The spiel for the interview

"TELL US ABOUT YOUR JOB MARKET PAPER."

In my job market paper, I study how to efficiently match heterogeneous supply and demand using information disclosure. Let me start by giving you an example.

To get to the hotel from the airport, I took an Uber. When my driver received my request he saw my rating and location but he didn't see where I was going until after he picked me up. Well, it is an interesting design decision because the drivers care about the passenger destination. Typically, they don't like doing short trips or traveling to the remote neighborhoods where it's hard to find another passenger.

A primary problem for many matching platforms, including Uber, is to find an efficient supply-demand fit. So in this situation you might think that any matching platform would maximize the information provision to both sides, because buyers and sellers could find the matches with the most value. However, it is not what we observe.

Motivated by this observation I ask the following question: Can a matching platform improve the efficiency of the marketplace by limiting information the buyers and sellers observe about each other before engaging in a match? This is an important question because there are potentially large economic gains from finding the right supply-demand fit, and many companies with platform business model spend a lot of resources trying to get it right. And my paper is looking exactly into this.

I develop a general framework, which is not limited just to Uber but also applies to markets for housing rental and on-demand labor contracting, such as Airbnb and TaskRabbit.

I have two main results. Let me preview them before going into more details. In my first result I show that the economic outcome is Pareto-inefficient under the full disclosure. The key intuition there is that information availability stimulates excessive search that leads to cream-skimming and low match rates. I'll tell you more about it in a minute. In the second main result I look at how the platform can improve efficiency, and I characterize the disclosure policy that maximizes the total surplus. In resolving this result I also make a technical contribution, which is the approach to solving information disclosure problems with heterogeneous and forward-looking receivers.

Now let me describe you the model I am working in. There are three groups of players: buyers, sellers and the platform. Buyers contact sellers in continuous time and want to match quickly. Sellers receive buyer requests and choose which to accept and which to reject. The sellers have limited capacity for serving buyers and, critically, sellers have preferences over what buyers they get matched with. The platform is the information intermediary. I restrict my attention to the platform's disclosure problem on the **seller** side of the market: The platform designs a policy that governs what buyer characteristics are disclosed to the sellers before sellers accept a match and how coarsely. The platform's objective is to maximize the weighted average of the buyer and seller surpluses. I hold prices fixed, because I want to focus on the search aspect of matching.

Back to the Uber example, Full disclosure is the one when Uber shows the exact passenger destination. A coarse disclosure would be, for example, to partition all destination into three categories, close ride, medium-range ride, far ride, and show to the driver only the category the destination belongs to.

Let me tell you more about my first main result. I show that under the full disclosure, a combination of buyer and seller surpluses is Pareto-inefficient. It is inefficient by two reasons: full disclosure reduces buyer match probability, and it also reduces seller payoffs. Let me describe the reduction in buyer surplus. The key here is that the set of matches that create positive **seller** profits is smaller than the set of matches with positive **buyer** surplus. If the platform shows more information to the sellers, they will single out the matches that are valuable to them and reject other matches that are valuable to the buyers. Disclosing more information reduces the platform's ability to induce sellers to accept the efficient matches.

Now let me describe what is perhaps more surprising finding, that is that under the full disclosure to sellers, the sellers as are also worse off as a whole. It happens due to a Prisoners' Dilemma problem among sellers. Intuitively, each seller keeps his schedule open by rejecting the low-value matches in order to increase his individual chances of getting the high-value matches. As a result, the sellers spend a lot of time waiting for the most valuable matches. Collectively, this behavior is suboptimal because all seller-valuable matches have to be accepted in order to maximize the joint seller surplus. The platform's policy of withholding of information makes sellers less picky, they settle for less, and can be directed towards accepting the efficient matches.

Back to the Uber example, if drivers could see full details of the trips, they would pick out the rides that remain in the busy areas. It hurts buyers because rides to far areas are not served or require very long wait times.

Now let me move on to my second main result. There I characterize the disclosure policy that maximizes the total surplus. I do it for the cases of known seller prefs, with two private seller types, and with continuum of seller types. The most intuition is concentrated in the two-type case but let me start with known preferences to explain the basic princple.

