EC 136

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General purpose: This course is an advanced-level class on decision theory. Decision theory studies an individual's decision making in contrast with game theory, which analyzes interactions between agents. One purpose of decision theory is to develop mathematical models that account for individual decision making. The class follows a specific methodological route-the axiomatic one. This means that instead of suggesting a model directly, we posit potentially testable assumptions (i.e., axioms) about behavior, and then find equivalent ways to model them in mathematically convenient terms.

Decision theory covers many different topics. This year, in this course, we will focus on two topics; (i) stochastic choice; (ii) dynamic choice. We start from (i) and then study (ii) time permitting.

(i) Stochastic choice: The study of stochastic choice is appealing in two ways. First, stochastic choice data are exactly the type of data we observe in empirical analysis. Second, the theory of stochastic choice contains interesting mathematical results that are distinct from those in deterministic choice theory.

However, it can be difficult for a student to gain a unified understanding of the literature on stochastic choice. This difficulty arises from the fact that the literature has developed independently across three different disciplines: psychology, decision theory, and mathematics. In fact, the axiomatization of random utility models was first provided by Falmagne (1978) in mathematical psychology. Without knowing the result, Barbera and Pattanaik (1986) obtained the same axiomatization in economics. Later, Mcfadden and Richter (1990) proposed an alternative axiomatization. Since then, economists, especially empirical researchers, have paid more attention to the result by Mcfadden and Richter (1990) than to the result by Falmagne (1978).

Moreover, ever since Gul and Pesendorfer (2006) generalized the random utility model to incorporate stochastic choice over lotteries, the literature in decision theory has become active again and has grown rapidly.

In this course we will review the classical results achieved by Block and Marschak (1960), Falmagne (1978), and Mcfadden and Richter (1990). Although these results have been regarded as independent of each other, I provide a new unified geometric way to understand these classical results. To demonstrate the usefulness of this geometric insight, I will show my recent preliminary result with Prof. Yusuke Narita (of Yale). In this result, we obtain a necessary and sufficient condition under which any random utility model can be represented by a random-coefficient multinomial logit model. (The result can be seen as a discrete version of the main result of Mcfadden and Train (2000).) Time permitting, I will also provide a detailed explanation of Gul and Pesendorfer (2006). We may also review more recent generalizations, including those in my papers with Prof. Jay Lu (of UCLA), such as Lu (2016), Lu and Saito (2018), and Lu and Saito (2019), as well as those in Frick, Iijima, and Strzalecki (2018).

(ii) Dynamic choice: The study of dynamic choice is important: almost all important decision making in our daily life involves dynamic consideration such as consumption-saving problem (how much we consume this month determines how much we can consume in future). The models of dynamic choice has been used intensively in macroeconomics and finance. (See Backus, Routledge, and Zin (2004)) We study the standard model for dynamic choice as well as popular generalizations of the standard model including Kreps and Porteus (1978) and Epstein and Zin (1991).

Other Information:

- Prerequisites: Ma 2 ab
- Grading:
  - Participation (20%)
  - Midterm Exam (40%)
  - Final Exam (Presentation) (40%): I require that you should ask at least one question every class in the presentation part.
- Class Schedule (Teaching about 10 classes: Presentation about 8 classes)
  - Random choice
    - Random utility model
    - Logit model
    - Mixed logit model
  - Dynamic choice
- Reference for stochastic choice

- Barbera, S. and P. K. Pattanaik (1986): " Falmagne and the rationalizability of stochastic choices in terms of random orderings," Econometrica, 707–715.
- Block, H. D. and J. Marschak (1960): "Random orderings and stochastic theories of responses," Contributions to Probability and Statistics, 2, 97–132.
- Chris Chambers and Federico Echenique "*Revealed Preference Theory*". Cambridge. Oxford University Press
- Falmagne, J.-C. (1978): " A representation theorem for finite random scale systems, " Journal of Mathematical Psychology, 18, 52–72.
- Gul, F. and W. Pesendorfer (2006): "Random expected utility," Econometrica, 74, 121–146.
- McFadden, D. and M. Richter (1990): " Stochastic rationality and revealed stochastic reference," in Preferences, Uncertainty, and Optimality, Essays in Honor of Leo Hurwicz, Boulder, CO: Westview Press, 161–186.
- McFadden, D. and K. Train (2000): " Mixed MNL models for discrete response, " Journal of Applied Econometrics, 447–470.
- Additional References
  - Frick, M., R. Iijima, and T. Strzalecki (2018): " Dynamic random utility, " Working paper.
  - Lu, J. (2016): " Random choice and private information, " Econometrica, 84, 1983–2027.
  - Lu, J. and K. Saito (2018): "Random intertemporal choice," Journal of Economic Theory.
  - Lu, J. and K. Saito (2019): "Repeated choice: A theory of stochastic intertemporal preferences, " Working paper.

- Reference for dynamic choice

  - Backus, David K., Bryan R. Routledge, and Stanley E. Zin. "Exotic preferences for macroeconomists." NBER Macroeconomics Annual 19 (2004): 319–390.
  - Epstein, L. G. and S. E. Zin (1989): "Substitution, Risk Aversion, and the Temporal Behavior of Consumption and Asset Returns: A Theoretical Framework, " Econometrica, 57, 937–969.
  - Kreps, D. M. and E. L. Porteus (1978): " Temporal resolution of uncertainty and dynamic choice theory, " Econometrica, 185–200.

- Participation:

  - At the beginning of each class, I will check your attendance.
  - During the quarter, you need to answer my questions in class at least 20 times.

- Homework:
  - In most of your homeworks, you need to provide mathematical proofs.
  - The proofs must be self-contained and do not have any gaps.
  - Your homeworks must be written by LATEX. I will not accept handwritten homeworks.

- Office Hours: Any time after the class or by appointment.