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# Introduction

The collapse of the investment bank Lehman Brothers on Sunday, September 14, 2008, caught almost everyone by surprise. It surprised investors, who dumped stocks and brought the market index down by 500 points on Monday. It surprised policymakers, who rushed to rescue other financial institutions after declaring for months that there would be no government bailouts. It also surprised economic forecasters. Only six weeks before the Lehman bankruptcy, in early August 2008, both the Federal Reserve and professional forecasters predicted continued growth of the U.S. economy. Contrary to that prediction, the U.S. financial system nearly melted down after the Lehman bankruptcy, and the economy slid into a deep recession. This happened despite extraordinary—and ultimately successful—government efforts to save the financial system after Lehman.

Why was the Lehman crisis such a surprise? After all, fragility has been building up in the financial system for quite some time. In the mid-2000s, the U.S. economy went through a massive housing bubble. As home prices rose, households levered up to buy homes with mortgages. Banks and other financial institutions levered up to hold mortgages and mortgage-backed securities. As the bubble deflated after 2006, the financial system

experienced considerable stress, as reflected in runs on financial institutions, followed by bankruptcies, rescues, and mergers. Yet the system and the economy stayed afloat until the fall of 2008, supported by successful interventions by the Federal Reserve aimed to avoid a financial panic. By mid-2008, investors and regulators expected that, despite the deflating housing bubble, the situation was under control. On May 7, 2008, Treasury Secretary Henry Paulson felt that "the worst is likely to be behind us." On June 9, 2008, Fed Chairman Ben Bernanke stated that "the danger that the economy has fallen into a 'substantial downturn' appears to have waned."

The relative quiet before the storm, expressed in both the official and private-sector forecasts of the economy and the speeches of government officials, gives us important clues as to why Lehman was such a surprise. It surely was not the news of Lehman's financial weakness per se, since the investment bank was in trouble and expected to be sold for several months prior to its September bankruptcy. U.S. banks more generally were making large losses for several months as the housing and mortgage markets deteriorated, and no major economic news surfaced that weekend. Nor can the surprise be attributed to the government reiteration of its "no bailout" policy. For if that were the reason for the collapse, the markets would have bounced back as soon as it became clear on Monday that bailouts were back in. In fact, markets bounced around a bit but continued their slide as the financial system deteriorated over the next several weeks, despite all the bailouts.

The evidence on the beliefs of investors and policymakers instead tells us that the news in the Lehman demise was the extreme fragility of the financial system compared to what was previously thought. Despite consistently bad news over the course of 2008, investors and policymakers came to believe that they had dodged the bullet of a major crisis. The pressures building up from home price declines and mortgage defaults

were attenuated by the belief that the banks' exposure was limited and alleviated by effective liquidity support from the Fed. The risks of a major crisis were neglected. The Lehman bankruptcy and the fire sales it ignited showed investors and policymakers that the financial system was more vulnerable, fragile, and interconnected than they previously thought. Their lack of appreciation of extreme downside risks was mistaken. The Lehman bankruptcy had such a huge impact because it triggered a major correction of expectations.

Ten years after Lehman, economists agree that the underestimation of risks building up in the financial system was an important cause of the financial crisis. In October 2017, the University of Chicago surveyed a panel of leading economists in the United States and Europe on the importance of various factors contributing to the 2008 Global Financial Crisis. The number-one contributing factor among the panelists was the "flawed financial sector" in terms of regulation and supervision. But the number-two factor among the twelve considered, ranking just below the first in estimated importance, was "underestimation of risks" from financial engineering. The experts seem to agree that the fragility of a highly leveraged financial system exposed to major housing risk was not fully appreciated in the period leading to the crisis.