First off, if the platform knows seller preferences, then it can implement any desirable outcome subject to participation constraints by centrally matching buyers to sellers. Now, the observation here is that by the Revelation Principle, such centrally-controlled matching can be implemented by a simple and very coarse disclosure policy. This policy just recommends matches to the sellers and provides no further information. The sellers follow the recommendations because on **average** they have positive value.

In practice, there is **unobserved heterogeneity** in preferences. In this situation, a simple mechanism with just one recommendation to accept will no longer be efficient, because it is impossible to tailor one incentive compatible recommendation to different sellers.

Imagine that there are **two** private seller types, call them professionals and amateurs. An interesting case is when sellers are vertically differentiated, that is when seller agree on buyer ranking but amateurs can profitably complete only a subset of tasks that professionals can. I show that the optimal disclosure policy has three cells in its partitioning, and in this respect, **more revealing** than in the case with known seller preferences, which had two cells in its partitioning. Also, it implements an outcome that is only constrained efficient.

The disclosure policy is more revealing because by the Revelation Principle, with 2 types and 2 actions, the disclosure policy requires 4 cells in its partitioning. It is either

a recommendation only for amateurs to accept, or only to professioals to accept, or both should accept, or both should reject.

Using such a policy, the best implementable outcome in terms of total surplus is still constrained efficient. This is because private vertically differentiated types introduce an additional constraint into the platform's optimization problem. Namely, a professional may want to act as an amateur. Let me tell you why because it is not exactly the same as in the second-degree price discrimination. When a professional receives a recommendation to accept, he **also** sees the recommendation for amateurs. If that recommendation reads "amateurs should reject", he infers it is a low-value task. Therefore, the platform is constrained in how many tasks it can recommend to the professionals to accept.

========== 10 MINUTE MARK ==========

Then, I also find the optimal disclosure policy in a setting with 1-dimensional continuous buyer and seller types and linear seller payoffs. The efficient policy has the form of upper-coarsening: the high buyer types are pooled and the low buyer types are perfectly revealed.

Let me tell you now how I solve this disclosure problem. Here I build on the information communication literature (Kamenica-Gentzkow 2011), where the platform faces a disclosure problem to reveal a buyer type to an unobservably heterogeneous audience of sellers who are also forward looking.

In this case, the design of the optimal information disclosure is a nontrivial problem. To see why, note that with forward-looking sellers, the information disclosure policy determines not only the seller's stage payoff but also his continuation value. As a result, a seller's decision to accept depends not only on the posterior mean of the buyer type–which is standard in this literature—but also on the entire signaling structure. This makes a typical approaches in the literature, such as concavification as in the recent bayesian persuasion literature, is unsuitable for the analysis of my model.

I approach this problem by representing signaling structures as a particular class of convex functions and then using the calculus of variations to find the first-order necessary conditions. The best way to see that the optimal disclosure policy is qualitatively different when sellers are forward-looking compared to when they are myopic is to consider the case when seller types have uniform distribution and the platform maximizes just the buyer surplus. In this case, when the sellers are myopic, the disclosure policy is irrelevant. However, when sellers are forward-looking, the strict optimal disclosure policy is upper-coarsening.

Other questions

"WHAT KIND OF WORK ARE YOU GONNA BE DOING IN THE NEXT FIVE YEARS?"
"WHAT ELSE ARE YOU WORKING ON?"
The paper with Greg Lewis.

- Many of today's leading companies can be thought of as multi-sided platforms.
- One of the most important services such platforms provide in order to attract consumers and compete with their rivals is search intermediation.

- The usual presumption is that these platforms try to optimally match consumers with the other side of the market
- We consider the following model. There are two downstream markets, selling differentiated goods A and B respectively. Consumers access these markets through a search intermediary that displays a default search result. Consumers that are dissatisfied with the default can search for an alternative, paying a search cost of c.
- In this environment, the intermediary has two ways of controlling the user search experience. First, they can invest in technology to lower the search cost c.
- By contrast, positive search costs are generically necessary for the intermediary to maximize joint seller revenue.
- This is easiest to see in the case where goods are sold downstream at fixed prices. If good A has a higher price than good B, the platform would prefer for each consumer to buy good A rather than good B, though buying good B is better than them not buying at all. To push traffic to market A, the platform can make market A the default search result; but this only has bite if search costs are positive. On the other hand, if search costs are too high, consumers who value good B will see the default A result, and walk away.
- When there is limited supply and goods are auctioned, things become more subtle, as it is harder to calculate where the platform should aim to steer traffic.
- Still, starting from zero search costs there is always a local improvement by raising search costs and steering consumers towards the thicker market (in the sense of the buyer-seller ratio).

