Xuhang (Shawn) Fan

Application: NBER Tutorial on Digital Economics and Artificial Intelligence

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Graduate Study

I am a third-year PhD student in Marketing at the Rotman School of Management, University of Toronto, enrolled since September 2024. I completed two years of doctoral coursework (2024 to 2026) and passed the departmental examination in Summer 2026. Most of my coursework is in the Economics PhD program.

- *Economics* (*University of Toronto*)*:* Microeconomic Theory I; Industrial Organization I and II; Econometrics II; Empirical Applications of Economic Theory; Behavioural Economics; Mathematics and Statistics for PhD Students.
- *Marketing and Management* (*Rotman*)*:* Marketing Theory I (Consumer Behaviour) and II (Strategy); Econometric Methods in Marketing; Advanced Topics in Strategy and Economics; Research Methods in Business; Workshop in Marketing.
- *PhD courses at Duke University:* Microeconomics I; Econometrics II.

Before the PhD, I earned an M.A. in Economics from Duke University (2022 to 2024) and a B.Econ. in Economics from Zhejiang University (2018 to 2022).

Research Interests

I study how digital platforms use fine-grained behavioral data and AI to decide when and how to reach consumers. I ask what these decisions do to engagement, competition, and consumer welfare. My empirical work pairs large-scale platform logs with quasi-experimental designs and field experiments. My theoretical work models how AI intermediaries, such as LLM-based search, change firms' incentives. Keywords: digital platforms, mobile marketing, attention, AI-mediated search, causal inference.

Research Projects in Progress

1. Not So Timely: Push-Notification Timing and User Engagement
with Sihan Li (INSEAD), Xinlong Li (Nanyang Technological University), and Zachary Zhong (Rotman). Submitted to *Marketing Science*; SSRN.

Platforms can now observe the moment a user picks up the phone. The industry heuristic is that a message works best when it arrives at exactly that moment. We test this heuristic. Prior work asks whom to target and what to send. We ask when, at the scale of minutes, a message should arrive.

We partner with a leading third-party push notification provider in China, whose SDK reaches

about 700 million daily active users. We observe the exact timestamps of screen-on events and notification deliveries for push campaigns of a major travel app over five weeks, linked to daily app logins. The provider's screen-on service queues a message and opens a listening window; a screen-on event inside the window triggers instant delivery.

Our identification rests on one assumption: users do not know when the listening window opens, so whether their screen-on falls just before or just after the opening is as good as random. We use this in two designs.

- *Fuzzy regression discontinuity at the window opening.* Contrary to the industry heuristic, instant delivery at screen-on reduces same-day logins by about 16%. Covariates and the density of the running variable are smooth at the cutoff.
- *Instrumental variables for the realized delivery lag.* Fine-grained variation in screen-on timing shifts the lag and traces out a flexible lag and engagement curve. Engagement is non-monotonic: a modest delay of one to six minutes yields the highest logins, above both instant delivery and longer lags.

The penalty from instant delivery is largest when attention is scarce, such as weekday mornings. A second app, a live-streaming platform, shows the same pattern, and instant delivery is associated with more app uninstalls. The implication is that delivery lag is a variable firms should optimize, not an inefficiency to eliminate. The findings also suggest that policy can look at how platforms use real-time behavioral data, not only at what they collect.

2. When Search Meets LLM: Sponsored Ads, Helpful GEO, and Market Competition (solo-authored)
Search platforms increasingly route consumers to LLM-generated answers instead of ranked results and sponsored links. I build a Hotelling duopoly in which firms choose product quality, search engine optimization, and two kinds of generative engine optimization (GEO): helpful GEO improves both LLM ranking and consumer value, while manipulative GEO improves ranking only. The platform chooses the share of consumers it routes to the LLM channel. On the one hand, a larger LLM channel improves matching and shifts firm effort toward LLM visibility. On the other hand, it cannibalizes sponsored impressions and can reward manipulative content. Sponsored revenue can be non-monotonic in LLM prominence, and a ranking rule that weights helpful over manipulative GEO raises welfare. The case for LLM prominence is strongest when matching improves and zero-click leakage is limited.

3. From Clips to Chapters: Do AI-Generated Trailers Create Readers?
Funded by a Rotman Management Data and Analytics Lab Research Grant (2026). This project studies whether AI-generated video trailers for serialized online fiction bring new readers to the books they promote, and which readers they reach.

Dissertation direction. I plan to develop these projects into a dissertation on how behavioral data and AI shape the timing, ranking, and content of what consumers see on digital platforms. The tutorial and the NBER Digital Economics and AI meetings would connect me with researchers working on exactly these questions in economics.