Every expectations operator, every variance and every covariance is conditioned on an information set. Therefore, every dynamic model makes assumptions about what information agents use when they forecast future events. Most macroeconomics and finance theories employ simple informational assumptions: common knowledge of the model, complete information about all past events and no additional information about any future events. A growing literature uses more stylized information assumptions: public and private signals, a constant flow of news about the future, or infrequent shocks to uncertainty, higher-order beliefs or even beliefs about the risk of a disaster. With the right information assumptions, we can explain many of the features of the world we observe, without resorting to suboptimal behavior or a different utility function for every puzzle. Information frictions are slowly bridging the gap between rational utility-maximizing economics and behavioral economics. Yet, this wave of information-based theories leave many uncomfortable. If the right information sets can rationalize almost any puzzle, what disciplines each model’s information sets? Perhaps this is just replacing old theories of preference shocks with new theories of belief shocks. Is this progress?

One way to select reasonable informational assumptions is to use data. We can count news stories, google searches or analyst reports, infer information from asset prices or other economic transactions; we can do textual analysis, administer surveys, or perform laboratory experiments. All of these approaches have informed economists about what others believe.

But another approach is to see beliefs as the outcome of a belief-formation process. Our beliefs are not independent of the economic environment. People change beliefs when they encounter new information. In my research, people encounter new information in three ways: by observing economic activity, by buying and selling information in competitive markets, or by choosing how to allocate limited cognitive resources to process available data. Although all my research uses endogenous information in some form, the questions I tackle with these information models span many topics: business cycles, monetary economics, labor, portfolio theory, financial intermediation, international finance, international trade, strategic management and coordination games.

**Connecting Information and Economic Activity**

My first two papers are early contributions to a now prolific literature on the role of uncertainty in business cycles. They connect information flow to the level of economic activity to explain why downturns are short and sharp, while recoveries are slow and protracted. In “Slow Boom, Sudden Crash,” (JET 2005) ample economic activity produces abundant information. When a boom turns to a slump, a large data set alerts investors to the change with a high degree of accuracy; investors respond decisively. In a slump, less economic activity generates less information and greater uncertainty. If the economy improves, uncertainty slows investor reactions, making the recovery gradual. “Learning Asymmetry in Real Business Cycles” (JME 2006 with Stijn Van Nieuwerburgh, hereafter ‘SVN’) refines the mechanism and embeds it in a production economy
to explain asymmetries in output, investment and employment. Recent work by Ordonez (JPE 2014) and Fajgelbaum, Schaal and Taschereau-Dumouchel (WP 2014) builds on these two models to explain emerging market financial crises and the persistence of large, negative business cycle shocks.

“Nature or Nurture” (with Alessandra Fogli, Ecma 2011) adds a geographic dimension to this learning process to explain the evolution of twentieth-century female labor force participation. A calibrated model where women learn from their neighbors explains the S-shaped rise in participation, as well as the rise and fall of heterogeneity across U.S. counties. Of course, people learn from friends (social network connections) as well as neighbors. The idea that spatial information diffusion may take place on a social network topology, rather than a geographic one, led Alessandra and I to explore the macroeconomic effects of social network structures in “Germs, Social Networks and Growth,” (WP).

My ongoing work returns to the question of why economic uncertainty fluctuates by considering what happens when people don’t know the true model of the economy and they use macro data to estimate it. “Understanding Uncertainty Shocks and the Role of the Black Swan” (WP with Anna Orlik) uses Bayesian econometrics to measure and understand the source of uncertainty fluctuations. Each quarter, an agent observes real GDP from the previous quarter and uses the new data to re-estimate a forecasting model. If the model allows the distribution of GDP growth to be skewed and the forecaster can learn about this skewness, the forecaster’s uncertainty about next quarter’s GDP growth is volatile and rises in recessions. These large uncertainty shocks arise because small changes in estimated skewness have large effects on the probability of unobserved extreme events (black swans). By embedding this mechanism in a production economy with heterogeneous private information, “Black Swans and the Many Shades of Uncertainty” (WP with Nic Kozeniauskas and Anna Orlik) constructs a framework that unifies an emerging, but disjointed literature on uncertainty shocks. Macroeconomic uncertainty, microeconomic uncertainty, higher-order belief uncertainty and time-varying disaster risk have each been modeled as distinct, exogenous phenomena and used to explain different features of business cycles. Our new framework explains why all four arise when forecasters re-estimate the probability of extreme, negative events.

**Information Choice and Rational Inattention**

My second line of research examines what information agents choose to observe or choose to exert cognitive effort to process and how this changes their ability to coordinate actions or share risk. “Information Acquisition and Portfolio Under-Diversification” (ReStud 2010 with SVN) tackles a central question in the finance literature: Why are investor portfolios so concentrated? The paper models investors who choose which securities to learn about before forming portfolios and shows how the interaction between portfolio choice and information choice motivates specialization. The key insight of the paper is that gains to specialization arise when learning and investment choices jointly reinforce each other. When an investor first chooses to learn about an asset, he expects to hold more of that asset in his portfolio, because he will be better informed about its payoff. As the asset’s expected portfolio share rises, it becomes more valuable to learn about: One signal applied to many shares generates more profit than the same signal applied to one share. This motivates the investor to obtain more information about that asset, making the asset even more valuable to hold.

