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Working papers

- **Scaling Up: Individual-Level Transfer Performance of Models**, with Keaton Ellis, UC Berkeley, and Erkut Ozbay, University of Maryland. Version: Nov 1, 2024.

  This study investigates the transferability of economic models for individual decision-making across different risk domains, specifically comparing performance between two- and three-state budgetary environments. Utilizing within-subject laboratory data, we evaluate the ability of Expected Utility Theory (EUT), Disappointment Aversion (DA), and machine learning models to predict choices when estimated in a simpler two-state environment and applied to a more complex three-state environment at the individual level. Our findings reveal two key insights: (i) there is substantial transferability across domains for the vast majority of subjects; and (2) EUT demonstrates substantial transferability, maintaining approximately 92.9% of its within-domain predictive accuracy when generalized across domains, outperforming both DA and machine learning models in terms of predictive consistency. These results underscore the robustness of parsimonious economic models, particularly EUT, in providing reliable extrapolations across experimental contexts, suggesting their utility in applications where predictions span diverse risk settings.

- **Predicting and Understanding Individual-Level Choice Under Uncertainty**, with Keaton Ellis, UC Berkeley, and Erkut Ozbay, University of Maryland. Version: Sep 30, 2024.

  Economic models are founded on parsimony and interpretability, which is achieved through axioms on choice behavior. We empirically evaluate the predictive accuracy of economic models of choice under risk and ambiguity, and the strength of their axiomatic foundations, using complementary methods of completeness (Fudenberg et al., 2022) and restrictiveness (Fudenberg et al., 2023), respectively. To better understand the tradeoff between the two concepts, we additionally relate their performance to machine learning models. We use budgetary choice environments with three dimensions to provide a strong test of axioms. We show that adding a third dimension of choice marginally reduces completeness of economic models, but significantly increases restrictiveness. Economic models are also more complete than machine learning models, and are significantly more restrictive. These results are robust to considering an environment of choice under ambiguity rather than choice under risk. Overall, economic models capture the behavior of individual subjects well.

– **Predicting and Understanding Individual-Level Choice Under Risk**, with Keaton Ellis, UC Berkeley, and Erkut Ozbay, University of Maryland. Version: Sep 30, 2024. Revise and resubmit, *Quantitative Economics*.

> We compare the predictive performance of economic models of choice under risk to various machine learning (ML) models by presenting nearly 1,000 subjects with a consumer decision problem – the selection of a bundle of contingent commodities from a budget set. We compare models' predictions at the individual level and relate them to the consistency of decisions with revealed preference axioms. Using dual measures of completeness and restrictiveness, we show that Expected Utility Theory (EUT) performs as well as non-EUT and outperforms all ML models, with a wider margin as choices align more with utility maximization.

Published and Forthcoming Papers

– **Linking Social and Personal Preferences: Theory and Experiment**, with Bill Zame, UCLA, Bertil Tungodden, NHH, Erik Sørensen, NHH, and Alexander Cappelen, NHH. Version: Mar 16, 2025. Forthcoming, *Journal of Political Economy*.

> We provide necessary and sufficient conditions for linking preferences for personal and social consumption and attitudes toward risk. We also offer an experimental test of the theory in which subjects were confronted with risky personal choices, riskless social choices and risky social choices. Revealed preference tests show that subject choices are generally consistent within each choice domain but frequently involve at least some errors. We test for consistency across choice domains using a revealed preference test that accounts for these errors. The choices of a large majority of subjects are consistent with the predictions of our theory.

– **Ever Since Allais**, with Aluma Dembo, Reichman University, Matthew Polisson, University of Leicester, and John K.-H. Quah, National University of Singapore. Forthcoming, ***Journal of Political Economy***. Version: Feb 13, 2025.

