Key Features:**
 - Turbulence Awareness: Before takeoff, the chatbot can inform passengers about the possibility of turbulence and emphasise the importance of seatbelt use, especially during expected periods of rough air.
 - Safety Guidelines: The chatbot will outline emergency procedures, seatbelt guidelines, and provide reminders about keeping aisles clear to prevent accidents.
 - Accessible Information: Tailored pre-flight information will be available in multiple formats (e.g., text, audio, and visual) to accommodate passengers with different accessibility needs, such as deafblind travellers.

2. Real-Time In-Flight Assistance

- **Functionality:** The chatbot will provide immediate, real-time support during the flight, especially in the event of turbulence, medical emergencies, or safety concerns.
- **Key Features:**
 - Turbulence Alerts & Safety Reminders: The chatbot will send real-time notifications if turbulence is expected or occurring, advising passengers to fasten their seatbelts and remain seated.

- Medical Assistance Requests: In the event of an injury or medical issue during turbulence, the chatbot will provide a direct link to contact the cabin crew for immediate assistance and help passengers report the incident.
- Emotional Support: For anxious passengers, the chatbot can offer calming messages and relaxation tips to help manage stress and anxiety during turbulent conditions.
- Accessibility for All: The chatbot will ensure that disabled passengers receive necessary support, including providing audible safety instructions for visually impaired travellers and enabling easy access to the assistance button for hearing-impaired passengers.

3. Post-Flight Support & Compensation Claims

- **Functionality:** After the flight, the chatbot will assist passengers in navigating the claims process for compensation, medical claims, or addressing grievances related to the flight experience.
- **Key Features:**
 - Compensation Guidance: The chatbot will guide affected passengers through the airline's compensation process, helping them understand their rights and what they are eligible for (e.g., reimbursement for medical expenses, compensation for delays, or lost luggage).
 - Incident Reporting: For passengers who wish to report negligence, safety concerns, or damaged property, the chatbot will collect details about the incident and escalate the case to human customer service representatives as needed.
 - Tracking Compensation Status: The chatbot will provide updates on the status of compensation claims, informing passengers of next steps and expected timelines for resolution.
 - Accessibility for Special Needs: The chatbot will allow disabled passengers to easily submit compensation claims related to issues like lack of accessibility or failure to provide promised assistance, ensuring that they are treated fairly and promptly.

4. Proactive Notifications & Updates

- **Functionality:** To keep passengers informed at every stage, the chatbot will proactively deliver updates and notifications, especially in the case of disruptions such as flight delays or cancellations due to exceptional circumstances like turbulence.
- **Key Features:**
 - Delay & Cancellation Alerts: The chatbot will notify passengers of any changes to their flight schedule, including delays due to turbulence or technical issues, and provide updates on new departure times or gate changes.
 - Alternative Arrangements: In the case of missed connections or significant delays, the chatbot will suggest alternate flight options and assist with booking new tickets or re-routing if necessary.
 - Information about Passenger Rights: Passengers affected by delays or cancellations will be informed about their rights to compensation, meal vouchers, and other forms of assistance that they may be entitled to.

5. Empathy-Driven Communication

- **Functionality:** A core aspect of the chatbot's design will be its ability to deliver empathetic and supportive responses, especially in emotionally charged situations such as those involving injuries, distress, or disappointment due to poor service.
- **Key Features:**
 - Apologies & Acknowledgment: The chatbot will include pre-programmed, empathetic responses that acknowledge passengers' negative experiences, such as the distress caused by turbulence or the inconvenience of delayed or damaged luggage.
 - Supportive Language: The chatbot will use gentle, calming language to reassure passengers, especially those who have been affected by difficult situations, like injuries or lost baggage.
 - Personalised Follow-Ups: After a disruptive event, the chatbot can initiate follow-up communication to check on affected passengers, ensuring they've received the necessary support and offering apologies again for any distress caused.

6. Special Assistance for Vulnerable Passengers

- **Functionality:** The chatbot will cater to the needs of vulnerable passengers, including elderly passengers, pregnant women, and those with disabilities, ensuring that their specific requirements are addressed throughout the flight experience.
- **Key Features:**
 - Customised Safety Reminders: Vulnerable passengers may receive personalised reminders about safety procedures, such as staying seated or avoiding movement during turbulence, tailored to their specific needs (e.g., extra assistance for those with limited mobility).
 - Real-Time Assistance: If a passenger needs additional support, such as help with finding the restroom or using in-flight amenities, the chatbot will guide them to the appropriate resources or escalate the request to the cabin crew.
 - Accessibility Features: For deafblind or visually impaired travellers, the chatbot will offer audio guidance, while for passengers with hearing impairments, it will provide visual and text-based support.

7. Seamless Integration with Human Support

- **Functionality:** While the chatbot will handle most routine inquiries, it will also be capable of escalating more complex or unresolved issues to human customer service representatives.
- **Key Features:**
 - Seamless Escalation: If a passenger's issue cannot be fully addressed by the chatbot (e.g., unresolved compensation disputes, complex medical issues), the chatbot will smoothly escalate the case to a human agent, passing along relevant details to minimise response time and ensure continuity in service.
 - Handoff for Special Cases: For particularly sensitive or complex cases (e.g., serious injuries, legal disputes), the chatbot will prioritise quick handoffs to human representatives who can provide more personalised and immediate assistance.

Designing the chatbot to respond to various lexical variations (using the customer_support dataset)

To ensure the chatbot can effectively handle a variety of customer queries, it is essential to use the **customer_support** dataset to analyse and understand the diverse lexical variations passengers may use when expressing concerns. By leveraging advanced NLP techniques and training the model on a broad range of language patterns and phrasing from the **customer_support** dataset's **instruction** and **response** columns , the chatbot will be able to recognize and respond appropriately, regardless of how the customer frames their inquiry.

The **customer_support** dataset provides real-world conversational data on how customers phrase requests, express frustration, or describe issues. This data can be used to train the model to:

1. **Recognize Synonyms and Variations:** The model can be trained to identify different terms that refer to the same issue (e.g., "flight delay," "cancelled flight," or "missed departure") and provide the appropriate response.
2. **Understand Emotional Tone:** The dataset includes various emotional expressions (frustration, confusion, urgency), allowing the chatbot to recognize and respond with empathy, even if the emotional tone is conveyed through different phrasing.
3. **Handle Informal and Formal Language:** The model can be trained to understand both casual and formal ways of asking for help, ensuring it can respond professionally while being flexible enough to accommodate different communication styles.

By leveraging this conversational data, the chatbot can be equipped to interpret and respond to a wide range of lexical variations, ensuring a smooth, consistent, and empathetic customer service experience.

Chatbot Linguistic Design Considerations

When designing a customer service chatbot for exceptional circumstances, such as flight delays, turbulence, or safety concerns, the linguistic approach must prioritise clarity, empathy, and simplicity. The following are key design considerations to ensure the chatbot communicates effectively:

1. **Apologetic Tone**

In situations where passengers are facing inconvenience or discomfort, the chatbot should use an apologetic tone to acknowledge their frustration and provide emotional reassurance. Apologies help in humanising the chatbot, fostering goodwill and empathy.

Example:

"We apologise for the delay and understand how frustrating this can be. We're here to help you through this process."

2. Detailed, but Clear Explanations

While it's important to provide detailed explanations, the language should remain simple and accessible, avoiding technical jargon or complex terms, and break down information into easy-to-understand steps. This ensures passengers feel informed without being overwhelmed.

Example:

"Due to turbulence, all passengers are asked to stay seated with their seatbelts fastened. We expect the turbulence to last for approximately 15 minutes."

3. Simple, Direct Sentences

To minimise confusion, the chatbot should use short, direct sentences that clearly convey important instructions or information. Complex sentences with multiple clauses can lead to misunderstandings, especially in high-stress situations like flight disruptions.

Example:

"Please remain seated with your seatbelt on until we notify you that it is safe to move around."

4. Empathetic Phrasing

The chatbot should express understanding of the passenger's distress and offer comfort or support in a way that is sensitive to their emotions. Phrases like "we understand," "we're sorry," and "we appreciate your patience" create a sense of empathy and consideration.

Example:

"We understand this delay is inconvenient, and we truly appreciate your patience as we work to resolve the issue."

5. Positive Language

While responding to customer complaints or queries, the chatbot should frame responses positively, focusing on solutions and next steps. This encourages a sense of control and optimism, even in challenging situations.

Example:

"Thank you for letting us know about the issue with your luggage. We'll take care of it and ensure you receive compensation promptly."

6. Politeness and Respect

The chatbot should always maintain a polite and respectful tone, reinforcing the airline's commitment to customer satisfaction. Words like "please," "thank you," and "we appreciate" should be used regularly to convey respect.

Example:

"Please allow us a moment to look into your request. We'll keep you updated as soon as possible."

By integrating these linguistic considerations, the chatbot can maintain a balance between functionality and emotional connection, making the customer experience smoother and more supportive, even in challenging circumstances.

Conclusion

By designing a customer chatbot following the above mentioned design considerations, Singapore Airlines can be better equipped to maximise the safety and experience of their passengers under both exceptional circumstances and daily operations.

