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Stephen C. Nelson and Peter J. Katzenstein

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Abstract The distinction between uncertainty and risk, originally drawn by Frank Knight and John Maynard Keynes in the 1920s, remains fundamentally important today. In the presence of uncertainty, market actors and economic policy-makers substitute other methods of decision making for rational calculation—specifically, actors' decisions are rooted in social conventions. Drawing from innovations in financial markets and deliberations among top American monetary authorities in the years before the 2008 crisis, we show how economic actors and policy-makers live in worlds of risk *and* uncertainty. In that world social conventions deserve much greater attention than conventional IPE analyses accords them. Such conventions must be part of our toolkit as we seek to understand the preferences and strategies of economic and political actors.

Financial crises are destructive; the near collapse of the American financial system in 2008 wiped out more than $11 trillion in household wealth.[1] Like forest fires, unanticipated crises can also be regenerative—revealing gaps in our thinking, they can shake loose deeply held assumptions. This crisis is no different. Economists failed to recognize a looming crisis on the horizon and, once it had arrived, struggled to say anything useful about it.[2] Political scientists writing on international economic relations did not do any better. A leading scholar of International Political Economy (IPE) calls the field's performance "embarrassing" and "dismal."[3]

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1. Financial Crisis Inquiry Commission 2011, xv.
2. See Posner 2010, 305–32; and Cooper 2008, 36.
3. Cohen 2009, 437.

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The financial crisis of 2008 reminds us that we live in a world of risk and uncertainty. Knight and Keynes developed the conceptual distinction between risk and uncertainty ninety years ago and it remains fundamentally important today.[4] In risky environments, sorting events into different classes poses no special challenge for sophisticated decision makers. We cannot be sure what tomorrow will bring, but we can rest assured that unforeseen events will be drawn from known probability distributions "with fixed mean and variance."[5] In the world of risk the assumption that agents follow consistent, rational, instrumental decision rules is plausible. But that assumption becomes untenable when parameters are too unstable to quantify the prospects for events that may or may not happen in the future.[6] The past is not a prologue. Realms of uncertainty are subject to dramatic transformations in the underlying economic structure that permanently shift the mean of the distribution.[7] In this new environment there is no basis for agents to settle on what the "objective" probability distribution looks like. Experienced as "turning points," crises elicit new narratives, signal the obsolescence of the status quo in markets and policy regimes, and inject deep uncertainty into agents' decision calculus.[8] Thus market players and policy-makers must often rely on social conventions that help stabilize uncertain environments.[9]

The question of how uncertainty and convention shape behavior is far from new.[10] We follow in this study the lead of economic sociologists and constructivist scholars of International Relations (IR) who view conventions as shared templates and understandings, "often tacit but also conscious, that organize and coordinate actions in predictable ways," and which serve as "agreed-upon, if flexible, guides for economic interpretation and interaction."[11] Conventions simplify uncertain situations by enabling agents to impose classification schemas on the world, thereby "delineating the set of circumstances in which it [the convention] is applicable and can serve as a guide."[12] They are adopted by pragmatic, intentional agents seeking steadier footing in the presence of epistemic uncertainty. Conventions tell us what decisions are reasonable even when they do not prescribe a precise decision rule.[13]

In this view conventions can, at best, stabilize uncertainty contingently, reliant on the interpretative capacities and practices of individual or collective actors.[14] They cannot eliminate uncertainty. Social conventions are important because they "provide a means in the present of calculating and feigning control over a necessarily

4. See Keynes 1948; and Knight 1921.
5. Meltzer 1982, 3.
6. See Keynes 1937; and Lawson 1985, 915–16.
7. Meltzer 1982, 17.
8. Widmaier, Blyth, and Seabrooke 2007.
9. See Beckert 1996 and 2002.
10. See Steinbruner 1974; Kratochwil 1989; and Wendt 2001, 1029–32.
11. Biggart and Beamish 2003, 444.
12. Kratochwil 1984, 688. See also Kratochwil 1989, 69–72.
13. See Steinbruner 1974, 65–71; Herrigel 2005, 560, 565; and Herrigel 2010, 17–23.
14. Latsis, de Larquier, and Bessis 2010.

uncertain future."[15] They give agents confidence to make judgment calls when resources and prestige are at stake. In the precrisis American financial system, agents employed social conventions to cope with uncertainty—from consumers' widely shared economic beliefs in the inevitably upward movement of prices in the housing market to bankers' unqualified trust in the quantitative models of market risk employed by financial institutions and credit rating agencies. These models were both tractable and rooted, however imperfectly, in some theory and historical evidence.[16] They embodied history that had been incorporated into routinized practices. But they were also badly flawed, and the financial system came close to falling off the cliff as a result.

Sometimes it is plausible to view conventions as self-consciously pursued solutions to coordination problems.[17] In "pure" coordination games with multiple equilibria, social conventions provide "a consistent structure of mutual expectations about the preferences, rationality and actions of agents" that facilitate stable, recurrent patterns of cooperation.[18] For conventions to be effective solutions in coordination games they must have the intersubjective character of "common knowledge." At other times common knowledge is so much taken for granted that social conventions are revealed through imitative and conformative patterns of practice.[19] Scholars disagree about the origins of enduring coordinative social conventions. Do they arise because agents perceive them to be more "prominent" or "conspicuous"[20] or do they emerge from random, perhaps accidental choices that evolve into taken-for-granted practices?[21] We emphasize conventions as shared social templates for managing epistemic uncertainty rather than as solutions to coordination dilemmas in strategic settings.[22]

The financial crisis of 2008 was not an exogenous shock followed by a period of distributional struggles among rational actors eventually yielding a new equilibrium. The crisis illustrates instead the central importance of social conventions that actors adopt so that they can cope with uncertainty and that generate endogenously the seeds of systemic crisis. Our analysis therefore needs to encompass the toolkits both rationalist and sociological styles of analysis provide. The rationalist view that we live in a world of only calculable risk is too simple and leaves us with a dangerously incomplete view of economic life. We need to attend also to the social and cultural contexts in which rational actors encounter the ineluctable uncertainties that inhere in financial markets,[23] particularly when market conditions are unprecedented.[24] In the words of

15. Langley 2008, 481.
16. Millo and MacKenzie 2009, 641.
17. See Lewis 1969; and Schelling 1960. In a very different vein, see also Thévenot 2001.
18. David 1994, 209.
19. Lewis 1969, 83–121.
20. Schelling 1960, 54–58.
21. Thus an enduring social convention may be a suboptimal solution to a coordination game. See Leibenstein 1984; Schotter 1981; and Sugden 1989.
22. See also Koslowski and Kratochwil 1994, 216.
23. Best and Paterson 2010.
24. For example, in June and July 2012 ten-year US Treasuries hit their lowest point (1.4 percent) since they were first brought to market in 1790, long-dated Dutch bond yields reached their lowest levels in 495

Akerlof and Shiller "theoretical economists have been struggling . . . to make sense of how people handle such true uncertainty."[25] Social conventions offer a useful analytical lens to complement and enrich rationalist explanations and thus help us understand the world of risk and uncertainty that we all inhabit. In a world containing substantial uncertainty, social conventions deserve more attention than conventional (pun intended) IPE analysis accords them.

Rationalist and Sociological Optics

The analysis of risk and uncertainty in economic life relies on two optics that frame market dynamics and economic policy choices differently.

Rationalist Optic

In the wake of Knight's and Keynes's conceptual innovation, rationalists are informed by decision theorists' efforts to model choice under uncertainty. People rarely face choices with well-defined, objective risks. For strong subjectivists, all probability estimates are subjective.[26] A coin toss offers fifty-fifty odds only if the coin is perfectly weighted—a condition about which "no one could ever be 'objectively' certain. Decision makers are therefore never in Knight's world of risk but instead always in his world of uncertainty."[27]

Subjective Expected Utility Theory (SEUT) works backward from choices to infer probability estimates. Decision makers may not have objective probabilities in a given choice setting, but in SEUT they behave as if they have a probability distribution in mind. The approach implies that "we should formulate our beliefs in terms of a Bayesian prior and make decisions so as to maximize the expectation of a utility function relative to this prior."[28]

In recent decades many economists discarded the old idea that uncertainty formed a special case in which decision making may not follow rational axioms. Hirshleifer and Riley referred to Knight's distinction as "a sterile one."[29] They were dismissive of critics who catalogued choices that deviated from SEUT's axioms: such anomalies are akin to "mental illusions" which are "only a footnote to the analysis of valid inference . . . when it comes to subtle matters and small differences, it is easy for people to

years, and British base rates were at their lowest point since the Bank of England's establishment in 1694. Deutsche Bank 2012, 3.

