

HANGCHENG ZHAO

The Wharton School, University of Pennsylvania

Address:

3730 Walnut Street
Philadelphia, PA, 19104

Email: zhaohc@wharton.upenn.edu**Website:** <https://hangcheng-zhao.github.io>

EDUCATION

The Wharton School, University of Pennsylvania 2020 – 2025 (*Expected*)

Ph.D. in Quantitative Marketing

Dissertation Committee: Ron Berman (Chair), Eric Bradlow, Pinar Yildirim

University of Chicago 2018 – 2019

Master in Economics

Thesis Advisor: Philip Reny

Tsinghua University, Beijing, China 2014 – 2018

Bachelor in Economics

RESEARCH INTERESTS

Substantive: Pricing, Algorithmic Decision-Making, Recommendation Algorithms, Advertising, Platforms, Online Marketing

Methodological: Reinforcement Learning, Artificial Intelligence, Empirical IO

WORKING PAPERS

Algorithmic Collusion of Pricing and Advertising on E-commerce Platforms (*Job Market Paper*)

With Ron Berman (University of Pennsylvania)

Analyzing Healthcare Price Transparency: Will Patients Shop for Services More Effectively? [\[SSRN\]](#)

With Ron Berman (University of Pennsylvania)

- Under Revision

Strategic Design of Recommendation Algorithms [\[SSRN\]](#)

With Ron Berman (University of Pennsylvania) and Yi Zhu (University of Minnesota)

- Under Review at *Management Science*

Ridge Distributions and Information Design in Simultaneous All-Pay Auction Contests [\[SSRN\]](#)

With Zhonghong Kuang (Remin University of China) and Jie Zheng (Shandong University)

- Minor Revision at *Games and Economic Behavior*

CONFERENCE PRESENTATIONS

Algorithmic Collusion of Pricing and Advertising on E-commerce Platforms

- 2024 INFORMS Marketing Science Conference *Sydney, Australia, June 2024*
- 14th Annual TPM Conference *Austin, TX, May 2024*

- 4th Annual AI in Management (AIM) Conference *Los Angeles, CA, March 2024*

Analyzing Healthcare Price Transparency: Will Patients Shop for Services More Effectively?

- 2023 INFORMS Marketing Science Conference *Miami, FL, June 2023*

Ridge Distributions and Information Design in Simultaneous All-Pay Auction Contests

- ASSA 2020 Annual Meeting *San Diego, CA, January 2020*
- 2018 Society for the Advancement of Economic Theory Conference *Taiwan, June 2018*

RESEARCH AND PROFESSIONAL EXPERIENCE

Ph.D. Economist Intern *July 2023 - September 2023*
 HP, Inc., Pricing Analytics Group

- Designed and executed multi-armed bandit experiments to optimize pricing strategies for various combinations of computer accessories.

Research Assistant to Prof. Pinar Yildirim and Prof. Ron Berman *July 2019 - June 2020*
 The Wharton School, University of Pennsylvania

- Conducted reduced form analyses and structural estimations for textual newspaper data, geographical railroad network data, and online experiments.

Research Assistant to Prof. Richard Hornbeck *October 2018 - June 2019*
 Booth School of Business, University of Chicago

- Constructed and analyzed historical individual manufacturing establishments data.

TEACHING EXPERIENCE

The Wharton School, University of Pennsylvania, Philadelphia, PA

Teaching Assistant to Prof. Jagmohan Raju *Summer 2022, Spring 2023, Spring 2024*

- MKTG 7540 Pricing Policy (MBA, WEMBA)

HONORS AND AWARDS

ISMS Marketing Science Doctoral Consortium Fellow	<i>2024</i>
Mack Institute Research Fellowship	<i>2023</i>
Analytics at Wharton Research Funding	<i>2023</i>
George James Travel Award for the Wharton Doctoral Program	<i>2023</i>
Wharton INSEAD Alliance Doctoral Student Short - Term Visit Award	<i>2023</i>
Ph.D. Program Fellowship, the Wharton School, University of Pennsylvania	<i>2020-Present</i>
University of Chicago Scholarship for Master of Arts Social Sciences Program	<i>2018-2019</i>
“Top Open” Student Overseas Research Grant, Tsinghua University	<i>2017</i>
Undergraduate Student Academic Research Grant, Tsinghua University	<i>2017-2018</i>

TECHNICAL SKILLS

Programming Languages Stata, C++/C, R, Python, Matlab, Mathematica, SQL, Amazon AWS

REFERENCES

Ron Berman
Associate Professor of Marketing
The Wharton School
University of Pennsylvania
Email: ronber@wharton.upenn.edu