Extra Question 1

Objective

The objective is to analyze the monthly performance of Singapore Airlines' stock based on historical data. The focus is to provide insights into:

- The highest and lowest stock prices for each month.
- The total transaction volume for each month.
- The daily average transaction volume for each month. This analysis aims to highlight trends in stock performance and trading activity, offering valuable information for stakeholders and investors regarding the airline's financial health and market activity.

Dataset Overview

The dataset captures daily stock market performance, including the following attributes:

- **StockDate:** The date of the stock entry.
- **Price:** The closing price of the stock on that day.
- **Open:** The opening price of the stock on that day.
- **High:** The highest price reached by the stock during the day.
- **Low:** The lowest price reached by the stock during the day.
- **Vol:** The transaction volume for the day, represented with suffixes such as "K" (thousands) or "M" (millions).
- **ChangePerc:** The percentage change in the stock price compared to the previous day.

The dataset is structured to allow quick analysis of trends and performance over time. This dataset provides a solid foundation for analyzing stock price behavior and trading activity, which can be correlated with market events or corporate decisions.

Results

	Year	Month	Monthly_HighPrice	Monthly_LowPrice	Total_TransactionVolume	Daily_Avg_TransactionVolume
►	2020	1	6.43	5.97	45048280.00	2145156.190476
	2020	2	6.17	5.64	65450000.00	3272500.000000
	2020	3	5.79	3.72	169190000.00	8056666.666667
	2020	4	4.54	3.85	99060000.00	4717142.857143
	2020	5	5.04	3.53	350500000.00	19472222.222222
	2020	6	4.5	3.73	348160000.00	15825454.545455
	2020	7	3.98	3.35	132800000.00	6323809.523810
	2020	8	3.93	3.2	148780000.00	7439000.000000
	2020	9	3.7	3.31	108160000.00	4916363.636364
	2020	10	3.69	3.38	94450000.00	4293181.818182
	2020	11	4.77	3.38	314600000.00	14980952.380952
	2020	12	4.51	4.15	178450000.00	8111363.636364
	2021	1	4.43	4.08	120720000.00	6036000.000000
	2021	2	5.04	4.05	194960000.00	10261052.631579
	2021	3	5.75	4.96	264960000.00	11520000.000000
	2021	4	5.78	4.96	225560000.00	10740952.380952

Figure - First 16 rows of the output

	StockDate	Vol	Volume_Format
►	01/31/2020	3.77M	Millions
	01/30/2020	2.98M	Millions
	01/29/2020	3.17M	Millions
	01/28/2020	5.37M	Millions
	01/24/2020	2.09M	Millions
	01/23/2020	2.69M	Millions
	01/22/2020	3.54M	Millions
	01/21/2020	3.40M	Millions
	01/20/2020	617.82K	Thousands
	01/17/2020	1.41M	Millions
	01/16/2020	989.12K	Thousands
	01/15/2020	1.40M	Millions

Figure - Handling of M (millions) and K (thousands) values

Detailed Analysis and Evaluation

1. Introduction to the Analysis

The focus is on identifying trends and fluctuations in stock prices and transaction volumes over the years. This evaluation helps uncover insights into how external and internal factors may have impacted the stock's trading activity.

2. Analysis of Stock Price Trends

Monthly High and Low Prices

- The **highest monthly stock price** over the analyzed period was observed in **June 2023** at **SGD 8.05**, reflecting strong investor confidence as global air travel recovered significantly.
- The **lowest monthly stock price** occurred in **September 2020** at **SGD 3.31**, likely influenced by market uncertainties during the height of the COVID-19 pandemic and its significant impact on the airline industry.

Trend Analysis

1. **2020:**
 - A sharp decline in stock prices began in **March 2020**, coinciding with the onset of the global pandemic.
 - Prices stabilized toward the latter months (e.g., **November 2020**) at **SGD 4.77**, reflecting potential investor optimism with adaptation to pandemic conditions.
2. **2021:**
 - Prices ranged between **SGD 4.78** and **SGD 5.78**, indicating a stabilization phase as the airline industry adjusted to the ongoing pandemic.
3. **2022:**
 - Stock prices showed modest improvements, peaking at **SGD 5.55** in **July 2022**, reflecting cautious investor optimism.
4. **2023:**
 - A significant recovery phase was observed, with the stock price peaking at **SGD 8.05** in **June 2023**, corresponding to increased travel demand and improved financial performance.
5. **2024:**
 - Sustained growth was evident, with prices ranging between **SGD 6.32** and **SGD 7.14**, showing stable investor confidence.

Quarterly Observations

- **Q1 2020 (January-March):**
 - Stock prices began the year strong (**SGD 6.43**) but dropped drastically by March (**SGD 4.32**) due to the pandemic's onset.
- **Q2-Q3 2020 (April-September):**

- Prices remained low, with the lowest price of the period (**SGD 3.31**) recorded in September.
- **Q4 2020 (October-December):**
 - Gradual price improvements suggested early signs of recovery.
- **2021–2022:** Prices stabilized, showing consistent yet modest growth, reflecting a slow recovery.
- **2023–2024:** Significant price growth and stabilization, indicating a full recovery and sustained investor confidence.

3. Analysis of Transaction Volume

Total Transaction Volume

- The **highest total transaction volume** was recorded in **March 2020**, at **161.99 million units**, reflecting heightened trading activity as investors reacted to the pandemic's onset.
- The **lowest total transaction volume** occurred in **September 2020**, at **10.82 million units**, signifying reduced investor interest during a period of uncertainty.

Daily Average Transaction Volume

- The **daily average transaction volume** peaked in **March 2020** at **8.06 million units per day**, indicating significant market activity during the initial shock of the pandemic.
- The lowest daily average transaction volume was in **September 2020**, at **0.49 million units per day**, reflecting subdued trading activity.

Trend Insights

1. **2020:**
 - The volume spike in **March 2020** reflects a mix of panic selling and speculative buying.
 - The drop in **September 2020** indicates market stabilization as the industry adjusted to new norms.
2. **2021–2022:**
 - Trading volumes normalized, averaging **7–26 million units**, reflecting steady market conditions.
3. **2023:**

- A resurgence in volumes (**37.58 million units** in June 2023) coincided with strong stock price performance, highlighting renewed investor confidence.

4. 2024:

- Consistent transaction volumes (**8–12 million units**) reflect stable trading activity and sustained investor interest.

4. Evaluation

Market Performance

1. Price Volatility:

- The sharp fluctuations in 2020 reflect the market's reaction to the pandemic's unprecedented impact on the airline industry.
- Stabilization and recovery phases (2021–2024) demonstrate the industry's resilience and renewed investor confidence.

2. Investor Sentiment:

- High trading volumes during volatile periods (e.g., March 2020) suggest speculative activity and heightened market attention.
- Stabilized volumes in later years indicate normalized trading behavior.

Economic Context

- The sharp decline in stock prices and high transaction volumes in 2020 align with reduced air travel demand and global lockdowns.
- Recovery in stock prices and trading activity in 2023 reflects the resumption of global travel and improved airline operations.

Trading Activity Patterns

- Spikes in trading volumes during volatile months (e.g., March 2020 and June 2023) highlight the role of external factors in driving market activity.
- Consistent volumes in stable months (e.g., 2024) suggest reduced market uncertainty.

5. Potential Implications

Investor Strategy

- **Short-Term Opportunities:** Volatile periods, such as March 2020, present opportunities for speculative gains.
- **Long-Term Investments:** Stabilized periods, such as 2024, provide opportunities for steady returns.

Corporate Insights

- Singapore Airlines can leverage these trends to better understand market reactions to external disruptions and align corporate strategies to mitigate risks and capitalize on recovery phases.

6. Limitations of the Analysis

1. Limited Dataset:

- The analysis is based on stock price and volume trends, without considering external datasets like passenger traffic or competitor performance.

2. Simplified Volume Conversion:

- The conversion from "K" and "M" assumes consistent formatting, potentially excluding minor data inconsistencies.

3. Lack of Contextual Data:

- External events (e.g., policy changes, financial reports) are not explicitly correlated with the data.

7. Suggestions for Future Analysis

1. Incorporate External Data:

- Include macroeconomic indicators, travel demand, and airline revenue data to provide a more comprehensive analysis.

2. Benchmarking Across Competitors:

- Compare Singapore Airlines' stock performance with other airlines or market indices.

3. Post-Pandemic Trends:

- Extend the analysis to cover trends beyond 2024 to capture long-term recovery and growth patterns.

Conclusion

This analysis highlights Singapore Airlines' stock performance trends over five years, revealing the profound impact of the COVID-19 pandemic and subsequent recovery phases. The evaluation underscores the importance of external factors in driving market behavior, providing valuable insights for investors and corporate stakeholders to navigate market uncertainties and capitalize on recovery opportunities. For a deeper understanding, future analyses can incorporate additional datasets and sector-wide benchmarks.

