Digital Economics and AI Tutorial

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Graduate Study

I am a fourth-year PhD student in Economics at Princeton University. My graduate training combines economic theory, empirical methods, and field specialization in industrial organization and digital markets.

During my first year, I completed the full microeconomics, macroeconomics, and econometrics sequences. In my second year, I took field courses in Industrial Organization and Labor Economics and passed the general exams with grades of A–, A–.

My Industrial Organization training includes courses taught by:

- Jakub Kastl – asymmetric information, nonlinear pricing, collusion, empirical auctions, financial markets;
- Nick Buchholz – dynamic single-agent problems, dynamic games, entry games, and spatial search;
- Adam Kapor – static demand estimation, matching theory, and education markets;
- Kate Ho – mergers, vertical integration, bargaining, insurance design, and health-plan markets.

I also completed an applied theory course with Sylvain Chassang.

Research

My research agenda is firmly centered on digital economics. My current projects span different settings related to digital economics — display advertising auctions, the eBay marketplace, and Amazon. I work on questions related to these markets both from a theoretical and empirical viewpoint. I approach these questions using both theoretical modeling and empirical methods. Taken together, these projects form a unified agenda on the economics of digital marketplaces. Below are my main ongoing research projects.

Amazon as Marketplace Operator and Competitor

This project studies Amazon's dual role as both marketplace operator and retailer, focusing on how private-label entry interacts with third-party seller behavior, pricing, and category structure. The project evaluates counterfactual policies restricting platform–competitor duality or algorithmic advantages.

Using large-scale product-level data from Keepa covering all Amazon categories, merged with brand-level panels, pricing histories, sales ranks, the project addresses three core questions:

1. How does Amazon select product spaces for private-label entry?
2. What happens to third-party sellers' pricing and quantities after Amazon enters?
3. How do prices, quantities, and consumer welfare change when private label products are introduced?

Preliminary evidence shows:

- Amazon disproportionately enters low-risk product spaces (cheap, high-frequency, stable-demand items); national brands enter more uniformly.
- National-brand prices change little after private-label entry, but quantities often rise due to demand expansion. This suggests that category growth frequently outweighs business-stealing effects.

Dynamically Optimal Reserve Prices in Display Advertising Auctions ***(with Marco Pagnozzi and Elia Sartori)***

This project analyzes stylized model of the market of online display-advertising, where advertisers bid repeatedly in real-time auctions to purchase multiple impressions for the same user, and publishers extensively adjust reserve prices across rounds. Recent empirical evidence (Ostrovsky & Schwarz, 2023) documents that such adjustments substantially increase seller revenue.

Motivated by these features, we develop an infinite-horizon model in which advertisers participate repeatedly — with a positive probability of bidding again in subsequent auctions — and publishers observe the complete history of bids and update reserve prices dynamically. In each round, the seller sets the reserve price using the information conveyed by bids in previous rounds.

The model delivers two key results. First, the optimal reserve either equals the most recent winner's valuation or, when that valuation is sufficiently high, falls strictly below it. In particular, in first-price auctions, the optimal reserve declines in the winner's value; in second-price auctions, it is constant and generally lower, because the winner's bid effectively acts as an implicit reserve. Second, second-price auctions generate higher revenue unless bidder persistence is extremely high.

Bargaining in eBay's Best Offer Marketplace

This project develops and estimates a dynamic bargaining model to study buyer–seller negotiations on eBay's Best Offer platform. I develop a dynamic model of bargaining that mirrors the platform's key features, with buyers and sellers alternating offers. In the model, each player has a valuation and a bargaining cost and utility reflects the immediate payoff as well as a continuation value based on beliefs about how the negotiation will evolve. To avoid equilibrium multiplicity and signaling issues that arise in incomplete-information bargaining games, I adopt a data-driven approach (building on the ideas in Keniston, 2021 and Gaineddenova, 2022)[1] that recovers players' beliefs directly from empirical bargaining sequences. This makes the project complementary to Freyberger and Larsen (2025), who analyze eBay's Best Offer mechanism using revealed-preference arguments to nonparametrically bound buyers' and sellers' valuations.

The estimation proceeds in three steps. First, I recover beliefs about state transitions – how the game evolves after each action – using empirical frequencies. Second, I estimate action probabilities (offers,

[1] In Keniston (2021) players' beliefs about their opponents' strategies are inferred from the data on bargaining sequences. The key difference is that data come from an experiment, where surveyors followed a specific bargaining protocol, therefore the estimation algorithm only computes the valuations and costs of one side of the market (the sellers). Gaineddenova (2022) develops a model to study efficiency on the ride-hailing platform inDriver, where riders propose prices for their trips and drivers can choose to accept, reject, or counteroffer. The estimation of participants' beliefs about the probabilities of rider arrivals, the distribution of idle drivers, and the distances between drivers and riders comes directly from the data. Using these estimated beliefs, the parameters of the distributions of riders' and drivers' valuations (assuming a functional form for the distribution) are then estimated through maximum likelihood. My approach adapts these insights to eBay's institutional environment, where rich observational data allow beliefs to be recovered for both sides of the market

counteroffers, acceptance, and exit) using a logit framework. Third, I recover the joint distribution of valuations and bargaining costs for buyers and sellers by maximum likelihood, matching the observed sequences of bargaining actions with those predicted by the model.

In the model, past actions update beliefs about an opponent's next move but do not reveal information about one's own valuation. To ensure this assumption is credible, I restrict the sample to brand-new products, where valuations are stable and do not change during the negotiation. Moreover, the estimation approach implicitly assumes that players have correct beliefs about their opponents' strategies. I provide evidence that sellers in this market are highly experienced, often with thousands of previous sales. This makes reasonable to assume that they have a strong understanding of the market and accurate beliefs about how negotiations typically evolve.

The estimation results show that mean buyer valuations exceed seller valuations and that buyers face higher bargaining costs than sellers, consistent with empirical patterns in which buyers more frequently allow offers to expire rather than explicitly rejecting them.

References

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- Keniston, D. (2011). Bargaining and welfare: A dynamic structural analysis. *Mimeo.*
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