

4.3 Comparative Analysis of Profit Margins

Based on the operation management, operation safety, operation efficiency and operation service quality of taxi enterprises, the operation performance of taxi enterprises is evaluated by constructing the taxi performance evaluation index system [29]. In the taxi market, profit margin is an important indicator to measure drivers' revenue, which has a significant effect on market demand and supply. A high profit margin can encourage drivers to accept many orders, which can increase market supply but cause traffic jam. By contrast, a low profit margin can entail the shortage of market supply but make catching rides difficult for people. Therefore, balancing profit margins indifferent service modes is necessary. This study compares and analyzes the imbalanced features of profit margins for taxi and online car-hailing services in Beijing and Shanghai in different dimensions.

4.3.1 Regional Differences on the Profit Margins of Online Car-hailing Service

Fig. 2 illustrates that the profit margins of taxis and online car-hailing services in Shanghai are relatively

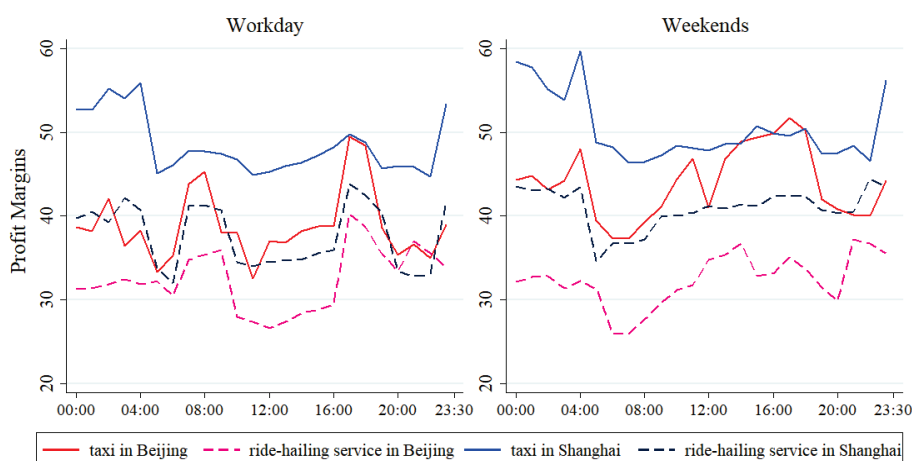


Figure 2 Comparison of the profit margins of online car-hailing service in Beijing and Shanghai

4.3.2 Differences on the Profit Margins of Online Car-hailing Service during Work Days and Weekends

The profit margin of online car-hailing service is unevenly influenced by work days or weekends, as displayed in Fig. 3. Overall, the profit margin on weekends is higher than that on work days. For example, on weekends, the daily average profit margins of taxis and online car-hailing services in Beijing and Shanghai are 38.19 CNY and 45.69 CNY per hour, which are 2.57 CNY and 2.62 CNY higher than that on work days, respectively. On weekends, the daily average profit margins of taxis in Beijing and online car-hailing service in Shanghai are 43.99 CNY and 40.93 CNY per hour, which are 5.15 CNY and 3.31 CNY per hour higher than those on work days, respectively. Relevant departments should consider the influences of work days and weekends on profit margins to avoid imbalance in operation. The highest profit margin of taxis during work days and weekends is the same. However, online car-hailing service has significant

higher than those in Beijing. For instance, on work days, the daily average profit margin of online car-hailing service in Shanghai is 37.62 CNY per hour, which is 5.21 CNY per hour higher than that in Beijing. On weekends, the daily average profit margin of taxis in Shanghai is 50.45 CNY per hour, which is 6.45 CNY per hour higher than that in Beijing. Furthermore, the time points in the highest profit margins of taxis and online car-hailing services are different between Beijing and Shanghai, thus reflecting different living habits in different regions. In Shanghai, the profit margin of online car-hailing service at night is generally higher than that in daytime. The opposite situation happens in Beijing. Therefore, citizens in Shanghai have a richer nightlife and more travel demands at night than those in Beijing. The highest profit margin of online car-hailing service in Beijing occurs during evening rush hours, whereas that in Beijing occurs at night. For instance, on work days, the highest profit margins of taxis in Beijing and Shanghai are 49.49 CNY and 55.96 CNY per hour at 17:00–18:00 (evening rush hours) and 4:00–5:00 (early morning), respectively. On weekends, the highest profit margins of online car-hailing service in Beijing and Shanghai are 37.25 CNY and 44.43 CNY per hour at 21:00–22:00 and 22:00–23:00 (at night), respectively.

