AARON P. KAYE

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Ann Arbor, MI 48109

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EDUCATION

Ph.D., Joint Degree in Business and Economics — 2024 (Expected)
University of Michigan, Department of Economics; And
Ross School of Business, Department of Business Economics and Public Policy
Committee: Ying Fan (co-chair), Francine Lafontaine (co-chair), Susan Athey, Zach Brown

Master of Arts, Economics — 2020
University of Michigan, Department of Economics

Master of Arts, Economics — 2015
Boston University Graduate School of Arts & Sciences, Boston, MA

Bachelor of Arts, Honors in Economics, Minor in Math — 2011
Colby College, Waterville, ME

Affiliations: Golub Capital Social Impact Lab

Research Interests: Industrial Organization, Business Economics, Digital Economics, Health Economics

DISSERTATION

The Personalization Paradox: Welfare Effects of Personalized Recommendations in Two-Sided Digital Markets (Job Market Paper) In many online markets, platforms engage in platform design by choosing product recommendation systems and selectively emphasizing certain product characteristics. In such markets, how do platform design decisions impact consumer welfare, seller outcomes, and platform profits? I answer this question in the context of the online market for hotel rooms using clickstream data from Expedia Group. This paper highlights a tradeoff between match quality and price competition. Personalized recommendations can improve consumer welfare through the "long-tail effect," where consumers find products that better match their tastes. However, sellers may then have an incentive to increase prices. To understand the welfare effects of personalized recommendations, I develop a structural model of consumer demand, recommendation systems, and hotel pricing behavior. On the demand side, this paper proposes an optimal sequential search model where consumers have beliefs about the joint distribution of product features and recommendations, form consideration sets through clicks, and make a final purchase decision from their consideration set. For the product recommendation model, I use a "model of a model" machine learning approach to reverse engineer Expedia's default recommendation system. Combining the results from the demand and recommendation system models allows for the supply-side model where capacity-constrained hotels consider how changes in price impact position on the page in search results. The paper concludes by using the structural model to estimate the welfare effects of personalized recommendations. I find that ignoring seller price

adjustments would cause considerable differences in the estimated impact of personalization. Without price adjustments, personalization would increase consumer surplus by 2.3% of total booking revenue (~$0.9 billion). However, once sellers update prices, personalization would lead to a welfare loss, with consumer surplus decreasing by 5% of booking revenue (~$2 billion).

Differential Impacts of Online Reviews in the Restaurant Industry: Evidence from Mobile Location Data *(with Susan Athey).* We ask: To whom does online reputation matter? To analyze this question, we combine two large-scale data sets from novel sources: 1) A large online platform that publishes crowd-sourced reviews about restaurants; And 2) mobile location (ping) data collected from smartphones. We use these data to ascertain the impact of online reviews on restaurant visits. In terms of customers, we compare locals to non-locals and repeat to new customers. In terms of restaurants, we compare chains to non-chains. Our setup allows us to uncover the heterogeneity in treatment effects and thus shed light on the mechanisms behind the impact of star ratings on restaurant visits. We take advantage of the fact that the platform rounds ratings to the nearest "half-star." As a result, two restaurants with nearly identical ratings can straddle the cutoff to display 4.5 versus 5-stars. These may be viewed as very different by consumers, even if the underlying quality is quite similar. We take advantage of this natural experiment to estimate the causal impact of ratings. We find positive and significant effects of half-star ratings on foot traffic of substantially larger magnitudes than previously documented in Luca (2016) and Anderson and Magruder (2012). The effect is greatest at the extremes; going from 4.5-stars to 5-stars increases foot traffic by over 30-50 percent. We also find that the effect of a half-star increase is largest for new customers, non-locals, and non-chain restaurants.

Differential Impacts of Online Ratings in the Market for Medical Services *(with Michael Luca and Sonal Vats)* This project focuses on ZocDoc.com – a unique website that integrates physician profiles, patient reviews, and appointment scheduling of physicians onto a single platform. We collected data from the website every day for over a year to construct a novel dataset consisting of profiles, reviews, and ratings for primary care physicians in eight metropolitan divisions. We infer bookings from daily records of appointment availability. ZocDoc displays ratings on a scale of one to five stars, with overall average ratings, rounded to the nearest half-star. We use a regression discontinuity design to identify the causal impact of reviews on patients' choice of physician. Our preliminary results suggest that patients care quite a bit about quality. However, due to physicians' capacity constraints and the level of demand, 4, 4.5, and 5-star doctors find most of their offered appointments are booked. The main distinction is timing, with lower rating physicians' appointments booked once the appointments with higher-rated physicians become scarce. We find approximately a doubling in patient volume across the cutoff from 4.5 to 5 stars. We conclude by evaluating the differential impact of ratings, finding that the effects are higher for women physicians, and physicians with more reviews. We find a small, but insignificant difference for hospital affiliate physicians.

