Uber Supply–Demand Gap: Data Insights Report

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🟢 1. Executive Summary

- Brief overview of the project objective
- Data used, tools applied (Excel, SQL, Python)
- High-level takeaway: the key issue is low supply during the Night and Early Morning

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🔵 2. Data Overview

- Dataset: Uber ride request logs
- Time period covered: [add if known]
- Key columns:
    - Request ID
    - Pickup Point
    - Request Timestamp
    - Status
    - Driver ID
- Cleaned in Excel: Created Request Hour, Time Slot

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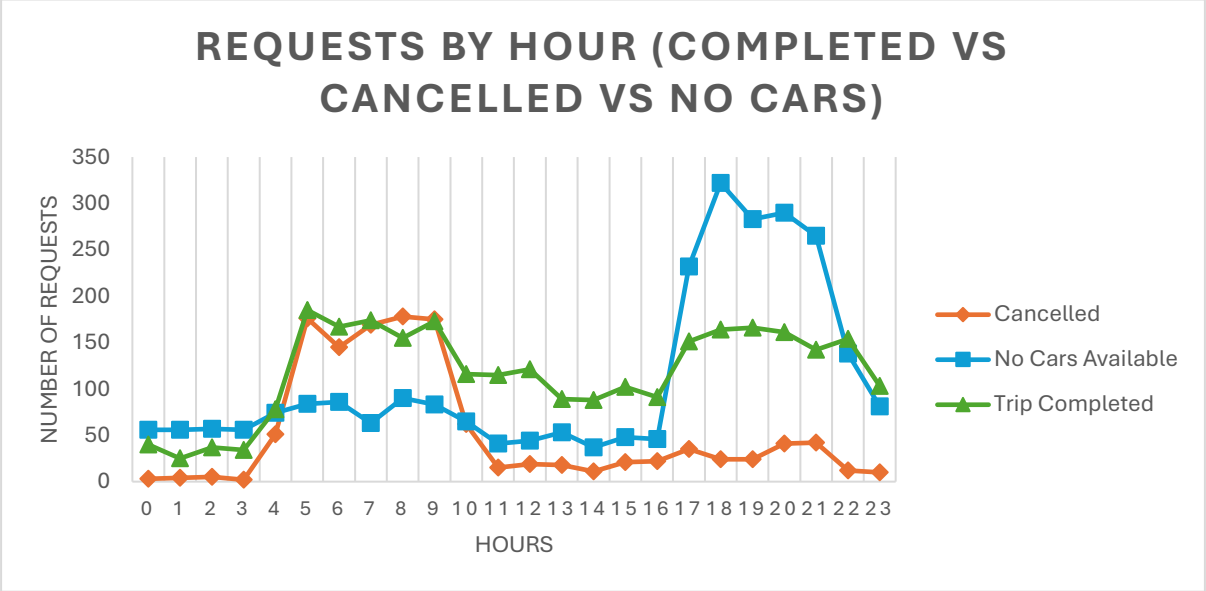
3. Excel Dashboard Insights

Insight 1: Hourly Demand vs Supply

- A clear gap exists during **Night (00:00–04:00)** and **Early Morning (04:00–08:00)** hours.
- During these periods, most of the requests result in **"No Cars Available"**, signalling a **driver shortage**.
- Demand peaks again in the **Morning (08:00–12:00)** and **Evening (16:00–20:00)**, but supply remains relatively consistent.

