

Research Statement—*Mohammad Akbarpour, Stanford University*

My research is defined broadly by questions of market design and network theory. Within these fields I investigate subjects as disparate as redistributive policies, auctions, dynamic matching, kidney markets, and diffusion in networks. Methodologically, some of my work is distinguished by applying an “algorithmic” perspective that, instead of (over)simplifying the models to make them tractable, includes first-order complexities and characterizes *near-optimal* solutions, which enables me to identify key features of the *exact optimum*. Below, I summarize the four branches of my research agenda.

I. Redistributive Market Design: Prices, Priorities, and Probabilistic Allocations

The first branch of my research agenda is on the border of market design and optimal taxation, exploring implications of macro-level inequality for microeconomic theory. In [1] (*Econometrica*, 2021), the leading paper that started this agenda, we reexamine the very standard Econ 101 market model from a utilitarian perspective in which individuals (possibly) have different marginal values for money. We prove that if agents’ values are privately known, then the 2nd welfare theorem does not apply, and there is a sharp trade-off between efficiency and redistribution. Our findings show that with low inequality, market equilibrium remains optimal, but when there is significant inequality in values for money, it may be optimal to impose price controls for “essential goods” even though doing so induces rationing.

In [2] (Forthcoming, *Journal of Political Economy*), the second paper of this agenda, we study the more practical problem of allocating a set of heterogeneous objects in a world where each agent has a (private) value and marginal value for money (equivalently, a “welfare weight”), as well as an observable label. The paper identifies when and why priorities and lotteries are superior to the price system.

The third paper, [3] (Forthcoming, *Quarterly Journal of Economics*), applies the results of this paper into the problem of vaccine allocation where agents have allocative externalities, and fully characterizes the optimal allocation scheme. The main result shows that while externalities and inequality considerations limit the use of prices in vaccine allocation, they rarely justify *entirely* ruling out prices—a careful mix of prices and priorities can improve welfare over both market allocation and pure priority-based allocation.

I have two other related working papers (both co-authored with GSB students). In [4] we ask: given some screening devices (e.g., money, waiting, traveling), which one dominates others? In the second paper [5], a policy piece, we apply our tools into the problem of energy pricing at the times of crisis.

I have two other papers inspired by distributional considerations. The first one [6] (*Review of Economic Studies*, 2020) tackles a market design impossibility result. It is known from prior work that with *intersecting constraints* in a matching problem (e.g., a school choice setting with both walk-zone and socioeconomic status quotas) it is in general impossible to find a fair lottery that satisfies all constraints [7]. We prove that if some constraints are *soft* in the sense that they can bear a small error with little cost, then intersecting constraints can be handled. The second paper [8] (*Journal of Public Economics*, 2022) is on school choice with unequal outside options (e.g. private schools). We prove that in non-truthful mechanisms, students with access to *private* schools are more likely to get into best *public* schools, because they can afford to apply to riskier schools. Truthful mechanisms, however, level the playing field for all. We validate the theoretical predictions by identifying a natural experiment in New Haven’s school choice. This provides an inequality-based argument in favor of truthful mechanisms.

II. Auction Market Design: Credibility and Computational Complexity

Since taking my first mechanism design class, I was puzzled by the question of *who guards the guardian?* The so-called “revelation principle” sets aside the possibility of an auctioneer deviating from the rules of the game by focusing on direct mechanisms. But what if the auctioneer is corrupt? This question is where my paper “*Credible Auctions: A Trilemma*” [9] (*Econometrica*, 2020) was born. We

consider a setting where the auctioneer can deviate from the rules, subject to not being detected by any bidder, saying that a mechanism is *credible* if it is incentive-compatible for the auctioneer to follow the rules. For instance, the sealed-bid second-price auction is not credible, because the auctioneer can exaggerate the second highest bid without being detected.