differences. For instance, on work days and weekends, the period of the highest profit margin of taxis in Beijing is 17:00–18:00. However, online car-hailing service in Shanghai appears at 17:00–18:00 on work days and 22:00–23:00 on weekends.

The profit margin of online car-hailing service is generally lower than taxi service. For instance, the average profit margin of online car-hailing service in Beijing is 32.40 CNY /hour, which is 9.01 CNY/hour lower than taxi service. On weekends, the profit margin of online car-hailing service in Beijing is significantly lower than taxi service in 0–3 km, and that on work days is 36.38 CNY /hour, which is 7.41 CNY lower than taxi service. On the contrary, the average profit margin of online car-hailing service in Shanghai on work days is 43.84 CNY /hour, which is 3.5 CNY /hour higher than taxi service. On weekends, the profit margin of online car-hailing service in Shanghai is 18.00 CNY /hour over 15 km, which is 11.8 CNY /hour lower than taxi service.

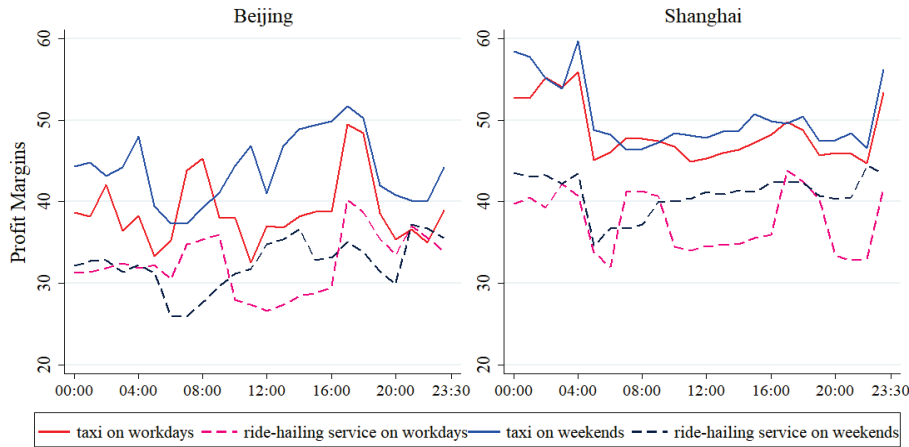


Figure 3 Comparison of the profit margins of online car-hailing service during workdays and weekends in Beijing and Shanghai

4.3.3 Specific Differences of Profit Margins based on Service Mileage

A significant difference is observed in the temporal distribution for orders with different service mileages. Short trips are mainly concentrated in rush hours, whereas long trips are mainly increased at night. For instance, 4.1% of the orders in 0–3 km appear at 18:00–18:30, and 13.7% of the orders over 15 km occur at 22:00–23:30 at night. By contrast, the order distribution in 3–15 km is relatively dispersed. The profit margins of taxis and online car-hailing services for different service mileages (0–3, 3–15, and over 15 km) on work days and weekends in Beijing

and Shanghai can be calculated using Eqs. (6) and (9), as demonstrated in Figs. 4 and 5, respectively. Statistics show that long-distance and short-distance orders tend to have high profit margins. Moreover, long-distance orders widely generate a higher profit margin than short-distance orders. Ranked from the highest profit margin to the lowest, the service mileage of taxi service (online car-hailing service) in Beijing and Shanghai are over 15, 0–3 and 3–15 km. That is, the profit margins of the long-distance orders of taxis and online car-hailing services in Beijing and Shanghai are high.

