On-Demand Service Platforms

Terry A. Taylor

Haas School of Business, University of California, Berkeley

Recent years have witnessed the emergence and rapid growth of platforms for on-demand services. Examples include restaurant food delivery (e.g., Caviar, DoorDash), consumer goods delivery (e.g., UberRush, Go-Mart) and taxi-style transportation (e.g., Fasten, Go-Jek, Lyft, Uber). These services are on-demand in the sense that upon experiencing a need for service, a customer desires service immediately and is sensitive to delay. In this way, on-demand service platforms are distinct from scheduled service platforms which book appointments in advance (e.g., StyleSeat).

A platform connects customers seeking service with independent agents that provide the service. In each of the preceding examples, an agent is an independent contractor who receives a payment from the platform for each service completion. The agent is independent in the sense that she decides whether and when to work. The platform business model is distinct from the traditional firm-employee business model, wherein the firm determines when its employees work and pays them a salary or hourly rate rather than a piece rate. Examples of on-demand services provided via the firm-employee model are food delivery (e.g., Munchery), picking-up-packaging-and-shipping (e.g., Shyp), and town-car transportation.

This paper explores two key features of on-demand service platforms: First, upon experiencing a need for service, waiting-time sensitive customers choose whether to seek service. Second, independent agents choose whether to work. Two elements that connect these customer and agent decisions are agent idleness and scale economies. The fraction of time an agent working for an on-demand service platform is idle can be significant; because an independent agent is not compensated for idle time, the fraction of idle time she anticipates significantly impacts her decision of whether to work. Although agents prefer this fraction be small, customers prefer that it be large because greater agent availability reduces customers’ congestion-driven delay. Whereas idleness hurts agents but benefits customers, both groups benefit from scale economies. Indeed, platforms point to scale economies from pooling efficiencies as one of their primary advantages over small-scale firms (e.g., an individual restaurant or retailer providing its own delivery service) in the provision of on-demand services.

The purpose of this paper is to provide insight into how on-demand service platforms should set per-service prices and wages. By comparing the setting with (self-scheduled) independent agents to one with (firm-scheduled) employee-agents, we address the question: What is the impact of agent
independence on the optimal price? Because of the on-demand nature of the service, customers are sensitive to delay. By comparing this base case to a benchmark case where customers are insensitive to delay, we address the question: What is the impact of delay sensitivity on the platform’s optimal price and wage?

To address these two questions we employ a queueing model in which the customer arrival rate and number of servers (agents) are endogenous. The platform commits to a per-service price and wage prior to the resolution of uncertainty in the customers’ valuation for receiving service and in the agents’ opportunity costs. Customers have a common valuation for receiving service, and an agent participates if the expected revenue generated from doing so exceeds her opportunity cost.

Delay sensitivity reduces expected utility for customers (directly, through waiting) and agents (indirectly, through idleness), which suggests that the platform respond to delay sensitivity by decreasing the per-service price (to encourage participation of customers) and increasing the per-service wage (to encourage participation of agents). These intuitive price and wage prescriptions are valid in a benchmark setting without uncertainty in the customers’ valuation or the agents’ opportunity costs. The paper’s first contribution is to identify and explain driving forces that cause these prescriptions to break. Moderate customer valuation uncertainty causes the price prescription to break. High opportunity cost uncertainty coupled with a moderate expected opportunity cost causes the wage prescription to break.

The second contribution is to identify and explain driving forces that lead agent independence to either increase or decrease the optimal price. Agent opportunity cost uncertainty causes agent independence to decrease the price. High (low) customer valuation uncertainty causes agent independence to increase (decrease) the price.