Referral and Learning on Social Networks: Implications for Inventory

Abstract

In the past decade, with the increasing proliferation of digital social networks and social media like Facebook and twitter, we have observed businesses using them more and more for marketing. Firms have identified a cheaper way of reaching their customers through social media campaigns, promotions and referral programs. The response to the social media campaigns is not bad for the firms. According to Sprout-social, "On Twitter, 53% of consumers recommend companies or products in their tweets. Of those, 48% follow through with the intent to buy that product or service" (https://sproutsocial.com/insights/social-networks-influence-buying-decisions/). Customer who share their recent purchase may inspire others to make similar decisions. Customers who observe their friends’ purchasing choice or receive a referral from their friends are more likely to make similar decisions. According to a study by the digital marketing agency ODM Group, "74% of consumers rely on social media to make a buying decision", and Nielsen suggests that "people are 4 times more likely to buy when referred by a friend" (https://sproutsocial.com/insights/social-networks-influence-buying-decisions/). The referral programs provide a large market exposure at a much lower cost as compared to traditional marketing campaigns. Firms even provide incentives to customers to refer their products to their friends. There is recent work investigating the incentives for referrals ((Lobel et al. [2016])).

Recognizing the importance of social influence in a customers’ decisions in product purchasing, companies have devoted significant amount of their marketing resources in gaining brand awareness. However, the influence of social networks on customers’ purchasing decisions varies with the product category and the impact of referral programs on customer demand is not well understood yet. According to the Deloitte, some 56% of people buying baby products say social media influences their purchase decisions, compared to 40% for home furnishings, 33% for health and wellness and 32% for automotive (https://www2.deloitte.com/content/dam/Deloitte/us/Documents/consumer-business/us-cb-navigating-the-new-digital-divide-051315.pdf). It is reasonable to imagine that people’s purchasing decisions are more
influenced by their friends when they do not know much about their own preferences and when their preferences are usually similar to their friends. Therefore, the product demand depends upon the referrals, social learning and how customers make purchasing decisions. Hence, it is important for companies to understand their customers’ social learning behavior and its consequences for product demand.

In addition, marketing strategies on social network are not enough for firms to be successful in the digital age. In particular, for physical products such as fashion and new technology products, it is vital for a firm to make wise decisions in inventory when facing customers, learning in a social network. On the one hand, excessive inventory may lead to unnecessarily waste in a supply chain and increase the potential operations cost of the products. On the other hand, lost demand, along with lost opportunity, may also invite criticism from loyal customers. For example, Xiaomi, a Chinese smartphone manufacturer, that successfully markets its products through social network and referral programs, was accused of creating artificial scarcity to generate excitement and stimulate buying frenzy.

The goal of the paper is to provide analytical model to examine the impact of social learning in a social network on product demand, and provide suggestions on a firm’s inventory decisions when customers’ preference is heterogeneous but can be correlated in a social network. In particular, we are going to first examine social learning of customers in a given social network and answering the following question: how a customer making purchasing decisions based on his/her observation of others decision; how does the distribution of aggregated demand affected by the social network structure; how is the firms’ inventory decision affected by the social network. We will also examine customer referrals where the social network structure is generated by the firm’s policy in the referral program. We will analyze the tradeoffs of a firm to design a referral program and illustrate the different impact on social learning and inventory policies.

The contribution of the paper are as follows

1. We developed an innovative and analytically tractable model to study the consumer decisions when influenced by the interactions with their peers in the social network. We demonstrate the potential of this model by characterizing the demand distribution in the presence of social learning in a special network (line) and a special referral program (one referral per customer). The framework could be used to characterize the demand distribution for general social networks general referral programs. In particular, we characterize the social learning process of uninformed customers, and find that there is a threshold for uninformed customers to follow their predecessors’ purchasing decision. Uninformed customers are more likely to follow their predecessors’ choices when the correlation is strong or more proportion of customers are informed. Also they are more likely to following when
their prior preference of the popular product is neither too small or too large. If the correlation is weak, then uninformed customers will never follow their predecessors’ choices. And if the correlation is in between, the following strategy only occurs in a block of customers.

2. Social learning also has important implications on demand substitution by customers. Consumers may be more or less likely to substitute products when they observe their peers. This indirectly influences market exposure because consumers who do not purchase a product are not likely to refer it to their peers. We found that the social learning and the network structure not only influence the demand expectation but also the demand variance. We find the bias and variance trade-off on the demand distribution of the two products. The existence of uninformed customers will bring more bias to the demand but social learning can compensate for this effect. However, the social learning will bring more variance to the demand.

3. The impact of social learning and network structure on demand distribution will also affect the firm’s inventory decision. The impact of stock-outs may be different in the presence of social learning than under traditional inventory models. Thus our work creates a new line of inquiry in inventory management that explores the interaction between demand and market exposure. We incorporate customer’s social learning behavior into the firm’s inventory decision problem. In a single referral case, we find that the inventory decision of one product will significantly affect the stockout probability of the other product. The influence becomes smaller if we allow multiple referrals. However, the demand variance could increase exponential, which brings a challenge for the firm’s inventory decision too.

4. While referral programs are widely used by businesses, there is no systematic methodology for designing such programs. Consumer referral programs have been studied recently with a focus on the design of incentives for referrals (Lobel et al. [2016]). Our work will explore the problem of designing referral programs with a focus on inventory management and assortment planning. Our work will provide an opportunity to identify efficient referral programs for different social network structures and consumer preferences.

References