25. Akerlof and Shiller 2009, 144.
26. Dequech 2003, 519.
27. Hirshleifer and Riley 1992, 10.
28. Gilboa, Postlewaite, and Schmeidler 2009, 287.
29. Hirshleifer and Riley 1992, 10.

fool themselves, or to be fooled. But less so when the issues are really important, for the economically sound reason that correct analysis is more profitable than error."[30]

In the rationalist optic, inconsistency is costly. The insight suggests that agents operating in hypercompetitive financial markets should invest in information to try to avoid making systematic mistakes. As Blyth puts it, "since being deluded all the time is very expensive, especially when making margin calls, one would expect agents operating in such markets to correct these mistakes."[31] Over time, subjective probability estimates should converge on objective probabilities. Thus the idea of rational expectations was born.[32]

SEUT says nothing about the utility function's content or the correctness of the probability estimates.[33] The rational expectations hypothesis goes a step further. It imposes "equality between agents' subjective probabilities and the probabilities emerging from the economic model containing those agents."[34]

The rational expectations hypothesis had profound implications for the pricing of assets in financial markets. If market participants all share the same (correct) model of the economy and information is reasonably well distributed throughout the financial system, "then agents' expectations about possible future states of the economy should converge and promote a stable and self-enforcing equilibrium."[35] An investment community composed of rational individuals who share knowledge of the true underlying structure of the economy would not drive asset prices too far away (in either direction) from their fundamental value. As Leamer says, "rationality of financial markets is a pretty straightforward consequence of the assumption that financial returns are drawn from a 'data generating process' whose properties are apparent to experienced investors and econometricians."[36]

The effort to reduce the world to risk is not a story that is relevant only to economic theorists. Many IR and IPE specialists also embraced the dissolution of the analytical boundaries that delineated situations of risk from uncertainty. Often uncertainty was simply defined as risk. Consider, for example, how Koremenos conceptualizes "uncertainty" in her work on the rational design of international agreements: "parties always know the distribution of gains in the current period, but know only the probability distribution for the distributions of gains in future periods."[37] We observe abundant research in IR and IPE that either neglects or dismisses the conceptual distinction between risk and uncertainty.[38] In fact, the paradigmatic approach to

30. Ibid., 34, 39.
31. Blyth 2003, 243.
32. See Muth 1961; Lucas 1972; and Sargent and Wallace 1976.
33. Gilboa, Postlewaite, and Schmeidler 2008, 181.
34. Hansen and Sargent 2010, 4.
35. Blyth 2003, 243.
36. Leamer 2010, 38.
37. Koremenos 2005, 550.
38. See Ahlquist 2006; Bernhard and Leblang 2006; Bernhard, Broz, and Clark 2002; Fearon 1998; Frieden et al. 2011; Koremenos 2005; Koremenos, Lipson, and Snidal 2001; Mosley 2006, 95; Rosendorff and Milner 2001; and Sobel 1999. See also Rathbun 2007.

the study of IPE—"Open Economy Politics" (OEP), as coined by Lake—moves entirely in the world of risk.[39]

Sociological Optic

That market actors and policy-makers behave as if they are maximizing utility with respect to subjective probability estimates—in other words, that they are rational agents living in the world of calculable risks—is by now a bedrock assumption in the social sciences. This is a big problem if, as we and others suggest,[40] the choice setting faced by decision makers is more likely to be characterized also or solely by uncertainty. Notwithstanding the fact that many economists and political scientists reject the idea that there is any useful analytical distinction between risk and uncertainty, if people followed the same decision rules when probabilities were known and unknown the distinction would indeed be trivial. There would be no need to retain Keynesian/Knightian uncertainty in the analysis.

However, a raft of experimental evidence documents anomalous behavior that is completely inconsistent with subjective expected utility theory and that underlines the mistakes we are likely to make when we ignore uncertainty. The experimental research suggests that people are not axiomatically rational in the presence of uncertainty.[41]

Important decisions in and around financial markets are undertaken without precise knowledge about the probabilities of payoffs and the size of those payoffs. We simply do not know enough about the underlying process to reliably forecast future returns from past events.[42] Nonetheless, financial market actors still have to make choices—and they need to be confident that their decisions are the right ones; otherwise, they would be paralyzed by indecision. If financial markets resembled actuarial models of life and property insurance (where, thanks to good information and relatively stable parameters, risks can be reliably quantified), confidence would simply mirror past and current objective economic conditions.[43] The economic landscape, however, is more treacherous for investors in asset markets than insurance companies: financial market actors can win or lose big because massive, unpredicted swings in market sentiment render probability distributions poor guides to decisions. Traders can sample the past

39. See Lake 2009a and 2009b.

40. See Abdelal, Blyth, and Parsons 2010; Beckert 1996, 2002, and 2009; Best 2010; Blyth 2002 and 2006; DiMaggio 2003; and Woll 2008.

41. See Camerer and Weber 1992; Ellsberg 1961; Fox and Tversky 1995; Heath and Tversky 1991; Hogarth and Kunreuther 1995; Kahneman and Tversky 1984; Kunreuther et al. 1995; and Zeckhauser 2010.

42. Leamer notes: "if we cannot reliably assess predictive means, variances, and covariances" for things such as asset prices, "then we are in a world of Knightian uncertainty in which expected utility maximization doesn't produce a decision." Leamer 2010, 38–39. See also Blyth 2013; and Mandelbrot and Taleb 2010.

43. Skidelsky 2009, 41.

to predict returns with some accuracy for some time, until catastrophic events that lurk in the far tails of the distribution "radically alter the distribution in ways that agents cannot calculate before the fact, irrespective of how much information they have."[44] Crises occur with alarming frequency, and their causes are very difficult to diagnose, even years after they have passed.

Constructivist and sociological approaches recognize that financial markets are complex, deeply interdependent patterns of economic and social activity. Market actors, and the policy-makers who observe and regulate financial markets, adopt social conventions to impose a sense of order and stability in their worlds, thereby allowing "exchange to take place according to expectations which define efficiency."[45] Conventions are not explicit agreements or formal institutions; rather, they are templates for understanding how to operate in contexts that are experienced as shared and common.[46] Conventions vary in their degree of materiality.[47] They can take the form of public discourses and mental models, such as the "new era stories"[48] that encouraged people to treat homes as assets that could not lose value, which anchored agents' expectations in uncertain environments. Conventions in financial markets also take material forms, such as risk-management technologies.

Economic sociologists argue that social conventions make it possible for markets to function with different degrees of efficiency. For example, securitization of mortgages (which we will discuss) hinges on practices of standardization. Creating liquid assets out of mortgage pools becomes possible when appraisers can define a neighborhood from which to draw comparable sales data and when the credibility and independence of appraisers are deemed to be high enough for their judgments to be trusted. Both depend on social trust and accommodative public policies.[49]

An important implication of the sociological optic is that models not only analyze markets but also alter them; they are not cameras, passively recording, but *engines* actively transforming such markets.[50] Representation and action are part of the same story. That story is not only about being right or wrong in our knowledge about the world but also about being able or unable to transform that world.[51] By incorporating financial economists' theoretical innovations into their practices, market participants brought their behavior closer to those theories' predictions. In this way asset prices and other data points appeared to confirm the risk-based theories that emerged from financial economics. Social reality has an ontological status that is

44. Blyth 2006, 496.
45. Storper and Salais 1997, 16.
46. Wagner 1994, 174.
47. Biggart and Beamish 2003, 452–53.
48. Akerlof and Shiller 2009.
49. Carruthers and Stinchcombe 1999, 360–66.
50. MacKenzie 2006, 25.
51. MacKenzie, Muniesa, and Siu 2007, 2. Hall notes that what sociologists call performativity is essentially the same as "what constructivists refer to as constitutive social processes." Hall 2009, 456. See, for example, de Goede 2005.

partly autonomous from the observing analyst while at the same time our theories exert undeniable effects on social reality rather than simply representing it.[52]

The sociological optic counters the image of markets "unaffected by ongoing social relations" in the rationalist, risk-based optic.[53] It views financial markets as environments riddled with uncertainty and stabilized by conventions; and it suggests that intentional, pragmatic agents turn to social conventions to classify events, refine their own expectations about the future, and settle on a course of action. Sometimes agents consciously coordinate their behaviors in the interest of creating mutual expectations in risky situations. Often, however, they follow conventions to reduce epistemic uncertainty, recognizing that the prescriptive element of social conventions provides "a basis for judging the appropriateness of acts by self and others."[54] Consequently we do not draw a bright line either between "coordinating" and "stabilizing" types of social conventions or between "conventions" and "norms." Conventions are thus more or less deeply internalized by market participants.[55] Keynes, after all, argued that conventional expectations resting on a "flimsy foundation" are inherently unstable.[56] The conventions informing market expectations do not mirror underlying economic fundamentals; rather, the partial and distorted views that market participants impose on the world shape markets. And these views often evolve in a social environment where "rumors, norms, and other features of social life are part of their understanding of finance."[57] In "reflexive feedback loops" these views drive markets, which then subsequently shape beliefs and thus can generate far-from-equilibrium situations.[58]

Taken together, the rationalist and sociological optics describe a world in which risk and uncertainty abound. We view financial markets erroneously if we impose on them the misplaced polarities of neoclassical economics and economic anthropology.[59] In their analysis of Wall Street traders, Beunza and Stark, for example, show how important it is to combine both styles of analysis to understand fully how new trading technologies are at one and the same time both socially disembedded and entangled.[60]

Rationalist and social optics, therefore, are both helpful for theorizing economic life under conditions of risk and uncertainty.[61] It seems unnecessary, even harmful,

52. See Abbott 1988, 35–40; and Zuckerman 2012, 245.
53. Granovetter 1992, 6. See also Dobbin 2004, 2–5. Seabrooke's notion of "axiorational" behavior, while not strictly organized around the concept of "convention," asserts a similar logic to the sociological optic traced here. Seabrooke 2006, 44–47.
54. Biggart and Beamish 2003, 444.
55. Marmor 2009.
56. Quoted in Skidelsky 2009, 93.
57. Sinclair 2009, 451.
58. George Soros, "General Theory of Reflexivity," *Financial Times* (Internet ed.), 26 October 2009, available at <http://www.ft.com/intl/cms/s/2/0ca06172-bfe9-11de-aed2-00144feab49a.html>, accessed 28 October 2013.
59. Callon and Muniesa 2005.
60. Beunza and Stark 2012.
61. Swedberg 2012.

to stipulate that only one or the other can be right. Instead their usefulness varies by empirical domain and by how we frame our questions in the first place.[62] Pragmatism about relying on different traditions of research encourages us to deploy all of the tools we have to explain the problem at hand, rather than offering a partial view of reality that obscures or suppresses part of the evidence.[63] We believe that it is more useful to employ both rational and sociological optics to make sense of the evidence than it is to unendingly tweak, revise, and amend existing models developed for a risk-only world to better fit them to the data.