These judgments are made with the benefit of hindsight. The world, however, has witnessed an extensive history of financial bubbles, expanding credit, and subsequent crises as the bubbles deflated. Errors in beliefs appear in multiple narratives. Classic studies such as Kindleberger (1978), Minsky (1977), and more recently Reinhart and Rogoff (2009) argue that the failure of investors to accurately assess risks is a common thread of many of these episodes. Rajan (2006) and Taleb (2007) stressed the dangers from low probability risks to financial stability. Even before the Lehman bankruptcy, Gerardi et al. (2008) drew attention to expectation errors in the developing subprime crisis. Since the 2008 crisis, a great deal

of new systematic evidence on credit cycles, both for the United States and worldwide, has been developed, starting with the pioneering work of Greenwood and Hanson (2013). Much of this work points to errors in expectations over the course of the cycle. Here we take this point of view further and put inaccurate beliefs at the center of the analysis of financial fragility.

To this end, we seek in this book to accomplish three goals. First, we would like to show that survey expectations data are a valid and extremely useful source of information for economic research. Expectations in financial markets tend to be extrapolative rather than rational, and this basic feature needs to be integrated into economic analysis.

Second, we seek to provide an empirically motivated and psychologically grounded formal model of expectation formation that can be used across a variety of domains, from lab experiments to studies of social beliefs to dynamic analyses of financial and macroeconomic volatility. In economics, nonrational beliefs have been typically formalized using so-called adaptive expectations, which describe mechanical extrapolation of past trends into the future. This approach has been criticized on the grounds that individuals are forward-looking in that they react to information about the future, not only to past trends. We develop a more realistic nonmechanical theory of belief formation, building on evidence from psychology. In this theory, decision makers react to objectively useful information, but in a distorted way.

Third, we use this model of expectation formation to account for the central features—including both market outcomes and beliefs—of the 2008 crisis both before and after Lehman and to explain credit cycles and financial fragility more generally. With the model of expectations we propose, many empirically established features of financial markets emerge in otherwise standard dynamic economic models. Getting the psychology right allows us to shed light on the conditions under which

financial markets are vulnerable to booms and busts. It may also help in thinking about the role of economic policy.

## Expectations Data

A natural starting point for assessing the significance of financial "instability from beliefs" is to analyze the beliefs themselves. This entails not only directly measuring expectations of market participants and systematically testing whether these beliefs are rational, but also characterizing the type of mistakes (if any) that investors make.

This enterprise is feasible because a wealth of available survey data reports the beliefs of investors, corporate managers, households, and professional forecasters. These data offer important insights on whether, in 2008 and in other historical episodes, investors appreciated the risks building up before the crisis or alternatively failed to see the trouble coming. More generally, survey data help identify regular patterns in beliefs during economic fluctuations, needed to develop better theories of expectation formation and credit cycles.

Our approach is a natural extension of the long-standing research agenda in behavioral finance. Traditional behavioral finance tests the rationality of beliefs *indirectly*, by looking at the predictability of security returns. Because returns should be mostly unpredictable when markets are efficient, the consistent findings of predictability are taken to be evidence that expectations are not rational. Here we take the next step and argue that actual expectations data should become a direct target of investigation. These data can shed additional light on what investors think and how they trade, but also on market behavior. The focus on beliefs is pivotal in high leverage situations, such as the study of credit cycles, because changes in expectations can trigger massive dislocations in the financial system, as we saw after the Lehman bankruptcy.

Although rather obvious, the use of survey expectations as direct targets of economic analysis has been quite controversial in economics, for an important methodological reason. Over the past forty years, macroeconomics has been dominated by the Rational Expectations Hypothesis (REH), and finance by its close relative, the Efficient Markets Hypothesis. These theories, which represent important intellectual achievements of twentieth-century economics, hold that economic agents are rational and, as such, form their expectations about the future in a statistically optimal way, given the structure of the economy. This view has one profound consequence. It implies that expectations are dictated by the structure of the economy itself, so that survey data on expectations are redundant and noisy information. The weakness of this approach is that the REH, like any other hypothesis, cannot be just assumed to hold. Rather, as forcefully argued by Charles Manski (2004), it should be subject to empirical tests. Assessing the statistical optimality of survey data on beliefs is a natural place to start.

