

Bounded Rationality: Theory and Experiments

Expectations, Social Influence and the Economy (ExSIDE) program

University Ca' Foscari, 9 – 13 October 2017

This course focuses on selected models of bounded rationality of financial markets and their validation in experimental laboratory. We will cover such key concepts of bounded rationality as K-level of thinking theories and reinforcement individual learning theories. Paying special attention to validation of the theories using experimental data, we will review recent experimental work on trading in financial market, expectation formation, and adaptation. In analysing the models and experiments apply some tools of nonlinear dynamics theory will have to be used.

Key topics:

- Bounded rationality, expectations and learning
- K-level of thinking theory
- Economic experiments of financial markets
- Bubbles and crashes in the models and labs
- Heuristic Switching Model, its estimation and validation
- Individual Evolutionary Learning model

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Program (preliminary):

Day 1: Experimental economics. Trading experiments on the market of goods and financial markets. Allocative and Informational efficiency of market mechanisms. Zero-intelligence traders. Individual Evolutionary Learning.

Day 2: Beauty contest experiments. Models of K-level of rationality. Experienced-Weighted Attraction (EWA) Model.

Day 3: Economics as an expectation feedback system. Role of expectations and learning. Learning to Forecast Experiments with 1-period ahead. Model with heterogeneous agents in cobweb economy.

Day 4: Present value asset pricing model of financial market. Financial bubbles and crashes in the lab: trading experiment and learning to forecast experiment. Bubbles and crashes in the model with heterogeneous expectations.

Day 5: Validation of the model with heterogeneous expectations. Heuristic Switching Model. Experiments on switching with exogenous and endogenous profits.

Literature:

Methodology of Experimental Economics

Roth, A.E. (1988): “Laboratory Experimentation in Economics: A Methodological Overview”, *Economic Journal*, 98, 974-1031.

Friedman D. and S. Sunder. (1994): *Experimental Methods: A primer for economists*. Cambridge University Press.

List, J., S. Sadoff and M. Wagner (2011): “So you want to run an experiment, now what? Some simple rules of thumb for optimal experimental design”, *Experimental Economics*

Moffatt P. (2016) *Experimetrics: Econometrics for experimental economics*. Palgrave.

Day 1

Smith, V. (1962): “An experimental study of competitive market behavior”. *Journal of Political Economy*, 70(2), 111-137.

Gode, D. and S. Sunder (1993): “Allocative Efficiency of Markets with Zero-Intelligence Traders: Market as a Partial Substitute for Individual Rationality” *Journal of Political Economy*, 101(1), 119-137.

Anufriev, M., Arifovic, J., Ledyard, J. and V. Panchenko (2013): “Efficiency of continuous double auctions under individual evolutionary learning with full or limited information”, *Journal of Evolutionary Economics* 23 (3), 539-573.

Day 2

Nagel, Rosemarie (1995): “Unraveling in Guessing Games: An Experimental Study,” *American Economic Review*, 85(5), 1313–1326.

Camerer, C. and T.-H. Ho (1999): “Experienced-Weighted Attraction Learning in Normal Form Games”, *Econometrica*, 67(4), 827-874.

Camerer C., Ho T.-H., and J.-K. Chong (2004): “A Cognitive Hierarchy Model of Games”, *Quarterly Journal of Economics*, 119(3), 861-898.

Day 3

Hommes, C. (2013): *Behavioral Rationality and Heterogeneous Expectations in Complex Economic Systems*. Cambridge University Press. Chapters 1, 5, 8.1, 8.2, 8.5.

Brock, W.A. and Hommes, C.H. (1997), “A rational route to randomness”, *Econometrica*, 65, 1059-1095.

Heemeijer, P., C. Hommes, J. Sonnemans, and J. Tuinstra (2009): “Price stability and volatility in markets with positive and negative expectations feedback: An experimental investigation,” *Journal of Economic Dynamics and Control*, 33, 1052-1072.

Day 4

- Lei, V., C. Noussair, and C. Plott (2001): “Nonspeculative Bubbles in Experimental Asset Markets: Lack of Common Knowledge of Rationality vs. Actual Irrationality.” *Econometrica*, 69(4): 831–59.
- Kirchler, M., J. Huber, and T. Stöckl (2012): “Thar She Bursts: Reducing Confusion Reduces Bubbles”, *American Economic Review*, 102(2): 865–883.
- Hommes, C. (2013): “Behavioral Rationality and Heterogeneous Expectations in Complex Economic Systems” Cambridge University Press. Chapter 6.
- Brock, W.A. and Hommes, C.H. (1998), “Heterogeneous beliefs and routes to chaos in a simple asset pricing model”, *Journal of Economic Dynamics and Control*, 22 (8), 1235-1274.

