

# Learning and Investor Behavior under Ambiguity

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Amos Tversky and several coauthors proposed the concept of sources of uncertainty to describe the richness of behavior when probabilities are unknown (Tversky and Kahneman, 1992; Tversky and Fox, 1995; Tversky and Wakker, 1995). A source of uncertainty is a mechanism that generates uncertainty. For example, the result of a football match is a source of uncertainty as is the temperature in Beijing tomorrow. Tversky showed that people's attitude to uncertainty depends on how competent they consider themselves about the source that generates the uncertainty (this is called the comparative ignorance hypothesis by Fox and Tversky, 1995). A Dutch football fan might consider the results of a football match as a source of uncertainty he feels competent about while the temperature in Beijing is an example of a source he does not know much about. He might then prefer betting on a football match to playing roulette (in which probabilities are known), but he might still prefer playing the roulette to betting on the temperature in Beijing. Sources of uncertainty not only impact people's (dis)like of the situation but also their sensitivity to changes in likelihood (Abdellaoui et al., 2011; Kilka and Weber, 2001). The combination of these two insights constitutes what Abdellaoui et al. (2011) call the richness of uncertainty.

Psychological and economic evidence supporting the existence of sources of uncertainty abounds. However, evidence about the formation of sources and their evolution when decision makers receive information is thin on the ground. Extant studies have adopted a static perspective, comparing different sources at a fixed point in time. When people receive information about a source, they update their beliefs, but we know little about whether they will also change their attitude towards the source.

To answer this question, we ran an experiment in which subjects receive new information about sources. Because both attitudes towards the source and beliefs change with the arrival of new information, it is crucial to separate the two. In our experiment, we used a new elicitation method based on the source method (Abdellaoui et al, 2011) which

makes such a separation possible. We used real financial data: the case of investors learning the return of a stock after an Initial Public Offering (IPO). We distinguished the following three situations in which subjects had different levels of information about a source:

- The IPO had not yet occurred and the exercise date of the option is in 21 trading days. Therefore, the subjects had no information about the return of the stocks.
- The IPO had occurred 5 trading days ago and the exercise date of the option is in 16 trading days. The subjects could make use of the information generated by one week of trading.
- The IPO had occurred 20 trading days ago and the exercise date of the option is in 1 trading day. The subjects could make use of the information generated by 20 days (roughly one month) of trading.

Every subject made five choices (four to elicit his beliefs and his attitudes towards the source of uncertainty and consistency check) for each of the three situations above. Five extra choices were asked for control of utility curvature. Upon completion of the experiment, subjects could verify the stock data on Yahoo-finance.

Our findings show that, new information about a stock increased subjects' sensitivity to changes in likelihood but their (dis)like of the source (ambiguity aversion) was unaffected. Sensitivity to likelihood is often considered a cognitive component of people's ambiguity attitude, while ambiguity aversion is considered as a motivational component. Our findings suggest that, through learning of information, subjects became more competent in distinguishing the difference between different likelihoods, implying a cognitive improvement.