“Information Immobility and the Home Bias Puzzle” (JF 2009, with SVN) embeds this insight in an equilibrium model with two countries. Information choices magnify arbitrarily small cross-
country differences in agents’ information sets. The results explain a broad set of facts about patterns of foreign investment, own-company stock bias (JEEA 2006, with SVN), and excess returns on locally-biased portfolios, all within a fully rational, general equilibrium framework. These papers have inspired a spate of empirical papers testing their many predictions and a recent theory paper using our divergent information choices to explain income inequality (Kacperczyk, Nosal and Stevens, WP 2014).

While rationalizing individual investment choices provides a foundation for understanding financial markets, perhaps an even more important feature of this information and portfolio choice framework is that it provides a coherent theory of active portfolio management. One of the most contentious debates in the finance literature is over whether fund managers add value. But to resolve this debate, it is helpful to have micro-founded, equilibrium theories that tell us what value-maximizing funds should do, how this activity produces returns, how it affects asset prices and how such funds interact in a financial market. “A Rational Theory of Mutual Funds’ Attention Allocation” (R&R Ecma with Marcin Kacperczyk and SVN) provides such a framework. It models fund managers who choose information to process and use that information to form higher-return portfolios than uninformed investors could. The paper derives new, surprising predictions for what value-adding managers ought to do and tests these predictions. (Some of the new facts are documented in “Time-Varying Skill,” JF 2014, also with Marcin and SVN.) In order to model agents who choose how much to learn about the aggregate economy and stock-specific shocks, we needed to extend the solution methodology developed in the previous papers to allow for a more general signal covariance structure. Once we did that, we found that our predicted cyclical patterns of time-varying skill, performance and portfolio dispersion looked strikingly similar to the empirical patterns. Most mutual fund theory papers explain flows and incentive problems. This is one of the few that explores the mechanics of how skilled fund managers generate their returns.

To understand the general connection between the strategic motives in actions and in information acquisition, “Knowing What Others Know” (ReStud 2009 with Christian Hellwig) incorporates information choices in a Morris and Shin (2002)-style strategic game. It shows that the strategic motives in action games are systematically passed on to information choices, but that information choice can generate multiple equilibria in settings where action choices alone would not. Similar ideas about the interaction between coordination games and information choice re-emerged in “Leadership, Coordination and Mission-Driven Management” (ReStud 2013 with Patrick Bolton and Markus Brunnermeier).

Finally, “Information Globalization, Risk Sharing, and International Trade,” (WP with Isaac Baley and Mike Waugh) explores whether information choices can explain the puzzlingly low volume of international trade. In the model, firms observe noisy signals about the average productivity of a foreign country’s firms. We call the variance of the signal noise the international information friction. While many researchers have claimed that information frictions and trade frictions have similar effects on trade volume and risk sharing, we show that their effects are opposite: Larger information frictions increase trade and improve risk sharing.

Information Markets and Hidden Complementarities

My third line of research examines what information is supplied when agents purchase signals from an information market and how this can explain puzzles in asset markets, drive business
cycles and interact with financial disclosure regulation. Asset market frenzies bear the hallmarks of coordination games: investors seem to want to buy at the same time and acquire the same assets as other investors. “Media Frenzies in Markets for Financial Information” (AER 2006) shows that increasing returns to information naturally generates such correlated investment decisions. Because of its high fixed cost, information that few people purchase is expensive; information sold to many is cheap. The low price encourages investors to buy information that many others also buy. Investors who observe the same information will want to buy and sell the same assets. What is really information complementarity mimics investment complementarity.

“Should We Regulate Financial Information?” (R&R JET with Pablo Kurlat) shows how financial information affects real economic efficiency and then explores how information disclosure affects investor welfare in this setting.

One of the central questions in business cycle research is why expansions and contractions are so synchronized across industries. While previous work debated the size of production complementarities, “Aggregate Shocks or Aggregate Information” (JME 2007 with Justin Wolfers) uses information complementarity instead. When firms purchase cheap, aggregate information but remain ignorant of their sector-specific shocks, their output reacts only to aggregate shocks, leaving output highly correlated across sectors. In “Information Markets and the Comovement of Asset Prices,” (ReStud 2006) it is not the agents, but the asset prices that behave similarly. This happens when agents observe signals they can use to infer the values of many assets. Competitive information markets supply signals with precisely this property.

**Why study endogenous information?**

One of the most important unknowns in economics and finance is agents’ beliefs. Knowing what agents believe, how uncertain they are about it, what they perceive to be risk and what they pay attention to could unlock answers to many of the biggest puzzles. Micro-founded theories of information transmission that deliver information sets as equilibrium outcomes give us insights about what these beliefs are. By linking information outcomes to fundamentals – for example, how much is produced, how volatile productivity is, or how many other people benefit from that information – these models begin and end with observable economic variables. Observables predict information patterns, which in turn, predict other observables. This makes for empirically testable hypotheses. In fact, in many of these papers, my coauthors and I not only derive new theories, but also verify that they are supported empirically. Thus a contribution of my research agenda is that these models provide new ways to use data to illuminate what it is that others know.