Extra Question 2

Step 1:

Understanding Each Dataset Individually

[*customer_booking*]

From Kaggle: Dataset is from British Airways

Data Dictionary:

- ****num_passengers**** = number of passengers travelling
- ****sales_channel**** = sales channel booking was made on
- ****trip_type**** = trip Type (Round Trip, One Way, Circle Trip)
- ****purchase_lead**** = number of days between travel date and booking date
- ****length_of_stay**** = number of days spent at destination
- ****flight_hour**** = hour of flight departure
- ****flight_day**** = day of week of flight departure
- ****route**** = origin → destination flight route
- ****booking_origin**** = country from where booking was made
- ****wants_extra_baggage**** = if the customer wanted extra baggage in the booking
- ****wants_preferred_seat**** = if the customer wanted a preferred seat in the booking
- ****wants_in_flight_meals**** = if the customer wanted in-flight meals in the booking
- ****flight_duration**** = total duration of flight (in hours)
- ****booking_complete**** = flag indicating if the customer completed the booking

[MySQL] Data Head:

	num_passengers	sales_channel	trip_type	purchase_lead	length_of_stay	flight_hour	flight_day	route	booking_origin	wants_extra_baggage	wants_preferred_seat	wants_in_flight_meals	flight_duration	booking_complete
▶	2	Internet	RoundTrip	262	19	7	Sat	AKLDEL	New Zealand	1	0	0	5.52	0
1	Internet	RoundTrip	112	20	3	Sat	AKLDEL	New Zealand	0	0	0	0	5.52	0
2	Internet	RoundTrip	243	22	17	Wed	AKLDEL	India	1	1	0	0	5.52	0
1	Internet	RoundTrip	96	31	4	Sat	AKLDEL	New Zealand	0	0	1	0	5.52	0
2	Internet	RoundTrip	68	22	15	Wed	AKLDEL	India	1	0	1	0	5.52	0

Unique Counts:

	UniqueRoutes		UniqueBookingOrigins		UniqueFlightHours		UniqueFlightDays
▶	799	▶	104	▶	24	▶	7

	num_passengers
▶	1
	2
	3
	4
	5
▶	6
	7
	8
	9

	UniqueTripTypes	UniqueSalesChannels
▶	RoundTrip	
	CircleTrip	▶ Internet
	OneWay	Mobile

Max, Min, and Avg:

	MaxNumPassengers	MinNumPassengers	AvgNumPassengers
▶	9	1	1.5912

	MaxPurchaseLead	MinPurchaseLead	AvgPurchaseLead
▶	867	0	84.9405

	MaxLengthOfStay	MinLengthOfStay	AvgLengthOfStay
▶	778	0	23.0446

	MaxFlightDuration	MinFlightDuration	AvgFlightDuration
▶	9.5	4.67	7.277560799998812

Top 10 Booking Counts per Route and BookingOrigin:

	Route	BookingCount		BookingOrigin	BookingCount
▶	AKLKUL	2680	▶	Australia	17872
	PENTPE	924		Malaysia	7174
	MELSGN	842		South Korea	4559
	ICNSIN	801		Japan	3885
	DMKKIX	744		China	3387
	ICNSYD	695		Indonesia	2369
	DMKPER	679		Taiwan	2077
	DPSICN	666		Thailand	2030
	DMKOOL	655		India	1270
	MELPEN	649		New Zealand	1074

[NoSQL] Data Head:

△	1 (1) 66b85f58c4a8d6813c87defc	{15 fields}
└─	_id (asc index)	66b85f58c4a8d6813c87defc
└─	num_passengers	2
└─	sales_channel	Internet
└─	trip_type	RoundTrip
└─	purchase_lead	262
└─	length_of_stay	19
└─	flight_hour	7
└─	flight_day	Sat
└─	route	AKLDEL
└─	booking_origin	New Zealand
└─	wants_extra_baggage	1
└─	wants_preferred_seat	0
└─	wants_in_flight_meals	0
└─	flight_duration	5.52
└─	booking_complete	0
▶	2 (2) 66b85f58c4a8d6813c87defd	{15 fields}
▶	3 (3) 66b85f58c4a8d6813c87defe	{15 fields}

Unique Counts:

{ UniqueRoutes : 799 }	{ UniqueBookingOrigins : 104 }	{ UniqueFlightHours : 24 }	{ UniqueNumPassengers : 9 }
{ UniqueFlightDays : 7 }	{ UniqueTripTypes : ["CircleTrip", "OneWay", "RoundTrip"] }	{ UniqueSalesChannels : ["Internet", "Mobile"] }	

Max, Min, and Avg:

{ MaxNumPassengers : 9, MinNumPassengers : 1, AvgNumPassengers : 1.59124 }
{ MaxPurchaseLead : 867, MinPurchaseLead : 0, AvgPurchaseLead : 84.94048 }
{ MaxLengthOfStay : 778, MinLengthOfStay : 0, AvgLengthOfStay : 23.04456 }
{ MaxFlightDuration : 9.5, MinFlightDuration : 4.67, AvgFlightDuration : 7.2775608 }

Top 10 Booking Counts per Route and BookingOrigin:

△	(1)	{ BookingCount : 2680, Route : "AKLKUL" }	△	(1)	{ BookingCount : 17872, BookingOrigin : "Australia" }
└─	BookingCount	2,680 (2.7K)	└─	BookingCount	17,872 (17.9K)
└─	Route	AKLKUL	└─	BookingOrigin	Australia
▶	(2)	{ BookingCount : 924, Route : "PENTPE" }	▶	(2)	{ BookingCount : 7174, BookingOrigin : "Malaysia" }
▶	(3)	{ BookingCount : 842, Route : "MELSGN" }	▶	(3)	{ BookingCount : 4559, BookingOrigin : "South Korea" }
▶	(4)	{ BookingCount : 801, Route : "ICNSIN" }	▶	(4)	{ BookingCount : 3885, BookingOrigin : "Japan" }
▶	(5)	{ BookingCount : 744, Route : "DMKKIX" }	▶	(5)	{ BookingCount : 3387, BookingOrigin : "China" }
▶	(6)	{ BookingCount : 695, Route : "ICNSYD" }	▶	(6)	{ BookingCount : 2369, BookingOrigin : "Indonesia" }
▶	(7)	{ BookingCount : 679, Route : "DMKPER" }	▶	(7)	{ BookingCount : 2077, BookingOrigin : "Taiwan" }
▶	(8)	{ BookingCount : 666, Route : "DPSICN" }	▶	(8)	{ BookingCount : 2030, BookingOrigin : "Thailand" }
▶	(9)	{ BookingCount : 655, Route : "DMKOOL" }	▶	(9)	{ BookingCount : 1270, BookingOrigin : "India" }
▶	(10)	{ BookingCount : 649, Route : "MELPEN" }	▶	(10)	{ BookingCount : 1074, BookingOrigin : "New Zealand" }

[airlines_reviews]

From Kaggle: Dataset contains reviews for the **top 10** rated airlines in 2023

Data Dictionary:

Title	The title of the review.	Name	The name of the reviewer.	Review Date	The date when the review was posted.	Airline	The airline being reviewed.	Verified	Indicates whether the review is verified (True or False).
Reviews	The main text of the review.	Type of Traveller	Type of traveler (e.g., Solo Leisure, Family Leisure, Business).	Month Flown	The month when the flight was taken.	Route	The route of the flight.	Class	The class of service (e.g., Economy Class, Business Class).
# Seat Comfort	Rating for seat comfort.	# Staff Service	Rating for staff service.	# Food & Beverages	Rating for food and beverages.	# Inflight Entertain...	Rating for inflight entertainment.	# Value For Money	Rating for value for money.
# Overall Rating	Overall rating given by the reviewer.	✓ Recommended	Indicates whether the reviewer would recommend the airline (Yes or No).						

[MySQL] Data Head:

	Title	Name	ReviewDate	Airline	Verified	Reviews	TypeofTraveller	MonthFlown
▶	Flight was amazing seats on this aircraft are dreadful	Alison Soetantyo	1/3/2024	Singapore Airlines	TRUE	Flight was amazing. The crew onboard this ...	Solo Leisure	Dec-23
		Robert Watson	21/2/2024	Singapore Airlines	TRUE	Booking an emergency exit seat still meant h...	Solo Leisure	Feb-24
	Food was plentiful and tasty how much food was available	S Han	20/2/2024	Singapore Airlines	TRUE	Excellent performance on all fronts. I would...	Family Leisure	Feb-24
	service was consistently good	D Laynes	19/2/2024	Singapore Airlines	TRUE	Pretty comfortable flight considering I was fl...	Solo Leisure	Feb-24
		A Olbman	19/2/2024	Singapore Airlines	TRUE	The service was consistently good from star...	Family Leisure	Feb-24

Route	Class	SeatComfort	StaffService	FoodnBeverages	InflightEntertainment	ValueForMoney	OverallRating	Recommended
Jakarta to Singapore	Business...	4	4	4	4	4	9	yes
Phuket to Singapore	Economy...	5	3	4	4	1	3	no
Siem Reap to Singapore	Economy...	1	5	2	1	5	10	yes
Singapore to London Heathrow	Economy...	5	5	5	5	5	10	yes
Singapore to Phnom Penh	Economy...	5	5	5	5	5	10	yes

Unique Counts:

		UniqueAirlines	
TotalReviews	UniqueReviewers	Singapore Airlines	UniqueRoutes
▶ 1579	▶ 1319	▶ Singapore Airlines Qatar Airways	▶ 1016

	EarliestReviewDate	LatestReviewDate	EarliestMonthFlown	LatestMonthFlown
▶	1/1/2018	9/9/2023	▶ Apr-13	Sep-23

TypeofTraveller	UniqueClass	verified	Count	recommended	Count
Business	Business Class				
Couple Leisure	Economy Class				
Family Leisure	Premium Economy	TRUE	1311	yes	1072
Solo Leisure	First Class	FALSE	268	no	507

Max, Min, Avg:

Airline	Class	TypeofTraveller	MinSeat	MaxSeat	AvgSeat	MinStaff	MaxStaff	AvgStaff	MinFood	MaxFood	AvgFood	MinInflight	MaxInflight	AvgInflight	MinValue	MaxValue	AvgValue	MinOverall	MaxOverall	AvgOverall
Qatar Airw...	Business Class	Business	1	5	4.2963	1	5	4.2037	1	5	3.8148	2	5	4.2963	1	5	3.7222	1	10	7.3148
Qatar Airw...	Business Class	Couple Leisure	1	5	3.6458	1	5	4.4167	1	5	4.0417	1	5	4.0625	1	5	3.4375	1	10	6.9167
Qatar Airw...	Business Class	Family Leisure	1	5	3.7500	1	5	4.0000	1	5	4.2000	1	5	3.3000	1	10	6.2500			
Qatar Airw...	Business Class	Solo Leisure	1	5	4.2710	1	5	4.4299	1	5	4.0841	1	5	4.2991	1	5	3.9720	1	10	7.7944
Qatar Airw...	Economy Class	Business	1	5	3.8704	1	5	4.1667	1	5	4.1111	1	5	4.1296	1	5	3.5556	1	10	6.9259
Qatar Airw...	Economy Class	Couple Leisure	1	5	3.9747	1	5	4.3038	1	5	4.1266	1	5	4.0633	1	5	3.3418	1	10	6.0759
Qatar Airw...	Economy Class	Family Leisure	1	5	3.8523	1	5	4.3409	1	5	3.8977	1	5	4.4432	1	5	3.6818	1	10	6.7727
Qatar Airw...	Economy Class	Solo Leisure	1	5	4.0144	1	5	4.2692	1	5	4.1490	1	5	4.2452	1	5	3.8750	1	10	7.4712
Qatar Airw...	First Class	Business	5	5	5.0000	1	4	2.3333	3	5	4.0000	4	5	4.6667	2	5	3.6667	1	10	6.3333
Qatar Airw...	First Class	Couple Leisure	2	5	3.5000	5	5	5.0000	3	4	3.5000	2	4	3.0000	4	4	4.0000	10	10	10.0000
Qatar Airw...	First Class	Family Leisure	4	4	4.0000	5	5	5.0000	4	4	4.0000	5	5	5.0000	4	4	4.0000	9	9	9.0000
Qatar Airw...	First Class	Solo Leisure	2	5	3.7143	1	5	4.1429	1	5	3.2857	2	5	4.2857	2	5	3.5714	7	10	9.0000
Qatar Airw...	Premium Eco...	Business	4	4	4.0000	5	5	5.0000	2	2	2.0000	5	5	5.0000	10	10	10.0000			
Qatar Airw...	Premium Eco...	Couple Leisure	5	5	5.0000	5	5	5.0000	3	3	3.0000	5	5	5.0000	10	10	10.0000			
Qatar Airw...	Premium Eco...	Family Leisure	1	5	3.3333	3	5	4.0000	1	5	3.6667	3	4	3.6667	5	5	5.0000	10	10	10.0000
Singapore ...	Business Class	Business	1	5	3.8113	1	5	4.1321	1	5	3.5849	1	5	4.2075	1	5	3.4717	1	10	6.3962
Singapore ...	Business Class	Couple Leisure	1	5	3.5571	1	5	4.0000	1	5	3.6429	1	5	3.8000	1	5	3.7000	1	10	7.4000
Singapore ...	Business Class	Family Leisure	1	5	3.7838	1	5	3.8108	1	5	3.5405	1	5	3.7568	1	5	3.6757	1	10	7.5946
Singapore ...	Business Class	Solo Leisure	1	5	3.4648	1	5	4.1408	1	5	3.3944	1	5	3.9014	1	5	3.9014	1	10	7.5352
Singapore ...	Economy Class	Business	1	5	3.6795	1	5	4.1538	1	5	3.7051	1	5	3.9231	1	5	3.2308	1	10	6.2692
Singapore ...	Economy Class	Couple Leisure	1	5	3.5957	1	5	3.6098	1	5	3.2837	1	5	3.8865	1	5	3.2695	1	10	6.0213
Singapore ...	Economy Class	Family Leisure	1	5	3.7537	1	5	3.9925	1	5	3.6119	1	5	3.8433	1	5	3.4925	1	10	6.4925
Singapore ...	Economy Class	Solo Leisure	1	5	3.7444	1	5	3.9238	1	5	3.5919	1	5	3.8789	1	5	3.6009	1	10	6.7578
Singapore ...	First Class	Business	4	4	4.0000	1	1	1.0000	2	4	3.0000	4	5	4.5000	3	4	3.5000	6	10	8.0000
Singapore ...	First Class	Couple Leisure	3	5	4.0000	5	5	5.0000	3	5	4.0000	1	5	3.3333	5	5	5.0000	10	10	10.0000
Singapore ...	First Class	Solo Leisure	3	5	3.6250	1	5	3.2500	2	5	3.6250	3	5	4.3750	4	5	4.7500	7	10	9.5000
Singapore ...	Premium Eco...	Business	1	5	3.5000	1	5	3.9000	1	5	3.6000	1	5	3.2000	1	4	2.2000	1	8	4.2000
Singapore ...	Premium Eco...	Couple Leisure	1	5	3.1176	1	5	4.1765	1	5	3.5000	1	5	4.2353	1	5	2.7059	1	10	5.3824
Singapore ...	Premium Eco...	Family Leisure	1	5	3.5455	1	5	3.3636	1	5	3.5455	2	5	4.0000	1	5	2.9091	1	9	6.3636
Singapore ...	Premium Eco...	Solo Leisure	1	5	4.2143	1	5	4.1071	1	5	3.4286	1	5	3.8214	1	5	3.4286	1	10	6.5714

Threshold-Based Filtering:

Qatar Airw...	yes	Business Class	Business	1	10	Singapore ...	yes	Business Class	Business	6	10
Qatar Airw...	yes	Business Class	Couple Leisure	4	10	Singapore ...	yes	Business Class	Couple Leisure	1	10
Qatar Airw...	yes	Business Class	Family Leisure	5	10	Singapore ...	yes	Business Class	Family Leisure	3	10
Qatar Airw...	yes	Business Class	Solo Leisure	3	10	Singapore ...	yes	Business Class	Solo Leisure	2	10
Qatar Airw...	yes	Economy Class	Business	5	10	Singapore ...	yes	Economy Class	Business	5	10
Qatar Airw...	yes	Economy Class	Couple Leisure	3	10	Singapore ...	yes	Economy Class	Couple Leisure	5	10
Qatar Airw...	yes	Economy Class	Family Leisure	3	10	Singapore ...	yes	Economy Class	Family Leisure	6	10
Qatar Airw...	yes	Economy Class	Solo Leisure	3	10	Singapore ...	yes	Economy Class	Solo Leisure	3	10
Qatar Airw...	yes	First Class	Business	8	10	Singapore ...	yes	First Class	Business	6	10
Qatar Airw...	yes	First Class	Couple Leisure	10	10	Singapore ...	yes	First Class	Couple Leisure	10	10
Qatar Airw...	yes	First Class	Family Leisure	9	9	Singapore ...	yes	First Class	Solo Leisure	7	10
Qatar Airw...	yes	First Class	Solo Leisure	7	10	Singapore ...	yes	Premium Eco...	Business	6	8
Qatar Airw...	yes	Premium Eco...	Business	10	10	Singapore ...	yes	Premium Eco...	Couple Leisure	3	10
Qatar Airw...	yes	Premium Eco...	Couple Leisure	10	10	Singapore ...	yes	Premium Eco...	Family Leisure	7	9
Qatar Airw...	yes	Premium Eco...	Family Leisure	9	9	Singapore ...	yes	Premium Eco...	Solo Leisure	1	10
Qatar Airw...	yes	Premium Eco...	Solo Leisure	7	10	Singapore ...	no	Business Class	Business	1	6
Qatar Airw...	yes	Premium Eco...	Couple Leisure	10	10	Singapore ...	no	Business Class	Couple Leisure	1	7
Qatar Airw...	yes	Premium Eco...	Family Leisure	10	10	Singapore ...	no	Business Class	Family Leisure	1	6
Qatar Airw...	no	Business Class	Business	1	7	Singapore ...	no	Business Class	Solo Leisure	1	7
Qatar Airw...	no	Business Class	Couple Leisure	1	7	Singapore ...	no	Economy Class	Business	1	10
Qatar Airw...	no	Business Class	Family Leisure	1	7	Singapore ...	no	Economy Class	Couple Leisure	1	7
Qatar Airw...	no	Business Class	Solo Leisure	1	7	Singapore ...	no	Economy Class	Family Leisure	1	6
Qatar Airw...	no	Economy Class	Business	1	5	Singapore ...	no	Economy Class	Solo Leisure	1	7
Qatar Airw...	no	Economy Class	Couple Leisure	1	6	Singapore ...	no	Premium Eco...	Business	1	5
Qatar Airw...	no	Economy Class	Family Leisure	1	6	Singapore ...	no	Premium Eco...	Couple Leisure	1	5
Qatar Airw...	no	Economy Class	Solo Leisure	1	9	Singapore ...	no	Premium Eco...	Family Leisure	1	5
Qatar Airw...	no	First Class	Business	1	1	Singapore ...	no	Premium Eco...	Solo Leisure	1	5

