

Research Statement

Alexey Kushnir

My primary research interest lies in the domain of economic theory. In particular, I am interested in market design, the field of microeconomics where theory is able to give practical advice regarding the design and implementation of actual markets. Successful applications of its methods include the redesign of the clearinghouse for new American doctors (Roth and Peranson, 1999) and the design of auctions for the sale of radio spectrum and electricity (see Cramton, 1997, and Milgrom, 2000).

My graduate work largely focuses on the analysis of a signaling mechanism in two-sided matching markets. Signals play an important role in many labor markets. Of significance, some markets have developed formal signaling mechanisms: the signaling in the job market for new Ph.D. economists (<http://www.aeaweb.org/>) and in the recruitment market for first-year Harvard Business School students (<http://www.skydeck360.com/>); in a similar setting, some online dating sites (e.g., <http://www.cupid.com/>) allow agents to send virtual roses to potential partners as signals of their interest.

My job market papers examine a natural signaling mechanism in a two-sided matching market between firms and workers. We consider a game of incomplete information. Each worker can send a limited number of *costless* signals to firms indicating her interest in positions there; workers send signals simultaneously. Then, each firm makes an offer to at most one worker; firms make offers simultaneously. Finally, workers choose at most one offer from those available to them

The two papers study the same model and differ only in how agents' preferences are assumed to be distributed. In the first, agents' preferences are quite dispersed. In the second, agents' preferences are tightly distributed. The influence of costless signaling in the two environments is quite different.

The paper "*Signaling in Matching Markets*" (written jointly with Peter Coles and Muriel Niederle) analyzes markets with firm segments. Workers agree on the ranking of firms across "segments," but have idiosyncratic (and uniformly distributed) preferences within segments. For instance, all workers may agree as to which firms are in the "top five" segment and which are in the "six to ten" segment, etc., but may disagree as to the exact ranking within a segment. Firm preferences over workers are idiosyncratic (and uniformly distributed). We show that, on average, introducing a signaling mechanism increases both the expected number of matches as well as the expected welfare of workers for this environment (more precisely, any non-babbling equilibrium that satisfies the refinement D1 of Cho and Kreps has these properties). The welfare of firms, on the other hand, changes ambiguously. In addition, the signaling mechanism adds the most value for markets wherein the number of firms and the number of workers are of roughly the same magnitude. Furthermore, the optimal number of signals—the number of signals that maximizes the expected increase in the number of matches—increases when workers have more positions to fill. Finally, additional periods of interaction between firms and workers decrease the impact of signaling.

By contrast, the paper “*Harmful Signaling in Matching Markets*” shows that there are instances when preference signaling is actually harmful for matching markets (more precisely, the expected number of matches is weakly smaller in any equilibrium of the game with signals than in the unique equilibrium of the game with no signals; moreover, there is an equilibrium where this comparison is strict). Workers have almost aligned preferences over firms: each worker has “typical” commonly known preferences with probability close to one and “atypical” idiosyncratic preferences with the complementary probability close to zero. Firms have some commonly known preferences over workers. Though signals transmit previously unavailable information, they also facilitate information asymmetry. Prior to the signaling, all firms have identical beliefs about worker preferences. However, after the signals are received they may have diverse beliefs. This disparity in beliefs leads to coordination failure. As a result, the introduction of a signaling mechanism may decrease the total number of matches and the welfare of agents.

The papers together suggest that signals play two important roles in match formation: they transmit information and they facilitate information asymmetry. When there is only a small amount of information about agent preferences available, as in “*Signaling in Matching Markets*,” information transmission plays a more important role in match formation. However, when there is almost complete information about agent preferences, as in “*Harmful Signaling in Matching Markets*,” the introduction of signals may lead to coordination failure.

Currently, I am also involved in two other fascinating projects. The first one analyzes the problem of optimal object allocation in a one-sided matching market without transfers. The project examines a model having many agents and many objects with interdependent values. Each agent receives noisy signals about object values. These signals would, if known to other agents, affect the values those other agents assign to the objects. This environment requires optimal mechanisms to aggregate information and to induce truthful revelation of preferences. We show the general impossibility of an incentive-compatible and Pareto-optimal mechanism in this environment. Moreover, we propose a mechanism that is undominated among all incentive-compatible mechanisms.

The second project analyzes an object allocation problem via contests in the environment of private values. Several buyers, whose valuations are independently and identically distributed, compete for one object. All buyers bid simultaneously. Each buyer can get the object with some probability. This probability equals the ratio of that buyer’s bid to the sum of all buyers’ bids. We consider two settings: one in which buyers always pay their bid and the other in which buyers pay only upon receiving the object. We establish the existence and characterize the properties of symmetric equilibria in both environments. We also derive an explicit solution for a certain class of agent value distributions.

Solving economic theory problems motivated by practical needs is an excellent way to develop new theory and design better markets. Auctions and matching are two branches of market design that have proven to have many real-world applications. Other branches include the design of carbon, prediction, and electronic markets as well as e-commerce. Though my future research will surely encompass other areas of economics, my research plans for the near future focus on modeling questions of market design.