> The Allais critique of expected utility theory (EUT) has led to the development of theories of choice under risk that relax the independence axiom but adhere to the fundamental/conventional axioms of ordering (completeness and transitivity) and monotonicity (with respect to first-order stochastic dominance). Unlike experimental work designed to test independence, our experiment is comprehensive—testing the entire set of axioms on which EUT is based. Our econometric analysis is also nonparametric and performed at the level of each individual subject. For the vast majority of subjects departures from independence are small relative to departures from ordering and/or monotonicity.

– **Physician Altruism and Spending, Hospital Admissions, and Emergency Department Visits**, with Jing Li, University of Washington, Larry Casalino, Cornell, Ray Fisman, Boston University, and Daniel Markovits, Yale Law School. *JAMA Health Forum*, 2024;5(10).

> We investigate the relationship between physician altruism, care quality, and spending. Our study sample includes 250 US primary care physicians and cardiologists, and over 7,500 Medicare beneficiaries. Altruism was measured

using a modified dictator-game experiment, where physicians allocated real money between themselves and an anonymous individual randomly selected from a broadly representative sample of the US population. We found that patients of altruistic physicians had significantly fewer potentially preventable hospital admissions and emergency department visits and incurred lower adjusted Medicare spending. Further research is needed to identify modifiable factors influencing altruism and to explore its impact across various medical practices, specialties, and countries.

- **The Development Gap in Economic Rationality of Future Elites**, with Alexander Cappelen, NHH, Erik Sørensen, NHH, and Bertil Tungodden, NHH. *Games and Economic Behavior*, November 2023, 142, pp. 866-78.

  We test the touchstones of economic rationality – utility maximization, stochastic dominance, and expected-utility maximization – of elite students in the U.S. and in Africa. The choices of most students in both samples are generally rationalizable, but the U.S. students' scores are substantially higher. Nevertheless, the development gap in economic rationality between these future elites is much smaller than the difference in performance on a canonical cognitive ability test, often used as a proxy for economic decision-making ability in studies of economic development and growth. We argue for the importance of including consistency with economic rationality in studies of decision-making ability.

- **The Distributional Preferences of Americans, 2013-2016**, with Ray Fisman, Boston University, Pamela Jakiela, Williams College, and Silvia Vannutelli, Northwestern University). *Experimental Economics*, September 2023, 26, pp. 727–48.

  We study the distributional preferences of Americans during 2013-2016, a period of social and economic upheaval. We decompose preferences into two qualitatively different tradeoffs -- fairness versus self-interest, and equality versus efficiency -- and measure both at the individual level in a large and diverse sample. Although Americans are heterogeneous in terms of both fair-mindedness and equality-efficiency orientation, we find that the individual-level preferences in 2013 are highly predictive of those in 2016. Subjects that experienced an increase in household income became more self-interested, and those who voted for Democratic presidential candidates in both 2012 and 2016 became more equality-oriented.

- **The Response of Consumer Spending to Changes in Gasoline Prices,** with Michael Gelman, Claremont McKenna, Yuriy Gorodnichenko, UC Berkeley, Dmitri Koustas, University of Chicago, Matthew Shapiro, University of Michigan, Dan Silverman, Arizona State University, and Steven Tadelis, UC Berkeley. *American Economic Journal: Macroeconomics,* April 2023, 15(2), pp. 129-60.

  This paper estimates how overall consumer spending responds to changes in gasoline prices. It uses the differential impact across consumers of the sharp drop in gasoline prices in 2014 for identification. This estimation strategy is implemented using comprehensive, high-frequency transaction-level data for a large panel of individuals. The estimated marginal propensity to consume (MPC)out of unanticipated, permanent shocks to income is approximately one. This estimate takes into account the elasticity of demand for gasoline and potential slow adjustment to changes in prices. The high MPC implies that changes in gasoline prices have large aggregate effects

- **Rational Illiquidity and Consumption: Theory and Evidence from Income Tax Withholding and Refunds**, with Michael Gelman, Claremont McKenna, Matthew Shapiro, University of Michigan, and Dan Silverman, Arizona State University. *American Economic Review*, September 2022, 112(9), pp. 2959-91.