[NoSQL] Data Head:

4	(1) 66b85f58c4a8d6813c87d8d1	{ Title : "Flight was amazing", Name : "Alison Soetantyo" } (18 fields)
	_id (asc index)	66b85f58c4a8d6813c87d8d1
	Title	Flight was amazing
	Name	Alison Soetantyo
	ReviewDate	1/3/2024
	Airline	Singapore Airlines
	Verified	TRUE
	Reviews	Flight was amazing. The crew onboard this flight were very welcoming, and gave a good atmosphere. The crew serving my aisle go ... riety of shows, mus
	TypeOfTraveller	Solo Leisure
	MonthFlown	Dec-23
	Route	Jakarta to Singapore
	Class	Business Class
	SeatComfort	4
	StaffService	4
	FoodnBeverages	4
	InflightEntertainment	4
	ValueForMoney	4
	OverallRating	9
	Recommended	yes
▶	(2) 66b85f58c4a8d6813c87d8d2	{ Title : "seats on this aircraft are dreadful", Name : "Robert Watson" } (18 fields)
▶	(3) 66b85f58c4a8d6813c87d8d3	{ Title : "Food was plentiful and tasty", Name : "S Han" } (18 fields)

Unique Counts:

{ TotalReviews : 1579 }	{ UniqueAirlines : ["Qatar Airways", "Singapore Airlines"] }
{ EarliestMonthFlown : "Apr-13", LatestMonthFlown : "Sep-23" }	{ EarliestReviewDate : "1/1/2018", LatestReviewDate : "9/9/2023" }
{ TypesOfTraveller : ["Business", "Couple Leisure", "Family Leisure", "Solo Leisure"] }	{ Count : 268, Verified : "FALSE" } { Count : 1311, Verified : "TRUE" }
{ UniqueClass : ["Business Class", "Economy Class", "First Class", "Premium Economy"] }	{ Count : 1072, Recommendation : "yes" } { Count : 507, Recommendation : "no" }
(Minor Incongruencies)	{ UniqueReviewers : 1320 } { UniqueRoutes : 1017 }

Max, Min, Avg:

4 (1)		{21 fields}
MinSeatComfort	1	
MaxSeatComfort	5	
AvgSeatComfort	4.2963	
MinStaffService	1	
MaxStaffService	5	
AvgStaffService	4.2037	
MinFoodnBeverages	1	
MaxFoodnBeverages	5	
AvgFoodnBeverages	3.8148	
MinInflightEntertainment	2	
MaxInflightEntertainment	5	
AvgInflightEntertainment	4.2963	
MinValueForMoney	1	
MaxValueForMoney	5	
AvgValueForMoney	3.7222	
MinOverallRating	1	
MaxOverallRating	10	
AvgOverallRating	7.3148	
Airline	Qatar Airways	
Class	Business Class	
TypeofTraveller	Business	
► (2)		{21 fields}
► (3)		{21 fields}

Threshold-Based Filtering:

4 (3) (1)		{6 fields}
MinOverallRating	1	
MaxOverallRating	5	
Airline	Singapore Airlines	
Recommendation	no	
Class	Premium Economy	
TypeofTraveller	Business	
► (2)		{6 fields}
► (3)		{6 fields}

Step 2:

Define Logical Assumptions for Merging

1. [customer_booking] contains data from British Airways, whereas [airlines_reviews] contains data from Singapore Airlines (SQ) and Qatar Airways.

According to Skytrax used in [airlines_reviews] the rankings of the three airlines of concern are as follows:

	2022 Rank	2023 Rank	2024 Rank
Singapore Airlines	2 nd	1 st	2 nd
Qatar Airways	1 st	2 nd	1 st
	...		
British Airways	11 th	18 th	13 th

Source: <https://www.worldairlineawards.com/worlds-top-100-airlines-2023/>

Assumption #1: Both datasets represent **globally competitive, premium airlines** with similar traveller bases. These airlines are benchmarked in global rankings like Skytrax, reflecting comparable standards in service quality (Top 20). While it can be argued that there would be a marked difference between 18th place and 1st and 2nd, I am using booking data from British Airways, which would not be fundamentally dissimilar to that of SQ and Qatar Airways.

Additionally, as full-service international airlines, all three attract **similar traveller segments, including business, leisure, and family travellers**, and maintain consistent service expectations across regions. Therefore, it is not far-fetched to superimpose reviews data from Singapore Airlines and Qatar Airways on booking data derived from British Airways.

2. Potential Points of Overlap includes:
 - a. num_passengers and length_of_stay from [customer_booking], and Type of Traveller from [airlines_reviews]
 - i. The following modifications have to be made to num_passengers:
 - 1 passenger, 7 days or less -> Business
 - 1 passenger, more than 7 days -> Solo Leisure
 - 2 -> Couple Leisure
 - More than 3 -> Family Leisure
 - ii. Limitations:
 - Not all groups of 3 or more of travellers are family
 - b. route from [customer_booking], and Route from [airlines_reviews]
 - i. The following modifications have to be made to Route
 - Extract both country names using “to” as a delimiter
 - Find the corresponding 6-letter code for the flight route between both countries
 - ii. Limitations:
 - Manual Processing or External Dataset Required
 - Lose out on data for which there are no overlapping routes between the two datasets
 - c. booking_origin from [customer_booking], and Route from [airlines_reviews]
 - i. The following modifications have to be made to Route
 - Extract the first country name using “to” as a delimiter

Decision: Merge on Type of Travellers and Routes (using an external dataset).

Assumption #2: By approximating traveller types through the num_passengers field in *customer_booking*, I create a reasonable match with TypeofTraveller in *airlines_reviews*, which aligns well with **common travel patterns**. Further, using Route allows me to **standardised potential complaint patterns by route**, under the assumption that any one customer's experience shouldn't differ vastly from the average customer's experience while flying the same route. This approach preserves key travellers information as well as provides the basis for meaningful analysis into complaint trends at the expense of a small portion of data and some extra effort.

Relevant Fields	Rationale
Merge-On Fields:	
<i>Types of Travellers</i>	Determines & standardises complaints by passenger profiles
<i>Route</i>	Standardises complaints by passenger profiles
Experience/Complaint-Related Fields	
<i>Flight Hour</i>	To see if the hour of flight affects fliers moods, and thus ratings and complaints (E.g., Late night/early morning flights having lower ratings altogether)
<i>Flight Duration</i>	To see if the length of flight affects fliers ratings and complaints (E.g., Longer flights cause more polarised reviews)
<i>Ratings</i>	Numeric Metric
<i>Recommendation</i>	Binary Metric
<i>Specific Reviews</i>	For Sentiment Analysis
Behavioural Fields	
<i>Purchase Lead Time</i>	Potential indicator of how much anticipation, and thus expectation the flier has for the trip
Analytical Fields (Value-Add)	
<i>Relevance Weights</i>	Implicitly considers the Verification status (Yes = 1, No = 0.5), as well as the Time from Flight to Complaint (in months) to weigh each complaint, represented by: RW = V * 1/T
<i>Sentiment Score</i>	Evaluate each review against a pre-prepared sentiment-dictionary, where each word with a positive or negative sentiment adds or deducts 1 point respectively.
<i>Correlation Score</i>	Using Python to calculate correlations between different fields to find relationships, such as the examples outlined in Flight Hour and Flight Duration.

Step 3a:

Building the SQL aggregation

Since I want to be able to conduct analysis on it later on, I aimed to model a secondary dataset from the two original datasets. This would be done by assigning review data to entries from *customer_booking* where the Traveller Type and Route are exact matches to allow for reviews to be mapped to actual flight data such as hour and duration.

