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# Case Study 1: Optimal pricing strategy for a ride-hailing service

## 1 Executive Summary

The objective of this study is to find out the optimal pricing strategy for a proposed ride-hailing company for a specific origin destination (OD) of Toledo Airport and Downtown Toledo.

Initially, four levels of granularity were proposed as follows:

- Option 1: A single wage across the 12 months.
- Option 2: Twelve wages for each of the twelve months.
- Option 3: A wage for each rider in each of the twelve months.
- Option 4: A wage for each individual ride that the rider requests.

Based on our assumed market situations under simulation environment, we can conclude that the optimal pricing strategy depends on the market demand and supply. No single strategy will generally optimize all ride-hailing market conditions.

In the absence of real field demand and supply data, some synthetic market demand and supply data were generated by using the business rules described in the case study problem descriptions.

Some key insights of performance evaluation of different pricing strategies are summarized as follows:

- **Option 1** (A single wage across the 12 months) would perform the best under assumed regular market condition.

- **Option 2** (Twelve wages for each of the twelve months) would perform the best under both low demand and high demand market conditions.

- **Option 3** (A wage for each rider in each of the twelve months) would perform better than **Option 4** in most market conditions.

- **Option 4** (A wage for each individual ride that the rider requests) would perform better than **Option 2** and **Option 3** in regular market condition where drivers' willingness to accept a ride offer is very flexible.

Please see Figure 1 which shows the performance evaluations of different pricing strategies under two different drivers' willingness to accept rides conditions.

We set first ride acceptance probability threshold condition as 0.5 when drivers are very much flexible and willing to accept an offered ride when the probability of an offered ride becomes greater than 0.5. Other condition is when the probability of a ride being accepted becomes greater than 0.8 when drivers are less open to accept the offered ride.

The profit margin of each ride is defined as the gain or profit from the ride income after paying the driver's wage. Our objective was to find the optimal pricing strategy which would offer us the maximum gain over the whole year.

Finally, we can recommend the following options to the pricing team based on our synthetically generated market conditions:

- Implement **Option 1** (a single wage across 12 months) under the regular market condition for this origin destination (OD) pair.
- Keep monitoring the market trend, and immediately implement **Option 2** when market demand fluctuates significantly, or market demand goes up or down significantly.

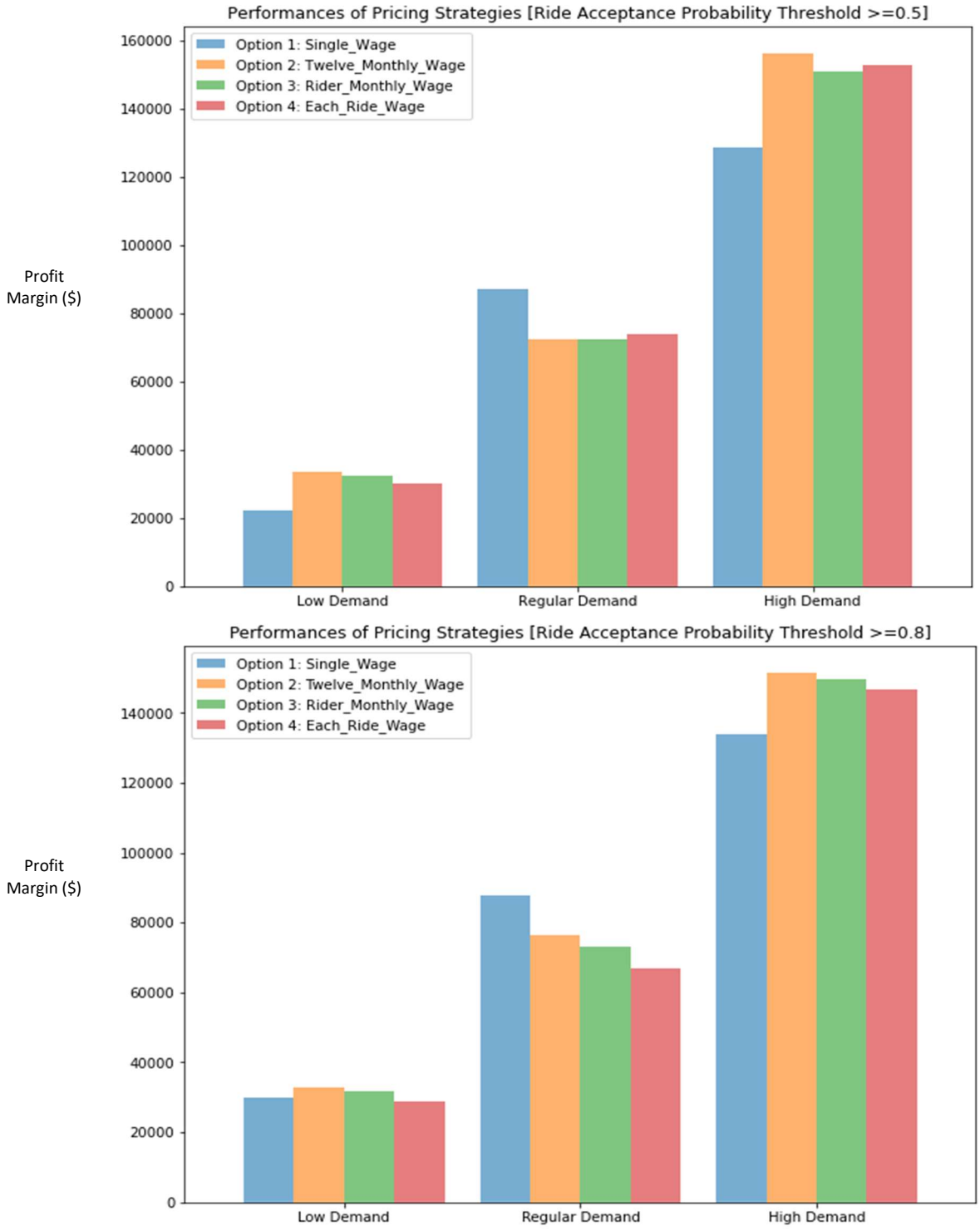
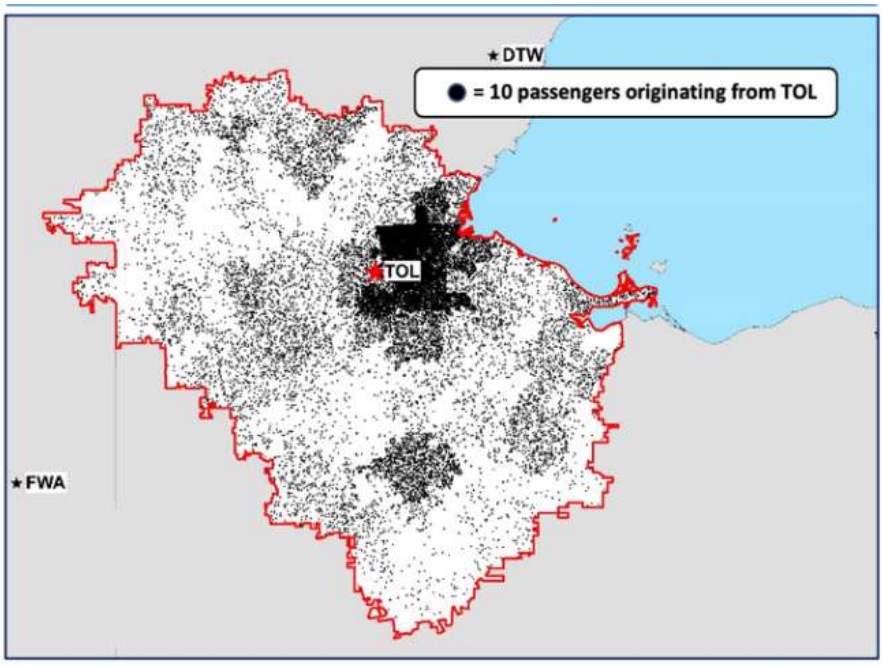



