Modelling Noisy Decisions

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Economists typically model risky choices using expected utility theory. Consider, for example, the choice between one gamble offering a 50% chance of winning 10 (otherwise nothing) and another offering a 25% chance of winning 30 (otherwise nothing). According to expected utility theory, amounts are first transformed into utilities by a utility function *U*, the expected (i.e., average) utility for each gamble is calculated, and the gamble with the higher utility is selected. Continuing the example, the first gamble is selected if $.50\times U(10) > .25\times U(30)$, the second gamble is selected if $.50\times U(10) < .25\times U(30)$, and there is indifference between the options if $.50\times U(10) = .25\times U(30)$.

But there is a problem with this theory. When presented with exactly the same choice on two different occasions people do not always make the same decision. Even though the expected utilities are the same on both occasions, actual choices can and do differ. Typically, choices reverse on one quarter to one third of repeated choices. Choices are said to be noisy.

There are two prominent approaches to modelling this noise. In one approach, the core utility of each option is calculated, and then noise is added to the utilities. Noise will be different on different occasions, and so choices can also differ on different occasions. In another approach, the decision maker has a set of different utility functions from which one is selected at random on each occasion. The utility function differs on different occasions, and so choices can also differ on different occasions. Recently these models have been compared in their ability to explain noise in risky decision making (e.g., Blavatsky & Pogrebna, 2010).

However, it seems likely that two different approaches to modelling noise might, under some circumstances, make very similar predictions, and may even be formally equivalent. This project will explore the relationship between the models using formal techniques from mathematical psychology. The goal is to produce a unifying model, integrating both approaches.

This project would suit a researcher with an interest in behavioural economics or economic psychology. Some mathematical competence would be required. Training will be given in the modelling techniques used. The intention is to submit the work for publication. This work is part of a larger collaboration between psychologists and economists, and could certainly form the beginnings of a PhD in this field.

Suggested reading:

Loomes, G. (2005). Modelling the stochastic component of behaviour in experiments: Some issues for the interpretation of data. *Experimental Economics, 8,* 301-323.

Blavatskyy, P., & Pogrebna, G. (2010). Models of stochastic choice and decision theories: Why both are important for analyzing decisions. *Journal of Applied Econometrics, 25,* 963-986.

Blavatskyy, P. R. (2007). Stochastic expected utility theory. *Journal of Risk and Uncertainty, 34,* 259-286.

Loomes, G., & Sugden, R. (1995). Incorporating a stochastic element into decision theories. *European Economic Review, 39,* 641-648.