

Stochastic Choice and Noisy Beliefs in Games: an Experiment*

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JOB MARKET PAPER #1

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Abstract

We study an equilibrium model in which players make stochastic choices given their beliefs *and* there is noise in the beliefs themselves. The model primitives are an action-map, which determines a distribution of actions given beliefs, and a belief-map, which determines a distribution of beliefs given opponents' behavior. These are restricted to satisfy axioms that are stochastic generalizations of “best response” and “correct beliefs”, respectively. In our laboratory experiment, we collect actions data and elicit beliefs several times for each game within a family of asymmetric 2-player games. These games have systematically varied payoffs, allowing us to “trace out” both the action- and belief-maps. We find that, while both “noise in actions” and “noise in beliefs” are important in explaining observed behaviors, there are systematic violations of the axioms. In particular, although all subjects observe and play the same games, subjects in different roles have qualitatively different belief biases. To explain this, we argue that the player role itself induces a higher degree of strategic sophistication in the player who faces more asymmetric payoffs, and this is confirmed by structural estimates.

Keywords: beliefs; quantal response equilibrium; noisy belief equilibrium

JEL Classification: C72, C92, D84

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Stochastic Equilibria: Noise in Actions or Beliefs?*

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JOB MARKET PAPER #2

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Abstract

Much is known about the empirical content of quantal response equilibrium (QRE) which relaxes the rationality requirement of Nash equilibrium by allowing for “noise in actions” while maintaining that beliefs are correct. By contrast, little is understood of the testable restrictions of equilibrium models which allow for “noise in beliefs” while maintaining best response. We introduce noisy belief equilibrium (NBE) for normal form games in which axioms restrict belief distributions to be *unbiased with respect to* and *responsive to changes in* the opponents’ behavior. The axioms impose testable restrictions both within and across games, and we compare these restrictions to those of regular QRE (*Goeree et al. 2005*) in which axioms are placed on the quantal response function as the primitive. We show that NBE generates similar predictions as QRE such as the “own payoff effect”, and yet is more consistent with the empirically documented effects of changes in payoff magnitude. Unlike QRE, NBE is a refinement of rationalizability and invariant to affine transformations of payoffs.

Keywords: beliefs; quantal response equilibrium; discrete choice models

JEL Classification: C72, C92, D84

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