OTHER RESEARCH IN PROGRESS

The Value of Data for Price Targeting (*with Susan Athey, Robert Donnelly, Ayush Kanodia, and Mitchell Linegar)*. Abstract

Government Payments and Private Prices: Evidence from Medicare Advantage (With Thomas Buchmueller, William Mandelkorn, and Sarah Miller). Abstract

WORKING PAPERS

How Do Medicare Advantage Prices Vary Geographically? Evidence from a New Price Index (With Thomas Buchmueller, William Mandelkorn, and Sarah Miller), 2022. Abstract

GOVERNMENTAL REPORTS AND PUBLICATIONS

Buchmueller, T, **Kaye, A**, Levy, H. Healthy Michigan Plan 2021 Report on Uncompensated Care. December 31, 2022

Buchmueller, T, **Kaye, A**, Levy, H. Healthy Michigan Plan 2020 Report on Uncompensated Care. December 21, 2021

WORK AND RESEARCH EXPERIENCE

Stanford Graduate School of Business, Stanford, CA — Summers 2019, 2020, 2021, 2022, 2023
Visiting Graduate Student Research Assistant to Professor Susan Athey
Part time in 2022 and 2023, full time all other years.

University of Michigan Ross School of Business — 2018 - 2023
Graduate Student Research Assistant to Professors
Tom Buchmueller (2020-2023), Jagadeesh Sivadasan (2019-20), and Achyuta Adhvaryu (2018-19)
Department of Business Economics and Public Policy

Microsoft Research New England, Cambridge, MA — 2015-2017
Research Assistant to Susan Athey (2015-17), Markus Mobius (2015-17),
Benjamin Handel (2016-17), and Jonathan Kolstad (2016-17)

Boston University Economics Department, Boston MA — 2015
Graduate Research Assistant to Professor Stefania Garetto

Summit Consulting, LLC*;* Washington, DC
*Senior Analyst***,** Modeling & Forecasting and Mortgage Finance — 2012–2014
*Analyst***,** Modeling & Forecasting and Mortgage Finance — 2011–2012

Colby College Department of Economics*, Waterville, ME*
Research Assistant to Professor Simge Tarhan — 2010-2011
Economics Tutor, Dean of Student — 2010- 2011

Delta Development Group*,* Harrisburg, PA
Consultant (Part Time) — 2010- 2011
Summer Intern — Summer 2010

TEACHING

Tutor, Executive MBA Quantitative Skills Workshop, University of Michigan — Summers 2022, 2023
Instructor of Record, Applied Microeconomics (BE300), University of Michigan — Fall 2019
Grader, Industrial Organization (Econ 431), University of Michigan — Fall 2019

HONORS AND AWARDS

Flamholtz Fellow, Ross School of Business	2022-23
Kathy Terrell Prize for Best PhD Paper (runner-up), Ross School of Business ($500)	2020-21
Spivey-Hall Fellow (for academic and research excellence), University of Michigan	2020-21
Kathy Terrell Prize for Best PhD Paper, Ross School of Business ($3,000)	2018-19
Graduate Fellowship, University of Michigan	2017-22
Mellon Scholar of Economics, Colby-Bates-Bowdoin Annual Economics Conference	2011
Honors in Economics, Colby College Department of Economics	2011
Distinction in Economics, Colby College Department of Economics	2011
George E. Murray Debate Prize (top debater), Colby College George E. Murray Debate Society	2011

INVITED PROFESSIONAL SEMINARS AND WORKSHOPS

NBER Digitization Tutorial, Competitively Selected	2023
NBER Workshop of Digital Economics, Invited Attendee	2023
NBER Economics of Privacy Tutorial, Competitively Selected	2022
NBER Economics of Privacy, Invited Attendee	2022
NBER Digitization Tutorial, Competitively Selected	2022
NBER Economics of Digitization Meeting, Invited Attendee	2021
NBER Digitization Tutorial, Competitively Selected	2021

ACADEMIC PRESENTATIONS

(* denotes scheduled; † presented by coauthor)

2023 Seminar: Golub Capital Social Impact Lab (Stanford GSB) *, Colby College*, Business Economics Seminar Series (Michigan Ross)*, University of Michigan IO Lunch Seminar, Michigan Summer Seminar(2x), University of Michigan IO Seminar, Business Economics Brown Bag Seminar Series
Conference: IRDES Workshop on Applied Health Economics and Policy Evaluation (Paris, France), ASHEcon 2022 (2x) (St. Louis, MO)

2022 Seminar: University of Michigan IO Seminar, University of Michigan Summer Seminar, University IO Lunch Seminar, Business Economics Brown Bag (Michigan Ross, 2x)
Conference: ASHEcon (Austin, TX), Allied Social Science Association Annual Meeting†

2021 Seminar: University of Michigan IO Seminar, Michigan Summer IO Seminar, Michigan Summer Seminar, University of Michigan IO Lunch Seminar, Kathy Terrell PhD Symposium (University of Michigan)

2020 Seminar: Business Economics Brown Bag Seminar Series (2x), University of Michigan IO Lunch Seminar(2x), Michigan Summer Seminar (2x), Michigan Summer IO Seminar
Conference: ASHecon 9th Annual Conference (Poster - Canceled COVID)

