

I am an industrial organization economist, focusing on how firms compete and respond to market incentives and regulation. My research falls into three main areas:

1. The study of how firms exercise market power and the associated consequences for consumers.
2. The analysis of intermediaries in otherwise decentralized markets.
3. The development of econometric methods to evaluate market outcomes.

The empirical analysis in my research is deeply rooted in combining the structure of theoretical economic models with variation in observational data on markets, including testing theoretical models' predictions and estimating deep structural parameters of models. My research is well published, including in *The Journal of Political Economy*, *The Review of Economic Studies*, and the *RAND Journal of Economics*, among others. My research is well cited, for example, three of my articles appear in the most recent *Handbook of Industrial Organization* (2022, edited by Kate Ho, Ali Hortacsu, and Alessandro Lizzeri) across four different chapters.

### Market Power, Antitrust, and Regulation

The exercise of market power, or the ability of sellers to price above marginal cost, is a crucial public policy issue. Understanding the consequences of market power for consumer outcomes is at the core of understanding how governments should regulate industry, design public policy, and bring antitrust actions that effectively protect consumers.

Traditional analysis of mergers involves predicting post-merger prices given expected cost efficiencies due to mergers, holding other aspects of competition unchanged. However, the U.S. Merger Guidelines also call attention to the idea that entry and exit can mitigate the harmful effects of market power after a merger. In "**Market Structure and Competition in Airline Markets**" (with Federico Ciliberto and Elie Tamer, *Journal of Political Economy*, 2022) we analyze the effects of USAir and American Airline merger, carefully measuring the price *and* entry/exit effects after the merger. Predicting entry is difficult because airline entry/exit decisions are strategic decisions. Entry games are well known to have multiple equilibria, which makes their quantitative analysis (estimation and simulation) challenging. As I discuss below in the "Methodology" section, estimating a static game with a continuous choice (the pricing decision) requires a novel empirical framework.

We simulate the merger and find that post-merger prices depend on endogenous market configurations. In some cases, the merger induces a potential rival to enter the market – e.g., if a market goes from two to one, perhaps a third airline would enter. This type of entry can restore competition and mitigate the negative consequences of the merger. Another possible outcome is that the merged firm enters new markets because cost synergies allow the merged firm to cover fixed costs. This results in a large increase in consumer welfare after the merger. However, entry can also reinforce the anticompetitive effects of the merger; for example, if the merged airline has a significant cost advantage, other incumbents may exit the market, leaving markets even more concentrated.

There is a growing literature documenting increasing concentration and rising market power across industries (particularly in the U.S.). Many of the existing results come from models of production relationships, estimated using accounting balance sheet data. However, an alternative approach to understanding market power comes from estimating supply and demand, a staple of analysis in Industrial Organization. The credible estimation of demand and supply relationships, however, necessitates a case study approach that can capture the details of each industry.

In "**The Evolution of Market Power in the U.S. Automobile Industry**" (with Paul Grieco and Ali Yurukoglu, revisions requested from *The Quarterly Journal of Economics*), we estimate the demand for new automobiles in the U.S. from 1980 to 2018. Using the estimates and an assumption on manufacturer competition, we measure markups and find that markups have decreased substantially. Our results contrast with existing findings in the literature that use a production-side approach. However, since we estimate a theoretically founded demand and supply model, we can say more about efficiency in this market.

Even though (real) prices rise substantially over our sample, we measure that consumer surplus rose markedly. One of our contributions is to show how to compute consumer surplus across a long time series in this class of demand models (logit discrete choice) because, generally, consumer surplus from two time periods is not comparable. We attribute the rise in consumer surplus to a substantial increase in car quality and production efficiency. The increase in consumer surplus is not due to changes in market structure over time.

Monopolists may use market power to price discriminate. However, with limited information, even price discriminating firms may not be able to capture all of the surplus in a market. In "**Price Discrimination in International Airline Markets**" (with Gaurab Aryal and Jonathan Williams, accepted at *Review of Economic Studies*) we estimate a model of airlines' dynamic pricing problem to measure inefficiencies due to: (a) airlines' uncertainty about consumers' willingness-to-pay for flights and (b) airlines' uncertainty about the realization of demand as the flight date approaches. Although there is an extensive literature studying airline pricing,

our contribution is to measure the dynamic effects of airlines screening business and leisure passengers across different cabins.

