RESEARCH STATEMENT

YingHua He, February 2022

My research focuses on matching and market design, most of which is in three strands. The first is the development of novel methods for empirical market design, in particular, the use of school choice data to estimate student preferences. The second is the analysis of information frictions in matching markets. The last is the design of new mechanisms, for example, for school choice and kidney exchange. I adopt a wide range of tools—empirical (structural and reduced-form), theoretical (economic and econometric), and experimental (laboratory and field)—and apply my results in a variety of substantive applications. All of my work is made possible by standing on the shoulders of numerous giants. Unfortunately, due to the page limit, I will not be able to discuss how their research has helped mine. I am grateful that I have the honor of being a coauthor/mentee of several of them.

1 METHODS FOR EMPIRICAL MARKET DESIGN

Much of my research examines methods of evaluating market designs. As an example, consider an ex-ante evaluation of a school choice reform such as implementing an affirmative action policy or a new mechanism. A common approach is to estimate student preferences from data on the current regime and simulate counterfactual outcomes. Several of my papers propose new estimation and simulation methods that are based on solid theoretical foundations as well as plausible assumptions.

In Fack et al. (2019), we study school choice under the student-proposing Deferred-Acceptance mechanism (DA). Schools are passive and rank students strictly based on their priority scores, and students, knowing their own priority score, submit rank-order lists (ROL) of schools. DA is strategyproof in that reporting true preferences, or *truth-telling*, is a dominant strategy for students. Hence, it seems natural to assume that submitted ROLs reveal students' true preferences. However, there are two potential issues. First, there can be multiple equilibria. For instance, a student may choose not to apply to a clearly out-of-reach school without any loss. Second, most school districts that use DA limit the length of submittable ROLs, making it non-strategyproof. Instead of studying student behavior or ROLs, we explore the properties of equilibrium outcomes. Among them, stability is a key concept and the main identifying assumption in the matching literature. In a sequence of random economies, we show that, even when there are application costs, stability can be asymptotically satisfied in Bayes-Nash equilibrium. This implies that, in a large economy, (almost) every student is matched with their favorite school among those they qualify for ex post. Because researchers observe how schools rank students, stability reduces a matching problem to a one-sided discrete choice, which makes preference estimation straightforward. Moreover, stability is implied by truth-telling, leading to a statistical test for the selection between the two assumptions. Such a test is useful because truth-telling, when satisfied, allows us to use more information from the data.

Several recent studies have documented that students make mistakes even in a strategically simple environment. We find similar evidence in Australia's university admissions (Artemov et al., 2020). This may jeopardize Fack et al. (2019)'s results which require rational behavior. Noting that only a minority of mistakes are *payoff-relevant*, Artemov et al. (2020) introduce a robust equilibrium concept to accommodate them. We prove that, under mild conditions, every equilibrium outcome is asymptotically stable and virtually the same as the truth-telling outcome. This is a stronger justification for stability in preference estimation. It also implies that, to study DA outcomes, we can simply assume truth-telling in theoretical and counterfactual analyses even when students make mistakes.

Outcome stability also allows us to investigate (decentralized) many-to-one *two-sided* matching without transfers (He et al., 2021). This problem is more challenging than school choice because we

do not observe how schools rank students. Assuming stability, we show nonparametric and semi-parametric identification of preferences of both sides under some exclusion restrictions and provide a practical estimation method. The identification uses variation generated by demand shifters, which only affect student preferences, and by supply shifters, which only enter school preferences.

The theoretically founded methods developed in these papers enable us to answer many critical policy questions under plausible assumptions. My coauthors and I have started several follow-up projects, including the analyses of school choice in Paris and college admissions in Ontario, Canada.

I have also worked on non-DA school choice. In He (2017), I investigate student behavior under the Boston Immediate-Acceptance mechanism (IA), while allowing for mistaken beliefs about admission probabilities. IA is not strategyproof. Hence, the ability to strategize matters, and I present survey evidence of heterogeneous/mistaken beliefs. Exploiting the properties of IA, I derive a set of belief-free, *dominated* strategies to estimate student preferences. Evidence shows that students are overcautious because they play "safe" strategies too often, revealing severe information frictions.

2 Information Frictions in Matching Markets

Information frictions are sometimes assumed away in the literature. For example, by assumption, students know their own preferences. In Chen and He (2021, forthcoming), we relax this assumption and study how DA and IA incentivize students' information acquisition about their own and others' preferences. Theoretically and experimentally, we show that information costs affect the performance of the mechanisms. In our lab experiment, most students over-invest in information acquisition, while some never invest in it. We find that providing information on own and others' preferences is welfare improving under both DA and IA. Unexpectedly, information on others is also useful under DA, a strategyproof mechanism, because it reduces wasteful information acquisition.