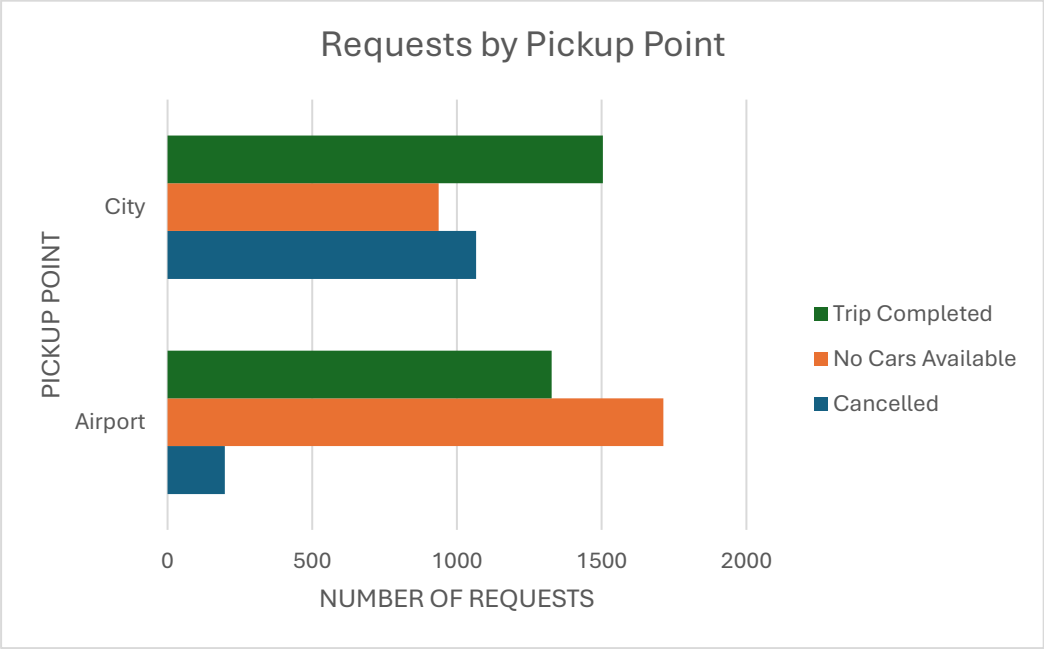
🎯 **Action:** Focus on increasing supply during low-availability hours.



Insight 2: Pickup Point Analysis

- The **Airport** faces a much larger supply gap than the **City**, especially in early hours.
- Cancellations and unavailability are higher at the Airport despite a consistent flow of demand.
- The **City** shows better request fulfillment overall.

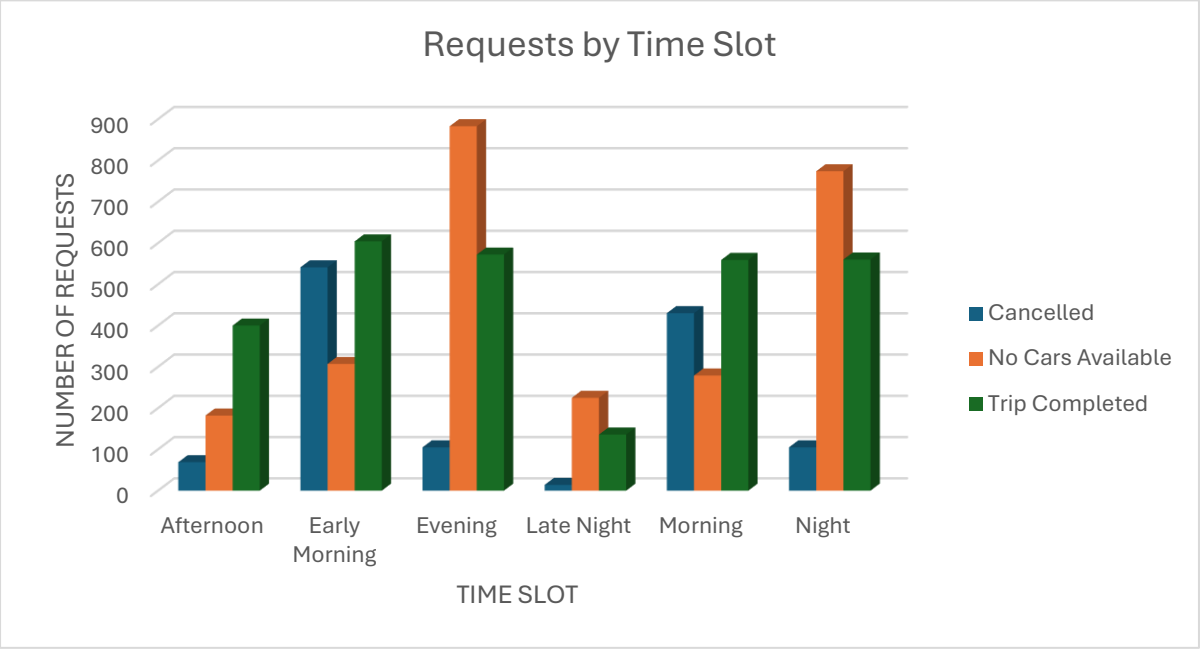
🎯 **Action:** Provide targeted incentives for airport pickups, particularly during night and early morning.



