The Hong Kong Polytechnic University
Department of Logistics and Maritime Studies
Research Seminar

Early Bird Discount with Bayesian Updating

by

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Venue: R501, Shirley Chan Building
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(Conducted in English)

Abstract:

With the early bird discount, customers can purchase the product with a lower price when they buy earlier. It is an effective selling strategy adopted by many industries, especially for the perishable products or services. When the discounted products stock out, unsatisfied customers can choose the full-price product as a substitute. In this paper, we adopt an extended newsvendor model to investigate the optimal inventory levels of both the discounted and total products in one period. In each period, there are two phases: an early bird phase followed by a normal selling phase. Some of the one-period results can be proven as extensions of some classic theories in revenue management.

The demands in two phases and the substitution rate are key information when we implement the early bird discount. In this paper, we use the Bayesian dynamic updating framework to learn the customer demands and estimate the substitution rate. We extend the research on Bayesian inventory management by incorporating an intertemporal substitution rate and optimizing two decision variables jointly. Some effective lower or upper bounds for the optimal Bayesian solutions are provided in our analysis. Under the unobservable-lost-sales case with a known substitution rate, the classic “stock more” result still holds as we can get more information on the demand. Particularly, when we increase the inventory level of the discounted product, we should increase the total inventory level by a same increment at the same time. Otherwise, we will lose some information on the demand in the normal selling phase. Under the totally-observable-lost-sales case with an unknown substitution rate, we should stock fewer discounted products (“stock less”) to observe more substitution trials, which yields a better estimation on the substitution rate. However, this “stock less” result is reversed to “stock more” under a partially-observable-lost-sales case which appears for the first time in the literature on Bayesian inventory management. In the partially-observable-lost-sales case with a given substitution rate, we should stock more discounted products to reduce the information ambiguity. For the “stock more” results and other cases where such certain “stock more” or “stock less” results cannot be got, we develop a series of general upper bounds by means of two special kinds of information updating and an enlarging technique.

Bio:

Luo Zhenwei is currently a PhD student under the supervision of Prof. GUO Pengfei. His research interests are Bayesian statistics, inventory and supply chain management, strategic queueing and healthcare systems.

Please email to clare.lau@polyu.edu.hk for enquiries.

All are welcome!