Risk and Uncertainty in the Crisis of 2008

We examine uncertainty and conventions in four domains that were central to the financial crisis: excessive risk taking, mortgage securitization, risk-management models, and central bank practices in financial markets. The claim that the excessively risky behavior of market players in the run-up to the crisis of 2008 was consistent with incentives produced by a hypercompetitive environment—an argument that fits comfortably in the risk-based, rationalist optic—is plausible in the first domain. In the other three domains, however, the evidence suggests an important role for social conventions in shaping agents' decision making. Three causal mechanisms—competition, learning, and emulation—used elsewhere to explain waves of policy diffusion help in specifying how conventions operate in different domains.[64]

Competition can push agents to make similar choices, as bankers did in taking excessive risks in the run-up to the financial crisis. Competition focuses on the strategic interdependence of actors and considerations of relative efficiency, rewarding some behaviors and punishing others. Learning in the process of securitizing mortgages led decision makers to change their behavior in response to new information. That kind of learning was strictly Bayesian: new information caused agents to update earlier beliefs and revise their behavior in ways that were consistent with the rules of rational decision theory.[65] A more social version of the learning mechanism emphasizes how "communication networks among actors who are already connected in other ways" shape learning, as in the way central bankers learned how to talk to markets.[66] As a third mechanism, emulation operates by scripts that follow from social conventions providing actors with appropriate means in the service of legitimate ends. Emulation evokes prestige-seeking and follow-the-leader practices that trump evidence-based comparison informing rational learning. When emulation

62. Fearon and Wendt 2002.
63. See Sil and Katzenstein 2010; and Katzenstein and Nelson 2013b.
64. Simmons, Dobbin, and Garrett 2006.
65. Meseguer 2006, 159.
66. Simmons, Dobbin, and Garrett 2006, 797. On the two approaches to learning, see Checkel 2001, 560–64.

dominates, agents' expectations are socially constructed.[67] Emulative practices shaped the conventional wisdom that house prices could only go up—an essential ingredient in the securitization process—and in the adoption of deeply flawed risk-management models. In sum, the four case studies we now turn to show different mechanisms as well as variants of the same mechanism operating in different empirical domains.

Betting the House: Excessive Risk Taking

Accurately captured by the rationalist optic, one proximate cause of the financial crisis of 2008 was the excessive risks taken by large, interconnected financial institutions. Why did market actors place such risky bets? Many observers assumed that participants with "skin in the game" had sufficient incentive to understand and effectively manage the risks created by buying and selling new financial instruments. Some, such as Federal Reserve Chairman Alan Greenspan, thought that the web of highly profitable but enormously complex bets placed by market actors made the system on the whole safer.[68]

We now know that the business model many of the world's largest financial institutions adopted before the crisis was unsustainable. Banks searched for risky assets "that could be securitized to create highly rated fixed-income instruments with attractive yields."[69] The assets that bankers turned to were mortgages of increasingly dubious quality. In order to originate loans for packaging into securitized assets that could be sold to investors or held by the bank itself,[70] banks borrowed heavily in the short-term money markets. On the eve of the crisis, leverage ratios for many banks exceeded forty to one.[71] This was a highly profitable strategy as long as banks could borrow cheaply and the collateral backing the securitized assets remained unimpaired. By 2007 at least $3.8 trillion of assets from "unconventional" mortgage securitization had spread around the world.[72] The model was lucrative but extremely dangerous: given that banks had borrowed enormous sums, "if problems emerged with the asset-backed securities the financial firms would have immense problems rolling over their debt."[73]

67. See DiMaggio 2003; McNamara 2002, 64; and Simmons, Dobbin, and Garrett 2006, 799.
68. In Greenspan's words, "These increasingly complex financial instruments have contributed to the development of a far more flexible, efficient, and hence resilient financial system than the one that existed just a quarter-century ago." Greenspan 2005.
69. Partnoy 2009, 5.
70. As Fligstein and Goldstein document, banks did not simply intend to sell risky assets to credulous investors; in fact, the biggest issuers of securitized assets retained substantial holdings themselves, and even ramped up their holdings as conditions in the US housing market worsened in 2006. Fligstein and Goldstein 2011, 38–39. Erel, Nadauld, and Stulz report that US banks' on- and off-balance-sheet holdings of highly rated securitized tranches increased by 72 percent between 2002 and 2006 (from $64 billion to $228 billion), though there was sizeable variation in the amounts that banks retained. Erel, Nadauld, and Stulz 2012.
71. FCIC 2011, xix.
72. Fligstein and Goldstein 2011, 42.
73. Rajan 2010, 136.

Starting in 2006, the decline and eventual collapse of house prices across the United States badly impaired the collateral underpinning securitized assets. Banks that owned securitized assets and kept them on their trading books were forced, per "mark-to-market" accounting practices, to write down massive losses.[74] Highly leveraged institutions that relied on the short-term commercial paper market found it much more difficult to roll over their debts. With credit markets at a standstill and cascading losses realized "across the portfolios of many of the world's leading banks, falls of this kind helped many of them close to, or beyond, the boundary of insolvency."[75]

Bankers who loaded up on risky assets were myopic—many of them lost badly when securitized assets turned "toxic."[76] This kind of behavior, however, is compatible with incentives generated by intense market competition. Individual financial managers are handsomely rewarded for producing returns that beat risk-adjusted benchmarks. One strategy for outperforming the market is to take on "tail risk": bets that in the short run offer high returns but have a low probability of catastrophic loss in the longer term.[77] Given that funds will flock to a manager who produces excess returns, the payoff for the manager's industry competitors encourages them to take similar risks, even when they are aware that catastrophe lurks in the tails of the probability distribution.[78]

Clark explains how competition can drive financial firms that feature regulatory cultures meant to reduce the scope for opportunism to relax their standards.[79] Some financial firms fixate on the outcome (market-beating returns) and do not care about the means by which managers and traders bring about the outcome. Because they do not closely regulate traders' actions and provide compensation packages that reward short-term rewards, these firms tend to attract opportunistic traders who ride market momentum and are unaware of what myopia costs. Furthermore, during periods when the pattern of returns in financial markets appears to reward lucrative but dangerously myopic positions, firms with strong regulatory cultures face pressure to recruit opportunistic traders by scaling back controls and offering rewards that reinforce short-term performance. Similarly, sophisticated traders who understand "that investment management is very problematic because of the indeterminate nature of observed patterns and the incomplete nature of markets"

74. The accounting rule stipulates that asset values must reflect current market prices. During the height of the panic market prices could not be identified, so accountants turned to indices based on buying and selling protection against subprime risk ("ABX") to enforce "marking." See Gorton 2010, 64, 130–31; and MacKenzie 2011, 1825.

75. MacKenzie 2011, 1829.

76. Rajan points out that CEOs at the helm of the banks taking huge risks were largely compensated in stock, and that the "banks in which CEOs owned the most stock typically performed the worst during the crisis." Rajan 2010, 141.

77. Ibid., 138–39.

78. Simmons, Dobbin, and Garrett describe the competition mechanism that produces convergence in states' economic policies in similar terms. Simmons, Dobbin, and Garrett 2006.

79. For Clark, systems of regulation are meant to "ensure that the trader and his or her sponsoring company are aware of the risks *and* uncertainties of investment." Clark 2011, 15 (emphasis in original).

face the choice of sitting back and watching markets, thereby "remov[ing] themselves from the competition for higher bonuses," or gambling on market moves and betting that they can call the top of the market.[80] In sum, the mechanism of competition supplies the incentives that encourage rational, risk-calculating market participants to take excessive risks.

Securitization: Spinning Mortgages into Gold

Securitized assets were at the center of the crisis; their spread illustrates the operation of both rationalist, information-based learning and social emulation mechanisms.[81] Securitization describes the process by which structured credit derivatives are built from an underlying pool of collateral. The manager of a collateralized debt obligation (CDO), for example, issues securities backed by portfolios of fixed-income assets (high-yield corporate bonds, credit card receivables, home mortgages, and so on) to investors.[82]

In the context of rising home prices and low mortgage default rates, it made a lot of sense for banks to aggressively pursue securitization and for investors to snap up asset-backed securities. By the mid-1990s, new and widely adopted conventions such as FICO credit scores and mortgage underwriting software enabled issuers to learn how to routinize credit risk.[83] The market rapidly expanded; between 2002 and 2007 there was a threefold increase in new issuance of securitized assets, the bulk of which were backed by mortgages.[84]

To meet the demand for loans to securitize, originators weakened lending standards and aggressively marketed risky adjustable rate mortgages (ARMs) to borrowers.[85] When prices began to fall in many major real estate markets at the same time that interest payments for many borrowers increased, serious delinquencies surged, reaching a national average of 9 percent in 2009. Since the value of asset-backed CDOs held by banks and investors hinged on the continued flow of cash payments, "homeowners' illiquidity spelled insolvency for financial institutions."[86] In October 2008, the International Monetary Fund (IMF) estimated that losses in mortgage-backed securities (MBS) and CDOs of asset-backed securities amounted to $770 billion.[87] Many large financial institutions were brought to the brink of collapse by cascading losses.

80. Ibid., 14, 15.
81. For detailed discussion of the evolution of structured assets see Fligstein and Goldstein 2011; MacKenzie 2011; and Partnoy 2006.
82. Securitization produced an array of products. Mortgage-backed securities were created from pools of loans purchased from originators. Collateralized debt obligations (CDOs) involved packaging tranches of the asset-backed securities (ABS) into new instruments that could be sold by the CDO manager to outside investors.
83. See Bhidé 2009; Langley 2008, 475; and Friedman 2009.
84. Acharya and Richardson 2009, 199–200.
85. In 2006 more than 90 percent of subprime mortgages were ARMs. Friedman 2009, 139.
86. Schwartz 2009, 183.
87. MacKenzie 2011, 1779.