By simulating a VCG auction pricing mechanism and a 1st-best allocation, we decompose the pricing inefficiencies and find that most of the inefficiencies (welfare difference from first best) is due to airlines' uncertainty about consumers' valuations for flights, not uncertainty due to random passenger arrivals. We also simulate a situation where airlines can distinguish between business and leisure passengers – business passengers have higher value for flying. In that case, airlines make more profit at the expense of business passengers, who are charged much higher prices.

In "**Consumer search and automobile dealer colocation**" (with Yiyi Zhou, *Management Science*, 2020), we study the ability of retailers, in this case, new car dealers, to exercise market power. Retailers' market power depends on their location relative to rival retailers. Retailers face a tradeoff when consumers must engage in costly search, as in new car buying. Rival retailers near each other may attract more searching consumers but face stiffer price competition. Isolated retailers may attract less demand but may price as a captive monopolists.

We estimate a model of spatial consumer search and price-setting by dealers and use the model to quantify the tradeoffs between demand/search agglomeration and price competition. Agglomeration implies that dealer closures could harm incumbent colocated dealers, even though the incumbent dealers would face less competition. Our results inform the recent policy debate surrounding the massive downsizing of car retail networks and generally highlight the role of contagion in brick-and-mortar retailing.

In other work, I study how market power is related to the advertising activity of sellers. In "**The Effect of Retail Competition on Relationship-specific Investments: Evidence from New Car Advertising**" (*International Journal of Industrial Organization*, 2018) I document that new car dealers spend more on advertising if they face less competition from rival car dealers. This lends credence to the idea that firms invest in marketing activities with higher market power. In "**Advertising in Vertical Relationships: An Equilibrium Model of the Automobile Industry**" (*working paper*) I estimate a model of demand for new cars and pricing/advertising decisions by dealers and manufacturers to study the effects of state new car franchising laws. In particular, state laws mandate linear wholesale pricing by car manufacturers. I simulate the adoption of an optimal two-part tariff and document large gains in consumer surplus due to the elimination of double marginalization. In particular, nonlinear contracts align the pricing incentives of dealers with manufacturers and advertising incentives. Under the counterfactual nonlinear pricing scheme, the average dealer would advertise 8% more.

Many states regulate the relationship between franchisors (e.g., McDonald's) and franchisees (e.g., the local franchise owner) across many industries. In particular, 26 U.S. states have adopted a regulation stating that franchisors can not terminate a franchise contract unilaterally. In “**Franchise Contract Regulations and Local Market Structure**” (with Peter Newberry, *Journal of Law and Economics*, 2022), we document that fewer quick-service food establishment franchises exist in states with these regulations.

## Intermediaries

The second theme in my research is the study of the value of intermediaries in otherwise decentralized markets. In many markets, intermediaries help facilitate trade among otherwise decentralized parties. I study intermediated trade in the market for used cars, where cars trade directly and through used car dealers.

In “Intermediaries and product quality in used car markets” (with Gary Biglaiser, Fei Li, Yiyi Zhou, *RAND Journal of Economics*, 2020), we provide evidence that used car dealers screen quality, providing higher quality cars than in the direct market. This is an important fact to document, as the original “Lemons” paper by Akerlof suggests that one reason that markets may overcome the lemons problem is through a third party intermediary.

We propose two models, one model of adverse selection and a second model where dealers screen *observed* quality (so there is no adverse selection). Both models make the same stark prediction about how the price premium of dealers over the private market varies across the vintage of cars – peaking near the mid-life of a car. Using administrative data on used car purchases in both the direct and intermediated market, we find strong support for both quality screening (adverse selection and observed quality) roles of used car dealers.