  Low liquidity and a high marginal propensity to consume are tightly linked. This paper analyzes this link in the context of income tax withholding and refunds. A theory of rational cash management with income uncertainty endogenizes the relationship between illiquidity and the MPC, and can explain the finding that households tend to spend tax refunds as if they valued liquidity, yet do not act to increase liquidity by reducing their withholding. The theory is supported by individual-level evidence based on financial account records, including a positive correlation between the size of tax refunds and the MPC out of those refunds.

- **Experimental Evidence of Physician Social Preference**, with Jing Li, University of Washington, Larry Casalino, Cornell, Ray Fisman, Boston University, and Daniel Markovits, Yale Law School. *Proceedings of the National Academy of Sciences*, July 2022, 119(28), pp. 1-11.

  Physicians' professional ethics require that they put patients' interests ahead of their own and that they should allocate limited medical resources efficiently. Understanding physicians' extent of adherence to these principles requires understanding the social preferences that lie behind them. These social preferences may be divided into two qualitatively different tradeoffs: the tradeoff between self and other (altruism) and the tradeoff between reducing differences in payoffs (equality) versus increasing total payoffs (efficiency). We experimentally measure social preferences among a nationwide sample of U.S. practicing physicians. Our design allows us to distinguish empirically between altruism and equality-efficiency orientation and to accurately measure both tradeoffs at the level of the individual subject. We further compare the experimentally measured social preferences of physicians to those of a representative sample of Americans, an "elite" subsample of Americans, and a nationwide sample of medical students. We find that physicians' altruism stands out. Although most physicians place a greater weight on self than on other, the share of physicians who place a greater weight on other than on self is twice as large as for all other samples—32% as compared to 15-17%. Subjects in the general population are the closest to physicians in terms of altruism. The higher altruism among physicians compared to the other samples cannot be explained by income or age differences. By contrast, physicians' preferences regarding equality-efficiency orientation are not meaningfully different from those of the general sample and elite subsample and are less efficiency-oriented than medical students.

- **How Individuals Smooth Spending: Evidence from the 2013 Government Shutdown Using Account Data** with Michael Gelman, University of Michigan, Matthew Shapiro, University of Michigan, Dan Silverman, Arizona State University, and Steven Tadelis, UC Berkeley. ***Journal of Public Economics***, September 2020, 189, pp. 103917.

  Using comprehensive account records, this paper examines how individuals adjusted spending and saving in response to a temporary drop in liquidity due

to the 2013 U.S. government shutdown. The shutdown cut paychecks by 40% for affected employees, which was recovered within 2 weeks. Because the shutdown affected only the timing of payments, it provides a distinctive experiment allowing estimates of the response to a liquidity shock holding income constant. Spending dropped sharply, implying a naïve estimate of 58 cents less spending for every dollar of lost liquidity. This estimate overstates the consumption response. While many individuals had low liquid assets, they used multiple sources of short-term liquidity to smooth consumption. Sources of short-term liquidity include delaying recurring payments such as for mortgages and credit card balances.

- **Liquidity Risk in Sequential Trading Networks**, with Maciej Kotowski, Harvard University, and Matthew Leister, Monash University. ***Games and Economic Behavior***, May 2018, 109, pp.565-581.

  This paper studies a model of intermediated exchange with liquidity-constrained traders. Intermediaries are embedded in a trading network and their financial capacities are private information. We characterize our model's monotone, pure-strategy equilibrium. Agents earn positive intermediation rents in equilibrium. An experimental investigation supports the model's baseline predictions concerning agents' strategies, price dynamics, and the division of surplus. While private financial constraints inject uncertainty into the trading environment, our experiment suggests they are also a behavioral speedbump, preventing traders from experiencing excessive losses due to overbidding

- **Social Preferences of Future Physicians,** with Jing Li, University of Washington, and William Dow, UC Berkeley. ***Proceedings of the National Academy of Sciences***, November 2017, 114(48) pp. 10291-10300.

