Bayesian Social Learning with Consumer Reviews

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ABSTRACT

We study a market of heterogeneous customers who rationally learn the mean quality of an offered product by observing the reviews of customers who purchased the product earlier in time. The seller, who is equally uniformed about the quality, prices dynamically to maximize her revenue. We find that social learning is successful—agents eventually learning the mean quality of the product. This result holds for an information structure when the sequence of past reviews and prices is observed, and, under some assumptions, even when only aggregate reviews are observed. The latter result hinges on the observation that earlier reviews are more influential than later ones.

In addition, we find that under general conditions the seller benefits from social learning *ex ante*—before knowing the quality of her product. Finally, we draw conclusions on the sellers pricing problem when accounting for social learning. Under some assumptions, we find that lowering the price speeds social learning, in contrast with earlier results on social learning from privately observed signals.

1. SYNOPSIS

Online review sites are playing an increasingly important role in consumers' purchasing decisions, most prominently in the hospitality industry, motion pictures, and restaurants. The proliferation of smartphones is making access to such review sites easier than ever. We study a stylized model in the spirit of the literature on social learning, for example [1], [2]. The key elements in the model are: (a) consumers learn in a fully rational Bayesian fashion; (b) the information structure resembles that of online review sites, where consumers have access to reviews generated by other consumers; and (c) consumers have fairly general heterogeneous preferences. These elements distinguish this paper from most of the literature on social learning, especially in the information structure: the social learning literature almost exclusively assumes that agents have access to private signal instead of reviews.

In more detail, consumers sequentially make a decision on whether or not to purchase a product. They are heterogeneous with respect to their preferences for the product,

which are private information. The quality of the product fluctuates unpredictably around its mean, which is unknown to consumers and can take two values: high or low.

Consumers who purchase the product post a review about their personal experience. These reviews are either 'like' if the consumer's net ex-post utility was positive or 'dislike' if it was negative. These reviews are only partially informative due to the heterogeneity in preferences and the fluctuations in the experienced quality. The consumers and the seller observe the sequence in which reviews were submitted and prices charged. Consumers who choose not to purchase the product are not observed, unlike classic models in the literature. Consumers are rational and make inferences about the mean quality in a Bayesian way, given the information available to them. The seller, who does not have an informational advantage over consumers, may modify her price dynamically as reviews accumulate. We formulate this model as a game and study its Perfect Bayesian Nash Equilibrium.

We establish that in equilibrium asymptotic learning occurs. That is, the conditional beliefs converge to a point mass distribution on the true state of the world. We show that consumers who decided not to purchase the product have no informational contribution. However, the sequence in which reviews are submitted matters, and under mild assumptions earlier reviews are more influential. In addition, learning is faster the smaller the dispersion of the perturbations around the quality.

We find that the seller benefits ex-ante from the presence of social learning; ex-ante she prefers to have her product listed on the review site. We show, under some distributional assumption, that the optimal dynamic price that accounts for social learning is lower than the one that does not account for it. This result is in contrast with the one obtained for social learning from signals obtained in [2].

2. REFERENCES

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