Eric Bradlow
K.P. Chao Professor
Professor of Marketing, Statistics, Economics and Education
The Wharton School
University of Pennsylvania
Email: ebradlow@wharton.upenn.edu

Pinar Yildirim
Associate Professor of Marketing and Economics
The Wharton School
University of Pennsylvania
Email: pyild@wharton.upenn.edu

ABSTRACTS

Algorithmic Collusion of Pricing and Advertising on E-commerce Platforms (*Job Market Paper*)

With Ron Berman (University of Pennsylvania)

Firms have been adopting AI learning algorithms to automatically set product prices and advertising auction bids on e-commerce platforms. When firms compete using such algorithms, one concern is that of tacit collusion—the algorithms learn to settle on higher than competitive prices which increase firm profits, but hurt consumers. We empirically investigate the impact of competing reinforcement learning algorithms to determine if they are always harmful to consumers, in a setting where firms learn to make two-dimensional decisions on pricing and advertising together. Our analysis uses a multi-agent reinforcement learning implementation of the Q-learning algorithm, which we calibrate to estimates from a large-scale dataset collected from Amazon.com. We find that learning algorithms can facilitate win-win-win outcomes that are beneficial for consumers, sellers, and even the platform when consumers have high search costs, i.e., the algorithms learn to collude on lower than competitive prices. The intuition is that algorithms learn to coordinate on lower bids, which lowers advertising costs, leading to lower prices for consumers and enlarging the demand on the platform. We collect and analyze a large-scale high-frequency keyword product search dataset from Amazon.com and estimate consumer search costs. We provide policy guidance by identifying product markets with higher consumer search costs that could benefit from tacit collusion, and markets where regulation on algorithmic pricing might be most needed. Further, we show that even if the platform responds strategically by adjusting the ad auction reserve price or the sales commission rate, the beneficial outcomes for both sellers and consumers are likely to persist.

Analyzing Healthcare Price Transparency: Will Patients Shop for Services More Effectively? [SSRN]

With Ron Berman (University of Pennsylvania)

Recently, the US mandated healthcare price transparency to facilitate easier comparison of healthcare prices. However, the potential effectiveness of this policy is an open question. We use a large-scale health insurance claims dataset to estimate the potential maximum savings from price transparency.

We focus on short-term, demand-side estimates, where patients can shop around and switch to cheaper providers. We analyze the set "shoppable" services whose price information must be reported online. Initially, our data points to a large potential for savings due to a large degree of price dispersion. However, when viewed from the consumer shopping perspective, even the most optimistic estimates of potential savings become limited. The reasons are that the location and insurance network of the patient, the structure of healthcare insurance payments, and the information made available by the transparency rule lower patients' incentive to save. We find that the best-case scenario for patients' out-of-pocket savings from price - shopping is 3% of the total cost on average. Our analysis suggests that the existing estimates in the literature might be overestimated, as they overlook the consumer shopping perspective. Hence, patients' potential savings and the demand-side impact of the transparency rule might not be as impactful as initially hoped for.

Strategic Design of Recommendation Algorithms [\[SSRN\]](#)

With Ron Berman (University of Pennsylvania) and Yi Zhu (University of Minnesota)

We analyze recommendation algorithms that firms can engineer to strategically provide information to consumers about products with uncertain matches to their tastes. Monopolists who cannot alter prices can design recommendation algorithms to oversell, i.e., that recommend products even if they are not a perfect fit, instead of algorithmically recommending perfectly matching products. However, when prices are endogenous or when competition is rampant, firms opt to reduce their overselling efforts and instead choose to fully reveal the product's match (i.e., maximize recall and precision). As competition strengthens, the algorithms will shift to demarket their products, i.e., under-recommend highly fitting products, in order to soften price competition. When a platform designs a recommendation algorithm for products sold by third-party sellers, we find that demarketing might be a more prevalent strategy of the platform. Additionally, we find that platforms bound by fairness constraints may gain lower profits compared to letting sellers compete, while discriminatory designs do not necessarily result in preferential outcomes for a specific seller.

Ridge Distributions and Information Design in Simultaneous All-Pay Auction Contests [\[SSRN\]](#)

With Zhonghong Kuang (Remin University of China) and Jie Zheng (Shandong University)

Two privately informed contestants compete in a contest, and the organizer ex-ante designs a public anonymous disclosure policy to maximize contestants' total effort. We fully characterize ridge distributions, under which the organizer achieves the first best outcome in equilibrium: the allocation is efficient, and the entire surplus goes to the organizer. When the prior is a mixture of a ridge distribution and a perfectly correlated distribution, the first-best outcome is achievable by the signal that solely generates ridge distributions as posteriors.

Last Updated: July 2024