Extended Abstract

Probabilistic Literacy: Measurement and Applications

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Beliefs about the probabilities of future events play a central role in many economic decisions over the life cycle. To measure these beliefs, a number of household surveys have adopted expectations measures in a probabilistic format as queried in the Health and Retirement Study. For example, respondents are asked the subjective probability that they will survive to age 75; workers are asked to give the subjective probability that they will work past age 62. These data have been found to be strongly predictive of future outcomes: respondents whose subjective probability of survival is relatively high survive longer; workers whose subjective probability of working past 62 is relatively high work longer. However, reported subjective probabilities have some response anomalies, such as rounding, excessive use of 50% and over prediction of rare events.

The importance of heterogeneity in financial literacy led us to assume that some of these anomalies are due to heterogeneity across persons in the ability to think in probabilistic terms. So,we developed a short survey battery to detect mistakes in people's probabilistic thinking. The battery included questions that ranged from very easy to quite hard so as to provide good separation of respondents by ability. The battery was included in three waves of the high frequency RAND American Life Panel Financial Crisis Survey (N=2873).

We found large heterogeneity in probabilistic thinking. The typical individual answered about 70% of the questions correctly, and most answered the simplest questions right. However, more than half of the people were not able to compute the probabilities of independent joint events, and about 10 percent incorrectly answered even the simplest questions, such as choosing if 30% or 70% is more likely. From the answers we created a probabilistic literacy score which is highly predictive of response anomalies, and correlates strongly with many variables such as education and cognitive ability.

Furthermore, we see evidence that performance on our literacy battery at least partly reflects whether individuals are paying attention to expectation questions: 1) people who score low on probabilistic literacy appear to provide answers to expectations questions that are much less stable over time, much more "random"; 2) performance on many literacy questions appears unstable as well; 3) a random half of individuals who answered these questions early on in the survey with a fresher mind performed significantly better.

In the second part of the paper we bring together the data on probabilistic literacy with data on subjective probabilities that were previously collected in the ALP. We test whether those who score higher on probabilistic literacy indeed provide probability answers that are more predictive of their economic behavior. The data on economic behavior come in the form of stated preferences so that we can control for unobserved individual tastes. We asked six hypothetical questions about whether people find certain insurance products good or bad deals (as well as purchase probabilities and reservations prices). These products offered insurance against 1) job-loss; 2) disability; 3) falling housing prices; 4) falling stock prices; 5) moving to a nursing home; and 6) surviving to old age. All of these insurance products mimicked a subjective probability question in the ALP. For example, the ALP asks individuals about the percent chance they will ever move to a nursing home. Then, we presented them with a hypothetical insurance product that paid $100,000 if a purchaser ever moved to a nursing home at a price of $10,000 today. As theory predicts, we found that people were more likely to find this insurance product a good deal (and they gave higher purchase probabilities and reservation prices) if their expectations about moving to a nursing home were higher. However, most importantly the relationship was found to be strong and consistent among those who scored high in probabilistic literacy, and it was weak and typically non-significant among those who scored low on probabilistic literacy. These results imply that there is strong individual heterogeneity in the quality of the subjective probabilistic expectations data that are being collected in surveys; and a non-significant portion of the population might find it challenging to properly evaluate the value of stochastic products like insurances.

We conclude the paper by offering guidance about how the estimation of models of choice behavior that embed subjective probabilities might be improved by using a measure of probabilistic literacy. For example, among those who are highly probabilistically literate the subjective probability of survival should better describe saving behavior in a life-cycle model than population survival rates calculated from a life table. But among those who are probabilistically illiterate the life table values may better describe saving behavior.