The first order of business would be to standardise the two merge-on fields. Types of Travellers was fairly easy to accomplish, following the logic I outlined earlier in Step 2. Routes was a bit harder, and I first had to find a suitable dataset that would help me standardise the routes across datasets. I recognised that the route codes provided by *customer_booking* is based off **IATA airport codes** of the origin and destination countries. As such, I found the following dataset ([Airport Codes by Country - Google Sheets](#), provided in the submission folder) that I imported to MySQL Workbench to help me with the standardisation. Here are the specifications of the import, as well as a sample of the dataset I employed:

Column Name	Datatype	PK	NN	UQ	B	UN	ZF	AI	G	Default/Expression
City	VARCHAR(45)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	NULL
Country	VARCHAR(45)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	NULL
Code	VARCHAR(45)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>						
Continent	VARCHAR(45)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	NULL

	City	Country	Code	Continent
▶	Al Arish	Egypt	AAC	Africa
	Annaba	Algeria	AAE	Africa
	Alborg	Denmark	AAL	Europe
	Al Ain	United Arab Emirates	AAN	Middle East
	Aarhus	Denmark	AAR	Europe
	Abadan	Iran	ABD	Middle East
	Allentown, PA	USA	ABE	North America
	Abilene, TX	USA	ABI	North America
	Abidjan	Ivory Coast	ABJ	Africa
	Bamaga	Australia	ABM	South Pacific
	Albuquerque...	USA	ABQ	North America
	Aberdeen, SD	USA	ABR	North America
	Abu Simbel	Egypt	ABS	Africa
	Abuja Intern...	Nigeria	ABV	Africa
	Albury	Australia	ABX	South Pacific
	Albany, GA	USA	ABY	North America
	Aberdeen	United Kingdom	ABZ	Europe
	Acapulco	Mexico	ACA	North America
	Accra	Ghana	ACC	Africa
	Arrecife/Lanz...	Spain	ACE	Europe

A lot more intricacies went into integrating this dataset, but none I would bore you with. It is worth noting that the dataset also allows for **continent mapping**. If too much data loss (as a

result of the specificity in route matching) is a concern, I would be availed the option of redefining routes relative to continents (*Inter-Asia*, *Asia – Africa*, *Asia – Europe*, etc.) If not, it still opened the possibility for further regional analysis.

Next, I set out to prepare my value-add analytical fields (Relevance Weights and Sentiment Score). Again, determining the Relevance Weights was a fairly simple task, following the formula I conceptualised earlier. However, for sentiment score, I first had to prepare a sentiment dictionary. I did this by doing the following:

- **First, I extracted individual words** and calculated their frequency. This was achieved through a **recursive query** to split each review title into words. The query generated a sequence of numbers to represent word positions in the title and used the `SUBSTRING_INDEX()` function to extract words based on these positions.
 - **Clean-up:** I also had to use the `REGEXP_REPLACE()` function to remove punctuation marks from the words (E.g., Periods, commas, exclamation marks) to ensure clean word counts.
 - **Excluding Stop Words:** Stop words are common words (like "the," "and," "is") that do not contribute much to the analysis. I came up with a list of common stop words and filtered them out from the word frequency calculation using a **NOT IN** condition.
- **Next, I categorised words** into *positive* and *negative* sentiments by creating a `sentiment_dict` table with two columns: word and sentiment. Each word is manually classified as either **positive** or **negative** based on its typical connotation. I omitted **neutral words** from this process.
- **Finally, I applied a frequency filter** where I would only consider words that appeared **>236 times**. This is because I noticed that there were a lot of one-off or isolated issues described by the complaints, so this filter ensures that only issues that **at least 15% of fliers** would have experienced would be surfaced.

	word	frequency		word	sentiment
▶	experience	9019		enjoyable	positive
	service	8943		impeccable	positive
	flight	7755		top-notch	positive
	airline	3354		upgraded	positive
	good	2759		impressed	positive
	crew	2371		outstanding	positive
	comfortable	2290		beyond	positive
	airways	2263		uncomfort...	negative
	excellent	2000		disappointing	negative
	class	1786		disappointed	negative
	amazing	1509		poor	negative
	uncomfortable	1436		awful	negative
	helpful	1393		disaster	negative
	economy	1357		downgrade	negative
	disappointed	1319		terrible	negative
	airlines	1233		unprofessi...	negative
	best	1224		disgusting	negative
	flights	1209		dissatisfac...	negative
	time	1206		unhelpful	negative
	quality	1115		unpleasant	negative

Before I present my final secondary dataset constructed in MySQL, here are some excerpts of how I tried to optimise the queries because it was taking a bit too long for my liking. I mainly indexed certain fields in order to speed up the querying process:

1. From *airlines_reviews*
 - a. **Route**: Used in joins and filtering
 - b. **Reviews**: Used in the LIKE condition for sentiment analysis
2. From *customer_booking*
 - a. **route**: Used in joins and filtering
 - b. **num_passengers**: Used in the CASE condition for *traveller type*
 - c. **length_of_stay**: Used in the CASE condition for *traveller type*
3. From *airport_codes*
 - a. **City**: Used in partial matches with *Route*

A screenshot of the code is provided below because I decided to not include it in the final code file.

```

1 • CREATE INDEX idx_route_airlines_reviews ON airlines_reviews (Route(100));
2 • CREATE FULLTEXT INDEX idx_reviews_airlines_reviews ON airlines_reviews (Reviews);
3 • CREATE INDEX idx_route_customer_booking ON customer_booking (route(8));
4 • CREATE INDEX idx_passengers_length_customer_booking ON customer_booking (num_passengers, length_of_stay);
5 • CREATE INDEX idx_city_airport_codes ON airport_codes (City);
6 • CREATE INDEX idx_continent_airport_codes ON airport_codes (Continent);
7
8 • SELECT
9     TABLE_SCHEMA,
10    TABLE_NAME,
11    INDEX_NAME,
12    COLUMN_NAME,
13    INDEX_TYPE,
14    NON_UNIQUE,
15    SEQ_IN_INDEX,
16    CARDINALITY,
17    SUB_PART
18 FROM
19     information_schema.STATISTICS
20 WHERE
21     TABLE_NAME IN ('airlines_reviews', 'customer_booking', 'airport_codes')
22 ORDER BY
23     TABLE_NAME, INDEX_NAME, SEQ_IN_INDEX;

```

	TABLE_SCHEMA	TABLE_NAME	INDEX_NAME	COLUMN_NAME	INDEX_TYPE	NON_UNIQUE	SEQ_IN_INDEX	CARDINALITY	SUB_PART
▶	bc2402_gp	airlines_reviews	idx_reviews_airlines_reviews	Reviews	FULLTEXT	1	1	1489	NULL
	bc2402_gp	airlines_reviews	idx_route_airlines_reviews	Route	BTREE	1	1	1016	100
	bc2402_gp	airport_codes	idx_city_airport_codes	City	BTREE	1	1	1720	NULL
	bc2402_gp	airport_codes	idx_continent_airport_codes	Continent	BTREE	1	1	15	NULL
	bc2402_gp	airport_codes	PRIMARY	Code	BTREE	0	1	0	NULL
	bc2402_gp	customer_booking	idx_passengers_length_customer_booking	num_passengers	BTREE	1	1	8	NULL
	bc2402_gp	customer_booking	idx_passengers_length_customer_booking	length_of_stay	BTREE	1	2	834	NULL
	bc2402_gp	customer_booking	idx_route_customer_booking	route	BTREE	1	1	728	8

Step 3b:

Building the NoSQL aggregation

Similar to my MySQL approach, I imported the Airport Codes dataset into the MongoDB environment. Here are the specifications of the import and a sample:

Specify Fields and Types [Learn more about data types](#)

	<input checked="" type="checkbox"/> City String	<input checked="" type="checkbox"/> Country String	<input checked="" type="checkbox"/> Code String	<input checked="" type="checkbox"/> Continent String
1	Praia	Cape Verde	RAI	Africa
2	Cape Town	South Africa	CPT	Africa
3	Johannesburg - Johannesburg Int'l	South Africa	JNB	Africa
4	Algiers	Algeria	ALG	Africa

```
_id: ObjectId('673e10fea572ea498e4bbb61')
City : "Praia"
Country : "Cape Verde"
Code : "RAI"
Continent : "Africa"

_id: ObjectId('673e10fea572ea498e4bbb62')
City : "Cape Town"
Country : "South Africa"
Code : "CPT"
Continent : "Africa"

_id: ObjectId('673e10fea572ea498e4bbb63')
City : "Johannesburg - Johannesburg Int'l"
Country : "South Africa"
Code : "JNB"
Continent : "Africa"
```

Since I already went through the effort of making a sentiment dictionary already, and for the sake of consistency, I imported it into MongoDB Compass as well. Of course, I am also able to create a sentiment dictionary from scratch in a NoSQL environment through \$regexFindAll, tokenising reviews, cleaning up punctuation, and extracting word frequencies.

Specify Fields and Types [Learn more about data types](#)

	<input checked="" type="checkbox"/> word String	<input checked="" type="checkbox"/> sentiment String
1	excellent	positive
2	amazing	positive
3	good	positive
4	fantastic	positive

```
_id: ObjectId('673e1deca572ea498e4bc242')
word : "excellent"
sentiment : "positive"

_id: ObjectId('673e1deca572ea498e4bc243')
word : "amazing"
sentiment : "positive"

_id: ObjectId('673e1deca572ea498e4bc244')
word : "good"
sentiment : "positive"
```

Step 4:

Interpretation and Analysis

So I ended up with fundamentally the same result across the MySQL and NoSQL executions, but in **two different form factors**. The main difference is that where MySQL's dataset consist of a **1:1 allocation of review to booking**, NoSQL's collection **aggregates data from many reviews to each booking**, based upon its specific combination of route and traveller type.

