Service Delivery Platforms: Pricing, Welfare, and Revenue Implications

Food delivery platforms, such as GrubHub, Caviar, and UberEats, act as intermediaries and offer consumers deliveries from restaurants, while Postmates offers deliveries from other types of services in addition to food. These platforms represent a growing segment of the so-called “sharing economy,” which refers to businesses whose revenue model relies on connecting customers with service providers—who may or may not be directly employed by the business—often via a mobile app.

While substantial research interest has recently been devoted to understanding the interaction between drivers and platforms in the sharing economy, a similarly important but less studied issue for food delivery platforms is the interaction between the platform and the restaurant. Ride-sharing platforms like Uber and Lyft and short-term housing platforms like AirBnB have disrupted existing business models by cannibalizing demand from the established players in their respective industries (taxis and hotels, respectively). Such platforms are in direct competition with the established providers. By contrast, food delivery platforms maintain a symbiotic relationship with the existing providers in their industry; rather than “stealing” demand from an established player, these platforms work with restaurants to connect customers with the restaurant’s product by providing an additional purchase channel.

However, while this relationship entails cooperation between the platform and the restaurant, there is substantial opportunity for misalignment between them. Specifically, the delivery platform earns revenue only from customers who order delivery and receives nothing from dine-in customers. When solving a revenue maximization problem, the platform will set its price to maximize what it receives from delivery customers, which will likely not yield the system-optimal revenue. Similarly, the restaurant earns different revenue per customer from the
different channels, and it may have a relative preference for one type or the other which does not match the coefficients of the aggregate revenue function.

We take a queueing approach to modeling this system, treating the restaurant’s kitchen as an observable M/M/1 queue with customer waiting costs. On arrival, a customer observes the queue length and chooses to dine in, order delivery, or balk (i.e., not purchase), based on her reward, the prices, and her expected cost of waiting on each channel.

We first study the revenue maximization problem faced by a monopolist who controls both the dine-in and delivery prices and receives all revenue from the system. Our results on the optimal pricing scheme are related to the priority queueing and pricing literature and are of independent interest. For the monopoly case, we take a similar approach to Adiri and Yechiali (1974) and Alperstein (1988). In equilibrium, we find that for short queues, customers dine in; for medium-length queues, they order delivery; and for long queues, they balk. We show that the optimal threshold between dine-in and platform customers is a constant which does not depend on the maximum total queue length but is a function of only the model primitives. In terms of comparative statics, the optimal dine-in control limit is increasing in the customer valuation, the service rate, and the amount of quality loss in delivery, and decreasing in the difference in unit waiting cost between waiting at home and waiting at the restaurant.

Second, we investigate means of coordinating the decentralized supply chain via different contracts between the restaurant and the platform, where “coordinating” has the usual meaning of implementing an equilibrium outcome which achieves the maximum possible aggregate revenue. Our system shares some characteristics with the traditional manufacturer-retailer (here restaurant-platform) setup, but a crucial difference is that in addition to serving as a wholesaler to the platform, the restaurant also has an independent revenue stream from dine-in customers. This
feature fundamentally changes the incentives. The traditional “one-way” revenue-sharing contract of the form found in Cachon and Lariviere (2005) does not behave in the same way as usual because such a contract would require only that the platform share revenue with the restaurant, not the other way around.

We identify a contract form which coordinates the supply chain and can assign arbitrary fractions of the aggregate revenue to each party. Specifically, a two-way revenue sharing contract coordinates the supply chain, where the restaurant shares some of its dine-in revenue with the platform and the platform shares some of its revenue with the restaurant. Notably, the share from the platform to the restaurant may be less than the retail price that the restaurant charges dine-in customers. What is required to coordinate the supply chain is that the fraction of the customer-facing price that each party receives is the same for both channels.

References