For the period leading to the 2008 crisis, we have a good deal of data on the expectations of homebuyers about future home price growth, on investor beliefs about the risk of home price declines and mortgage defaults, and on forecasts of economic activity made by both private forecasters and the Federal Reserve. We also have a variety of contemporaneous documents and speeches of policymakers, as well as discussions at the Federal Open Market Committee (FOMC) meetings, which shed light on the beliefs of policymakers. We can then ask directly: What were homebuyers, banks, investors, and policymakers thinking as the events leading up to the crisis unfolded?

The answers to this question cast doubt on the "too big to fail" theory of the crisis, which holds that the banks knew the risks but gambled on bailouts. The expectations of bank executives and employees seem to be very similar to those of other investors. Bankers were optimistic about

housing markets and made loans as well as personal home purchases accordingly. There is no evidence that bankers understood the risks better than anybody else.

Beliefs are more in line with the classical analyses of Kindleberger (1978) and Minsky (1977) that emphasize excessive optimism before crises. Homebuyers were unrealistically optimistic about future home price growth. Investors in mortgages and in securities backed by these mortgages, including financial institutions, considered the possibility that home prices might fall but did not fully appreciate how much and what havoc these declines would wreak. And macroeconomic forecasters from both the private sector and the Federal Reserve did not, in forming their expectations, recognize the risks facing the U.S. financial sector and the economy as late as the summer of 2008. The evidence does not suggest that investors or policymakers were totally naïve or oblivious to the risks in the financial system. Rather, they did not fully appreciate tail risks until the Lehman collapse laid them bare.

The data on beliefs prior to the Lehman crisis point to two key patterns: the extrapolation of past home price growth into the future, and the neglect of unlikely downside risks. Extrapolation of past home price growth sheds light on the housing bubble. Neglected downside risk explains how the financial system became so leveraged. This levering up of both households and financial institutions was most plausibly supported by the widely shared beliefs that the prices of homes were unlikely to collapse and that financial institutions were protected from bad shocks by diversification and hedging.

Neglect of downside risk explains how it took a year between initial bad news and the Lehman bankruptcy to ignite a financial panic. As home prices started falling, beliefs began deflating as well, leading to an unwinding of unwanted risk exposures. Starting in the summer of 2007, this unwinding led to mortgage defaults, foreclosures, fire sales of assets,

liquidations, runs on some financial institutions, and other correlates of distress. But markets did not collapse, despite the deflating housing bubble, and the financial system held together for over a year. In part, this was due to successful liquidity interventions from the Fed. But it was also due to the continued belief that banks were not vulnerable to extreme tail risks, even if home prices fell. The Lehman bankruptcy was a massive surprise precisely because it laid bare these extreme downside risks. Investors learned that they were wrong in thinking that the situation was under control. This was the making of the financial crisis and of the Great Recession that followed, driven by erroneous beliefs.

Beliefs tie together the transmission mechanisms of the crisis, which are well understood by economists (Brunnermeier 2009). Prior to Lehman, the financial system already faced significant instability, such as asset fire sales, bank runs, and rescues of failing institutions, but there was no major disruption because investors did not anticipate a full meltdown. After Lehman, the very same amplification mechanisms could no longer be controlled without capital injections, and the financial system nearly collapsed before the government injected capital to prevent massive insolvencies. Lehman was an eye opener. It proved that financial institutions were much more exposed to risk than previously thought. To understand the pivotal role of the Lehman bankruptcy in the crisis, one needs to understand the evolution of beliefs.

Looking at beliefs data also sheds light on financial fragility more broadly, beyond the 2008 crisis. A great deal of survey data on investor and professional forecaster expectations about not only stock markets, individual stocks, and credit markets, but also the real economy, are available and can be examined. The evidence presented in this book—both new and summarized from earlier studies—suggests that extrapolation of past trends is in fact a common feature of expectations held by investors, corporate managers, and professional forecasters. This is in line with

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