  This paper advances scientific understanding of social preference—a topic of longstanding cross-disciplinary interest—by studying the preferences of future physicians. In making treatment decisions, physicians make fundamental tradeoffs between their own (financial) self-interest, patient benefit, and stewardship of social resources. These tradeoffs affect patient health, adoption of new scientific medical technologies, and the equity and efficiency of our health care system. Understanding physicians' decisions about these tradeoffs requires understanding the social preferences that are behind them. Our main finding that future physicians are substantially less altruistic and more efficiency focused than the average American challenges notions of physician altruism, the fundamental feature of medical professionalism, and has potential implications for policy in a host of health care areas.

- **Distributional Preferences and Political Behavior**, with Ray Fisman, Boston University, and Pam Jakiela, University of Maryland. ***Journal of Public Economics***, November 2017, 155, pp. 1-10.

  We document the relationship between distributional preferences and voting decisions in a large and diverse sample of Americans. Using a generalized dictator game, we generate individual-level measures of fair-mindedness (weight on oneself versus others) and equality-efficiency tradeoffs. Subjects' equality-efficiency tradeoffs predict their political decisions: equality-focused subjects are more likely to have voted for Barack Obama in 2012, and to be

affiliated with the Democratic Party. Our findings shed light on how American voters are motivated by their distributional preferences.

- **The Distributional Preferences of an Elite**, with Ray Fisman, Boston University, Pam Jakiela, University of Maryland, and Daniel Markovits, Yale Law School). ***Science***, September 2015, 349(6254), pp. 1300.

  We study the distributional preferences of an elite cadre of J.D. students at Yale Law School (YLS), a group that hold particular interest because they will assume future positions of power and influence in American society. Our experimental design provides a rigorous test of the rationality of redistributive decisions and allows us to decompose the underlying distributional preferences into two qualitatively different tradeoffs: the tradeoff between fair-mindedness and self-interest, and the tradeoff between equality and efficiency. We find that the YLS subjects are much more rational than subjects drawn from the American Life Panel (ALP) – a large and diverse sample of Americans. The YLS subjects are also less fair-minded than the ALP subjects, and, most importantly, substantially and significantly less inclined to sacrifice efficiency to reduce inequality. We further show that our experimental measure of equality-efficiency tradeoffs predicts the YLS students' career choices: equality-minded subjects are significantly more likely to be employed at non-profit organizations. Finally, we show that two samples of "intermediate" elites display distributional preferences that lie between the YLS elite and the general population, providing further external validation for the experimental results.

- **How Did Distributional Preferences Change During the Great Recession?** with Ray Fisman, Columbia B-School, and Pam Jakiela, University of Maryland. ***Journal of Public Economics***. August 2015, 128, pp. 84–95.

  To better understand how support for redistributive policies is shaped by macroeconomic shocks, we explore how distributional preferences changed during the recent "Great Recession." We conducted identical modified dictator games during both the recession and the preceding economic boom. The experiments capture subjects' selfishness (the weight on one's own payoffs) and equality-efficacy tradeoffs (concerns for reducing differences in payoffs versus increasing total payoffs), which we then compare across economic conditions. Subjects exposed to recession exhibit greater selfishness and higher emphasis on efficacy relative to equality. Reproducing recessionary conditions inside the laboratory by confronting subjects with possible negative payoffs [weakly] intensifies selfishness and increases efficacy orientation, bolstering the interpretation that differing economic circumstances drive our results.

- **Estimating Ambiguity Aversion in a Portfolio Choice Experiment**, with David Ahn, Berkeley, Syngjoo Choi, UCL, and Douglas Gale, NYU. ***Quantitative Economics***, July 2014, 5(2), pp. 195–223.

