Signal-based Learning Models without the Rational Expectations Assumption: Identification and Counterfactuals (Job Market Paper)

The decisions of economic agents are often affected by their beliefs about relevant future outcomes. An accurate characterization of these beliefs is crucial for estimating decision rules and conducting counterfactual analysis. While the traditional approach for characterizing beliefs typically involves imposing some form of Rational Expectations (RE), a recent burgeoning literature on the direct elicitation of subjective expectations is motivated by the appeal of relaxing this assumption. Since expectations data are often unavailable in standard datasets, I propose an alternative method to jointly identify and estimate individuals’ beliefs and decision rules without either the RE assumption or expectations data. Specifically, I consider learning models in which individuals use signals to update their beliefs about an unknown permanent factor and repeatedly make decisions based on these beliefs. Econometricians observe individuals’ decisions and the signals they receive at each period. Identification builds on an assumption that is both intuitively appealing and standard in the literature: The posterior mean of the distribution describing beliefs is the same as the prior mean whenever the signal equals the prior mean. If individuals’ decisions only depend on the mean of the distribution describing beliefs in a time-invariant fashion, this assumption implies that the prior mean for individuals who do not change decisions in two consecutive periods equals the signal they receive between periods. Using data from the Berea Panel Study, I demonstrate the empirical importance of relaxing the RE assumption by applying my method to estimate the relationship between college students’ study time and their beliefs about learning ability as measured by the ratio of semester GPA to study time. I find that high expectations about own learning ability have a negative effect on students’ study effort. The RE assumption is rejected at a 10% level for students who spent less than 2 hours per day studying in high school. These students over-estimate their learning ability in college. Incorrectly imposing the RE assumption would lead to a much more negative estimate of the effect of beliefs about learning ability on college study time.

Uncertainty about Future Income: Initial Beliefs and Resolution during College (with Todd Stinebrickner and Ralph Stinebrickner), Quantitative Economics, 10(2), 607-641, 2019.

We use unique data from the Berea Panel Study to characterize how much earnings uncertainty is present for students at college entrance and how quickly this uncertainty is resolved. We characterize uncertainty using survey questions that elicit the entire distribution describing one’s beliefs about future earnings. Taking advantage of the longitudinal nature of the expectations data, we find that roughly two-thirds of the income uncertainty present at the time of entrance remains at the end of college. Taking advantage of a variety of additional survey questions, we provide evidence about how the resolution of income uncertainty is influenced by factors such as college GPA and college major, and also examine why much income uncertainty remains unresolved at the end of college. This paper also contributes to a literature interested in understanding the relative importance of uncertainty and heterogeneity in determining observed earnings distributions.


While a large literature is interested in the relationship between family and labor supply outcomes, little is known about the expectations of these objects at earlier stages. We examine these expectations, taking advantage of unique data from the Berea Panel Study. In addition to characterizing expectations, starting during college, the data details outcomes for ten years after graduation, which allows for a direct comparison of beliefs and outcomes. On average, both male and female college students are well-informed about the future gender gap in labor supply. Gender differences in beliefs about this future gap are primarily explained by gender differences in beliefs about how future family outcomes are related to future labor supply. Methodological contributions come from an approach for addressing measurement error in survey questions and the recognition that expectations data, along with longitudinal data, can potentially help address endogeneity issues that are present because changes in dependent variables are influenced by changes in beliefs.