Insight 3: Time Slot Trends

- **Early Morning (04:00–08:00)** has the **highest cancellation rate** by drivers.
- This may be due to lower driver availability or reluctance to accept rides during these hours.
- **Morning and Evening slots** (commute hours) are high-demand but have better fulfillment rates.

🎯 **Action:** Introduce “rush hour rewards” to motivate drivers during peak periods.



Key Metrics (KPI Summary)

Metric	Value
Total Ride Requests	6745
Completed Trips (Supply)	2831
Cancelled Trips	1264
No Cars Available	2650

✅ Approximately **42%** of all requests were completed.
❌ Around **58%** of requests went unfulfilled, indicating a **significant supply-demand gap**.

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4. SQL-Based Insights

SQL queries were used to confirm and expand the insights gained from the initial Excel analysis. They provided detailed information on demand-supply dynamics across various hours, locations, and time slots.

Query 1: Total Requests and Trip Status by Hour

Insight: This analysis shows the busiest hours and clearly outlines the demand-supply gap throughout the day. It points out specific hours with low completion rates and high cancellations or unavailability.

Findings:

- The hours of 5 AM, 6 AM, 7 AM, and 8 AM have a large number of "cancelled" requests (185, 176, 169, 178 respectively). This indicates a high rate of unmet demand during the early morning commute.
- The late evening and night hours, especially 6 PM, 7 PM, 8 PM, 9 PM, and 10 PM, show a significant number of "no_cars" available (322, 283, 290, 265, 290 respectively). This confirms a major supply shortage during these times.
- Overall, "no_cars" available consistently outnumber "completed" trips during the night and early morning hours (00:00 - 08:00). This highlights the serious supply constraints.

	Request_hour	total_requests	completed	cancelled	no_cars
1	0	99	40	3	56
2	1	85	25	4	56
3	2	99	37	5	57
4	3	92	34	2	56
5	4	203	78	51	74
6	5	445	185	176	84
7	6	398	167	145	86
8	7	406	174	169	63
9	8	423	155	178	90
10	9	431	173	175	83
11	10	243	116	62	65
12	11	171	115	15	41
13	12	184	121	19	44
14	13	160	89	18	53
15	14	136	88	11	37
16	15	171	102	21	48
17	16	159	91	22	46
18	17	418	151	35	232
19	18	510	164	24	322
20	19	473	166	24	283
21	20	492	161	41	290
22	21	449	142	42	265
23	22	304	154	12	138
24	23	194	103	10	81

Query 2: Status Summary for Airport vs. City

Insight: This query shows clear differences in supply fulfillment between the Airport and City locations. The Airport has a much higher "No Cars Available" rate.

Findings:

- The City had 3,507 requests, with 1,504 completed, 1,066 cancelled, and 937 marked as "no cars available."
- The Airport received 3,238 requests, with 1,327 completed, 198 cancelled, and a notably high 1,713 marked as "no cars available." This highlights that the Airport has a significantly larger supply gap compared to the City.

	Pickup_point	total_requests	completed	cancelled	no_cars
1	City	3507	1504	1066	937
2	Airport	3238	1327	198	1713

Query 3: Demand and Supply by Time Slot

Insight: This breakdown by defined time slots further highlights the gaps between demand and supply, especially during Night and Early Morning hours. It also provides a chance to track performance based on these slots.