In the risk-based view, the mortgage securitization machine was driven by competition and rational learning; in Posner's words, by "intelligent businessmen rationally responding to their environment yet by doing so creating the preconditions for a terrible crash."[88] The system became unglued because of information problems and misaligned incentives that skewed market competition. Borrowers know more about their capacity and willingness to repay than lenders do, and this information asymmetry was likely exacerbated by the streamlining of lending standards that occurred after the securitization machine was cranked up.[89] The intense competitive pressure in the financial industry further encouraged the originators of securitized assets to purchase riskier loans. As one market participant told economic sociologist Donald MacKenzie, "they've [CDO arrangers] got a mandate to do the CDO, they've got to get it done. They've got to buy something because they want their fees."[90] By 2006 fees for churning out structured financial products had become the major source of profits garnered by large financial institutions.[91]

The credit rating agencies (CRAs) played an important role in the securitization story. CRAs developed models to grade CDO tranches. Ratings were particularly important given the complexity of securitized assets. By issuing ratings that rendered the CDO tranches "more valuable than the underlying assets," CRAs created arbitrage opportunities.[92] Here, too, rationalist learning mattered. As market players came to understand how the CRAs' models worked, they were able to "tweak the inputs, assumptions, and underlying assets to produce a CDO" that did not merit the high rating that it had received.[93]

However, another side to the securitization story is more consistent with the view of individuals relying on conventions as they were grappling with uncertainty. Most financial market actors did not think that their bets on securitized mortgages were bad.[94] Their expectations about future prospects were crucially shaped by widely shared but patently inaccurate beliefs that justified securitization. "The claim that uncertainty was finally transformed into calculable risk," writes Engelen, "was powerfully refuted" when confidence in the quality of the collateral backing securitized assets collapsed.[95]

88. Posner 2009, 100.
89. Keys et al. 2010.
90. Donald MacKenzie, "Beneath All the Toxic Acronyms Lies a Basic Cultural Issue," *Financial Times* (Internet ed.), 26 November 2009, available at <http://www.ft.com/intl/cms/s/0/cf119e5e-da2b-11de-b2d5-00144feabdc0.htm>, accessed 10 January 2013.
91. Fligstein and Goldstein 2011, 38.
92. Partnoy 2006, 76. Ralph Cioffi, a money manager at Bear Stearns whose fund sustained massive losses on ABS CDOs, told the Financial Crisis Inquiry Commission that "the thesis behind the fund was that the structured credit markets offered yield over and above what their ratings suggested they should offer." FCIC 2011, 135. See also Sinclair 2005.
93. Partnoy 2006, 79.
94. MacKenzie 2011, 1827–30.
95. Engelen 2009, 128.

Historically, average home prices have appreciated by about 1 percent annually, and price corrections occurred in the early 1980s and early 1990s.[96] The securitization machine hinged on the belief in continuously increasing home prices: "banks and borrowers alike needed a continued 10 percent annual appreciation in housing prices to bring their bets into money."[97] Akerlof and Shiller describe the collective belief that home prices could only increase as "new era stories."[98] This convention was shared by homeowners, investors, and policy-makers alike.[99] In 2005 Shiller and Case asked homeowners in the San Francisco area to predict the path of home prices; the average predicted increase was 14 percent. As Nobel Prize-winning economist Phelps puts it, financial market actors "appear to have expected that housing prices would go sky-high, so prices took off and then went on climbing in anticipation that those prices were getting closer."[100] Participants expected that the explosive growth in prices after 2000 (home prices climbed by 11 percent each year between 2002 and 2007) would continue unabated.

Further, bankers and raters who should have known better shared fully and propagated this new "story" and discounted the possibility of a widespread collapse in home prices. In 2005, one of the major investment banks assigned probabilities to future housing price outcomes in a confidential internal report. The bank guessed that there was a 5 percent chance of what its analysts called a "meltdown" scenario over the next three years (–5 percent for three years, then +5 percent thereafter).[101] The workhorse model analysts at Moody's employed to rate mortgage-backed securities "put little weight on the possibility prices would fall sharply nationwide;" as housing prices climbed upward, the model was not adjusted "to put greater weight on the possibility of a decline."[102] Banks emulated a widespread social consensus on the nature of the housing market. Lawrence Lindsey, former member of the Federal Reserve's board of governors, retrospectively observed: "we had convinced ourselves that we were in a less risky world. And how should any rational investor respond to a less risky world? They should lay on more risk."[103]

96. Data used in the figure were collected by Robert Shiller. Available at <http://www.econ.yale.edu/~shiller/data.htm>. Accessed 10 January 2013.
97. See Schwartz 2009, 188; and Chinn and Frieden 2011, 44–45.
98. Akerlof and Shiller 2009, 55.
99. During his appearance before the Financial Crisis Inquiry Commission, financier Warren Buffett stated that the belief in the irreversibility of the housing price trend was a "mass delusion . . . a mistake that virtually everybody in the country made." Tom Braithwaite and Aline van Duyn, "Buffett Defends Rating Agencies," *Financial Times* (Internet ed.), 3 June 2010, available at <http://www.ft.com/intl/cms/s/0/8921f492-6ea6-11df-ad16-00144feabdc0.html>, accessed 10 January 2013.
100. Edmund Phelps, "A Fruitless Clash of Economic Opposites," *Financial Times* (Internet ed.), 2 November 2009, available at <http://www.ft.com/intl/cms/s/0/72d6c698-c818-11de-8ba8-00144feab49a.html>, accessed 10 January 2013.
101. Gerardi et al. 2008, 46.
102. FCIC 2011, 121.
103. Ibid., 61.

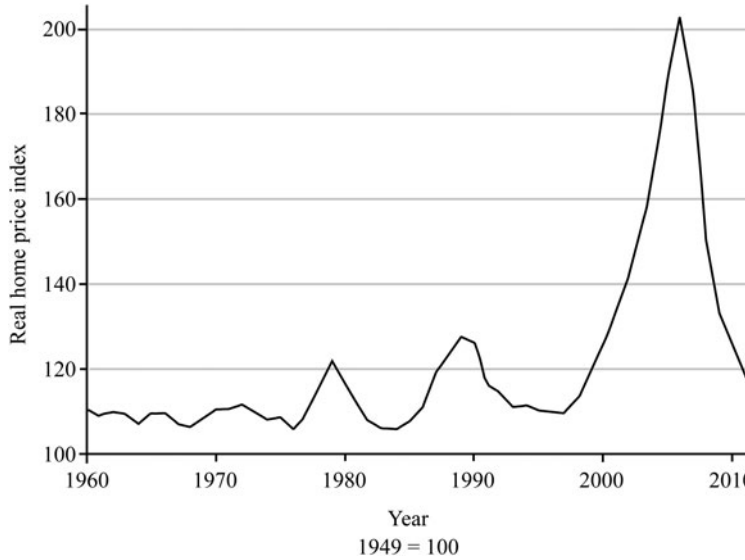

FIGURE 1. *Real home price index in the US (data by Shiller. See note 96)*

Policy-makers were caught in the same web of social beliefs and remained largely sanguine about the prospects for the American housing market. In a speech to the Federal Reserve of Chicago in the spring of 2007, Federal Reserve Chairman Ben Bernanke stressed that home prices were in line with "fundamentals" and that spillover from rising defaults in the subprime class of mortgages would be limited. Like most others, Bernanke was wrong. When the smoke began to clear in early 2009, the average home price in the United States had fallen by more than 30 percent.[104]

Perhaps people knew that prices of homes and the securities backed by home mortgages had deviated from their fundamental value, and they rationally chose to surf the bubble anyway. But if agents had perfect foresight, as rational expectations assumes, then lots of canny investors should have shorted the housing bubble.[105] If this happened housing prices would have never reached the heights that they did. Rogoff points to the difficulty of fitting asset price bubbles into the rationalist framework: "in theory, 'rational' investors should realize that no matter how many suckers are

104. Posner 2009, 105.

105. The fact that only a few did is surprising. The poor quality of the collateral was, after all, not a secret. As MacKenzie points out, investors "could, and not infrequently did, demand to see the 'loan tapes' (the electronic records of the underlying mortgages) . . . and they had to be allowed a reasonable time . . . to analyze the contents of such tapes. If they didn't approve of what they found . . . they might say 'I don't like the collateral' and demand that the mortgage pool be changed before they would buy securities based on it." MacKenzie 2011, 1799–800. See also Fligstein and Goldstein 2011, 48.

born every minute, it will be game over when house prices exceed world income. Working backward from the inevitable collapse, investors should realize that the chain of expectations driving the bubble is illogical and therefore it can never happen."[106] Phelps goes further: "the expectations underlying asset prices cannot be 'rational' relative to some known and agreed model since there is no such model."[107]

The conventional belief that house prices could only increase was fallacious, but that does not necessarily mean that the convention's adopters were irrational. Hirshleifer proposes a model in which agents adopt a convention even when their private information suggests that the convention is erroneous.[108] Early adopters of the convention, especially if they have high social prestige, can send a signal that encourages others to ignore their own intuition (which is not likely to be held with much confidence in the presence of uncertainty) and join the cascade. In an environment where asset prices are steadily increasing, individuals coming late to the party are apt to set aside any private reservations they might have. A social convention that is not deeply internalized may nonetheless have powerful effects when decision makers confront epistemic uncertainty. Only a brave few in the years before the crisis of 2008 resisted the dominant social convention embodied in "new era stories" about the American housing market.[109] In brief the rise and collapse of securitization of the mortgage market illustrates competition, learning, and emulation mechanisms that require us to rely on both rationalist and sociological optics.

The Failure of Risk-Management Models

Banks and credit rating agencies employed sophisticated risk-management techniques in the run-up to the crisis. As in the securitization of mortgages this involved learning how to manipulate risk models. But risk calculation gradually merged with risk management and thus appeared to have created a systematic operational capacity for organizational action to minimize risk. These models' usefulness was rooted less in their predictive accuracy than in their providing clearer communications within trading organizations, solving clearing houses' operational challenges for calculating risk-based deposits of traders, and providing regulators with greater legitimacy for their decisions.[110] Inside banks, risk measurement and risk management reinforced

106. Kenneth Rogoff, "Spotting the Tell-Tale Signs of Bubbles Approaching," *Financial Times*, 18 April 2010, available at <http://www.ft.com/intl/cms/s/0/f22a3704-4248-11df-9ac4-00144feabdc0.html>, accessed 10 January 2013.
107. Edmund Phelps, "A Fruitless Clash of Economic Opposites," *Financial Times* (Internet ed.), 2 November 2009, available at <http://www.ft.com/intl/cms/s/0/72d6c698-c818-11de-8ba8-00144feab49a.html>, accessed 10 January 2013.
108. Hirshleifer 1997.
109. And those who bet against the residential housing market, upon which the value of securitized assets depended, were rewarded handsomely. Lewis 2010.
110. Millo and MacKenzie 2009, 639.

a normative commitment to the notion of shareholder value that has come to define a world culture of managing uncertainty.[111]

The financial crisis revealed deep flaws in the assumptions upon which these models were built.[112] Consider, for example, the evidence in Table 1. Actual default rates for CDO tranches exceeded projections, on average, by 20,155 percent.[113] In light of the yawning gap between the raters' models and the actual default rates, the three main agencies (Moody's, Standard and Poor's, and Fitch) downgraded huge quantities of the mortgage-backed securities that they had initially regarded as relatively safe.[114]

TABLE 1. *Defaults on CDOs of subprime mortgage-backed securities*

Rating	*CDO Evaluator's estimated three-year default rate, as of June 2006 (%)*	*Actual default rate, as of July 2009 (%)*	*Percent difference*
AAA	0.008	0.1	9,900
AA+	0.014	1.68	16,700
AA	0.042	8.16	20,300
AA−	0.053	12.03	23,960
A+	0.061	20.96	34,833
A	0.088	29.21	32,356
A−	0.118	36.65	30,442
BBB+	0.340	48.73	14,232
BBB	0.488	56.10	11,349
BBB−	0.881	66.67	7,476

Note: The probability estimates were generated by S&P's CDO Evaluator software system.
Source: Data source for collateralized debt obligation (CDO) tranches issued from 2005 to 2007 is MacKenzie 2011, 1821.

