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Bayesian Networks and Boundedly Rational Expectations

CFM-DP2014-17

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I present a framework for analyzing decision makers with an imperfect understanding of their environment's correlation structure. The framework borrows the tool of "Bayesian networks", which is ubiquitous in statistics and artificial intelligence. In the model, a decision maker faces an objective multivariate probability distribution (his own action is one of the random variables). He is characterized by a directed acyclic graph over the set of random variables. His subjective belief filters the objective distribution through the graph via the factorization formula for Bayesian networks. This representation of the relation between objective and subjective distributions enables us to capture a variety of systematic departures from rational expectations, such as excessively coarse subjective models, reverse causality, missing variables, and various attribution errors. Optimal choices in this model is fundamentally an equilibrium notion, because the decision maker's own long-run behaviour may affect his perception (via his distorted beliefs) of the consequences of his own actions. Accordingly, I define a "personal equilibrium" notion of optimal choices. A few stylized macroeconomic illustrations of this framework are presented. In particular, I formalize the intuition that an incorrect causal interpretation of the debt-output correlation may lead to sub-optimal fiscal policy, and I translate Sargent's (1999) argument that a mis-specified Phillips curve can cause a central banker to implement above-optimal inflation.