Findings:

- The Evening time slot has the highest number of "No Cars Available" at 883, closely followed by Night with 774. This strongly points to supply shortages during these times.
- Early Morning shows the highest number of "Cancelled" trips at 541, suggesting that drivers may be reluctant or unavailable during these hours.
- Despite a high total number of requests, Morning and Evening time slots have relatively lower completion rates compared to Afternoon.

	Time_slot	total_requests	completed	cancelled	no_cars
1	Evening	1560	572	105	883
2	Morning	1268	559	430	279
3	Early Morning	1452	604	541	307
4	Late Night	375	136	14	225
5	Afternoon	651	400	69	182
6	Night	1439	560	105	774

Query 4: Requests by Date

Insight: This data helps track daily demand patterns. It shows if requests are steady or changing over time.

Findings:

- During the five days from 2016-07-11 to 2016-07-15, total ride requests were fairly stable, ranging from 1307 to 1381.
- Likewise, completed trips, cancelled trips, and "no cars available" counts showed similar patterns each day. This indicates a steady supply-demand imbalance instead of an irregular problem.

	request_date	total_requests	completed	cancelled	no_cars
1	2016-07-11	1367	601	262	504
2	2016-07-12	1307	562	240	505
3	2016-07-13	1337	577	270	490
4	2016-07-14	1353	530	252	571
5	2016-07-15	1381	561	240	580

Query 5: Cancellation Rate by Pickup Point and Hour

Insight: A high cancellation rate shows potential user dissatisfaction due to unavailability, long wait times, or high prices. These factors collectively suggest potential supply issues.

Findings:

- The City, Early Morning time slot has the highest cancellation rate at 47.13% (526 cancelled out of 1116 total requests).
- City, Morning shows a high cancellation rate of 41.99% (406 cancelled out of 967 total requests).
- These findings reinforce the earlier insight that early morning hours, especially in the City, pose challenges due to driver cancellations.
- Airport cancellation rates are generally lower across all time slots compared to the City. However, "No Cars Available" remains a significant issue at the Airport.

	Pickup_point	Time_Slot	Cancelled_Count	Total_Requests	Cancellation_Rate_Percentage
1	City	Early Morning	526	1116	47.13
2	City	Morning	406	967	41.99
3	Airport	Afternoon	36	278	12.95
4	City	Night	45	437	10.30
5	City	Evening	42	420	10.00
6	City	Afternoon	33	373	8.85
7	Airport	Morning	24	301	7.97
8	City	Late Night	14	194	7.22
9	Airport	Night	60	1002	5.99
10	Airport	Evening	63	1140	5.53
11	Airport	Early Morning	15	336	4.46
12	Airport	Late Night	0	181	0.00

Query 6: Hourly Service Performance by Location

Insight: This query offers a detailed look at service performance (completion, no cars, cancellations) by the hour and organized by pickup point. It helps identify problem areas.

Findings:

- The Airport has very low completion rates and high "No Cars Available" percentages during certain hours. For example, at 6 PM, the Airport has only a 17.97% completion

rate and a 76.30% "no cars available" rate. At 7 PM, the completion rate is 19.68% with a 73.22% "no cars available" rate.

- In the City, early morning hours also show low completion rates and high cancellation rates. For instance, at 7 AM, the City has a 30.65% completion rate and a 50.77% cancellation rate.
- This hourly breakdown by location highlights the serious supply issues at the Airport during evenings and the high cancellation rates in the City during early mornings.