Figure 1: Profit margin performances of different pricing strategies under different ride acceptance levels.

# 2 Methodology

Three different demand scenarios were assumed: regular demand, lower ride demand and higher ride demand.

The regular market demand was assumed from Toledo Airport Traffic Report 2019. There was a total of 245,389 passenger traffic was in 2019 during pre-Covid time. This means a monthly average of 20,449 passenger traffic to/from Toledo airport. Only 3% of Toledo City population lives in Toledo Downtown. Please see Figure 2 for Toledo airport catchment area. Assuming additional 2% visitors a month, a total of 5% of Toledo airport passenger traffic can be assumed to use Toledo airport to/from Toledo downtown which is around 1022 passengers. Also, further assuming approximately 50% of these trip makers are willing to take ride-hailing service, we get around 500 passenger rides to/from Toledo airport as our regular monthly base condition.




Source: Adjusted ARC, CY 2019.

Figure 2: Catchment area of Toledo Airport

Finally, we assumed the following three demand scenarios:

a) Low Demand: 200 riders (monthly average)
b) Regular Demand: 500 riders (monthly average)
c) High Demand: 1000 riders (monthly average)

Three demand scenarios were run in a simulation environment for all the stated pricing strategies by Python Coding inside Jupyter platform.

These demand conditions were further run under two different driver's ride acceptance conditions using the probability of a ride being accepted which are 0.5 (flexible) and 0.8 (less flexible) driver conditions.

Each demand scenario was simulated with 10 simulation runs because the total ride request by a rider follows Poisson distribution and Offered Ride Wage was assumed equally likely random distribution between two values where necessary. Thus, a total of 10 simulation runs were generated for each demand scenario, and then the final grand average profit margin of simulation runs was reported under each driver's flexibility condition.

For the sake of simulation processing within this short time, the offered wage starts from $5 as minimum which can be termed as minimal booking price for a ride, otherwise drivers will not be interested at all about the offered ride request.

Please see the attached Python Codes (in HTML) for more technical details.

# 3 Observations

In plain sight without the data, it seems that **Option 4** might be the optimal solution because the probability of a ride being accepted solely depends on the offered wage for the individual ride. This might increase more rides under changing demand and supply conditions.

However, with our synthetic data, **option 4** fares not the best but performs comparably along with **option 3.**

**Option 1** may not produce optimal number of accepted rides because of high market demand and supply fluctuations but it works well under regular market condition.

If the market fluctuates too low (like Covid condition with very low demand) or too high when sudden big events happen in Toledo downtown that might attract more domestic or international tourists, then **Option 2** may perform better for highest gains in profit.

## 4 Conclusion

The management should consider further the following options before deciding final pricing strategy under current market:

- Collect real sample data from the field or take some user survey before implementing the recommended **option 1** for current regular market
- The wage formulation must be refined. For example, for any month we can't set offered wage to zero to all riders or rides. Further modelling tests to be taken by setting some predefined wage values from mid-range to high range to attract the drivers more to accept the ride request.
- Some other options like variable rates or slab-based rates like daytime, night time, traffic peak period rates can be further explored.

## References:

1) https://www.toledoport.org/media-room/press-releases/news/2020/january/toledo-express-airport-reports-169-percent-increase-in-passenger-traffic-for-2019/

2) https://www.point2homes.com/US/Neighborhood/OH/Toledo/Downtown-Toledo-Demographics.html