

Adaptive Learning as a Propagation Mechanism^{*}

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ABSTRACT

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Dynamic stochastic general equilibrium models of the business cycle often rely heavily on unobserved exogenous shocks to match the volatility and persistence of observed macroeconomic data. This reflects the weak amplification and propagation mechanism inherent of these models. Both in real and monetary models of business cycle fluctuations, model foundations have been enriched by adding various frictions — such as adjustment costs to investment and pricing decisions and habit formation in consumption and decision delays— to enhance the amplitude and persistence of internal propagation of exogenous disturbances.

In this paper we explore the role of adaptive learning as a potential amplification and propagation mechanism of shocks. We consider a simple RBC model, augmented with cost complementarities in the production of consumption and investment goods. As shown in Beaudry and Portier (2006) this simple modification of the benchmark RBC framework engenders the possibility of expectations-driven business cycles. Economic agents are assumed to have incomplete knowledge about the economic environment and therefore do not know the true structural model determining aggregate variables. As in Marcet and Sargent (1989) and Evans and Honkapohja (2001), agents forecast the set of state variables relevant to their decision problems beyond their control using a-theoretical regression models.

The agents' learning process renders the model self-referential: the evolution of firm and household beliefs influence the actual realizations of observed macroeconomic variables so that learning induces time variation in the data generating process. Because expectations are not well anchored as in a rational expectations analysis of the model, shifts in expectations (changing beliefs) may provide a plausible source of business cycle fluctuations.

In the model, productivity shocks represent the exogenous driving force of business cycle. In the absence of learning the model displays a weak propagation mechanism, as shown for example in Cogley and Nason (1995). We first evaluate the role that cost complementarities and adjustment costs to investment have in enhancing the role of learning as a propagation mechanism and also evaluate whether learning alone serves to generate sufficient persistence in model dynamics. To do so, we establish a connection between the local stability properties of the model under learning (E-Stability) and the asymptotic distribution of agents beliefs in the simulated economy. The role of different parameters in the model in the dispersion of

agents beliefs is evaluated. We then determine the effects of the dispersion of beliefs on the volatility and persistence of the data generating process in the model.

Finally, following Smith (1993), we estimate the model using indirect inference methods. The empirical implications of the model both under learning and rational expectations are explored. Furthermore, we test the relative importance of various model frictions and learning dynamics in capturing the volatility and persistence of observed macroeconomic data.

References

Beaudry and Portier (2006), "When Can Changes in Expectations Cause Business Cycle Fluctuations in Neo Classical Settings?", forthcoming Journal of Economic Theory.

Cogley and Nason (1995), "Output Dynamics in Real Business Cycle Models", American Economic Review, 85, 492-511.

Evans and Honkapohja (2001), *Learning and Expectations in Macroeconomics*, Princeton.

Marcet and Sargent (1989), "Convergence of Least-Square Learning Mechanisms in Self Referential Linear Stochastic Models", Journal Of Economic Theory, 48, 337-368.

Smith (1993), "Estimating Non-Linear Time Series Models Using Simulated Vector Autoregressions", Journal of Applied Econometrics, 8 , S63-S84.