  We report a portfolio-choice experiment that enables us to estimate parametric models of ambiguity aversion at the level of the individual subject. The assets are Arrow securities corresponding to three states of nature, where one state is risky with known probability and two states are ambiguous with unknown probabilities. We estimate two specifications of ambiguity aversion, one kinked and one smooth that encompass many of the theoretical models in

the literature. Each specification includes two parameters: one for ambiguity attitudes and another for risk attitudes. We also estimate a three-parameter specification that includes an additional parameter for pessimism/optimism (underweighting/overweighting the probabilities of different payoffs). The parameter estimates for individual subjects exhibit considerable heterogeneity. We cannot reject the null hypothesis of Subjective Expected Utility for a majority of subjects. Most of the remaining subjects exhibit statistically significant ambiguity aversion or seeking and/or pessimism or optimism.

- **Harnessing Naturally Occurring Data to Measure the Response of Spending to Income,** with Michael Gelman, University of Michigan, Matthew Shapiro, University of Michigan, Dan Silverman, Arizona State University, and Steven Tadelis, UC Berkeley. ***Science***, July 2014, 345(6193) pp. 212-215.

  This paper presents a new data infrastructure for measuring economic activity. The infrastructure records transactions and account balances, yielding measurements with scope and accuracy that have little precedent in economics. The data are drawn from a diverse population that overrepresents males and younger adults but contains large numbers of underrepresented groups. The data infrastructure permits evaluation of a benchmark theory in economics that predicts that individuals should use a combination of cash management, saving, and borrowing to make the timing of income irrelevant for the timing of spending. As in previous studies and in contrast to the predictions of the theory, there is a response of spending to the arrival of anticipated income. The data also show, however, that this apparent excess sensitivity of spending results largely from the coincident timing of regular income and regular spending. The remaining excess sensitivity is concentrated among individuals with less liquidity.

- **Who is (More) Rational?** with Syngjoo Choi, UCL, Wieland Müller, Tilburg University, and Dan Silverman, Arizona State University. ***American Economic Review***, June 2014, 104(6), pp. 1518–1550.

  Revealed preference theory offers a criterion for *decision-making quality*: if decisions are high quality then there exists a utility function the choices maximize. We conduct a large-scale experiment to test for consistency with utility maximization. Consistency scores vary markedly within and across socioeconomic groups. In particular, consistency is strongly related to wealth: a standard deviation increase in consistency is associated with 15-19 percent more household wealth. This association is quantitatively robust to conditioning on correlates of unobserved constraints, preferences, and beliefs. Consistency with utility maximization under laboratory conditions thus captures *decision-making ability* that applies across domains and influences important real-world outcomes.

- **An Old Measurement of Decision-making Quality Sheds New Light on Paternalism**, with Dan Silverman, Arizona State University. ***Journal of Institutional and Theoretical Economics***, February 2013, 169(1), pp. 29-44.

  Definitive judgment about the quality of decision making is made difficult by twin problems of measurement and identification. A measure of decision-making quality is hard to formalize, to quantify, and to make practical for use in a variety of choice environments; and it is difficult to distinguish

differences in decision-making quality from unobserved differences in preferences, information, beliefs, or constraints. In this paper, we describe a widely applicable set of tools for theoretical analysis and experimental methods for addressing these problems. These tools and methods can indicate a more targeted approach to "light paternalism" polices aimed at improving decision-making quality.

- **Social Learning in Networks: A Quantal Response Equilibrium Analysis of Experimental Data,** with Syngjoo Choi, UCL, and Douglas Gale, NYU. ***Review of Economic Design***, September 2012, 16(2-3), pp. 175-191.

  Individuals living in society are bound together by a social network and, in many social and economic situations, individuals learn by observing the behavior of others in their local environment. This process is called social learning. Learning in incomplete networks, where different individuals have different information, is especially challenging: because of the lack of common knowledge individuals must draw inferences about the actions others have observed, as well as about their private information. This paper reports an experimental investigation of learning in three-person networks and uses the theoretical framework of Gale and Kariv (2003) to interpret the data generated by the experiments. The family of three-person networks includes several non-trivial architectures, each of which gives rise to its own distinctive learning patterns. To test the usefulness of the theory in interpreting the data, we adapt the Quantal Response Equilibrium (QRE) model of McKelvey and Palfrey (1995, 1998). We find that the theory can account for the behavior observed in the laboratory in a variety of networks and informational settings. This provides important support for the use of QRE to interpret experimental data.

