Research Statement

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My broad research interest is in Microeconomic Theory. My research agenda is two-pronged. First, I am interested in developing modeling and mathematical tools that allow us to study economically relevant problems. Second, I am keen to use these tools to answer concrete questions about markets, institutions, and decision-making. I specialize in studying information as both an incentive device and as a commodity.

Information Intermediaries

My PhD thesis focuses on markets with information intermediaries. Intermediaries provide (Blackwell) experiments to agents who then use the outcomes of these experiments for economic purposes. In my work, I focus on the use of these experiment outcomes for signaling. In particular, the intermediary provides information as a commodity to an agent. This information is then used by the agent, as an incentive device, to persuade decision makers. I study the sale of information by a profit-maximizing intermediary to an agent who is privately imperfectly informed about some underlying fundamental. The agent uses this information to persuade decision makers to take desirable actions. I will refer to the agent's private belief about the fundamental as his type.

The intermediary faces a screening problem in selling experiments to privately informed agents. The intermediary also faces an information design problem, as the experiments must be informative enough to persuade the decision makers. The intermediary provides hard information as outcomes of the experiment depend on the underlying fundamentals. Experiment outcomes also contain soft information, as the decision maker learns about the fundamentals through the agent's

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self-selection into different testing options made available by the intermediary. By applying the revelation principle, the intermediary's screening problem can be studied through incentive compatibility constraints for the agent, and the information design problem through obedience constraints. I develop techniques to study the intermediary's problem and use them to analyze employer competition in labor markets, online marketplaces, and other applications.

Employer Competition and Certification (Job Market Paper)

In my job market paper, Employer Competition and Certification, I develop a theory of employer competition in labor markets where employers rely on third-party certification to screen applicants. The applicant (agent) contracts with a certifier (intermediary) to signal his ability to potential employers (decision makers). I model imperfect employer competition through vertical differentiation. The employers are in a duopsony, where being hired by the top (bottom) employer yields greater (lower) utility to the applicant. Employers compete in their selectivity to attract applicants by committing to hiring standards (minimum expected ability of the applicant that the employer is willing to hire).

Traditionally, the connection between certification requirements and employer competition is viewed through the lens of certification requirements' role in creating barriers to entry for the applicant, which drives up employer competition by restricting labor supply. I show that inefficiency in experiment allocation due to the second-degree price discrimination by the certifier steers the applicants towards less selective employers, leading to increased competition between employers. This presents a novel channel linking certification requirements and employer competition.

The certifier steers allocation to less selective employers, as less selective employers are willing to hire a greater mass of low ability applicants. A greater mass of low ability applicants reduces heterogeneity in experiment outcome across different applicant types and hence reduces information rents. This informativeness reducing distortion is characteristic of the certification market and is driven by the joint screening and information design problem. The effect on employer competition is due to equilibrium feedback between the certifier's choice and employers' hiring standards.

Incentive-Compatible Information Design (joint with Jeffrey C. Ely)

In an ongoing project, Incentive-Compatible Information Design (joint with Jeffrey C. Ely), we develop general tools to study the intermediary's joint screening and information design problem, and we specialize them to study online marketplaces, college admission tests, and budget-balanced selling mechanisms in a lemons market. This work differs from my job market paper in two key aspects. First, the techniques for analyzing the intermediary's information design problem are tailored to the applications and can involve the decision maker's second-order beliefs (the decision maker's belief about the agent's beliefs). Second, unlike my job market paper, our work does not study the equilibrium feedback between the intermediary's design objective and the decision makers' commitment.

Our college admission example is essentially the intermediary's problem in a single-employer version of my job market paper. However, the techniques developed to solve these problems are distinct. In my job market paper, I solve the intermediaries problem by point-wise maximizing the Lagrangian of a relaxed problem and then demonstrating that, under regularity conditions on the employers' prior about the applicant's type, the solution to the relaxed problem also solves the original problem. In contrast, we approach the college admission problem geometrically. We characterize all extreme points of the set of incentive compatible, individually rational, and obedient experiment allocations. Using this characterization, we find conditions on the decision maker's prior under which the optimal allocation is an extreme point and conditions on the prior under which the optimal allocation is a strict mixture of extreme points. Under the former condition, we show that the experiment allocation involves allocating less informative experiments to lower types and increasing the informativeness for higher types. In the latter case, we show that the optimal allocation spreads the informativeness of experiments more evenly among different agent types.

In our online market platform application, we study bilateral trade between a privately and partially informed buyer (agent) and an uninformed monopolist seller (decision maker). The platform (intermediary) can provide information to the buyer and the seller. The former guides the buyer's purchases while the latter disciplines the prices set by sellers. The platform sells access to the buyer, and by controlling the information available to sellers, the platform also controls the consumer surplus provided to buyers and thus increases the value of membership on the platform. The key theoretical feature of this setting is that the seller's pricing strategy depends on her second-order beliefs, which are the seller's beliefs about

the buyer's belief about the item's valuation. This is unlike the previous applications, where the decision maker's choice only depends on her expectation of the underlying fundamental and hence only on the decision maker's first-order beliefs. In particular, the price offered by the platform is the optimal monopoly price given the seller's second-order beliefs.

We identify a class of demands comprising iso-elastic distributions of buyer types (seller is indifferent between charging any price in the support of such a demand). These demands are constructed to produce the maximum possible buyer surplus for any given market price. Importantly, any demand generated in equilibrium can be turned into a demand from such a class by garbling the information provided by the platform.

