Strategically Giving Service: The Effect of Real-Time Information on Service Efficiency

1. Research Problem

Real-time information is becoming available in many services and both customers and agents can easily access a wealth of information that may affect their decisions. This availability of real-time information is particularly important in two-sided markets, where a platform connects service providers with customers. In those markets, real-time information not only affects customers’ actions, but also service providers’. For example, Airbnb connects individuals looking for accommodation with private property owners; Uber connects individuals looking for a ride with drivers able to offer one. The supply side of these markets consists of a large number of individual agents who try to maximize their individual profits. When doing so, they have access to very detailed information, often real-time. The focus of this paper is to study how hypergranular spatial real-time information affects the decisions of individual service providers, and to explore the consequences of the availability of such detailed information for the efficiency of service platforms.

One of the leading applications of service platforms can be found in e-hailing. E-hailing taxi platforms based on ride-sharing or professional capacity providers are becoming an important alternative to traditional taxis, which have helped matching supply with demand in a very convenient way for both sides, and have also brought more business information to market participants. For example, drivers in traditional taxi services have limited information about their competitors. However, the location of drivers is available to competing drivers. Therefore, the use of e-hailing platforms provides drivers with access to an unprecedented amount of information about their competitors.

Such new forms of real-time information bring new opportunities for the agents to be more strategic and can lead to changes in agents’ behavior. For example, agents may interpret the arrival of another idle agent into their serving-zone in two different ways. On one hand, they may think that this new agent comes chasing a high sales opportunity in the zone. This might make agents already in the zone decide to
stick with their serving-zone. On the other hand, agents may see this new agent as a threat to their business and think that their sales chance decreases significantly as a consequence of this arrival. Thus, they may decide to move to another zone.

Agents are heterogeneous in how they react to the information indicating new arrivals. Different interpretations can affect the performance of the agents differently as well. More specifically, heterogeneity in decisions may affect server utilization. Since monitoring and reacting to the information is costly for agents, it is interesting to study whether such behavior substantially increases sales.

Changes in the behavior of individuals in response to real-time information can potentially affect the quality of service as well. Through better balancing of capacity, platforms can potentially serve more customers and/or respond to their requests in a short time.

Previous research has studied the consequences of strategic behavior by customers on the efficiency of service (see Lariviere and Van Mieghem 2004). Recent work has also considered capacity management problems where the service provider achieves the required service level by giving incentives to its profit-maximizing agents (see Gurvich et al. 2015). We complement this literature by analyzing the strategic behavior of servers who compete with each other in an emerging and increasingly important empirical setting.

2. Methodology
We ascertain the effects of availability of real-time information on the behavior of competing service providers using a novel high frequency, spatial dataset that contains very granular data about the movements of drivers affiliated to the e-hailing platform in South America. At the time of our analysis (September 2014), the focal company had over 19,000 taxi drivers in a large South American city where we focus our analyses. Our focal company was the largest e-hailing platform in the country, as international competitors such as Uber or Lyft had not entered this country yet. Similar to most other e-hailing taxi platforms, customers can observe all available taxi drivers around their location via the mobile phone app, and they can use the app to make a ride request.

We have obtained access to anonymized, high-frequency, hyperlocal information from the GPS logs of all the drivers in their network during our period of analysis. Our data set records the status and the location of each driver (latitude and longitude) at a given time, whenever they are logged-in.

Such data is also available to customers and drivers in real-time, and can potentially influence the behavior of drivers. In a similar setting of the investors of the company noted that, over time, drivers
realized how their revenue could increase if they used smartphones with 3G services instead of old phones with a prepaid services. The reason is that if they use a smartphone they are able to access richer real-time spatial information. Therefore, this data set is very appropriate to analyze the central question addressed in this paper – how the entry of a new competitor in the zone affects the behavior of the other drivers in the zone. Moreover, this dataset is a great source to investigate differences in the degree of sophistication of the drivers in terms of reacting to the available information, and how these differences translate into sales and system efficiency.

3. Preliminary Results
We reach two important conclusions: (1) the arrival of a new competitor increases the probability of changing the zone, and (2) drivers with a more frequent scattering behavior as a response to a newly entering competitors have higher utilization rates than drivers with a less frequent scattering behavior. The estimated effects are statistically significant and robust to alternative specifications. We observe that the predicted probability of changing the zone increases almost linearly with the number of new drivers entering into the zone. On average, the arrival of a competitor increases the probability of changing a zone by 3.1%.

In our study, we follow vacant drivers and their interaction. However, this could create some endogeneity concerns because the different competition situations that drivers face could be correlated with unobserved factors that drive their decisions. First, a driver may want to stay in the zone, but events of an unobservable nature, such as traffic conditions, may force her to change her zone. We use the speed of drivers as a control for traffic conditions in a zone and focus on time periods where the probability of observing heavy traffic is low. Second, there may be cases where we believe that the driver has chosen to move as a reaction to the arrival of competitors, but in reality the driver was changing her zone regardless of the entry. First, the driver may get a ride-request through the platform from another zone, thereby inducing her to change the zone. Since we only consider cases where the driver is vacant after the implementation time, this case is not an issue for our observations. Second, the driver may be carrying a passenger that she finds through another platform (or hailing from the street), but nonetheless stays logged into the platform as a vacant driver. To prevent this case, we consider drivers that have high utilization, which is a sign that they are using other platforms or hailing the passenger from the street less likely, as well as observations where the driver has waited in the same zone for at least 5 minutes. Waiting in the same zone for 5 minutes minimizes the concern of carrying a passenger from another platform.

Finally, by using simulations we demonstrate that the scattering behavior can reduce passenger waiting time up to 20.6% while decreasing the abandonment behavior. Therefore, platforms significantly benefit from the scattering behavior of service providers.

For details, see TechCrunch (2015).
References