- **Network Architecture and Mutual Monitoring in Public Goods Experiments**, with Jeffrey Carpenter, Middlebury College, and Andrew Schotter, NYU. ***Review of Economic Design,*** September 2012, 16(2-3), pp. 93-118.

  Following Fehr and Gäechter (2000), a large and growing number of experiments show that public goods can be provided at high levels when mutual monitoring and costly punishment are allowed. Nearly all experiments, however, study monitoring and punishment in a complete network where all subjects can monitor and punish each other. The architecture of social networks becomes important when subjects can only monitor and punish the other subjects to whom they are connected by the network. We study several incomplete networks and find that they give rise to their own distinctive patterns of behavior. Nevertheless, a number of simple, yet fundamental, properties in graph theory allow us to interpret the variation in the patterns of behavior that arise in the laboratory and to explain the impact of network architecture on the efficiency and dynamics of the experimental outcomes.

- **Network Architecture, Salience and Coordination,** with Syngjoo Choi, UCL, Douglas Gale, NYU, and Thomas Palfrey, Caltech. Version: January 5, 2011. ***Games and Economic Behavior***, September 2011, 73(1), pp. 76-90.

  This paper reports the results of an experimental investigation of dynamic games in networks. In each period, the subjects simultaneously choose whether or not to make an irreversible contribution to the provision of an

indivisible public good. Subjects observe the past actions of other subjects if and only if they are connected by the network. Networks may be incomplete so subjects are asymmetrically informed about the actions of other subjects in the same network, which is typically an obstacle to the attainment of an efficient outcome. For all networks, the game has a large set of (possibly inefficient) equilibrium outcomes. Nonetheless, the network architecture makes certain strategies salient and this in turn facilitates coordination on efficient outcomes. In particular, asymmetries in the network architecture encourage two salient behaviors, strategic delay and strategic commitment. By contrast, we find that symmetries in the network architecture can lead to mis-coordination and inefficient outcomes.

- **An Experimental Test of Advice and Social Learning,** with Boğaçhan Çelen, Columbia B-School, and Andrew Schotter, NYU. Version: June 17, 2010. ***Management Science***, October 2010, 56(10), pp. 1678-1701.

  Social learning describes any situation in which individuals learn by observing the behavior of others. In the real world, however, individuals learn not just by observing the actions of others, but also learn from advice. This paper introduces advice giving into the standard social-learning experiment of Çelen and Kariv (2005). The experiments are designed so that both pieces of information – action and advice – are equally informative (in fact, identical) in equilibrium. Despite the informational equivalence of advice and actions, we find that subjects in a laboratory social-learning situation appear to be more willing to follow the advice given to them by their predecessor than to copy their action, and that the presence of advice increases subjects' welfare.

- **Trading in Networks: A Normal Form Game Experiment,** with Douglas Gale, NYU. Version: September 30, 2008. ***American Economic Journal: Microeconomics***, August 2009, 1(2), pp. 114-132.

  This paper reports an experimental study of trading networks. Networks are incomplete in the sense that each trader can only exchange assets with a limited number of other traders. The greater the incompleteness of the network, the more intermediation is required to transfer the assets between initial and final owners. The uncertainty of trade in networks constitutes a potentially important market friction. Nevertheless, we find that the pricing behavior observed in the laboratory converges to competitive equilibrium behavior in a variety of treatments. However, the rate of convergence varies depending on the network, pricing rule, and payoff function.

- **Sequential Equilibrium in Monotone Games: Theory-Based Analysis of Experimental Data,** with Syngjoo Choi, UCL, and Douglas Gale, NYU. *Journal of Economic Theory*, December 2008, 143(1), pp. 302–330.