	Pickup_point	Request_hour	Completion_Rate_Percentage	No_Cars_Rate_Percentage	Cancellation_Rate_Percentage
13	Airport	6	91.01	4.49	4.49
14	City	6	27.83	26.54	45.63
15	City	7	30.65	18.58	50.77
16	Airport	7	90.36	3.61	6.02
17	City	8	25.14	24.57	50.29
18	Airport	8	91.78	5.48	2.74
19	City	9	28.95	22.22	48.83
20	Airport	9	83.15	7.87	8.99
21	City	10	37.50	30.95	31.55
22	Airport	10	70.67	17.33	12.00
23	Airport	11	76.56	15.63	7.81
24	City	11	61.68	28.97	9.35
25	City	12	59.79	30.93	9.28
26	Airport	12	72.41	16.09	11.49
27	Airport	13	53.85	32.31	13.85
28	City	13	56.84	33.68	9.47
29	Airport	14	74.00	14.00	12.00
30	City	14	59.30	34.88	5.81
31	City	15	52.63	36.84	10.53
32	Airport	15	68.42	17.11	14.47
33	Airport	16	62.30	14.75	22.95
34	City	16	54.08	37.76	8.16
35	Airport	17	24.03	69.81	6.17
36	City	17	70.00	15.45	14.55
37	City	18	79.05	12.38	8.57
38	Airport	18	20.00	76.30	3.70
39	Airport	19	22.68	73.22	4.10
40	City	19	77.57	14.02	8.41
41	City	20	76.32	13.16	10.53
42	Airport	20	19.58	72.75	7.67
43	City	21	76.42	10.38	13.21
44	Airport	21	17.78	74.05	8.16
45	Airport	22	43.72	54.64	1.64
46	City	22	61.16	31.40	7.44
47	City	23	42.71	46.88	10.42
48	Airport	23	63.27	36.73	0.00

Query 7: Time Slot Performance Summary: Highlighting Key Gaps

Insight: This aggregated view by time slot gives a clear overview for strategic planning. It summarizes the key demand-supply metrics effectively.

Findings:

- Evening and nighttime slots have the lowest completion rates at 36.67% and 38.92%, along with the highest "No Cars Rate Percentage" at 56.60% and 53.79%. This confirms the significant supply shortage during these times.
- Early morning shows the highest "Cancelled Rate Percentage" at 37.26%, highlighting the issue of driver cancellations during these hours.
- Afternoon presents the best performance with a completion rate of 61.44%, and a lower "No Cars Rate Percentage" of 27.96%.

	Time_Slot	Total_Requests	Completed_Trips	Completion_Rate_Percentage	No_Cars_Available_Count	No_Cars_Rate_Percentage	Cancelled_Count	Cancellation_Rate_Percentage
1	Early Morning	1452	604	41.60	307	21.14	541	37.26
2	Morning	1268	559	44.09	279	22.00	430	33.91
3	Evening	1560	572	36.67	883	56.60	105	6.73
4	Night	1439	560	38.92	774	53.79	105	7.30
5	Late Night	375	136	36.27	225	60.00	14	3.73
6	Afternoon	651	400	61.44	182	27.96	69	10.60

Query 8: Overall Service Health: Ratio of Unmet Demand to Completed Trips

Insight: This query gives a simple, high-level measure of the overall supply and demand imbalance. A higher ratio shows a more serious issue.

Findings:

- The "Unmet_to_Completed_Ratio" is 1.38. This means that for every successful trip, there are 1.38 unsuccessful requests (canceled or no cars available). This highlights a significant supply and demand imbalance.

	Unmet_to_Completed_Ratio
1	1.38

Query 9: Problematic Peak Hours by Pickup Point (Combined High Demand & Unmet Demand)

Insight: This query helps identify areas that need attention. It finds segments (Pickup Point and Hour) where there are many requests and a high percentage of unmet demand (No Cars + Cancelled).

Findings:

- The top problematic hours mostly occur at the Airport in the evening (6 PM, 7 PM, 8 PM, 9 PM, 10 PM, 5 PM). The percentage of unmet demand ranges from 75.97% to 82.22%.
- The City also sees significant unmet demand, especially in the early morning hours (8 AM, 6 AM, 5 AM, 7 AM). Here, unmet demand percentages range from 69.35% to 74.86%.
- This data shows where to focus efforts to improve service at specific times and places.