"WHAT'S YOUR NEXT QUESTION?"

We do not completely understand how information design interacts mechanism design and pricing schemes. In my job market paper I study an information design question of information disclosure. The question is whether the same outcomes can be implemented by some pricing schemes? What is the benefit of using transfers over strategic information manipulation? My intuition is that mechanism and information design are complimentary. One reason information design can be preferred, for the designer it can be easier to enforce uniformity of goods with few prices than computing fine prices for all transaction. This intuition is based on Ilya Segal's work on communication complexity. The other reason is that if the designer opt out of pricing and lets the markets work, the existing markets can be too thin under pronounced heterogeneity. Withholding information thickens the markets and makes them work. The latter line of logic was used in Milgrom's work on conflation in online advertising.

"WHAT CLASSES CAN YOU TEACH?"

Potential questions to the spiel

1. Do you think Uber cares about efficiency? Do you study the case when it is profit-maximizer?
    (a) Yes. Literally, a hiring ad I received from Lyft had a line: "We are looking for an economist to help us efficiently match supply and demand."
2. How broadly does it apply? What's different from a regulator in a normal market with buyers and sellers?
3. What would you hide in the other examples, labor platforms and Airbnb?
4. If full disclosure always inefficient?? I can see a mechanism but I am surprised it is always the case. Can you tell me more about that?
    (a) I said "The sellers accept the set of matches that are valuable to them, and this set does not coincide with the set of efficient matches." Why?
5. "I study a setting with pronounced heterogeneity, so that buyer and seller preferences over matches are not aligned." Isn't there a price mechanism to take care of it?
    (a) "Prices are fixed. I am interested in the following question. Fix prices; what can the platform do just by manipulating the information the sellers observe about the buyers?" Do you have a story why Uber is doing it using information and not prices?
        i. In practice it may be easier to implement information withholding than a fine pricing.
6. Can you say in one sentence what externality a seller imposes by accepting or rejecting a match?
    (a) Yes. The externality has to do with the constrained capacity. When a seller rejects a buyer request, he stays available on the marketplace, and attracts a fraction of buyers that otherwise would go to his competitors. As a result, the other sellers face a weaker demand, and are worse off.
        i. But isn't the case that rejected buyers go to the other sellers?
            A. In the base model the buyers make a single request attempt.
7. Is there a differential sense to your first result? If I decrease information a little bit, does it necessarily increase the surplus?
    (a) Yes, I can tell you the differential result. The short answer is that the effect on surplus depends on how exactly you restrict the information. In a generic case, there is always a perturbation to full disclosure that increases the surplus and a perturbation that decreases the surplus.

8. What's a disclosure policy? How does the platform disclose information? How do you model it?

    - Buyers have types, which are relevant for sellers (destination on Uber). The platform maps buyer types into signals, and shows to sellers only the signals. If all possible destination locations are broken down into three groups, then there are just three signals. Such a disclosure policy is quite coarse.

9. Do you think this technical approach (representation+calculus of variations) is applicable to other problem and will be valuable to other people?

    (a) Yes. The approach is quite general and can be applied to other disclosure problems. Especially it will be useful in the situations where the receivers optimal actions depend not only on the posterior mean of the signal but on the entire signaling structure.

10. Do you allow for the sellers to reveal their types?

    (a) No, sellers do not reveal their types, and neither the platform tries to elicit them.

11. If you allow for communication between sellers and the platform, will the results change?

    (a) I do not know in my setting, but a paper by Kolotilin et al. showed that communication does not matter in the special case of my model, when the matching is static and seller are not limited in capacity.

12. Why do we care about online marketplaces?

13. Is it a Hirshleifer effect?

    - No, the Hirshleifer effect is about risk-sharing, while my framework is about search frictions.