An excerpt of each output is provided below:

The NoSQL output comprises many different documents, each with its own set of **nested documents** pertaining to relevant reviews, embedding the review averages directly within the booking document for seamless analysis.

Key	Value
↳ (1) 66b85f58c4a8d6813c87defc	{8 fields}
↳ _id (asc index)	66b85f58c4a8d6813c87defc
↳ num_passengers	2
↳ sales_channel	Internet
↳ length_of_stay	19
↳ route	AKLDEL
↳ booking_origin	New Zealand
↳ TypeofTraveller	Couple Leisure
↳ RelevantReviews	Array[1]
↳ 0	{7 fields}
↳ TotalReviews	356
↳ AverageSeatComfort	3.618
↳ AverageStaffService	4.0056
↳ AverageFoodnBeverages	3.632
↳ AverageInflightEntertainment	3.927
↳ AverageValueForMoney	3.3174
↳ AverageOverallRating	6.3315
↳ (2) 66b85f58c4a8d6813c87defd	{8 fields}
↳ (3) 66b85f58c4a8d6813c87defe	{8 fields}
↳ (4) 66b85f58c4a8d6813c87deff	{8 fields}
↳ (5) 66b85f58c4a8d6813c87df00	{8 fields}
↳ (6) 66b85f58c4a8d6813c87df01	{8 fields}
↳ (7) 66b85f58c4a8d6813c87df02	{8 fields}
↳ (8) 66b85f58c4a8d6813c87df03	{8 fields}
↳ (9) 66b85f58c4a8d6813c87df04	{8 fields}

On the other hand, the MySQL output takes on the form of a flat table consisting of:

- 110 rows x 20 columns

	Route	TypeofTraveller	Flight_Hour	Flight_Duration	Purchase_Lead	Title	Reviews	ReviewDate			
▶	AKLDEL	Couple Leisure	14	5.52	185	Singapore...	We had a very unpleasant ...	2022-05-11			
	BLRMEL	Solo Leisure	10	8.83	12	disappoin...	My recent experience in b...	2018-07-13			
	BLRMEL	Solo Leisure	18	8.83	6	helpful staff	Delhi to Cairns via Singapor...	2019-11-27			
	CANSYD	Couple Leisure	12	8.58	47	there is n...	Johannesburg to Singapor...	2019-08-19			
	CCUSYD	Couple Leisure	13	8.58	17	on time a...	My wife and I flew London...	2016-11-03			
	CMBSYD	Couple Leisure	7	8.58	12	No salad ...	The check in was excellent...	2022-02-08			
	CMBSYD	Family Leisure	0	8.58	15	received ...	Melbourne to Chitose retu...	2019-12-17			
	CMBSYD	Solo Leisure	23	8.58	3	nothing w...	Flew roundtrip on Singapo...	2017-03-24			
	DACMEL	Solo Leisure	1	8.83	1	crew prov...	Manila to Singapore in Sing...	2016-03-24			
	DACSYD	Couple Leisure	15	8.58	12	economy ...	Singapore to Johannesbur...	2019-11-01			
	DELDPS	Couple Leisure	13	5.52	11	it is compl...	Although the service and f...	2016-08-13			
	DELMEL	Solo Leisure	5	8.83	0	minimal se...	Singapore to Los Angeles v...	2018-06-07			
	DELSIN	Business	7	5.52	22	the crew ...	Early morning flight to Jak...	2019-08-25			
	DELSIN	Business	11	5.52	11	crew wer...	Dhaka to Melbourne via Si...	2016-03-23			
	DELSIN	Couple Leisure	3	5.52	31	would alw...	Great to be flying with Sin...	2022-09-05			
	DELSIN	Couple Leisure	9	5.52	260	a very co...	Singapore to Brisbane. We...	2018-09-09			
MonthFlown	Class	Seat	Staff	Food	Inflight	Value	Overall	Recommend	Relevance	SentimentWords	SentimentScore
Apr-22	Premium ...	5	5	2	5	1	3	yes	1.00000	unpleasant	-2
Jul-18	Business ...	3	1	4	5	2	3	no	1.00000	disappointing,...	-2
Nov-19	Economy ...	5	1	1	4	5	10	yes	1.00000	good,great,u...	1
Aug-19	Premium ...	4	4	5	5	4	7	yes	1.00000	disappointing,...	-1
Nov-16	Economy ...	1	4	3	3	5	10	yes	0.50000	good	1
Jan-22	Economy ...	3	4	4	2	1	3	no	1.00000	excellent	1
Dec-19	Economy ...	4	1	5	3	1	3	no	1.00000	NULL	0
Mar-17	Premium ...	5	3	4	3	4	6	yes	0.50000	better,impres...	3
Nov-15	Business ...	4	4	5	5	5	9	yes	0.12500	excellent,goo...	3
Oct-19	Premium ...	1	5	5	3	4	7	yes	1.00000	better,efficie...	0
Jul-16	Business ...	1	5	5	5	4	8	yes	0.50000	excellent	1
May-18	Premium ...	4	5	2	3	3	6	yes	1.00000	disappointed	-2
Aug-19	Economy ...	3	3	2	4	3	9	yes	1.00000	better,friendl...	2
Mar-16	Economy ...	5	5	3	4	4	9	yes	0.50000	good,unprofe...	0
Sep-22	Economy ...	1	1	4	1	5	10	yes	1.00000	caring,excelle...	3
Sep-18	Premium ...	2	1	4	4	3	6	yes	1.00000	excellent,goo...	0

At this juncture, I still need to interpret these outputs and draw out inferences that might be beneficial to the airlines or other interested parties.

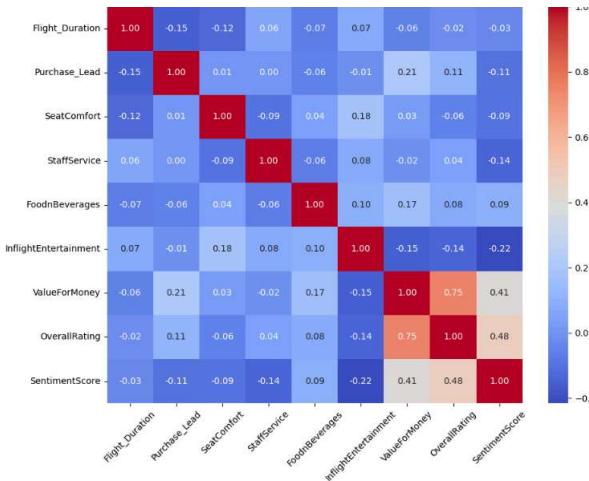
Of course, I could look at the entries manually to infer the potential type of travellers for the complaints and the causes of the complaints. However, the better option would be to conduct a **correlation analysis** between the fields. Since this wasn't covered in the course, I will be using Python (you may view the full code [here](#)) for it, as well as for visualisation and providing an overall conclusion on what the underlying issues are.

With this decision made, I also had to choose between which output I would like to work with moving forwards. Both have **high viability for python analysis** and have dedicated libraries

(*pymongo* and *pandas*) that facilitate such analysis. However, the NoSQL **JSON output requires more preprocessing** and is **not as easily interpretable** as compared to the flat MySQL table. So that's what I went with and imported into the Python Google Colab environment for further analysis.

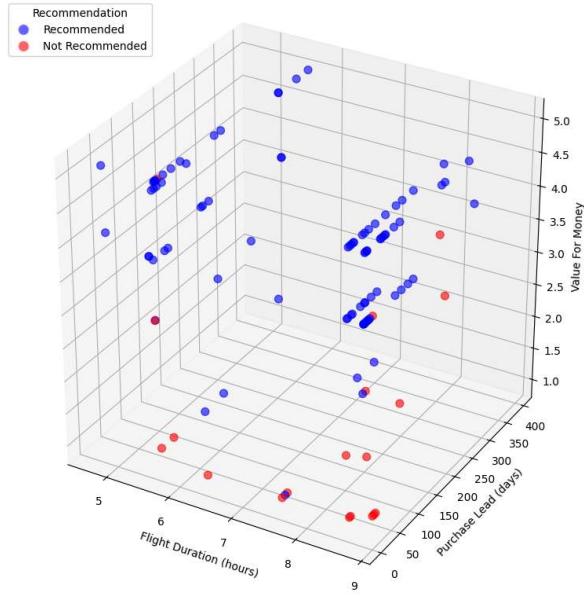
1. Correlation Heatmap

- **Value for Money** has a high positive correlation (0.75) with **Overall Rating**, which strongly suggests that value for money is a crucial determinant of the overall experience and, likely, the recommendation decision.
- **Inflight Entertainment**, **Seat Comfort**, and **Staff Service** have smaller positive correlations with **Overall Rating**, implying they play less critical roles.