In addition to relying on the agencies' seal of approval for CDOs, which reassured prospective investors that the risks in the underlying pool of mortgages were well understood, banks had developed their own techniques for measuring and controlling risk. The most widely adopted model was based on the concept of Value-at-Risk (VaR). The idea behind VaR was straightforward: analysts would use data on the distribution of profits and losses over some prespecified period to estimate loss thresholds on current trading positions within some confidence interval.[115] By observing daily returns on trading positions over, for example, the past 365 days and assuming that the data-generating process fit the Gaussian (that is, normal) distribution, risk managers within investment banks could "provide senior management

111. Power 2005.
112. See Danielsson 2008; and Derman 2012.
113. See also Silver 2012, 29. One study estimated that 36 percent of all CDOs built from US asset-backed securities had defaulted by July 2008. Coffee 2011, 232.
114. Moody's, for example, downgraded 83 percent of the MBS it had rated Aaa in 2006 and 100 percent of Baa tranches. FCIC 2011, 222.
115. See Blyth 2003, 248–51; Cassidy 2009, 274–79; Litzenberger and Modest 2010; and Turner et al. 2009.

with an exact dollar estimate of the firm's losses under a worst-case scenario."[116] Banks used the VaR procedure to estimate how much capital they should reserve to stay solvent in the event of a bad market day. The people managing the bank's trading book would know when they arrived at the office that the chances of losing more than, say, $25 million that day were less than one in twenty (if the confidence interval was set at 95 percent). When the Swiss bank UBS applied its variant of the VaR technique to mortgage-backed securities, the models "implied that super-senior [AAA-rated CDOs] would never lose more than 2 percent of its value, even in a worst-case scenario."[117]

The public release of a framework (RiskMetrics) to implement the model originally developed by JP Morgan to calculate VaR was the most important learning mechanism for all market players. By the late 1990s, VaR measures had been widely adopted. It was not just the investment banks that put their faith in VaR to manage risk. The methodology was formally endorsed by international regulators; in the 1996 amendment to the Basel accord, banks were allowed to rely on their VaR models to calculate the limits of their market exposure. In the second international agreement negotiated in 2004, "the governments of most advanced countries, including the United States, agreed to use [VaR] as the basis for their own regulatory systems."[118]

VaR's broad diffusion and its endorsement by regulators is surprising given the litany of problems associated with the approach.[119] After analyzing the VaR figures for sixty banks, Perignon and Smith conclude that there is "at best a weak relationship" between VaR forecasts and the volatility of subsequent trading revenues.[120] The VaR methodology makes sense as an efficient mechanism for handling risk only if the world of finance is one of risk rather than uncertainty. If the world of finance is characterized, at least in part, by irreducible and unquantifiable uncertainty, the control VaR affords is illusory.

Bankers and regulators should have known better. The East Asian financial crisis of 1997–98 and the Russian sovereign default of 1998 were recent memories. Whereas financial crises are often treated as exogenous "bolts from the blue," Blyth makes a convincing case that VaR was an endogenous source of instability: "by relying on VAR analysis as a way to minimize risk, market participants ended up precipitating a crisis that had massive dislocative effects across the financial system as a whole."[121] As the *Turner Review* noted, VaR "can generate procyclical

116. Cassidy 2009, 274.
117. Tett, 2009, 136.
118. Cassidy 2009, 275.
119. Three major problems are discussed in the *Turner Review*: (1) VaR was calculated on the basis of very short time series of data (often less than twelve months); (2) because it was based on the Gaussian distribution, VaR systematically underestimated the threat from low-probability, high-cost events that lay in the tails of the distribution; and, most importantly, (3) models failed to appreciate that the very adoption of VaR by many banks could amplify crises by inducing "similar and simultaneous behavior by numerous players." Turner 2009, 44–45.
120. Perignon and Smith 2010, 372. We thank Erin Lockwood for bringing the article to our attention.
121. Blyth 2003, 251.

behavior . . . and it can suggest to individual banks that the risks facing them are low at the very point when, at the total system level, they are most extreme."[122]

So why did banks, hedge funds, credit rating agencies, and regulators all come to rely on quantitative risk models that were deeply flawed? In the presence of uncertainty, financial market actors evolved a new convention based on both learning and emulation. Specifically, risk-management models, which many regarded as evidence of the emerging science of financial economics, were actually operating like social conventions that offered the illusion that irreducible uncertainty could be transformed into manageable risk. These conventions were supported by a powerful, collectively held idea: financial actors were rational agents operating in a world of measurable risk and efficient markets.[123] If that was true then the risk-management models could not lead participants to blow the markets, and themselves, up. Events belied this assumption: spectacularly during the crisis of 2008 but also in subsequent multibillion dollar losses sustained by trading units of UBS in 2011 and JP Morgan in 2012. These episodes illustrate the inherent limits of any variants of VaR modeling to measure risk accurately.[124] The assumptions and historical data that inform these models make them too restrictive to deal with all contingencies, and thus limit models, in the words of one observer, to "the point of uselessness."[125] Focusing on both risk and uncertainty helps us understand how intelligent people, in an environment of copious information, adhered to social conventions that led them to believe that they were making decisions in a world of risk, when, in reality, those very conventions led them to the cliff's edge. In this story learning and emulation are closely intertwined.

Central Banks: Autonomous from and Talking to Markets

Central bank policy was important to both the conditions that produced the crisis and its resolution. Rationalists provide a valuable if truncated view of central bankers' work. In the rationalist optic, fully independent central banks can achieve price stability.[126] Governments cannot credibly promise to maintain it since they face short-term electoral incentives to unleash surprise inflationary spending sprees before elections. Rational, forward-looking agents build inflationary expectations into their behavior, thus leading to higher inflation but not output. Central bankers

122. Turner 2009, 58.
123. As Gordon Clark notes, "the Fed board was transfixed by quantitative models of expected market performance that implied a low probability of crisis. . . Myopia was justified by a panoptic theory of market behaviour and efficiency where any market distortions would be automatically 'corrected' by self-interest principals and agents." Clark 2011, 7.
124. Ben Protess, Andrew Ross Sorkin, Mark Scott, and Nathanial Popper, "Bet by a Bank: Its Confidence Yields to Loss," *New York Times*, 12 May 2012, A1, B4.
125. "Value at Risk: Time for More Rigour," *Financial Times* (Internet ed.), 13 May 2012, available at <http://www.ft.com/intl/cms/s/3/b56bb39c-9d09-11e1-9327-00144feabdc0.html>, accessed 10 January 2013.
126. Rogoff 1985.

are assumed to be effective inflation-fighters; the puzzle is whether governments choose to delegate to central banks or use other tools to address price stability, such as fixing the exchange rate.[127] Central bankers do not grapple with uncertainty in the rationalist optic. Rather, central bankers and market actors' choices are constrained by "a *fixed* model of the economy with *known* parameters (or sometimes unknown parameters with known probability distributions)."[128]

The sociological optic, on the other hand, suggests that much of central banks' work involves constructing market expectations in conditions of uncertainty. Central banks seek to cultivate not only reputational trust based on calculation but also affective trust based on an internally guaranteed sense of security. Central bankers pour effort into constructing credibility with publics and investors regarding what their expectations should be. Learning how to talk and listen to markets is crucial.[129]

Decision making in the Federal Reserve typically takes place in the presence of risk *and* uncertainty.[130] Consider the accuracy of forecasts provided by individual members of the Federal Open Market Committee (FOMC). Members (including the nonvoting heads of the regional banks) submit forecasts of output growth, inflation, and unemployment twice annually (in February and July) before the publication of the Federal Reserve's *Monetary Policy Reports* to Congress. FOMC members have access to copious information, including the detailed forecast supplied by the staff of the Federal Reserve; they also have two weeks after the FOMC meeting to revise their forecasts. We use Romer's data set, which records every forecast provided by members between 1992 and 1999, to track how well the forecasts matched reality.[131] Less than 4 percent of all forecasts issued between 1992 and 1999 were correct. One plausible inference is that the FOMC was not operating in a world of risk only.[132]

The members of the FOMC appear to agree with our assessment, judging by the transcripts of their meetings. We rely here on meetings from 2003, 2005, and 2007. The 2003 meetings were held just before the invasion of Iraq when the war and its uncertain effects on oil markets was all-pervasive; the 2005 meetings in the context of skyrocketing housing prices; and the 2007 meetings at the onset of the financial crisis. If we had access to even more recent discussions of the FOMC during the financial crisis, the emphasis on uncertainty would most likely be even stronger than it is in the records for these three years. The discussions show that central bankers were framing their policy choices in terms of the distinction

127. Bernhard, Broz, and Clark 2002.
128. Blinder and Reis 2005, 8 (emphasis in original).
129. Hall 2008, 3, 168–69, 183–88, 198.
130. Katzenstein and Nelson 2013a; Schonhardt-Bailey 2013.
131. Romer 2010. The FOMC released the information on member forecasts with a ten-year lag. See also Bailey and Schonhardt-Bailey 2005.
132. In 2007, several FOMC members, including Tim Geithner, Donald Kohn, and Ben Bernanke, suggested using past errors as a way to "convey some measure of uncertainty" (in Kohn's words) about the Federal Reserve's forecasts. FOMC 2007a, 160, 179, 212.

between risk and uncertainty. They were fully aware that the institution was groping in the dark and that their informed guesses had the power to move markets one way or the other.