2019 Seminar: University of Michigan IO Lunch Seminar, Kathy Terrell PhD Symposium (University of Michigan), Business Economics Brown Bag Seminar Series, Michigan Summer Seminar, H2D2 Seminar (University of Michigan)

2018 Seminar: Kathy Terrell PhD Symposium (University of Michigan), Business Economics Brown Bag Seminar Series, Michigan Mind Meld

2017 Conference: International Health Economists World Congress (Boston University)

ADDITIONAL ACTIVITIES AND SERVICE

University of Michigan

Pre-doctoral Program Task Force, Ross School of Business	Winter 2023
Research Chair and Grants Committee Chair, Ross School of Business PhD Forum	2021-2022
Interim President, Ross School of Business PhD Forum	Winter 2022
Research Chair and Grants Committee Chair, Ross School of Business PhD Forum	2020-2021
Social Chair, Graduate Economics Society, Department of Economics	2020-2021
Co-organizer, Industrial Organization Summer Seminar, Department of Economics	Summer 2020
Social Chair, Graduate Economics Society, Department of Economics	2018-2019
Grants Committee Member, Ross School of Business PhD Forum	2018-2019
First-Year Mentor, Department of Economics	2018-2019

SKILLS

Numeric/Statistical Languages: Matlab, Stata, Mata, R, Matlab, SAS
General Purpose: Python, C#, Powershell
Database Languages: SQL**,** SCOPE
Additional Software: LaTeX, Git, Access
Some experience with AWS, HTLM, Java, VBA, and Bloomberg Terminal

ADDITIONAL ABSTRACTS

The Value of Data for Price Targeting (*with Susan Athey, Robert Donnelly, Ayush Kanodia, and Mitchell Linegar)* This paper analyzes the value of information for targeting price discounts in shopping applications. It applies methods that combine standard consumer choice models from marketing and economics with matrix factorization techniques from machine learning, whereby users have latent preferences and products have latent attributes, and these are learned from data about consumer choice in a setting where prices vary over time. The paper applies the model to individual panel data from supermarket shopping for a large retailer. The paper analyzes the value of data for increasing profits through personalized price targeting, assessing the relative importance of enriching the model (adding more latent factors) versus more precisely estimating parameters of a fixed model, finding that enriching the model as data grows is an important contributor to improved performance. The paper shows that increasing the length of the history of data used for given set of individuals is substantially more valuable for targeting to those users than adding data about more products or additional users. The results have implications for privacy policy and competition policy.

Government Payments and Private Prices: Evidence from Medicare Advantage *(with Thomas Buchmueller, William Mandelkorn, and Sarah Miller)* In Medicare Advantage, the federal government pays private plans on a per enrollee basis to provide health coverage for Medicare beneficiaries. Previous research has demonstrated that higher plan payments result in greater entry into markets and enrollment of beneficiaries, but that relatively little is passed on the beneficiaries in the form of lower premiums. However, enrollees and insurance companies are not the only ones affected by higher government payments. In this paper, we investigate how higher Medicare Advantage payments affect the transaction prices for medical care. The impact of government payments on provider prices is theoretically ambiguous: if in a strong bargaining position, providers may be able to extract some of this windfall for themselves in the form of higher prices. Alternatively, higher government payments may increase the number of Medicare Advantage beneficiaries enrolled in a plan and increase that plan's

bargaining power, allowing them to lower negotiated prices with providers. We investigate this empirically by taking advantage of the urban floor cutoff used in Duggan, Starc and Vabson (2016) and combining this with a price index based on detailed data on transaction prices from Health Care Cost Institute claims data (HCCI) in a regression discontinuity design. We find that Medicare Advantage enrollment is higher but transaction prices for outpatient care are lower in counties that receive higher payments due to the urban floor. In contrast, prices for inpatient care do not appear to be affected by the higher payments, and prices for these services are similar across the threshold. This pattern suggests that the bargaining channel is relevant for determining outpatient prices and that higher government payments can lead to lower prices in health care markets through this mechanism. In ongoing work, we plan to investigate how this effect varies across counties with different levels of provider and insurer concentration.

How Do Medicare Advantage Prices Vary Geographically? Evidence from a New Price Index *(with Thomas Buchmueller, William Mandelkorn, and Sarah Miller), 2022* In this paper, we investigate geographic variation in the prices paid by Medicare Advantage plans across counties. To document price variation, we create novel county-level price indices using itemized transaction-level claims data. In 2016, we find that prices vary substantially across the country, with counties at the 75th percentile of the distribution paying 48.7% more for outpatient procedures and 11.2% more for inpatient care compared to the median. We also examine variation in prices for categories of procedures and admissions, such as radiology and emergency care to uncover the potential drivers of the price variation. Finally, we document persistence in high prices over time and show the relationship between prices and Medicare Advantage penetration rates.

Personal

Citizenship: U.S.A, Germany

ACADEMIC REFERENCES

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