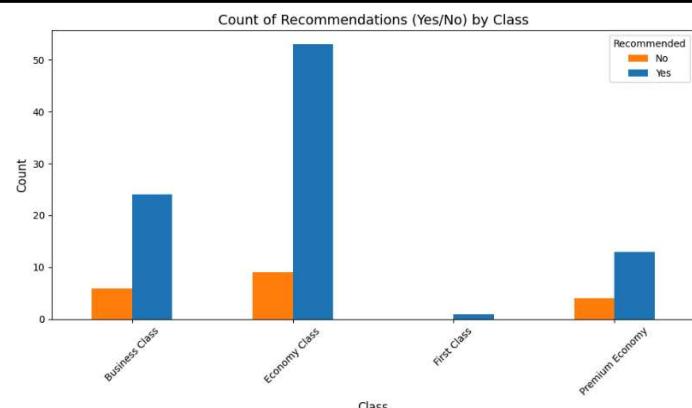
2. 3D Visualisation of Flight Data

- Contrary to my initial prediction, longer **Flight Duration** does not result in more polarised experiences and recommendations.
- "No" recommendations cluster around lower **Value for Money** scores, regardless of the other variables. This strongly supports the hypothesis that value for money is a primary driver for recommendations.

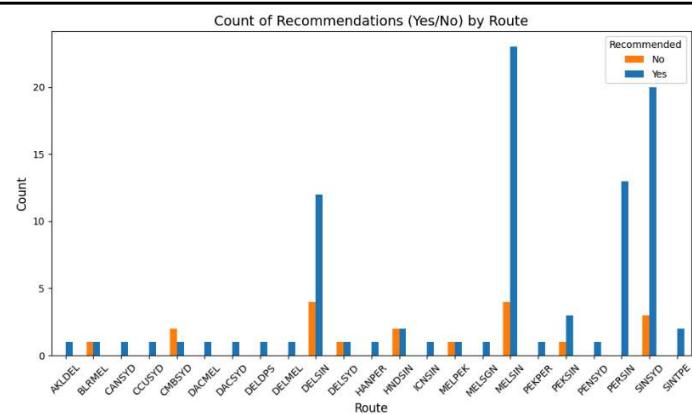


3. Recommendation Distribution

By Class: Business and Premium Economy have slightly higher proportions of "No" recommendations. This might reflect **unmet expectations** due to higher prices and a **mismatch** between perceived and actual value (Supported by reviews like "*It is unfortunate that the enhanced level of service expected in premium economy is not provided*").



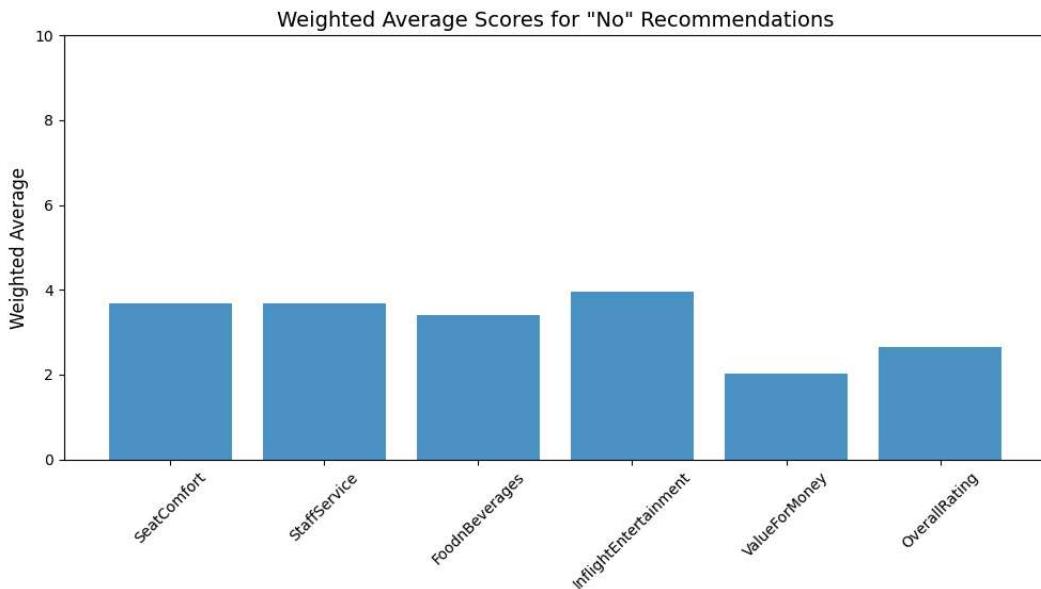
By Route: Certain routes, like **MEL-SGN** and **SIN-SYD**, have significantly more "Yes" recommendations, while others like **CMB-SYD** see a higher proportion of "No" recommendations.



Route-specific services or customer demographics might contribute to these differences.																																																																												
By Flight Hour: There's no clear pattern linking Flight Hour to recommendations. Both "Yes" and "No" recommendations occur across all times of day, suggesting this variable is not a key driver , contrary to initial predictions.	<p>Count of Recommendations (Yes/No) by Flight Hour</p> <table border="1"> <thead> <tr> <th>Flight Hour</th> <th>No (Count)</th> <th>Yes (Count)</th> </tr> </thead> <tbody> <tr><td>0</td><td>1</td><td>1</td></tr> <tr><td>1</td><td>1</td><td>7</td></tr> <tr><td>2</td><td>1</td><td>5</td></tr> <tr><td>3</td><td>1</td><td>5</td></tr> <tr><td>4</td><td>1</td><td>1</td></tr> <tr><td>5</td><td>1</td><td>8</td></tr> <tr><td>6</td><td>1</td><td>3</td></tr> <tr><td>7</td><td>2</td><td>3</td></tr> <tr><td>8</td><td>1</td><td>6</td></tr> <tr><td>9</td><td>3</td><td>7</td></tr> <tr><td>10</td><td>2</td><td>6</td></tr> <tr><td>11</td><td>1</td><td>1</td></tr> <tr><td>12</td><td>1</td><td>5</td></tr> <tr><td>13</td><td>1</td><td>5</td></tr> <tr><td>14</td><td>1</td><td>8</td></tr> <tr><td>15</td><td>1</td><td>2</td></tr> <tr><td>16</td><td>1</td><td>1</td></tr> <tr><td>17</td><td>1</td><td>1</td></tr> <tr><td>18</td><td>1</td><td>1</td></tr> <tr><td>19</td><td>1</td><td>1</td></tr> <tr><td>20</td><td>1</td><td>1</td></tr> <tr><td>21</td><td>1</td><td>1</td></tr> <tr><td>22</td><td>1</td><td>1</td></tr> <tr><td>23</td><td>1</td><td>4</td></tr> </tbody> </table>	Flight Hour	No (Count)	Yes (Count)	0	1	1	1	1	7	2	1	5	3	1	5	4	1	1	5	1	8	6	1	3	7	2	3	8	1	6	9	3	7	10	2	6	11	1	1	12	1	5	13	1	5	14	1	8	15	1	2	16	1	1	17	1	1	18	1	1	19	1	1	20	1	1	21	1	1	22	1	1	23	1	4
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By Travel Type: Family Leisure and Business travellers have relatively higher "No" recommendations, possibly due to higher expectations or different service priorities. However, this may be due to non-airline stressors , derived from their work or rowdy infants/children.	<p>Count of Recommendations (Yes/No) by Traveller Type</p> <table border="1"> <thead> <tr> <th>Traveller Type</th> <th>No (Count)</th> <th>Yes (Count)</th> </tr> </thead> <tbody> <tr><td>Business</td><td>9</td><td>25</td></tr> <tr><td>Couple Leisure</td><td>3</td><td>32</td></tr> <tr><td>Family Leisure</td><td>5</td><td>5</td></tr> <tr><td>Solo Leisure</td><td>2</td><td>28</td></tr> </tbody> </table>	Traveller Type	No (Count)	Yes (Count)	Business	9	25	Couple Leisure	3	32	Family Leisure	5	5	Solo Leisure	2	28																																																												
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4. (Relevance) Weighted Average Scores for "No" Recommendations

- **Value for Money** and **Overall Rating** are notably low in "No" recommendations. **Inflight Entertainment**, **Seat Comfort**, and **Staff Service** are higher, indicating that customers may still appreciate individual aspects of service even when the overall experience does not warrant a recommendation.
- A **faux Necessary Conditions Analysis** was not fruitful, as it showed the minimum necessary score for each distinct category was 1, and the minimum necessary overall rating for a 'Yes' Recommendation was 3.



Conclusion

To answer the question, the complaints are most prominent among Business travellers, who have the highest count of "No" recommendations, and Family Leisure travellers, who display a 50/50 split between recommendations. On the other hand, Economy Class shows fewer complaints overall, suggesting alignment with expectations.

Business travellers likely have elevated expectations for service quality and operational efficiency, leading to dissatisfaction when those standards are not met. Family Leisure travellers, on the other hand, may experience inconsistencies in meeting diverse needs during travel, contributing to mixed feedback. Altogether, these two groups are very likely to also face additional stressors that may detract from their in-flight experience.

The analysis also indicates that one of the most pertinent underlying issues is a poor Value for Money evaluation by fliers, potentially caused due to unmet expectations, and a mismatch between perceived and actual value of service.

Airlines should take care to better cater to business and family travellers' more intricate needs, while also finding ways to better convey the value of their services and products, either through better publicity, or through direct conduct and quality improvements.

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