Applying this definition to the setting of optimal auctions helps us answer a classic auction theory question: *what accounts for the popularity of the first price and ascending auctions?* This is especially puzzling when we note that the first-price auction requires complex strategizing and the ascending auction

requires many rounds of communications, whereas William Vickrey’s ingenious second-price auction is nonetheless strategically and logistically simple. We show that credibility is the shared feature of the first-price and ascending auctions; in both, *the mechanism* guards the guardian! In fact, credibility turned out to be more fundamental than what we imagined: The first-price auction is the unique static, credible optimal auction and the ascending auction is the unique strategy-proof, credible one! Together with the classic Green-Laffont-Holmström result, this leads to an auction trilemma, fully characterizing the three most common practical auctions. (Figure 1 illustrates.)

My second auction theory paper [10] (*Econometrica*, 2023) is about resource allocation in computationally complex settings where practitioners use approximate algorithms to determine who gets what. We ask: how do these algorithms perform when participants can invest and modify their values? We combine insights from CS theory and microeconomics to provide an answer for this question.

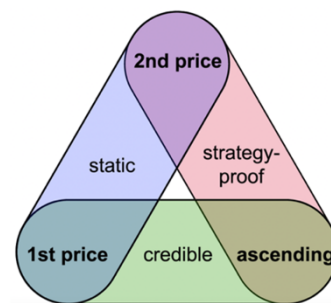


Figure 1 - An Auction Trilemma

III. Matching Market Design: Timing, Tokens, and Taboos

Every year, thousands of kidney patients die, and dialysis costs are about 1% of the entire U.S. federal budget. My third research agenda is around finding solutions that save lives by increasing the supply of kidneys or improving their allocative efficiency.

In my PhD years, I observed that kidney exchange algorithms tend to be evaluated based on their performance on given sets of patient-donor pairs, even though the way the pool of pairs evolves over time also depends on the algorithm. In my job market paper [11] (*Journal of Political Economy*, 2020), we show that matching algorithms that consider this endogeneity, and thus optimize for *when* to match—in addition to the static question of *who* to match—can potentially match many more patients-donor pairs. Algorithms designed in this paper were—unexpectedly—picked up by some researchers working on data from DiDi ridesharing platform [12]. Inspired by this, in a new paper [13], we prove that in spatial markets, mild excess supply can substantially improve performance, and even naïve, greedy algorithms can realize these gains.

In a second dynamic kidney exchange paper [14] (*PNAS*, 2022), we propose a new design—*global kidney chains*—which helps patients in poor countries receive transplants by participating in an American kidney chain. We prove that savings to the U.S. are more than enough to cover foreign patients’ costs. My third kidney paper [15] (Accepted, *Review of Economic Studies*) introduces an algorithm based on *kidney tokens* to break the problem of double coincidence of wants. Our counterfactual analysis on the French kidney data shows that our algorithm substantially outperforms the state-of-the-art.

While kidney exchange is a poster child of success in market design, the total number of transplants facilitated by kidney exchange is less than 2.5% of the kidney demand. As such, many are now asking: Is it time to legalize kidney sales? In [16] (R&R, *Journal of Political Economy*), we collect six years of data from the only *legal* market for kidneys in the world in Iran and find that the market has substantially increased the supply of kidneys. Simple welfare calculations show that a market for kidneys can increase U.S. patients’ lifetime by about 7 years and save taxpayers more than \$6 billion per year. Of course, there

are many ethical concerns associated with this market, some of which we investigate through the lens of our data.

IV. Network Diffusion, Random Seeds, and Learning in Networks

Finally, I have been working on questions on the intersection of network theory and policy. Perhaps most importantly, in “*Just a Few Seeds More*” [17] (R&R, *American Economic Review*), we study the problem of how to identify individuals who are the best ‘seeds’ for maximizing the spread of information in a social network. This is a widely studied problem in development economics, marketing, and health policy. The main result of the paper proves that under a wide range of practically relevant conditions, seeding a slightly larger number of individuals *randomly* can prompt a larger cascade than seeding by optimizing over the network structure. We verify the results using data from multiple development economics settings. In two other papers, I examine the impact of heterogeneous activity patterns and changing population on diffusion [18] (*PNAS*, 2018), social learning [19] (R&R, *Operations Research*), and optimal lockdown [20].

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