Take, for instance, Chairman Greenspan's comments from 28 January 2003 on uncertainty about the effect of the direction of monetary policy changes and financial market fragility:

> In other words, we start with a degree of uncertainty that is very high; it is much higher than it is for those who take the data and put them into a model and do projections. . . Lots of technical things that we do would seem to be wrong in a sort of optimum sense. Yet we do those things because we don't trust the models to be capturing what is going on in the real world.[133]

The FOMC convened again in March 2003. The meeting was held the day before the invasion of Iraq. Several policy-makers distinguished between risk and uncertainty in describing the tumult in financial and commodities markets and possible policy responses. The following discussion took place between Greenspan and FOMC member Anthony Santomero:

> Santomero: At this point, it might be useful for us to recognize again the difference between risk and uncertainty. With risk, as we know, one can assign probabilities to the list of outcomes and act appropriately given the distribution. With uncertainty, it is difficult to assign probabilities to outcomes. . . Today we are operating in a world of increased uncertainty.[134]

> Greenspan: In general, I think that we have here, as a number of you have mentioned, a true Knightian uncertainty issue. In the past when we talked about the balance of risks, we presumed that we were able to judge that balance, which implies some judgment of the probability distribution on both sides of the forecast. As many of you have indicated, that does not seem to be the case at this stage.[135]

Greenspan recognized that any contact between the FOMC and market actors would have to communicate uncertainty's impact on the committee.

The problem facing FOMC members in 2005 concerned uncertainty over the path of home prices. In retrospect it is clear that housing prices had become detached from fundamentals in many regional real estate markets. In 2005, however, the committee was operating in the presence of uncertainty, as FOMC member and future Treasury secretary Timothy Geither explained: "What if what you don't know is simply the likely path of home prices going forward? You could take the group here around

133. FOMC 2003a, 37–38.
134. FOMC 2003b, 44–45.
135. Ibid., 75.

the table and assume some path, but there would be a fairly fat band of uncertainty around that path."[136]

The committee members knew that markets would be closely watching them for signals, and that, as in 2003, the FOMC would have to frame any policy positions it took in terms of increasing uncertainty, as board member William Poole pointed out: "When the minutes come out in three weeks, they're going to have to reflect the fact that there is widespread uncertainty around the table. And somehow I think that ought to be in the statement, because that is really part of the outcome of this meeting."[137]

Uncertainty was a dominant theme in the 2007 meetings. There were 534 separate references to the terms "uncertain," "uncertainty," or "uncertainties" in the transcripts from the eight meetings. FMOC members, as exemplified by comments from committee members Randall Kroszner, Jeffrey Lacker, and Charles Plosser, struggled to interpret events in financial markets and to communicate their uncertainty about the rapidly evolving policy environment to markets:

> Kroszner: The last time we met, one theme was the greater uncertainty, and Governor Kohn mentioned that he is feeling greater uncertainty now than he ever had.[138]

> Lacker: I couldn't agree more that there is a vast range of uncertainty out there about which we can't help markets and they can't help us.[139]

> Plosser: I think that revealing a dispersion or the varying underlying policy assumptions that people are using going forward helps on the issue of uncertainty—that the world is uncertain and that our understanding of the way the macroeconomy works is uncertain. By revealing that some underlying sets of assumptions that we on the Committee are making to get to this set of objectives are different could actually be very helpful in reinforcing the view that the future is uncertain.[140]

In 2000 the FOMC began to include a summary of the "balance of risks" along with its postmeeting policy statement. In 2007 it made more sense to convey uncertainty than to estimate risks, as Vice Chairman Donald Kohn and board member Kroszner discussed:

> Kohn: I don't feel as though I know enough to say that the risks are balanced. I don't know. The range of outcomes is just too wide, and there's very little central tendency in it. So I'd be very uncomfortable with a statement saying that I kind of thought the risks were balanced. I am much more comfortable

136. FOMC 2005b, 42.
137. FOMC 2005a, 85.
138. FOMC 2007b, 65.
139. FOMC 2007c, 189.
140. Ibid., 161.

> with a statement that says there is a lot of uncertainty out there and that's uncertainty around the economic outlook.[141]

> Kroszner: It is important for us to express the uncertainty with respect to the balance of risks rather than try to describe the balance of risks.[142]

The Federal Reserve eventually decided to directly inject liquidity into the panic-stricken funding markets.[143] In an emergency conference call, Kohn explained why the Federal Reserve needed to take such bold actions: "Institutions are protecting themselves against tail risk and against a true Knightian uncertainty that they can't price and don't know how to protect themselves against."[144]

The tenor of these discussions makes it abundantly clear that members of the FOMC were fully aware of the distinction between risk and uncertainty.[145] Derived from the analysis of Knight and Keynes, this distinction can also be found in sociological analyses of finance. Central banks are not only autonomous from markets but also discursively deeply enmeshed with them.[146] "Talking to markets" is as much about conveying meaning as conveying information, which "the Oracle of the Fed," Chairman Greenspan, understood only too well. In Abolafia's words, discursive politics is a powerful weapon of the Federal Reserve. For "there is uncertainty in acting and uncertainty in not acting . . . the Fed is compelled to shift uncertainty to risk . . . The danger is that proficient masters of spin become so confident in their technical discourse that the restraints of uncertainty and legitimacy are no longer sufficient to encourage prudent questioning of the current operating models."[147]

The creation of "intersubjective" rather than "rational" expectations depends heavily on the transparency that increasingly sophisticated central bank communication strategies generate in the hope of enlisting market actors to reinforce central bank policy's direction. Relying on the interpretive and scholarly writings of Ben Bernanke and, especially, Alan Blinder, Holmes shows that central banks manage individual expectations and social biases through official statements, interviews, press conferences, and other ways of "talking to markets."[148] This is a never-ending cycle of learning and emulation.

141. FOMC 2007d, 110.
142. FOMC 2007e, 115.
143. On 12 December, the Federal Reserve announced the establishment of the Term Auction Facility (TAF) and foreign exchange swap lines with a handful of other central banks.
144. FOMC 2007f, 36–37.
145. It is noteworthy that Greenspan's lengthy reprise of the crisis refers only to risk and has virtually nothing to say about uncertainty. Greenspan 2010. It is interesting to compare to Greenspan 2004, where uncertainty is put front and center ("policymakers often have to act, or choose not to act, even though we may not fully understand the full range of possible outcomes, let alone each possible outcome's likelihood." Greenspan 2004, 38).
146. See also Katzenstein and Nelson 2013.
147. Abolafia 2012, 110–11. See also Abolafia 2004 and 2010.
148. See Holmes 2009 and 2013.

TABLE 2. *Mechanisms and key elements of the crisis*

	Mechanisms		
Empirical domain	*Competition*	*Learning*	*Emulation*
Excessive risk-taking	Bankers take on tail risk to produce excess returns	—	—
Securitization	Bankers garner big fees for assembling and selling securitized assets, so they seek riskier collateral	Market participants learn how to exploit arbitrage created by models with which CRAs rate tranches of securities	The securitization machine hinges on the widely held convention that home prices will continue to rise
Risk models	—	Diffusion of RiskMetrics teaches participants how to implement risk models	Flawed models become market conventions
Central bank policy-making	—	Central bankers learn to talk to markets and markets learn how to listen to central banks	The practice of "talking to markets"

Conventions and the Crisis

We proposed mechanisms that highlight how social conventions operate in realms of risk and uncertainty.[149] Our analysis of four different aspects of the financial crisis—excessive risk taking, securitization, risk management, and central bank policy—highlights in particular competition, learning, and emulation.[150] Table 2 summarizes the mechanisms and associated evidence for each case.

Conclusion

While many IPE specialists and economists assume that finance lies squarely in the world of risk, the historical record suggests otherwise.[151] Financial markets are frequently rocked by unpredictable and highly destabilizing events. Fully half of the dollar's decline against the yen between the mid-1980s and 2003 occurred over a ten-day period.[152] Ten trading days account for 63 percent of stock market returns accrued over the past half century.[153] On 19 October 1987, the New York Stock Exchange fell by 20 percent; in a seventy-five-minute period the Dow Jones index plunged by 300 points, "three times as much in a little over an hour as it had in any other full trading day in history."[154]

149. Falleti and Lynch suggest that while mechanisms are abstract and portable concepts, scholars must be sensitive to the contexts in which they operate. Falleti and Lynch 2009.
150. Simmons, Dobbin, and Garrett 2006.
151. Pauly 2011, 250–51.
152. Blyth 2011, 87.
153. Mandelbrot and Taleb 2010, 50.
154. Bookstaber 2007, 87.

In a Gaussian distribution—the familiar normal curve—sigma is defined as a single standard deviation away from the average. One can compute probabilities of exceeding multiples of sigma. Mandelbrot and Taleb do just that and show that the chances of exceeding twenty-two sigmas are one in a googol—a googol being 1 with 100 zeroes after it.[155] In other words, twenty-two-sigma events are almost unimaginably rare. Yet we have witnessed three of them in advanced industrial countries over the past twenty years—the 1987 stock market crash in the United States, the 1992 crisis in Europe's Exchange Rate Mechanism, and the 2007–2008 subprime meltdown. In August 2007, David Viniar, Goldman Sachs's chief financial officer, declared to the *Financial Times* that his risk-management team was "seeing things that were twenty-five standard deviation moves, several days in a row."[156] Viniar's statement implied that "Goldman Sachs had therefore suffered a once-in-every-fourteen-universes loss on several consecutive days."[157]

The financial crisis of 2008 invites us to reexamine the role of risk *and* uncertainty in our analysis of political economy. We can and should do better than Admiral Horatio Nelson who is reported to have inverted his glass deliberately during the Battle of Copenhagen, put it on his blind eye, and then shouted, "mate, I cannot read the signal." Preferring to be a one-eyed king among the blind, we argue, is second best to acquiring the depth of vision and the range of imagination that comes with viewing the world through two lenses. Yet judging by current standards of political economy scholarship, there is scant evidence that good reason prevails.[158]

Focusing on the financial crisis that started in 2008, depth of vision requires dual lenses for analyzing variable admixtures of risk and uncertainty on questions of excessive risk taking, securitization, risk-management models, and central bank strategies. Accepting that agents make decisions in the presence of uncertainty as well as risk invites us to put the social back into the science with which we analyze financial and other markets.