Our analysis of the platform's problem depends on two key relaxations. First, we relax a monotonicity requirement that results from incentive compatibility constraints. This relaxation is similar to the one used in my job market paper, with differences stemming from the difference in the agent's preferences in the two applications. The second relaxation is to the obedience constraints. We relax the obedience constraint to a single "target" mean constraint and an interim participation constraint for the buyer. For a uniform prior, the solution to the relaxed problem generates a demand that is a mean-preserving contraction of an iso-elastic demand and thus implementable.

In a third example, we study bilateral trade between an informed seller (agent) and an uninformed buyer (decision maker). The seller is partially and privately informed about the item's underlying value. The seller offers the item to the buyer and has a reservation value lower than the buyer's valuation, making trade efficient. We show that, under a regularity condition on the buyer's prior about the item's value, any outcome that is implementable by a budget-balanced selling mechanism is also implementable by a simple market mechanism. Where a simple market mechanism is budget-balanced and involves neither market segmentation nor information design. Additionally, we show the extent to which the incentive compatibility constraints reduce the set of implementable consumer-producer surplus.

Certifying Lemons with Discernible Hard Information

In this paper, unlike the previous settings with partial information, I consider an agent who knows his binary ability (state) and has a state-independent preference. The decision maker chooses between two actions and has a state-dependent

preference. The agent uses experiments purchased from a third-party certifier to persuade the decision maker to take a favorable action. This paper focuses on the equilibrium interaction in this certification game when the receiver can distinguish between outcomes of the experiment based on the hard information contained in the outcome. The emphasis on discernible hard information is to capture applications such as quality assurance of goods, where certification involves sampling and testing of large batches and essentially takes the form of statistical procedures. With binary ability, for a given experiment, an outcome's hard information is the likelihood ratio of that outcome.

In principle, a researcher can estimate the hard information that a certification outcome generates and the actions chosen by the receiver upon being presented with this outcome. By studying the equilibrium test structure in an environment with discernible hard information, my model can make positive (testable) statements about information intermediary markets; a researcher can deduce facts about the market based on observable properties of experiments offered.

The main result characterizes all possible equilibrium outcomes in terms of a convex combination of menus containing only simple experiments. Where a simple experiment has support with cardinality of at most three outcomes. Using this characterization, I show the existence of an equilibrium in which soft information overrules hard information; due to equilibrium self-selection of the sender, some outcomes whose hard information makes the receiver more pessimistic about the sender's ability end up persuading the receiver to choose the favorable action.

Competitive Sale of Information

In a work in progress, I aim to expand on the research agenda of the previous papers to incorporate imperfect competition between information intermediaries. I use a (delegated) common agency approach to study differentiated intermediaries who compete by simultaneously posting menus of experiment and price pairs. An agent is privately imperfectly informed about a binary state and chooses the order of contracting with the intermediaries (allowing for contacting with just one or none of the intermediaries). This project is at an early stage, with the precise modeling assumptions and research question still evolving. I am interested in understanding the link between the nature of differentiation between intermediaries and how different agent types sort themselves among the intermediaries. Another interesting question is the role of two-part tariffs in the form of disclosure fees. Disclosure fees allow an intermediary to capture part of the rents that the

agent earns from contracting with a competing intermediary after observing the realization of his purchased experiments.

Information Design

I am also interested in a more classical approach to information provision where the intermediary's role is played by agents' ability to commit to a costless experiment or, more abstractly, information provision by an omniscient designer.

Interim Information Design (joint with Jeffrey C. Ely)

We analyze information design in a single-item bilateral trade environment where the private disclosures to the buyer can impact her willingness to pay. We study this problem from an interim perspective. The buyer begins with some initial, partial, private information about his value for the object. This allows for disclosures that are targeted based on the buyer's private information but constrains the overall information policy to be no less informative than the initial, partially, informed buyer. We ask how market outcomes, like the probability of trade, prices, and welfare, are affected by interim information disclosures.

We characterize all possible consumer-producer surplus pairs for any given distribution of initial private information. A result central to our analysis is the identification of a new class of canonical demands that are sufficient to generate all possible efficient consumer-producer surplus pairs. We show that any efficient equilibrium demand can be transformed into a demand in this family through some information policy without affecting the welfare or price. Moreover, any equilibrium demand, not necessarily efficient, can be transformed into a demand in this family with possibly different consumer-producer surplus.

As an application, we derive a comparative static relationship between prices and information. Fixing some efficient consumer-producer surplus pair, as the buyer becomes better informed prices necessarily increase. This highlights an important friction involved with information provision in such environments; a more informed buyer makes a better purchase decision, but also faces higher prices. Importantly, we show that more informed buyers can drive up prices without affecting the welfare. The decoupling of price and welfare is only possible because the buyer and the seller are initially asymmetrically informed.

Public vs Private Feedback in Dynamic Contest (joint with Kyohei Okumura)

In a work in progress, Public vs Private Feedback in Dynamic Contest (joint with Kyohei Okumura), we study a model of dynamic moral hazard when a designer can flexibly use information to incentivize multiple agents competing for a monetary reward. Agents can exert costly effort to stochastically accumulate capital. The designer offers a monetary reward to the agent who accumulates the most capital by the end of a fixed terminal date. The designer can use information about the competing agent's performance to incentivize agents to accumulate capital. We investigate the role of private and public information disclosure in incentivizing maximum total capital accumulation.