  A monotone game is an extensive-form game with complete information, simultaneous moves and an irreversibility structure on strategies. It captures a variety of situations in which players make partial commitments and allows us to characterize conditions under which equilibria result in socially desirable outcomes. However, since the game has many equilibrium outcomes, the theory lacks predictive power. To produce stronger predictions, one can restrict attention to the set of sequential equilibria, or Markov equilibria, or symmetric equilibria, or pure-strategy equilibria. This paper explores the relationship between equilibrium behavior in a class of monotone games,

namely voluntary contribution games, and the behavior of human subjects in an experimental setting. Several key features of the symmetric Markov perfect equilibrium (SMPE) are consistent with the data. To judge how well the SMPE fits the data, we estimate a model of Quantal Response Equilibrium (QRE) (McKelvey and Palfrey 1995, 1998) and find that the decision rules of the QRE model are qualitatively very similar to the empirical choice probabilities.

- **Consistency and Heterogeneity of Individual Behavior under Uncertainty,** with Syngjoo Choi, UCL, Douglas Gale, NYU, and Ray Fisman, Columbia B-School. *American Economic Review*, December 2007, 97(5), pp. 1921-1938. (Some of the results reported here are also distributed in Substantive and Procedural Rationality in Decisions under Uncertainty.)

  By using graphical representations of simple portfolio choice problems, we generate a very rich data set to study behavior under uncertainty at the level of the individual subject. We test the data for consistency with the maximization hypothesis, and we estimate preferences using a two-parameter utility function based on Faruk Gul (1991). This specification provides a good interpretation of the data at the individual level and can account for the highly heterogeneous behaviors observed in the laboratory. The parameter estimates jointly describe attitudes toward risk and allow us to characterize the distribution of risk preferences in the population.

- **Individual Preferences for Giving,** with Ray Fisman, Columbia B-School, and Daniel Markovits, Yale Law School. *American Economic Review*, December 2007, 97(5), pp. 1858-1876. (Previously distributed in three different papers titled Individual Preferences for Giving, and Distinguishing Social Preferences from Preferences for Altruism and Pareto Damaging Behaviors.)

  We utilize graphical representations of Dictator Games which generate rich individual-level data. Our baseline experiment employs budget sets over feasible payoff-pairs. We test these data for consistency with utility maximization, and we recover the underlying preferences for giving (tradeoffs between own payoffs and the payoffs of others). Two further experiments augment the analysis. An extensive elaboration employs three-person budget sets to distinguish preferences for giving from social preferences (tradeoffs between the payoffs of others). And an intensive elaboration employs step-shaped sets to distinguish between behaviors that are compatible with well-behaved preferences and those that are compatible only with not well-behaved cases.

- **Revealing Preferences Graphically: An Old Method Gets a New Tool Kit**, with Syngjoo Choi, UCL, Ray Fisman, Columbia B-School, and Douglas Gale, NYU. *American Economic Review*, Papers & Proceedings, May 2007, 97(2), pp. 153-158.

  This paper describes the necessary tools, both methodological and analytical, for providing a comprehensive individual-level analysis of decision-making under risk. Two distinctive features of the paper are the new experimental technique, and the application of the tools of the theory of consumer demand to individual decision-making in the laboratory. To characterize an individual's decision-making under risk, it is necessary to generate many observations per subject over a wide range of choice sets. An innovative graphical interface was developed for this purpose, where subjects see on a

computer screen a geometrical representation of a portfolio choice problem. Subjects choose portfolios through a simple point-and-click. This intuitive and user-friendly interface allows for the quick and efficient elicitation of many decisions per subject under a wide range of choice scenarios. The experimental platform and analytical techniques that have been developed can also be applied to many types of individual choice problems.

- **Financial Networks**, with Douglas Gale, NYU. *American Economic Review*, Papers & Proceedings, May 2007, 97(2), pp. 99-103.

