Pricing Ancillary Service Subscriptions
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Many firms offer ancillary services to support their core products, services or activities. For example, the main activity of airlines is to take their customers to their destinations safely, while airlines often sell in-flight Wi-Fi access, movie streaming, food and beverage and bag check-in services to enhance customer experience. Ancillary services have become one of the major revenue sources for many airlines. In 2013, United Airlines reported $6.2 billion revenues solely from ancillary services, which accounts more than 15% of its total revenue. Not surprisingly, 43% of Spirit Airlines’ revenue is also generated from ancillary services; see CarTrawler (2016).

Ancillary services are common in many other industries, from entertainment, sports to information and web services. Six Flags, Disneyland and some US National Parks charge admission fees and also sell food and beverages, rent equipments at additional cost. Gyms and sporting clubs charge for access to the clubs and sell towel service, exercise class and pool access for additional fees after customers are admitted. Finally, Amazon Web Services, a business unit of Amazon, sells virtual machine capacity in Amazon servers. Customers who purchase virtual machine capacity can also utilize its machine learning algorithms at an additional fee.

In this paper, we study ancillary service subscription and its impact on main product demand and pricing. Although subscriptions for main products are widespread in many industries, ancillary product subscriptions have recently gained popularity among firms. Indeed, there have been more and more industries where the subscription option is available not for the main product but for an ancillary or facilitating service with which it is coupled. If the firm offers ancillary service subscription, the subscribed customers can use the service for free whenever they purchases the main product from the firm during the subscription period. A prototypical case is that of United Airlines that recently introduced an annual subscription for checked luggage (Forbes 2013), which is an additional option to paying a fixed fee per check-in bag. This subscription is an alternative to Southwest’s “bags-fly-free” program that bundles ticket prices with baggage fees. Similarly, Amazon Web Services sells monthly subscriptions for machine learning algorithms that can be utilized if Amazon virtual machines are rented. Six Flags offers drink bottles that allow its customers to have unlimited refills during the season (3-months) in Six Flags Parks.

Motivated by these examples, we study the impact of service subscription on the pricing of the main products and customer surplus. Customers have to make a choice between paying each time when service is used (pay-per-use) or subscribing to the services for multiple uses in a given period of time, like a year. Several questions arise naturally: 1) How does ancillary service subscription affect consumption of the main product? 2) What is the optimal pricing strategy for the main product and service subscription with heterogeneous customers? How does it affect customer surplus? 3) What is the optimal pricing strategy under competition?
In our modeling framework customers take into account the full benefits of ancillary services when considering service subscription, and thereafter always choose the alternative (perhaps the outside option) with the highest net utility in monopolistic or competitive scenarios. Moreover, customers make decisions in two stages: in the first stage, they decide whether or not to subscribe to ancillary service; in the second stage, they choose a main product (perhaps the associated ancillary service), which is governed by the multinomial logit choice model for consistency with their utility-maximization behavior. We ask whether firms should offer subscription of ancillary services, and then further investigate its effects on the pricing strategy for main products and service subscriptions as well as customer surplus in a variety of monopolistic and duopolistic settings with homogeneous and heterogeneous customers.

Customers are heterogeneous in main product utility, purchase frequency and in need of ancillary service. In particular, all customers of the same type associate with the same nominal utility for the product and service bundle, but the actual utility is not fully observable due to the unobservable uncertainty. The random component of an individual customer’s utility is often interpreted to capture the differences with respect to preferences or a measure of the unobservable heterogeneity in customer preferences. We call this the first degree of heterogeneity for customers. Moreover, different types of customers have different nominal utility for the same product and service bundle, which is referred to as the second degree of heterogeneity. In many scenarios, it is not uncommon that customers who purchase a main product always use the ancillary service. However, there may be instances where the ancillary service is not needed; for example, a frequent business traveler may not need a check-in bag. Such uncertainty can also be accommodated in our general framework. Let a binary random variable represent whether a type of customer will use the ancillary service when consuming the main product. This can be viewed as the third degree of heterogeneity for customers. Finally, different types of customers have different number of purchase opportunities, which can be considered as the fourth degree of heterogeneity for customers. Customers are often referred to homogeneous (ex ante) if they only differ in the first degree of heterogeneity.

Customers first decide whether to purchase the subscription or not. Then at each purchase occasion, they decide whether to consume the ancillary service (for free for subscribed customers and at a fee otherwise). We derive the willingness-to-pay of each type of customers for service subscription in closed form. After subscription decision is made, customer choice behavior for main products is modeled using the multinomial logit choice model. We characterize the impact of service subscription on the pricing strategy and customer surplus. Ancillary service subscription can help firms to better price-discriminate heterogeneous customers through different subscription decisions and subsequent purchase behavior.

Our Contributions. In the monopolistic scenario with homogeneous customers, if the main product price is fixed, offering a service subscription option may result in a “win-win” situation, under which both parties, the customers and the firm may be better-off, compared to the case without service subscription. If the main product price is also a decision variable, it may result in a “win-lose” situation, under which the firm’s revenue increases and customer surplus decreas-
es. Similar results may happen in a market with heterogeneous customers differing on multiple dimensions. The firm always results in higher total revenue by providing service subscription at an appropriate price in addition to the existing pay-per-use option in a variety of markets, although different customers may yield higher, same or lower surplus depending on model primitives and market composition. Moreover, along with fully characterizing the willingness to pay for each type of customers, we conduct an extensive numerical study and illustrate the impact of service subscription on the pricing strategy and customer surplus.

In the competitive scenario with fixed prices for the main products of two firms, there exists a unique Nash equilibrium, in which each firm will offer a service subscription that may result in a “win-win-win” situation, i.e., all parties including customers and both firms are better-off than without service subscription. We also fully characterize the equilibria under price competition for main products when only one firm offers a service subscription at a pre-determined price. In the joint competition in prices of main products and service subscription by a firm only, there always exists a unique Nash equilibrium, in which the firm offering a service subscription is always better-off if the other one only offers the pay-per-use option. However, if both firms offer service subscriptions, joint competition may result in a “lose-lose-win” situation, i.e., both firms are worse-off but customers are better-off. Especially, if the product quality for both firms, measured by nominal utility, is not significantly different, more fierce price competition resulting from offering service subscription may lead to higher customer surplus.

In the current models, we assume that the main product and ancillary service are independent. It would also be insightful to investigate the benefits of ancillary service subscription in correlated scenarios. It is a common practice to dynamically change prices for some products (e.g., airline tickets) based on market conditions, remaining unsold capacity and time to go. In these time-changing scenarios, it remains to determine what will be the optimal dynamic pricing strategy for the main products or ancillary service subscriptions. We also provide many theoretical predictions in competitive scenarios. As a future research direction, one may empirically test some of our predictions if data can be obtained in corresponding industries.

References
