

Research Statement

My research focuses on how economic agents form their expectations, with a particular emphasis on information limitations and processing constraints. Recent work has documented that economic agents' expectations differ in pronounced ways from the full-information benchmark commonly used in macroeconomic models, but how best to interpret those deviations, and how to model them, remains an open question. My research sheds new light on how to interpret and quantify those deviations. I have focused in particular on two main areas – information frictions and level-k thinking. Information frictions describe the challenges or costs that agents face in collecting information, costs that result in agents forming optimal forecasts that include dated or imperfect information. Level-k thinking, also termed depths of reasoning, describes agents' inability to consider the full general equilibrium effects of their own actions or beliefs due to computing constraints or limitation in reasoning.

Information Frictions

My research touches on three different classes of information frictions, or explanations for why agents might deviate from the full-information benchmark. Noisy or imperfect information, as in Woodford (2001), arises when agents can observe noisy signals about the state they are trying to estimate. The noise in the signals induces them to optimally downplay new information they receive. Rational inattention models following the seminal work of Sims (2003) and Makowiak and Wiederholt (2009, 2015), limit information by imposing a processing cost. Given a finite ability to process information, agents must endogenously choose how to allocate their information resources. I also consider imperfect knowledge about the structure of the economy, studied for example by Orphanides and Williams (2005), as an alternative form of limited information on the part of economic agents. Each approach creates lags between the occurrence of macroeconomic shocks and when these shocks fully register in agents' expectations. The resulting discrepancy between actual economic conditions and agents' expectations of these conditions has pronounced implications for macroeconomic dynamics. My work focuses primarily on the empirical estimation of these frictions and how to distinguish and quantify each.

In “What Do (and Don't) Forecasters Know about U.S. Inflation” I first develop a new framework for estimating the degree of noisy information using *individual* forecasts from agents, whereas previous work has focused on mean forecasts. My novel approach is more powerful because it brings to bear the power of much more variation in the data and can also be applied more generally than the standard framework across multiple forecasting horizons. I further extend this framework to incorporate forecaster misperception of the structural parameters of the underlying process, so this extended specification nests different forms of information limitations that can apply to economic agents. Applying this framework to U.S. inflation forecasts of professional forecasters, I find that this distinction matters: forecasters display much less noisy information than found in previous work but significantly misperceive the underlying persistence of the inflation process. Accordingly, I develop a structural model to jointly estimate noisy information and parameter misperception and quantify the relative importance of each friction in accounting for the dynamics of agents' forecasts. This work illustrates that, even for professional forecasters, there are multiple economically significant forces driving them away from the full-information benchmark.

In “Time-Varying Attention,” I further exploit the individual dimension of forecaster data and develop a *time-varying* measure of the average information flow of forecasters in the Survey of Professional Forecasters. I document forecasters show increasing attention to inflation over time but decreasing attention to unemployment. I further show that for each of these variables, periods of greater attention also display greater cross-sectional dispersion of attention across forecasters. This indicates that circumstances calling for higher attention also prompt the greatest heterogeneity in forecaster reaction.

Depths of Reasoning or Level-k Thinking

I also work with depths of reasoning or higher-order (level-k) thinking, a new channel for explaining information frictions that can affect aggregate dynamics. Level-k thinking describes the limitations of economic agents in anticipating the higher order effects of their beliefs or actions. This concept derives from the Keynesian beauty contest in which newspaper readers are asked to select the six most attractive people from one hundred pictures to win a prize. The prize will be awarded to those who pick the most popular faces. Some readers will choose the faces most pleasing to them; these readers do not engage in strategic thinking about the beliefs of others and are therefore considered naïve or low-level thinkers. Readers engaging in one level more of thinking will consider not their own preferences but the pictures likely to appeal to the average reader. The next level thinkers will consider the average perception of the average preferences, and so on. Rosemarie Nagel structured an experiment to test participants for their level of thinking using a numerical guessing game in which the participant closest to some transformation of the mean receives a prize. She, and several others after her, have found that survey participants do not usually exceed the third level of reasoning, with the majority falling at level one or two.

The task of reconciling macroeconomic models with data creates a natural role for level-k thinking in macroeconomics. Fahri and Wherning (2017) combine individual heterogeneity in market risks and level-k thinking to explain the forward guidance puzzle: the fact that standard macroeconomic models counterfactually that future changes in monetary policy can have extremely large contemporaneous effects on economic activity. In this model idiosyncratic risk is compounded by limitations in agents’ ability to anticipate the general equilibrium effects of their consumption decisions and mitigates the effects of monetary policy.

In “Do You Know that I Know that You Know...?: Higher Order Expectations in Survey Data,” joint with Olivier Coibion, Yuriy Gorodnichenko, and Saten Kumar, we use new survey data from New Zealand and a novel experimental design to measure the depths of reasoning for firm managers. Our survey contains questions about firms’ beliefs about macroeconomic variables and higher order expectations, allowing us to consider differences in beliefs across reasoning types. In an ongoing experiment, we provide information about other firms’ beliefs (a higher order signal) and track revisions in firms’ expectations as well as the resulting effects on their economic decisions. Our measure of the firm managers’ levels of thinking will allow us to

assess the effect of higher-order reasoning on signal processing and information utilization and the extent to which these higher-order expectations matter for their actions, providing a direct test of this new mechanism emphasized in the macroeconomics literature.

In “Depths of Reasoning and Rational Inattention,” Leonardo Melosi and I look at depths of reasoning as a form of attention in a rational inattention model. We are currently building a rational inattention model with decision makers having to choose their optimal level of thinking as well as their optimal information flow. This work follows from the time I spent as a CSWEP Dissertation Fellow at the Federal Reserve Bank of Chicago.

In “Depths of Reasoning and Uncertainty” I show that models of level-k thinking or cognitive hierarchy as in Camerer et al (2004) predict greater individual uncertainty about underlying states for agents performing higher levels of thinking. I use data from the New Zealand Survey of Firms to support these conclusions.

Summary and Future Work

Jointly, these papers shed new light on the mechanisms underlying what appears to be pervasive inattention to macroeconomic conditions displayed by a wide range of economic agents. In future work, I will build on these papers by further identifying and quantifying the different forces that affect agents’ expectations formation, incorporate the relevant ones into macroeconomic models, and study their implications for policy-makers. This work will contribute to a growing agenda in macroeconomics that emphasizes the role of information limitations on the part of economic agents in explaining not just their beliefs but how these beliefs translate into their decisions and therefore macroeconomic dynamics.