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NBER Digitization Tutorial 2021 Application

I am a third year PhD student at Chicago Booth and I enrolled in the program in the autumn of 2018. Before starting the PhD program, I was a full-time research professional at Chicago Booth working with Professors Sanjog Misra and Günter Hitsch. My major field of study is quantitative marketing and my minor field of study is econometrics and statistics. I have taken the UChicago economics department's PhD sequences in microeconomics and econometrics. I have also taken inverse problems & data assimilation and machine learning courses at the statistics department as well as topics of information economics, topics in econometrics, behavioral economics, industrial organization, applications of machine learning to the empirical sciences, and both advanced quantitative marketing courses offered at the economics department and at the business school. Throughout my coursework, I focused on acquiring a set of tools and methods for working with structural econometrics.

My research interests lie at the intersection of machine learning and quantitative marketing. I am interested in integrating statistical techniques with structural economic models in order to better understand marketing. The economics of digitization appeals to me because it is both an important frontier of modern marketing research and that the setting provides a plethora of data to train, analyze, and validate complex models.

One of my research projects examines the effect of catalog mailings for a large U.S. retailer. We have data on a large-scale randomized control trial for catalog mailings in two years, and we want to examine the effect of the catalog mailing on the company's sales in order to propose an optimal targeting strategy for future catalog mailing campaigns. Under the RCT framework and assuming SUTVA, we can transform the problem of estimating heterogeneous treatment effects into a problem of predicting the counterfactual sales level for each individual. With a prediction problem framework, we are then able to directly implement a myriad of machine learning techniques to estimate heterogeneous treatment effects. After we have estimated treatment effects, we can prescribe an optimal targeting policy. Further, we evaluate

different models by examining the expected profits from each model's proposed targeting strategy on various holdout datasets. We also find that the distribution of sales is highly right-skewed, as only a small percentage of people end up purchasing, and many commonly used off-the-shelf machine learning techniques do not perform well. To help remedy this problem, we also propose a scalable KNN-based machine learning technique for estimating heterogeneous treatment effects and find that it performs adequately in our scenario. Digital marketing is an ideal setting for extending our research because the online context provides large amounts of data and often has heavily skewed outcome variables. I intend to use the tools and skills I have acquired from working on this project on future projects that directly work with online data.

Another research project that I am working on examines the effect of brand awareness on a consumer's purchasing behavior. We have individual-level data on brand recall sets and their purchasing behavior. Under a structural framework, we postulate that each individual has certain utility primitives that affect both her awareness of brands as well as her purchasing behavior. Further, awareness and purchase behavior can be influenced by brand advertising as well as price promotions. Consumers may be more aware of the brands that they have seen ads for or have a higher intrinsic brand equity for and thus are more likely to recall those brands. We extend the literature on modeling awareness by allowing for network effects in brand awareness. The network structure approximates the first order Markov processes of brand recall that is often explored in the consumer behavior and psychology literatures, and prior literature in economics assumes that brand awareness are independent constructs. After implementing a network model, our structural models will provide richer counterfactuals about the role of brand advertising and promotions on consumer awareness and on their subsequent purchasing behavior. Working on the project gave me a framework of how to construct micro-level structural models to analyze the impact of marketing on economic behavior, and I intend to use this structural economic framework in building models to analyze individual-level online and digital behavior.

I am confident that NBER Digitization Tutorial will equip me with the skills I need to further my research interests of intertwining statistical techniques and structural economic models. I am interested in extending the results from my research projects to the online domain and my background gives me a strong footing to further explore the economics of digitization. I am particularly excited about this tutorial because of its course program as well as its wide-

ranged group of researchers. The program offers a strong foundation to build upon, and I look forward to advancing my research agenda with the tools and ideas learned from the tutorial.