

Recursive equilibria in dynamic economies with boundedrationality

Runjie Geng

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Abstract: This paper provides a general framework to model bounded rationality in dynamic stochastic general equilibrium models with infinitely lived heterogeneous agents. A boundedly rational agent is associated with an information set I and an extra parameter ϵ , which can be interpreted as the “level of irrationality”. To make decisions, the boundedly rational agent forms a belief of a stationary joint distribution of the exogenous and endogenous variables and uses the marginal distribution (conditional on I) to form forecasts. If the equilibrium distribution stays within ϵ of the forecasted next-period distribution, the agent would consider it as ϵ -stationary. In equilibrium, each agent maximizes utility with an ϵ -stationary belief and markets clear. The main theorem of this paper shows that for any strictly positive ϵ , a recursive equilibrium exists. With a quantifiable “level of irrationality”, the model incorporates many behavioral economics models as well as rational-expectations models with computational approximations into a unified framework.

There are predominately two ways in which bounded rationality arises in economic models. One is as a deliberate modeling choice to describe the cognitive limitations of human minds. The other is through the backdoor: econometricians who are, because of their own limitations, unable to compute precise equilibria make simplifying assumptions on agents’ information sets or policy functions rendering the modeled agents boundedly rational. In this paper, we provide a general way of modeling bounded rationality in the dynamic stochastic general equilibrium framework, which gives a theoretical underpinning for both forms of bounded rationality. The boundedly rational agent in this model deviates from the rational agent in two aspects: first, the information set the agent uses may differ from the full information set that contains values of all exogenous and endogenous variables in the economy; second, this paper breaks the link between agents’ models of the economy and the economic model they inhabit, thus relaxing the rational-expectations assumption. The boundedly rational agent forms a belief of a stationary joint distribution of the exogenous and endogenous variables and uses the marginal distribution (conditional on her information set) to form forecasts. If the equilibrium distribution stays within ϵ of the forecasted next-period distribution, the agent would consider it as ϵ -stationary. In equilibrium, each agent maximizes utility with an ϵ -stationary belief and markets clear. In this way, the agents are allowed to make mistakes when forming beliefs, but their mistakes are bounded by their “level of irrationality” ϵ . The main contributions of the paper are twofold. First, we prove the existence of recursive equilibria for any strictly positive ϵ , thereby providing a theoretical foundation for numerically computed equilibria

using recursive methods with a generalized information structure. Second, we provide a general way of modeling bounded rationality and measuring the “level of irrationality”, which helps to explain behavioral biases while retaining discipline on model predictions.