After the end of the Cold War the field of security studies was as shaken as the field of naval engineering after the *Titanic* sank.[159] To answer different questions and develop different lines of argument required that old approaches were modified and new approaches developed. Scholarship did not remain shrouded in awkward silence but engaged in vigorous debates to inquire into some of the important changes that had reshaped the world. In underlining the importance of uncertainty and reintroducing social styles of analysis into the field of international political

155. Mandelbrot and Taleb 2010, 50–51.
156. Viniar quoted in Chinn and Frieden 2011, 91.
157. Skidelsky 2009, 6.
158. As noted in the introduction to the article, Cohen, a doyen of the field, observes that mainstream IPE scholars by and large failed to even anticipate the crisis—a "myopia" that he blames on the "distinct loss of ambition, reflecting the gradual 'hardening' of methodologies." Cohen 2009, 442. The counterpoint to Cohen is Helleiner's more optimistic view. Helleiner 2011.
159. Katzenstein 1996.

economy, the financial crisis of 2008, we hope, might eventually have a salutary effect comparable to the experience in the field of national security studies.

References

Abbott, Andrew. 1988. *The System of Professions: An Essay on the Division of Expert Labor*. Chicago: University of Chicago Press.

Abdelal, Rawi, Mark Blyth, and Craig Parsons, eds. 2010. *Constructing the International Economy*. Ithaca, NY: Cornell University Press.

Abolafia, Mitchel Y. 2004. Framing Moves: Interpretive Politics at the Federal Reserve. *Journal of Public Administration Research and Theory* 14 (3):349–70.

———. 2010. Narrative Construction as Sensemaking: How a Central Bank Thinks. *Organization Studies* 31 (3):349–67.

———. 2012. Central Banking and the Triumph of Technical Rationality. In *The Oxford Handbook of the Sociology of Finance*, edited by Katrin Knorr Cetina and Alex Preda, 94–114. New York: Oxford University Press.

Acharya, Viral V., and Matthew Richardson. 2009. Causes of the Financial Crisis. *Critical Review* 21 (2–3):195–210.

Ahlquist, John S. 2006. Economic Policy, Institutions, and Capital Flows: Portfolio and Direct Investment Flows in Developing Countries. *International Studies Quarterly* 50 (3):681–704.

Akerlof, George, and Robert Shiller. 2009. *Animal Spirits: How Human Psychology Drives the Economy, and Why It Matters for Global Capitalism*. Princeton, NJ: Princeton University Press.

Bailey, Andrew, and Cheryl Schonhardt-Bailey. 2005. Central Bankers and Big Ideas: Independence, Credibility, Uncertainty, and Measurement in FOMC Transcripts. Unpublished manuscript, London School of Economics and Political Science, London.

Beckert, Jens. 1996. What Is Sociological About Economic Sociology? Uncertainty and the Embeddedness of Economic Action. *Theory and Society* 25 (6):803–40.

———. 2002. *Beyond the Market: Social Foundations of Economic Efficiency*. Princeton, NJ: Princeton University Press.

———. 2009. The Social Order of Markets. *Theory and Society* 38 (3):245–69.

Bernhard, William, J. Lawrence Broz, and William Roberts Clark. 2002. The Political Economy of Monetary Institutions. *International Organization* 56 (4):693–723.

Bernhard, William, and David Leblang. 2006. *Democratic Processes and Financial Markets: Pricing Politics*. New York: Cambridge University Press.

Best, Jacqueline. 2010. The Limits of Financial Risk Management: Or What We Didn't Learn from the Asian Crisis. *New Political Economy* 15 (1):29–49.

Best, Jacqueline, and Matthew Paterson. 2010. Introduction: Understanding Cultural Political Economy. In *Cultural Political Economy*, edited by Jacqueline Best and Matthew Paterson, 1–25. New York: Routledge.

Beunza, Daniel, and David Stark. 2012. From Dissonance to Resonance: Cognitive Interdependence in Quantitative Finance. *Economy and Society* 41 (3):383–417.

Bhidé, Amar 2009. An Accident Waiting to Happen. *Critical Review* 21 (2–3):211–47.

Biggart, Nicole Woolsey, and Thomas D. Beamish. 2003. The Economic Sociology of Conventions: Habit, Custom, Practice, and Routine in Market Order. *Annual Review of Sociology* 29:443–64.

Blinder, Alan S., and Ricardo Reis. 2005. Understanding the Greenspan Standard. Paper prepared for the Federal Reserve Bank of Kansas City Symposium "The Greenspan Era: Lessons for the Future," 25–27 August, Jackson Hole, WY.

Blyth, Mark. 2002. *Great Transformations: Economic Ideas and Institutional Change in the Twentieth Century*. New York: Cambridge University Press.

———. 2003. The Political Power of Financial Ideas: Transparency, Risk, and Distribution in Global Finance. In *Monetary Orders: Ambiguous Economics, Ubiquitous Politics*, edited by Jonathan Kirshner, 239–59. Ithaca, NY: Cornell University Press.

———. 2006. Great Punctuations: Prediction, Randomness, and the Evolution of Comparative Political Science. *American Political Science Review* 100 (4):493–98.

———. 2011. Ideas, Uncertainty, and Evolution. In *Ideas and Politics in Social Science Research*, edited by Daniel Béland and Robert Henry Cox, 83–104. New York: Oxford University Press.

———. 2013. This Time It Really Is Different: Europe, the Financial Crisis, and "Staying on Top" in the Twenty-first Century. In *The Third Globalization: Can Wealthy Nations Stay Rich in the Twenty-First Century?*, edited by Dan Breznitz and John Zysman, 207–31. New York: Oxford University Press.

Bookstaber, Richard. 2007. *A Demon of Our Own Design: Markets, Hedge Funds, and the Perils of Financial Innovation*. Hoboken, NJ: John Wiley and Sons.

Callon, Michel, and Fabian Muniesa. 2005. Peripheral Vision: Economic Markets as Calculative Collective Devices. *Organization Studies* 26 (8):1229–50.

Camerer, Colin, and Martin Weber. 1992. Recent Developments in Modeling Preferences: Uncertainty and Ambiguity. *Journal of Risk and Uncertainty* 5 (4):325–70.

Carruthers, Bruce, and Arthur Stinchcombe. 1999. The Social Structure of Liquidity: Flexibility, Markets, and States. *Theory and Society* 28 (3):353–82.

Cassidy, John. 2009. *How Markets Fail: The Logic of Economic Calamities*. New York: Farrar, Strauss, and Giroux.

Checkel, Jeffrey T. 2001. Why Comply? Social Learning and European Identity Change. *International Organization* 55 (3):553–88.

Chinn, Menzie D., and Jeffry A. Frieden. 2011. *Lost Decades: The Making of America's Debt Crisis and the Long Recovery*. New York: Norton.

Clark, Gordon L. 2011. Myopia and the Global Financial Crisis: Context-Specific Reasoning, Market Structure, and Institutional Governance. *Dialogues in Human Geography* 1 (1):4–25.

Coffee, John C., Jr. 2011. Ratings Reform: The Good, the Bad, and the Ugly. *Harvard Business Law Review* 1:231–78.

Cohen, Benjamin J. 2009. A Grave Case of Myopia. *International Interactions* 35 (4):436–44.

Cooper, George. 2008. *The Origin of Financial Crises: Central Banks, Credit Bubbles and the Efficient Market Fallacy*. New York: Vintage Books.

Danielsson, Jon. 2008. Blame the Models. *Journal of Financial Stability* 4 (4):321–28.

David, Paul A. 1994. Why Are Institutions the "Carriers of History?" Path Dependence and the Evolution of Conventions, Organizations, and Institutions. *Structural Change and Economic Dynamics* 5 (2):205–20.

de Goede, Marieke. 2005. *Virtue, Fortune, and Faith: A Genealogy of Finance*. Minneapolis: University of Minnesota Press.

Dequech, David. 2003. Uncertainty and Economic Sociology: A Preliminary Discussion. *American Journal of Economics and Sociology* 62 (3):509–32.

Derman, Emanuel. 2012. *Models.Behaving.Badly: Why Confusing Illusion with Reality Can Lead to Disaster, on Wall Street and in Life*. New York: Free Press.

Deutsche Bank. 2012. *LT Asset Return Study: A Journey into the Unknown*. London: Deutsche Bank.

DiMaggio, Paul. 2003. Endogenizing "Animal Spirits": Toward a Sociology of Collective Response to Uncertainty and Risk. In *The New Economic Sociology: Developments in an Emerging Field*, edited by Mauro Guillen, Randall Collins, Paula England, and Marshall Meyers, 79–100. New York: Russell Sage Foundation.

Dobbin, Frank. 2004. The Sociological View of the Economy. In *The New Economic Sociology: A Reader*, edited by Frank Dobbin, 1–46. Princeton, NJ: Princeton University Press.

Ellsberg, Daniel. 1961. Risk, Ambiguity, and the Savage Axioms. *Quarterly Journal of Economics* 75 (4): 643–69.

Engelen, Ewald. 2009. Learning to Cope with Uncertainty: On the Spatial Distributions of Financial Innovation and Its Fallout. In *Managing Financial Risks: From Global to Local*, edited by Gordon L. Clark, Adam D. Dixon, and Ashby H.B. Monk, 120–39. New York: Oxford University Press.