	Pickup_point	request_hour	Total_Requests	Unmet_Demand_Count	Unmet_Demand_Rate_Percentage
1	Airport	21	343	282	82.22
2	Airport	20	378	304	80.42
3	Airport	18	405	324	80.00
4	Airport	19	366	283	77.32
5	Airport	17	308	234	75.97
6	City	8	350	262	74.86
7	City	6	309	223	72.17
8	City	5	353	253	71.67
9	City	9	342	243	71.05
10	City	7	323	224	69.35
11	City	4	131	89	67.94
12	City	2	58	37	63.79
13	City	10	168	105	62.50
14	City	23	96	55	57.29
15	Airport	0	53	30	56.60
16	Airport	22	183	103	56.28
17	Airport	4	72	36	50.00
18	City	15	95	45	47.37
19	Airport	13	65	30	46.15
20	City	16	98	45	45.92
21	City	13	95	41	43.16
22	City	14	86	35	40.70
23	City	12	97	39	40.21
24	City	22	121	47	38.84
25	City	11	107	41	38.32
26	Airport	16	61	23	37.70
27	Airport	23	98	36	36.73
28	Airport	15	76	24	31.58

Query 10: Hourly Breakdown of All Request Statuses (Demand Segmentation)

Insight: This hourly breakdown of demand distribution across all outcomes (completed, no cars, cancelled) provides useful context for understanding the dynamics of unfulfilled requests.

Findings:

- This table confirms the patterns seen in earlier analyses. For example, between 5 AM and 8 AM, the "Cancellation_Rate_Percentage" is notably high, ranging from 25.12% to 42.08%.

- From 6 PM to 10 PM, the "No_Cars_Rate_Percentage" stays very high, ranging from 55.50% to 63.14%. This shows ongoing supply issues during these evening hours.
- The completion rate consistently falls during the night and early morning hours, and also during the evening peak. This highlights the need for targeted supply strategies during these times.

	request_hour	Total_Requests	Completed_Trips	Completion_Rate_Percentage	No_Cars_Available_Count	No_Cars_Rate_Percentage	Cancelled_Count	Cancellation_Rate_Percentage
1	0	99	40	40.40	56	56.57	3	3.03
2	1	85	25	29.41	56	65.88	4	4.71
3	2	99	37	37.37	57	57.58	5	5.05
4	3	92	34	36.96	56	60.87	2	2.17
5	4	203	78	38.42	74	36.45	51	25.12
6	5	445	185	41.57	84	18.88	176	39.55
7	6	398	167	41.96	86	21.61	145	36.43
8	7	406	174	42.86	63	15.52	169	41.63
9	8	423	155	36.64	90	21.28	178	42.08
10	9	431	173	40.14	83	19.26	175	40.60
11	10	243	116	47.74	65	26.75	62	25.51
12	11	171	115	67.25	41	23.98	15	8.77
13	12	184	121	65.76	44	23.91	19	10.33
14	13	160	89	55.63	53	33.13	18	11.25
15	14	136	88	64.71	37	27.21	11	8.09
16	15	171	102	59.65	48	28.07	21	12.28
17	16	159	91	57.23	46	28.93	22	13.84
18	17	418	151	36.12	232	55.50	35	8.37
19	18	510	164	32.16	322	63.14	24	4.71
20	19	473	166	35.10	283	59.83	24	5.07
21	20	492	161	32.72	290	58.94	41	8.33
22	21	449	142	31.63	265	59.02	42	9.35
23	22	304	154	50.66	138	45.39	12	3.95
24	23	194	103	53.09	81	41.75	10	5.15

5. Python (Pandas) EDA Insights

Uber Supply & Demand Gap - Key Insights and Recommendations

This report summarizes key insights from the Exploratory Data Analysis (EDA) of Uber trip request data. The main goal was to find the root causes of the supply-demand gap and suggest practical, data-based solutions.

1. Overview of the Problem

The analysis showed a notable imbalance between the demand for Uber rides and the number of drivers available, resulting in many unfulfilled requests. The two main issues identified are:

- Cancelled: Trips that were requested but later canceled by the rider or the driver.
- No Cars Available: Cases where no driver could be found to accept the ride request.

2. Key Findings: A Tale of Two Mismatches

Our analysis found that the supply-demand gap isn't a single problem. It shows up in two different ways, depending on the pickup location and the time of day.