Day 5

- Anufriev, M. and C. Hommes (2012): “Evolutionary Selection of Individual Expectations and Aggregate Outcomes in Asset Pricing Experiments”, *American Economic Journal: Microeconomics*, 4 (4), pp. 35-64.
- Anufriev, M., C. Hommes and R. Philipse (2013): “Evolutionary Selection of Expectations in Positive and Negative Feedback Markets”, *Journal of Evolutionary Economics*, 23(3), 663-688.
- Anufriev, M., T. Bao and J. Tuinstra (2015): “Microfoundations for switching behavior in heterogeneous agent models: An experiment”, *Journal of Economic Behavior & Organization* 129, 74-99

Other suggested reading:

Day 1:

- Sunder S. (1995): “Experimental Asset Markets: A Survey”, pp. 445-500, in *Handbook of Experimental Economics* (Vol.1) ed. by Kagel J. and A. Roth.
- Arifovic, J. and J. Ledyard (2007): “Call market book information and efficiency”, *Journal of Economic Dynamics and Control*, 31(6), 1971-2000.
- Chamberlin, E. H. (1948): “An Experimental Imperfect Market”, *Journal of Political Economy*, 56 (2), 95-108.
- Fano, S., LiCalzi, M. and P. Pellizzari (2013): “Convergence of outcomes and evolution of strategic behavior in double auctions” *Journal of Evolutionary Economics*, 23(3), 513-538.
- Forsythe, R., Palfrey, T. and C. Plott (1982): “Asset Valuation in an Experimental Market”, *Econometrica*, 50(3), 537-567.
- Gode, D. K., and S. Sunder (1997): “What makes markets allocationally efficient?” *Quarterly Journal of Economics*, 112(2), 603-630.

Plott, C. R. and S. Sunder (1982): "Efficiency of Experimental Security Markets with Insider Information: An Application of Rational-Expectation Models", *Journal of Political Economy* 90(4), 663-698.

Plott C. R. and S. Sunder (1988): "Rational Expectations and Aggregation of Diverse Information in Laboratory Security Markets", *Econometrica*, 56(5), 1085-1118.

Sunder, S. (1992): "Market for Information: Experimental Evidence", *Econometrica*, 60(3), 667-695.

Day 2:

Agranov, M., Caplin, A. and C. Tergiman (2015): "Naive play and the process of choice in guessing games", *Journal of Economic Science Association*, 1 (2), 146-157.

Bosch-Domenech, A., Montalvo J. G., Nagel, R., and A. Satorra (2002): "One, two,(three), infinity,...: Newspaper and lab beauty-contest experiments", *American Economic Review*, 92(5), 1687-1701.

Costa-Gomes, M., and V. Crawford (2006): "Cognition and Behavior in Two-Person Guessing Games: An Experimental Study." *American Economic Review*, 96(5): 1737-1768.

Güth, W., Kocher, M. and M. Sutter (2002): "Experimental 'beauty contests' with homogeneous and heterogeneous players and with interior and boundary equilibria." *Economics Letters*, 74(2), 219-228.

Ho, T.-H., Camerer C. and K. Weigelt, (1998) "Iterated Dominance and Iterated Best-response in p-Beauty Contests," *American Economic Review*, 88, 947-969.

Sutan, A. and M. Willinger (2009): "Guessing with negative feedback: An experiment", *Journal of Economic Dynamics and Control*, 33, 1123-1133.

Day 3:

Bao, T., Duffy, J. and C. Hommes (2013): "Learning, forecasting and optimizing: An experimental study", *European Economic Review*, 61, 186-204.

Bao, T., Hommes, C., Sonnemans, J. and J. Tuinstra (2012): "Individual expectations, limited rationality and aggregate outcomes", *Journal of Economic Dynamics and Control*, 36(8), 1101-1120.

Hommes, C. (2011): "The heterogeneous expectations hypothesis: Some evidence from the lab", *Journal of Economic Dynamics and Control*, 35(1), 1-24.

Hommes, C., and T. Lux (2013): "Individual expectations and aggregate behavior in learning-to-forecast experiments." *Macroeconomic Dynamics*, 17(2), 373-401.

Hommes, C., Sonnemans, J., Tuinstra, J. and H. van de Velden (2007): "Learning in cobweb experiments", *Macroeconomic Dynamics*, 11(S1), 8-33.

Sonnemans, J. and J. Tuinstra (2010): "Positive expectations feedback experiments and number guessing games as models of financial markets," *Journal of Economic Psychology*, 31, 964-984.

Day 4:

Haruvy, E., Lahav, Y. and C.N., Noussair (2007): "Traders' Expectations in Asset Markets: Experimental Evidence", *American Economic Review*, 97(5), 1901-1920.

Hommes, C., Sonnemans, J., Tuinstra, J. and H. van de Velden (2004): "Coordination of expectations in asset pricing experiments", *Review of Financial Studies*, 18(3), 955-980.

Hommes, C., Sonnemans, J., Tuinstra, J. and H. van de Velden (2008): "Expectations and bubbles in asset pricing experiments", *Journal of Economic Behavior & Organization*, 67(1), 116-133.

Smith V., G. Suchanek and A. Williams (1988): "Bubbles, Crashes and Endogenous Expectations in the Experimental Spot Asset Markets", *Econometrica*, 56(5), 1119-1151.

Day 5:

Anufriev, M. and C. Hommes (2012): "Evolution of market heuristics", *Knowledge Engineering Review*, 27(2), 255-271.

Anufriev, M., Chernulich A., and J. Tuinstra (2017): "A laboratory experiment on the heuristic switching model", mimeo.