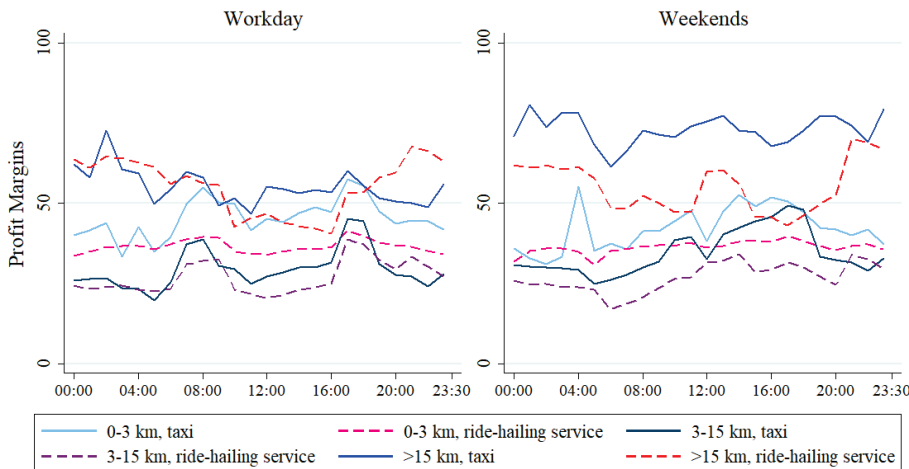


Figure 4 Comparison of the profit margins of taxi and online car-hailing services in Beijing on different service mileages

The profit margins of taxis and online car-hailing services on weekends are higher than those on work days, and the fluctuations are smaller. Influenced by travel demands and pricing mechanisms indifferent service modes, the highest and lowest profit margins of online car-hailing and taxi services are in different durations. For example, the period of the highest profit margin of taxi service (online car-hailing service) in Beijing is during evening rush hours and night time, whereas the lowest appears at noon time and morning rush hours. No evident fluctuation occurs in the morning and evening rush hours in Shanghai, and the period of the highest profit margins in taxi and online car-hailing services is during evening rush hours and night time; the lowest is before morning and evening rush hours. Another example is taking a 3–15 km

trip on work days. The highest profit margin of taxi service in Beijing is 45.08 CNY /hour, occurring at 17:00–18:00 (during evening rush hours), which is 5.56 CNY/hour higher than the daily average. The lowest profit margin is 19.84 CNY/hour at 5:00–6:00, which is 19.59 CNY/hour lower than the daily average. On the contrary, the highest profit margin of online car-hailing service is 38.63 CNY /hour at 17:00–18:00, which is 5.81 CNY /hour higher than the daily average. The lowest profit margin is 20.39 CNY/hour at 12:00–13:00, which is 12.43 CNY /hour lower than the daily average. The relatively low profit margin of online car-hailing service at noon time can reduce drivers' enthusiasm in accepting orders, which further entails market supply shortage. In Shanghai, the highest profit margin of taxi service for a 3–15 km trip on

workdays appears at midnight, which is 47.92 CNY /hour, and the lowest occurs at 5:00, which is 30.27 CNY /hour. By contrast, online car-hailing service reaches the highest

and lowest points of profit margins at 22:00 and 6:00, which are 39.15 and 25.86 CNY/hour, respectively.