Information frictions are relevant in practice. Grenet et al. (forthcoming) are one of the first to document quasi-experimental evidence that students lack information on their own preferences when applying to university programs. We use data from Germany's university admissions where the first stages of DA are implemented in real-time, allowing for multiple offers per student. We find that non-exploding early offers are accepted more often than later offers, despite not being more desirable. These results, together with survey evidence and a theoretical model, are consistent with students having costly discovery of preferences. They imply that common single-offer mechanisms such as DA can be inefficient in that they require students to acquire information on their own preferences and rank programs *before* knowing which programs will accept them. Improving upon the mechanism used in Germany, we propose a dynamic multi-offer mechanism that informs students of offer availability before their preference discovery. In simulations based on our data, the efficiency advantage of the new mechanism is sizable.

Such frictions also matter for recruiters (e.g., graduate programs or employers) in a *two-sided* setting. Due to recent developments in IT and market design, it is becoming easy for an individual to apply to more programs. Consequently, congestion emerges, as each program often has to screen a large number of applicants, including many who are unlikely to choose the program, to form its preferences. To study how to combat congestion, He and Magnac (2020) conduct a field experiment on matching students and graduate programs. Specifically, we consider two forms of application costs—a per-application cost and a limit on the number of applications—and integrate them in DA. Applying structural estimation to experimental data, we find that imposing application costs reduces congestion; in particular, a small per-application cost can significantly reduce congestion without sacrificing any match efficiency.

3 New Mechanisms

In Grenet et al. (forthcoming) and He and Magnac (2020), empirical findings have resulted in the design of improved mechanisms. I have also developed new mechanisms in two additional papers.

He et al. (2018) propose a pseudo-market mechanism for allocation with priorities, e.g., school choice with coarse priorities. In the mechanism, students are given token money, face priority-specific prices, and buy utility-maximizing probability shares in schools. We show that this mechanism is asymptotically incentive compatible and that the resulting assignments are fair and constrained Pareto efficient. When priorities generate a strict ranking over students by each school, our mechanism is equivalent to DA. With coarse priorities, our mechanism allows a student to trade-off assignment probabilities at different schools based on their cardinal utilities, in contrast to DA which only uses students' ordinal preferences. With colleagues at Rice, we aim to make it easy to put the mechanism into practice. We believe that it has the potential of being a practical solution as well as a theoretical benchmark for mechanism evaluation.

Moving beyond education, I have also worked on dynamic problems such as kidney exchange. In Akbarpour et al. (2020), we propose an unpaired kidney exchange mechanism. For an incompatible patient-donor pair, kidney exchanges often forbid receipt-before-donation (the patient receives a kidney before the donor donates) and donation-before-receipt, causing a double-coincidence-of-wants issue. Our mechanism uses "memory" as a medium of exchange to eliminate these timing constraints. In a dynamic matching model, we prove that the mechanism delivers a waiting time for patients that is close to optimal and substantially shorter than currently utilized state-of-the-art mechanisms. Using data from France and two large U.S. platforms, we confirm these theoretical results. We also propose a range of solutions that can address some potential practical concerns. More excitingly, a version of the mechanism is being considered for implementation in France, and my coauthors and I look forward to making more progress on this topic.

References

Akbarpour, M., J. Combe, Y. He, V. Hiller, R. Shimer, and O. Tercieux (2020): "Unpaired Kidney Exchange: Overcoming Double Coincidence of Wants without Money," Unpublished.

Artemov, G., Y.-K. Che, and Y. He (2020): "Strategic Mistakes: Implications for Market Design Research," Unpublished.

Chen, Y. and Y. He (2021): "Information Acquisition and Provision in School Choice: An Experimental Study," *Journal of Economic Theory*, 197, 105345.

——— (forthcoming): "Information Acquisition and Provision in School Choice: An Theoretical Investigation," *Economic Theory*.

Fack, G., J. Grenet, and Y. He (2019): "Beyond Truth-Telling: Preference Estimation with Centralized School Choice and College Admissions," *American Economic Review*, 109, 1486–1529.

Grenet, J., Y. He, and D. Kübler (forthcoming): "Preference Discovery in University Admissions: The Case for Dynamic Multi-offer Mechanisms," *Journal of Political Economy*.

He, Y. (2017): "Gaming the Boston School Choice Mechanism in Beijing," Unpublished.

He, Y. and T. Magnac (2020): "Application Costs and Congestion in Matching Markets," *Economic Journal*, conditionally accepted.

He, Y., A. Miralles, M. Pycia, and J. Yan (2018): "A Pseudo-Market Approach to Allocation with Priorities," *American Economic Journal: Microeconomics*, 10, 272–314.

He, Y., S. Sinha, and X. Sun (2021): "Identification and Estimation in Many-to-one Two-sided Matching without Transfers," Unpublished.