Shaping Demand Peaks and Valleys in Service Industries through Online Deals

Matching demand and supply is a challenging problem for most service providers. Capacity is rarely flexible enough to costlessly adjust to the peaks and valleys of demand – even when the timing of demand swings are known well in advance. Consider a restaurant on the Valentine’s Day. The timing of the holiday is not in question, but the ability of the restaurant to take advantage of it may be limited. Holiday demand is likely to exceed the firm’s regular capacity, and staffing up to meet this spike may be challenging if the firm’s employees also want to celebrate the holiday. This tension creates an opportunity for the firm to design consumer offers to lock in demand early in order to plan capacity and, perhaps more importantly, to smooth extreme swings in demand. We consider a new form of such offers, online deals offered via deal offering platforms available on a smartphone app or their websites.

In this paper, we empirically study how service providers utilize online deals to shift demand and increase profit during holidays. We build a structural model to estimate various service industries’ marginal service costs and their demand sensitivity with respect to the deals’ design parameters, discounts and time elapsed from launch date to holiday, the preparation time. From the service providers’ perspective, we confirm that during extreme demand, deal launches do serve to shape demand and can increase profits up to 3.5 times more compared to the case where no deal is offered. Subsequently, we identify the key determinants of the deals design and propose a profit-optimizing deal strategy tailored to market conditions. Via counterfactual analysis, we further show optimal deals shift excessive holiday demand off-peak and boost up the holiday demand valley, and that properly setting preparation time is key to shaping demand.

In the market we consider, service providers launch their deals on an online platform. Consumers purchase the service upfront and later redeem in store. Such deals are very popular in
China. In year 2016, the total sales in Chinese online deals industry achieved a 64.2% growth rate to reach $105.6 billion (Sina and Trustdata, 2017). The monthly active users of online deals exceed 220 million (Sina and Trustdata, 2017). We utilize a comprehensive dataset from Meituan and Dianping, the two leading deal platforms in China with more than 35% market share. Our dataset, collected at the deal level, covers all deal launches from January 1, 2012 to March 31, 2012 on the platforms, including 2,270 deals, 1.7 million purchases from 15 service industries and total sales of $24.8 million. Our data covers four holidays, including New Year’s Day, Chinese New Year, Valentine’s Day and Qingming Festival. Approximately 62.4% of deals are active during one of the four holidays. We label these as the holiday deals. For each deal, we observe its original and discounted price where the ratio between the two gives the discount; launch date, from which preparation time is the time elapsed from launch to the holiday; and lastly service industries. We also observe the cumulated sales volume on the 1st, 5th and last day the offer is available. Verified by statistical tests, design parameters differ significantly across industries. For instance, outdoor activity deals (e.g., theme parks, hot springs, ski resorts) are launched 10 days earlier on average than photography services, with a 37% shallower discount.

Identification of the structural model, a profit maximization problem, comes from the variations in deal designs within as well as across service industries. Optimal online deal strategies (discount, preparation time) are functions of the demand sensitivities, the regular service price, natural holiday demand change, and the marginal cost price ratio. Demand sensitivities are the changes in demand perturbing the deal designs. Deal determinants estimation requires two steps. First, demand changes for each service industry is estimated via fitting a second order spline model on the observed sales volumes, with a first order knot at the first day of the holiday. Second, demand sensitivities and marginal costs per service industry can be estimated using
constrained least squared estimation as functions of the observed deal strategies, prices and estimated demand changes from step one. Counterfactual analysis confirms that even under their current deal strategies, 11 out of 15 service industries observed in our data see an improvement in profit when introducing online deals during holiday. Among the 11 industries, outdoor activities achieve a profit 4.5 times the case in which no holiday deal is offered. Other industries see a mean profit increase of 15.2% with a standard deviation of 23.1%. All industries that enjoy a profit increase from online deals show decreases in unit costs. The cost benefits partly come from locking in seasonal staffing costs early.

Pooling all service industries together, we further examine how the optimal deal design depends on the service industries’ cost price ratio and market demand change. In particular, we see a 10% increase in cost price ratio leads to a 5% less aggressive discount. The preparation time is concave in cost price ratio, and linear in demand change. Most industries in the market, except three, design deals that closely match our model’s suggested strategy. We see a 26% profit increase, relative to their profit under the current strategies, in travel industry, 8.4% increase in outdoor and 1% increase in high-end hotels. We do not a priori assume that holiday demand increases for all service industry. We find, however, that under the optimal deal design, holiday total demand decreases whenever market expands naturally during holiday, i.e. positive demand changes, and vice versa. Deals help to fill up the valley and reduce the peak load. Additionally, we see that a holiday only discount alone could not smooth demand; it makes the peak higher. It is crucial to take launch date into consideration when it comes to the deal design.

**Bibliography**