Mismatched Scenario 1: Airport Shortage

- When: Mostly during evening and night hours (about 5 PM to 1 AM).
- What: The main reason for unfulfilled requests is "No Cars Available."
- Insight: During these peak hours, passenger demand for rides from the airport is high, but the number of available drivers at the airport is low. This leads to lost revenue for Uber and a poor experience for customers who are left without a ride.

Mismatched Scenario 2: City Cancellations

- When: Primarily during the morning rush hours (around 5 AM to 9 AM).
- What: The biggest reason for unfulfilled requests is driver "Cancellations."
- Insight: There is high demand for rides from the city in the morning. However, many requests are being turned down by drivers. This suggests that drivers in the city might not want to accept certain trips, possibly due to low profit on longer trips to the airport with the chance of an empty return, or a preference for shorter, more frequent city rides.

3. Proposed Recommendations

Based on these findings, we recommend a two-part strategy to effectively tackle the supply-demand gap.

1. For the Airport Shortage (Evening/Night):

• Implement Dynamic Incentives: Introduce a surge pricing system or provide targeted bonuses for drivers who take trips from the airport during the evening and night. This will encourage more drivers to be at the airport during these busy hours.

• Proactive Driver Positioning: Use historical data to predict peak airport demand and actively send or guide drivers to the airport before the evening rush starts.

2. For the City Cancellations (Morning):

• Investigate Driver Behavior: Conduct a detailed analysis or set up feedback systems to understand why drivers are canceling trips from the city.

• Adjust Pricing and Incentives: Consider offering special incentives for drivers to complete city-to-airport trips during morning hours. This could help alleviate their concerns about empty return trips.

• Optimize Ride-Sharing: Explore promoting carpooling or other shared-ride options for popular routes to the airport, making these trips more attractive for drivers by ensuring increased efficiency and capacity use.

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6. Future Works

Building upon the insights gained from this Exploratory Data Analysis, there are several avenues for future work that could further enhance our understanding of the Uber supply-demand dynamics and lead to even more impactful solutions:

1. **Predictive Modeling for Supply-Demand Forecasting:**
    - Develop machine learning models to predict future demand and potential supply shortfalls based on historical data, time of day, day of the week, special events, and even weather patterns. This could enable Uber to proactively position drivers and manage expectations.
2. **Driver Behavior Analysis:**
    - Conduct a deeper dive into driver-specific data (if available and permissible) to understand patterns of trip acceptance, cancellations, and idle times. This could reveal factors influencing driver decisions, such as perceived profitability of certain routes, traffic conditions, or shift fatigue.
    - Analyze driver retention and churn in relation to unmet demand and earnings.
3. **Impact of External Factors:**
    - Incorporate external datasets such as real-time traffic data, local event schedules (concerts, sporting events), public transport availability, and major

flight schedules at the Airport. This could provide a more holistic view of demand fluctuations and supply constraints.

4. **Geospatial Analysis:**
    - Utilize advanced geospatial analysis to identify hyper-local hotspots of supply-demand imbalance beyond just "City" and "Airport." Mapping driver locations and request origins/destinations could reveal specific neighborhoods or micro-zones with persistent issues.
5. **A/B Testing of Interventions:**
    - Once potential solutions (e.g., new incentive structures, dynamic pricing adjustments) are proposed, design and implement A/B tests in controlled environments to measure their effectiveness and quantify their business impact before a full-scale rollout.
6. **Customer Feedback Integration:**
    - Integrate customer feedback and satisfaction scores with demand-supply data to understand the direct impact of unmet demand on user experience and loyalty. Analyzing reviews and ratings related to wait times or cancellations could provide qualitative insights.

By pursuing these future works, Uber can move towards a more sophisticated and proactive approach to managing its marketplace, ultimately leading to higher efficiency, increased driver earnings, and improved customer satisfaction.

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8. Conclusion

This analysis identifies critical demand-supply mismatches that Uber can fix through strategic scheduling, driver incentives, and location-specific deployment.
Cross-tool analysis (Excel, SQL, Python) ensures robust and actionable findings