Discussion: Ambiguity and the Business Cycle by Altug, Cakmakli, Mukerji, and Ozsoylev

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Uncertainty

- Uncertainty distinct from risk: Knight (1921), Keynes (1921; 1937), Mises (1940; 1949)
- At the heart of the recent economic crisis: Blanchard's article at *Economist*
- Altug et al. incorporate uncertainty into business cycle models (going beyond applications in finance)
  - Uncertainty about model specification
  - Where macro is headed IMHO

Relaxing Rational Expectations

- RE a good benchmark but too strong
- Relaxation of RE in the literature:
  - Ambiguity represented by multiple priors
    - Maxmin: Gilboa and Schmeidler (1989), Epstein and Schneider (2003); Epstein and Wang (1994); Hansen and Sargent (XXXX)
    - Smooth ambiguity: Klibanoff, Marinacci, and Mukerji (2005; 2009; 2012); Ju and Miao (2012); ACMO
  - Rational inattention: Sims (XXXX); Wiederholt and Mackowiak (2009)
  - Econometric learning: Sargent (2001); Evans and Honkapohja (XXXX); Preston and Eusepi (2011)
  - Higher order beliefs: Morris and Shin (1998; 2002); Nimark (2014)
  - Learning and equilibrium selection in game theory: Fudenberg and Levine (1998); Young (2009; 2012)

Two Ingredients

- Smooth ambiguity and irreversible investment
- The source of uncertainty is productivity growth process
  - Stochastic processes that are difficult to distinguish one from another; Bansal and Yaron (2004) demonstrated the relevance of such mechanism for the US consumption
- Irreversible investment is an important feature for macro (Bernanke, 1983)
  - But this alone is not sufficient for matching fluctuations in aggregate time series (Veracierto, 2002)
- The intended outcome: wait and see
  - The uncertainty amplifies the effect of the irreversibility
  - Related to the literature on lumpy investments (Guo, Miao, and Morellec, 2005)
- Nice parallel with Hansen and Sargent (2008)'s robust control approach
  - Ambiguity, Bayesian learning, and asset pricing implications

Preliminary Results

- Welfare theorems
- Modigliani-Miller theorem