The Strange Case of Privacy in Equilibrium Models

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We study how privacy technologies affect user and advertiser behavior in a simple economic model of targeted advertising. In our model, a consumer first decides whether or not to buy a good, and then an advertiser chooses an advertisement to show the consumer. The consumer's value for the good is correlated with her type, which determines which ad the advertiser would prefer to show to her—and hence, the advertiser would like to use information about the consumer's purchase decision to target the ad that he shows.

In our model, the advertiser is given only a differentially private signal about the consumer's behavior—which can range from no signal at all to a perfect signal, as we vary the differential privacy parameter. This allows us to study equilibrium behavior *as a function of the level of privacy provided to the consumer*. We show that this behavior can be highly counter-intuitive, and that the effect of adding privacy in *equilibrium* can be completely different from what we would expect if we ignored equilibrium incentives. Specifically, we show that increasing the level of privacy can actually *increase* the amount of information about the consumer's type contained in the signal the advertiser receives, lead to decreased utility for the consumer, and increased profit for the advertiser, and that generally these quantities can be non-monotonic and even discontinuous in the privacy level of the signal.

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