Experimental Design in Two-Sided Platforms: An Analysis of Bias

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We develop an analytical framework to study experimental design in two-sided platforms. In the settings we consider, *customers* rent *listings*; rented listings are occupied for some amount of time, then become available. Platforms typically use two common designs to study interventions in such settings: customer-side randomization (CR), and listing-side randomization (LR), along with associated estimators. We develop a stochastic model and associated mean field limit to capture dynamics in such systems, and use our model to investigate how the performance of these estimators is affected by interference effects between listings and between customers. Good experimental design depends on market balance: we show that in highly demand-constrained markets, CR is unbiased, while LR is biased; conversely, in highly supply-constrained markets, LR is unbiased, while CR is biased. We also study a design based on *two-sided randomization* (TSR) where both customers *and* listings are randomized to treatment and control, and show that appropriate choices of such designs can be unbiased in *both* extremes of market balance, and also yield low bias in intermediate regimes of market balance.

Full paper available at: https://arxiv.org/abs/2002.05670.

CCS Concepts: • **General and reference** → **Experimentation**; • **Information systems** → **Electronic commerce**; • **Applied computing** → **Economics**.

Additional Key Words and Phrases: marketplace, interference, SUTVA, econometrics