Application to the NBER Digitization Tutorial

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Application Statement

I am a fifth-year Ph.D. student in information systems and economics at the Wharton School of the University of Pennsylvania, pursuing research on digital technologies under the supervision of Prof. Kartik Hosanagar. Through my coursework at Wharton, I've studied microeconomics, judgment and decision making, marketing, statistics, machine learning, and information technology. My dissertation is related to the empirical practice of A/B testing among e-commerce companies, on which I have three working papers (abstracts for each of them are provided in a copy of my C.V. attached here). They all have in common the use of meta-analytic techniques to derive empirical insights across a sample of many online experiments. I have an additional working paper (and a related book chapter) on the effects of personalization algorithms in online media ecosystems. I've also written about technology regulation, algorithmic bias, and automated decision making in popular press outlets like *Quartz* and the *Harvard Business Review*. I would be very interested in learning from—and believe I am qualified to contribute to—the important discussions around the economics of digitization at this year's NBER workshop at Stanford. Thank you for considering my application.

—Alex P. Miller

ALEX P. MILLER — CURRICULUM VITAE, abbrv.

EDUCATION

The Wharton School, University of Pennsylvania
Doctoral Candidate in Information Systems & Economics
Philadelphia, PA; 2015 – Present
Advisor: Kartik Hosanagar

Clark Honors College, University of Oregon
Bachelor of Arts, Mathematics, *summa cum laude*, ΦBK
Eugene, OR; 2008 – 2012

RESEARCH INTERESTS

digital experimentation, causal inference, machine learning, algorithmic decision making, online recommendation systems

RESEARCH

Working Papers:

- **Alex P. Miller** & Kartik Hosanagar. "Who benefits from personalization? On the distributional effects of personalized pricing in e-commerce".

  Abstract (work in progress): We use price variation in a meta-analysis of randomized, online experiments to measure the heterogeneity of consumer response to price changes across different geographic characteristics. By correlating users' locations to US Census data, we are able to investigate how consumers with different demographic characteristics respond to exogenous price variation. We conclude by discussing the relevance of these empirical results for understanding and modeling the forms of bias that revenue-maximizing personalized pricing algorithms would be expected to exhibit if implemented by the firms in our sample.

- **Alex P. Miller** & Kartik Hosanagar. "A meta-analysis of p-hacking behavior in e-commerce experimentation".

  Abstract: We study the prevalence of p-hacking in a large sample of 2,482 experiments from 245 e-commerce firms conducted on a third-party A/B testing platform. If firms choose to end experiments based on their contemporaneous p-values, we would expect to see a disproportionate number of p-values in our sample just below conventional significance thresholds. In particular, we would expect to observe a discontinuity in the aggregated distribution of experimental p-values near 0.05. In this research, we develop a statistical method to detect this type of discontinuity and apply it to our sample. Across several specifications, we find little to no evidence for p-hacking in our data. We then we use counterfactual simulations to estimate the power of our technique and find that, if a modest effect of p-hacking were present in our dataset, our methodology would have high levels of power to detect it at our current sample size. Despite finding a null result, this research makes a valuable contribution by outlining a robust method for detecting p-hacking in similar datasets and provides an important data point in an increasingly important discussion on how real-world firms use A/B testing platforms.

- **Alex P. Miller** & Kartik Hosanagar. "A meta-analysis of e-commerce A/B testing practices".
  - **Best Student Paper Award Winner**, 2018 Conference on Information Systems & Technologies, Phoenix, AZ.

Abstract: While there is much interest in the field of digital experimentation generally, little is known empirically about the testing strategies of firms in real-world environments and how these strategies are related to business outcomes. In this work, we textual meta-descriptions of a large sample of A/B tests to study the testing strategies of real world e-commerce companies. We then develop a framework for categorizing the experimental interventions in our sample along two dimensions: the type (or content) of an experiment and its location within a website's conversion funnel. Using meta-analytic techniques to aggregate the results across our entire sample, we find that experiments involving price promotions and those targeted on category or product listing pages are associated with the largest effect sizes, relative to other experiment types in our sample. We then attempt to identify heterogeneity in the effectiveness of different types of interventions at different stages of the conversion funnel. We find evidence that consumers' response to different types of promotions depends on where those promotions are targeted within a website's architecture. In particular, we find that promotional interventions on product prices are most effective early in the conversion funnel, whereas shipping-related promotions are most effective late in the conversion funnel (on product and checkout pages). This project makes a unique contribution to our understanding of empirical e-commerce practices by documenting how firms use online experiments and how different types of experimental interventions affect online consumer purchasing behaviors.

- Kartik Hosanagar & **Alex P. Miller**. "Improving recommender diversity with probabilistic item selection".

Book Chapters

- Kartik Hosanagar & **Alex P. Miller** "Who do we blame for the filter bubble? On the interaction between people, data, and algorithms in online social systems". *After the Digital Tornado*. Forthcoming, 2020.

POPULAR PRESS

- "How Targeted Ads and Dynamic Pricing Can Perpetuate Bias." 8 November 2019. *Harvard Business Review*.
- "Want Less-Biased Decisions? Use Algorithms." 26 July 2018. *Harvard Business Review*.
- "Regulations like GDPR will make Big Tech stronger". 24 July 2018. *Quartz Ideas*.

HONORS & AWARDS

Center on Teaching and Learning Graduate Fellowship, 2018
Best Predictive Model at Applied Machine Learning Conference, 2018
Mack Institute Research Fellowship, 2017, 2018
Baker Retail Center Research Grant, 2017

KEY COURSES

Economics: STAT520/521 Applied Econometrics, ECON681/682 Microeconomics & Game Theory, FNCE926 Empirical Methods in Coporate Finance, MKTG956 Empirical Models in Marketing, OIDD955 Information Systems & Economics

Machine Learning & Statistics: CIS520 Machine Learning, STAT974 Machine Learning for the Social Sciences, MKTG40 Data Analysis in Marketing, STAT921 Causal Inference in Observational Studies, BSTA771 Applied Bayesian Statistics