In another paper with Yiyi, Fei, and Can Tian, “**Inventory Management in Markets with Search Frictions**” (revisions requested at *International Economic Review*), we study the value intermediaries bring to a market by keeping and managing inventory. Inventory creates value because high inventory levels mean consumers spend less time searching for cars and are more likely to find a good match. A theoretical contribution of the paper is to extend directed search models from the labor/macro literature (Menzio and Shi, 2011) to a setting where an intermediary facilitates directed search on the buyer and seller side. We then calibrate the model to quantify the value of inventory management by simulating alternative inventory management schemes, like if the dealer could only hold a single car at a time.

## Methodology

I have also made methodological contributions to the measurement of market outcomes. In a paper mentioned above, “**Market Structure and Competition in Airline Markets**,” we offer a solution to a well-known potential problem in demand estimation. Nearly every time a researcher estimates demand, they implicitly assume that sellers in their dataset are drawn randomly with respect to unobserved quality and costs. However, high cost and low quality sellers likely decide not to enter, and it is also likely that quality and costs are correlated. This problem is similar to the Heckman selection problem for wages and employment, however, the entry/exit selection problem is a game with multiple equilibria, so there isn’t a properly defined probability of selection/entry.

We develop an estimation procedure based on simulating a model of an entry and pricing game. The method involves matching the distributions of errors between the model and the data, which we can bound without taking a stance on equilibrium selection. We set identify demand and supply parameters because we do not take a stand on equilibrium selection mechanisms. We use the framework to estimate airlines' demand, supply, and entry costs. We find that the selection of firms on unobservables creates a substantial bias in critical parameters that determine market outcomes, like elasticities and price-cost markups. Markups are almost twice as large as estimated with the typical GMM procedure for demand and supply estimation.

Mixed logit discrete choice, as pioneered by Berry, Levinsohn, and Pakes (1995), is the dominant framework for estimating demand by industrial organization economists. In "Conformant and Efficient Estimation of Discrete Choice Demand Models" (with Paul Grieco, Joris Pinkse, Stephan Sagl; working paper), we propose a mixed-data likelihood estimator (MDLE) for a mixed logit demand system that makes use of product-level and consumer-level data while allowing for price endogeneity. The estimator is efficient compared to the GMM approach commonly used by applied researchers (e.g., Petrin, 2002; Berry, Levinsohn, and Pakes, 2004). This is an important contribution because researchers increasingly have access to multiple data sources at different levels of aggregation, and our likelihood approach guarantees the most efficient use of all of the data. We benchmark our likelihood-based estimator to the GMM approach with a Monte Carlo exercise and find superior performance in finite samples. For example, when the typical GMM procedure has very poor RMSE, even when using moments generated from the microdata, our procedure does remarkably well. This is particularly important for random coefficients, as the microdata turns out to be crucial in identifying those parameters.

### Early Stage Projects

I have a number of projects in the earlier-than-draft stage. One project, joint with a graduate student at Boston College, Rodrigo Gonzalez, is about mergers and asset divestitures in the generic prescription pharmaceutical market. Our goal is to understand the welfare effects of divestitures when firms are forward looking and anticipate future entry and exit in markets. On one hand, divestitures restore competition in the short run, but on the other hand divestitures may mis-allocate production from an efficiency stand point, and firms may unwind asset divestitures through future entry, exit, or acquisition behavior. We are at the data collection stage of this project.

I am also continuing my research agenda on intermediaries. With Yiyi Zhou and Fei Li, we are in the process of measuring the effects of the massive proliferation of online used car dealers. To do so requires the careful measurement of the social value of both online and brick-and-mortar used car dealers. On one hand, dealers may improve allocative efficiency by better matching sellers and buyers of cars, but on the other hand, they may capture substantial rents from providing this service and costly search from consumers. We have novel data on online and brick-and-mortar used car dealers and are in the process of estimating a model of consumer search and dealer pricing of used cars.

Lastly, I have an early stage project with Gaurab Aryal on the allocation of airport slots in the United States. Slots at congested airports have historically been allocated by assigning current rights to previous slot-holders. On one hand, previous slot-holders tend to have a large presence at an airport and therefore may have substantial market power, but on the other hand, providing air travel may involve massive scale economies, so there may be some efficiency argument for allowing concentration in airline markets. We are in the data collection stage of this research and recently been talking with current and former experts at the DOJ.