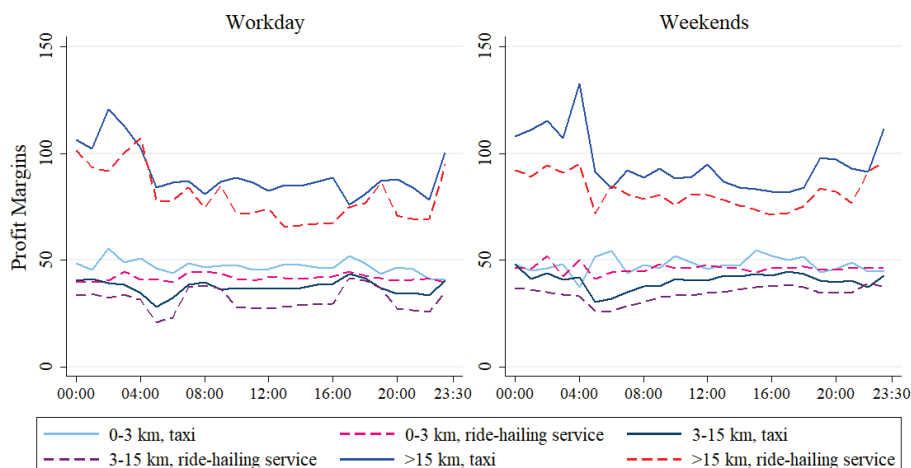


Figure 5 Comparison of the profit margins of taxi and online car-hailing services in Shanghai on different service mileages

In Shanghai, the profit margins of taxi and online car-hailing services reach the relatively high point at midnight (0:00–5:00). For instance, on work days, the average profit margin of taxis during that time span (0:00–5:00) for trips of over 15 km is 108.99 CNY per hour, which is 23.64CNY per hour higher than the average profit margins in other periods. On weekends, the average profit margins of taxis and online car-hailing services for 3–15 km trips during daytime (6:00–18:00) are 39.97 and 33.58 CNY /hour, which are 0.84 and 1.33 lower than those at night. Consequently, due to the rich nightlife in Shanghai, the combination of long-distance and duration fees for taxis and online car-hailing services increases drivers' income, thus improving the service supply of taxis and online car-hailing services at a certain extent.

5 CONCLUSIONS

It is of great significance to improve the operation efficiency of taxi, promote the effective utilization of resources and improve the sustainable development of taxi market by studying the imbalance of taxi service profit margin. So, the capacity utilization rates model and profit margins model of taxis and online car-hailing services were built in this study, and the corresponding profit margins by employing the Didi trajectory data from Beijing and Shanghai of China. The main conclusions are drawn as follows:

(1) The capacity utilization rates of taxis and online car-hailing services have roughly the same daily variation tendency, with higher in the morning and evening rush hours and lower in the night-time. During the morning and evening rush hours, the supply of taxis and online car-hailing services is less than the actual demand, which means that the capacity utilization rate is relatively lower but it is difficult to take a taxi for consumers. The calculation based on profit margins of taxis and online car-hailing services can conduct more accurate analysis and processing for urban online car-hailing service mode, and solve the problem that the previous method is not directly applicable to the actual problem.

(2) The profit margin of weekends for taxis (online car-hailing service) is generally higher than that of work days.

For taxis and online car-hailing services, there are significant differences between work days and weekends in the higher profit margin period, reflecting that people have different travel habits on work days and weekends. The measurement results obtained by constructing service models of taxis and online car-hailing services based on the Didi trajectory data, can reflect the service mode of Beijing and Shanghai of China ride-hailing industry better to provide a feasible and effective measurement method for the transportation department.

(3) The capacity utilization rates and profit margins proposed in this study can also be applied to the research of service mode in related fields with similar characteristics. "In the online transportation service industry", the imbalance of profit margin in the taxi market is affected by not only the pricing mechanism but also the supply and demand of the market. It is important to fully demonstrate the regional economic development and the diversified demands of passengers, making a differential pricing.

By analysing the capacity utilization rates and profit margins of taxi and online car-hailing services in different dimensions, a series of valuable conclusions are drawn. However, there are still some shortcomings in the research: First, due to the limitation of data, it is impossible to take taxi drivers' meal and rest time into consideration, thus a certain amount of error in the calculation of taxi CUR may occur. Secondly, although profit margins rate is a key factor influencing driver's income, it still cannot fully represent. The Profit Margins of taxi will be calculated more accurately in further research.

Acknowledgements

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