  Apart from centralized exchanges such as the NYSE, most financial transactions take place in networks where one or more intermediaries link the initial seller and final buyer. This paper presents a model of financial networks, in which financial exchange is intermediated by traders who form a chain of links between the initial owner of the assets and ultimate owner of the assets. Networks are incomplete in the sense that each trader can only exchange assets with a limited number of other traders. The greater the incompleteness of the network, the more intermediation is required to transfer the assets between initial and final owners. Intermediation takes time and time is costly, so incompleteness constitutes a potentially important market imperfection. The cost and uncertainty of trade in networks may give rise to other problems and, in extreme cases, lead to a market breakdown. The results are applicable not just to financial networks but to any model of exchange which shares the same basic network structure.

- **An Experimental Test of Observational Learning under Imperfect Information,** with Boğaçhan Çelen, Columbia B-School. *Economic Theory*, October 2005, 26(3), pp. 677-699.

  To explore the difference between social learning under perfect and imperfect information, this paper takes an experimental look at a situation in which individuals learn by observing the behavior of their immediate predecessors. Our experimental design is based on the theory of Çelen and Kariv (Observational Learning under Imperfect Information) and uses the procedures of Çelen and Kariv (Distinguishing Informational Cascades from herd Behavior in the Laboratory) with the exception that the history of actions observed by subjects is different. We find is that imitation is much less frequent when subjects have imperfect information, even less frequent than the theory predicts. Further, while we find strong evidence that under perfect information a form of generalized Bayesian behavior adequately explains behavior in the laboratory, under imperfect information behavior is not even consistent with this generalization of Bayesian behavior. To reconcile this with the conclusions under perfect information, we undertake a modification of the model that abandons the assumption of common knowledge of rationality.

- **Distinguishing Informational Cascades from Herd Behavior in the Laboratory**, with Boğaçhan Çelen, Columbia B-School. *American Economic Review*, June 2004, 94(3), pp. 484-497.

  This paper reports an experimental test of how individuals learn from the behavior of others. By using techniques only available in the laboratory, we elicit subjects' beliefs. This allows us to distinguish informational cascades (convergence of beliefs) from herd behavior (convergence of actions). By

adding a setup with continuous signal and discrete action, we enrich the ball-and-urn observational learning experiments paradigm of Anderson and Holt (1997). We test a model that explains subjects' behavior as a form of generalized Bayesian behavior that incorporates limits on the rationality of others. We find strong evidence that, in Bayesian terms, subjects put too much weight on their own information and too little weight on the public information. Put differently, subjects are overconfident in the precision of their private information. To put the observed behavior into perspective, we use a simple modification of the Bayesian model, which provides a framework that enables us to understand individual behavior in the laboratory.

- **Observational Learning under Imperfect Information**, with Boğaçhan Çelen, Columbia B-School. *Games and Economic Behavior*, March 2004, 47(1), pp. 72-86.

  This paper explores Bayes-rational sequential decision making in a game with pure information externalities, where each decision maker observes only her predecessor's binary action. Under perfect information, the martingale property of the stochastic learning process is used to establish convergence of beliefs and actions. Under imperfect information, in contrast, beliefs and actions cycle forever. However, despite the instability, over time the private information is ignored, and decision makers become increasingly likely to imitate their predecessors. Consequently, we observe longer and longer periods of uniform behavior, punctuated by increasingly rare switches. These results suggest that the kind of episodic instability that is characteristic of social behavior in the real world makes more sense in the imperfect-information model, and that the imperfect information premise provides a better theoretical description of fads and fashions.

- **Bayesian Learning in Social Networks**, with Douglas Gale, NYU. *Games and Economic Behavior*, November 2003, 45(2), pp. 329-346.

  In this paper, we extend the standard model of social learning in two ways. First, we introduce a social network and assume that agents can only observe the actions of agents to whom they are connected by this network. Secondly, we allow agents to choose a different action at each date. If the network satisfies a connectedness assumption, the initial diversity resulting from diverse private information is eventually replaced by uniformity of actions, though not necessarily of beliefs, in finite time with probability one. We look at particular networks to illustrate the impact of network architecture on speed of convergence and the optimality of absorbing states. Convergence is remarkably rapid, so that asymptotic results are a good approximation even in the medium run.