Erel, Isil, Taylor Nadauld, and Rene Stulz. 2012. Why Did Holdings of Highly Rated Securitization Tranches Differ So Much Across Banks? Unpublished manuscript, Ohio State University, Columbus.
Falleti, Tulia G., and Julia F. Lynch. 2009. Context and Causal Mechanisms in Political Analysis. *Comparative Political Studies* 42 (9):1143–66.
Fearon, James D. 1998. Bargaining, Enforcement, and International Cooperation. *International Organization* 52 (2):269–305.
Fearon, James D., and Alexander Wendt. 2002. Rationalism v. Constructivism: A Skeptical View. In *Handbook of International Relations*, edited by Walter Carlsnaes, Thomas Risse, and Beth A. Simmons, 52–72. Thousand Oaks, CA: Sage.
Financial Crisis Inquiry Commission (FCIC). 2011. *The Financial Crisis Inquiry Report*. Washington, DC: US Government Printing Office.
Fligstein, Neil, and Adam Goldstein. 2011. The Roots of the Great Recession. In *The Great Recession*, edited by David Grusky, Bruce Western, and Christopher Wimer, 21–56. New York: Russell Sage Foundation.
Federal Open Market Committee (FOMC). 2003a. Transcript of the Meeting of the Federal Open Market Committee on January 28–29. Washington, DC: US Federal Reserve.
———. 2003b. Transcript of the Meeting of the Federal Open Market Committee on March 18. Washington, DC: US Federal Reserve.
———. 2005a. Transcript of the Meeting of the Federal Open Market Committee on May 3. Washington, DC: US Federal Reserve.
———. 2005b. Transcript of the Meeting of the Federal Open Market Committee on June 29–30. Washington, DC: US Federal Reserve.
———. 2007a. Transcript of the Meeting of the Federal Open Market Committee on January 30–31. Washington, DC: US Federal Reserve.
———. 2007b. Transcript of the Meeting of the Federal Open Market Committee on May 9. Washington, DC: US Federal Reserve.
———. 2007c. Transcript of the Meeting of the Federal Open Market Committee on June 27–28. Washington, DC: US Federal Reserve.
———. 2007d. Transcript of the Meeting of the Federal Open Market Committee on September 18. Washington, DC: US Federal Reserve.
———. 2007e. Transcript of the Meeting of the Federal Open Market Committee on December 11. Washington, DC: US Federal Reserve.
———. 2007f. Transcript of the Conference Call of the Federal Open Market Committee, December 6. Washington, DC: US Federal Reserve.
Fox, Craig R., and Amos Tversky. 1995. Ambiguity Aversion and Comparative Ignorance. *Quarterly Journal of Economics* 110 (3):585–603.
Frieden, Jeffry A., David A. Lake, Michael Nicholson, and Aditya Ranganath. 2011. Uncertainty, Relative Prices, and Political Change. Unpublished manuscript, Harvard University/University of California San Diego, Cambridge, MA/San Diego. Available at <http://dss.ucsd.edu/~dlake/documents/FLNRCrisis2.4.pdf>. Accessed 4 November 2013.
Friedman, Jeffrey. 2009. Introduction: A Crisis of Politics, Not Economics: Complexity, Ignorance, and Policy Failure. *Critical Review* 21 (2–3):127–83.
Gerardi, Kristopher S., Andreas Lehnert, Shane M. Sherlund, and Paul S. Willen. 2008. Making Sense of the Subprime Crisis. Federal Reserve Bank of Boston Public Policy Discussion Paper No. 09-01. Boston: US Federal Reserve.
Gilboa, Itzhak, Andrew Postlewaite, and David Schmeidler. 2008. Probability and Uncertainty in Economic Modeling. *Journal of Economic Perspectives* 22 (3):173–88.
———. 2009. Is It Always Rational to Satisfy Savage's Axioms? *Economics and Philosophy* 25 (3):285–96.
Gorton, Gary B. 2010. *Slapped by the Invisible Hand: The Panic of 2007*. New York: Oxford University Press.
Granovetter, Mark. 1992. Economic Institutions as Social Constructions: A Framework for Analysis. *Acta Sociologica* 35 (1):3–11.

Greenspan, Alan. 2004. Risk and Uncertainty in Monetary Policy. *American Economic Review* 94 (2): 33–40.

———. 2005. "Economic Flexibility." Remarks Before the National Italian-American Foundation, Washington, DC, 12 October.

———. 2010. The Crisis. *Brookings Papers on Economic Activity* (Spring):201–46.

Hall, Rodney Bruce. 2008. *Central Banking as Global Governance: Constructing Financial Credibility*. New York: Cambridge University Press.

———. 2009. Intersubjective Expectations and Performativity in Global Financial Governance. *International Political Sociology* 3 (4):453–57.

Hansen, Lars Peter, and Thomas Sargent. 2010. Wanting Robustness in Macroeconomics. Unpublished manuscript, New York University, New York.

Heath, Chip, and Amos Tversky. 1991. Preferences and Belief: Ambiguity and Competence in Choice Under Uncertainty. *Journal of Risk and Uncertainty* 4 (1):5–28.

Helleiner, Eric. 2011. Understanding the 2007–2008 Global Financial Crisis: Lessons for Scholars of International Political Economy. *Annual Review of Political Science* 14:67–87.

Herrigel, Gary. 2005. Institutionalists at the Limits of Institutionalism: A Constructivist Critique of Two Edited Volumes from Wolfgang Streeck and Kozo Yamamura. *Socio-Economic Review* 3 (3):559–67.

———. 2010. *Manufacturing Possibilities: Creative Action and Industrial Recomposition in the United States, Germany, and Japan*. New York: Oxford University Press.

Hirshleifer, David. 1997. Informational Cascades and Social Conventions. Working Paper No. 9705-10. Ann Arbor: University of Michigan.

Hirshleifer, Jack, and John G. Riley. 1992. *The Analytics of Uncertainty and Information*. New York: Cambridge University Press.

Hogarth, Robin M., and Howard Kunreuther. 1995. Decision Making Under Ignorance: Arguing with Yourself. *Journal of Risk and Uncertainty* 10 (1):15–36.

Holmes, Douglas R. 2009. Economy of Words. *Cultural Anthropology* 24 (3):381–419.

———. 2013. *Economy of Words: Communicative Imperatives in Central Banks*. Chicago: University of Chicago Press.

Kahneman, Daniel, and Amos Tversky. 1984. Choices, Values, and Frames. *American Psychologist* 39 (4): 341–50.

Katzenstein, Peter J., ed. 1996. *The Culture of National Security: Norms and Identity in World Politics*. New York: Columbia University Press.

Katzenstein, Peter J., and Stephen C. Nelson. 2013a. Worlds in Collision: Uncertainty and Risk in Hard Times. In *Politics in the New Hard Times: The Great Recession in Comparative Perspective*, edited by Miles Kahler and David Lake, 233–52. Ithaca, NY: Cornell University Press.

———. 2013b. Reading the Right Signals and Reading the Signals Right: IPE and the Financial Crisis of 2008. *Review of International Political Economy* 20 (5):1101–31.

Keynes, John Maynard. 1937. The General Theory of Employment. *Quarterly Journal of Economics* 51 (2):209–23.

———. 1948 [1921]. *A Treatise on Probability*. New York: MacMillan.

Keys, Benjamin, Tanmoy Mukherjee, Amit Seru, and Vikrant Vig. 2010. Did Securitization Lead to Lax Screening? Evidence from Subprime Loans. *Quarterly Journal of Economics* 125 (1):307–62.

Knight, Frank. 1921. *Risk, Uncertainty, and Profit*. New York: Houghton Mifflin.

Koremenos, Barbara. 2005. Contracting Around International Uncertainty. *American Political Science Review* 99 (4):549–65.

Koremenos, Barbara, Charles Lipson, and Duncan Snidal. 2001. The Rational Design of International Institutions. *International Organization* 55 (4):761–99.

Koslowski, Rey, and Friedrich V. Kratochwil. 1994. Understanding Change in International Politics: The Soviet Empire's Demise and the International System. *International Organization* 48 (2):215–47.

Kratochwil, Friedrich. 1984. The Force of Prescriptions. *International Organization* 38 (4):685–708.

———. 1989. *Rules, Norms, and Decisions: On the Conditions of Practical and Legal Reasoning in International Relations and Domestic Affairs*. New York: Cambridge University Press.

Kunreuther, Howard, Jacqueline Mezaros, Robin M. Hogarth, and Mark Spranca. 1995. Ambiguity and Underwriter Decision Processes. *Journal of Economic Behavior and Organization* 26 (3):337–52.

Lake, David A. 2009a. TRIPs Across the Atlantic: Theory and Epistemology in IPE. *Review of International Political Economy* 16 (1):47–57.

———. 2009b. Open Economy Politics: A Critical Review. *Review of International Organizations* 4 (3): 219–44.

Langley, Paul. 2008. Sub-prime Mortgage Lending: A Cultural Economy. *Economics and Society* 37 (4): 469–94.

Latsis, John, Guillemette de Larquier, and Franck Bessis. 2010. Are Conventions Solutions to Uncertainty? Contrasting Visions of Social Coordination. *Journal of Post Keynesian Economics* 32 (4):535–58.

Lawson, Tony. 1985. Uncertainty and Economic Analysis. *Economic Journal* 95 (December):909–27.

Leamer, Edward E. 2010. Tantalus on the Road to Asymptopia. *Journal of Economic Perspectives* 24 (2): 31–46.

Leibenstein, Harvey. 1984. On the Economics of Conventions and Institutions: An Exploratory Essay. *Journal of Institutions and Theoretical Economics* 140 (1):74–86.

Lewis, David K. 1969. *Convention: A Philosophical Study*. Cambridge, MA: Harvard University Press.

Lewis, Michael. 2010. *The Big Short: Inside the Doomsday Machine*. New York: Norton.

Litzenberger, Robert, and David M. Modest. 2010. Crisis and Non-Crisis Risk in Financial Markets: A Unified Approach to Risk Management. In *The Known, the Unknown, and the Unknowable in Financial Risk Management: Measurement and Theory Advancing Practice*, edited by Francis X. Diebold, Neil A. Doherty, and Richard J. Herring, 74–102. Princeton, NJ: Princeton University Press.

Lucas, Robert E. 1972. Expectations and the Neutrality of Money. *Journal of Economic Theory* 4 (2): 103–24.

MacKenzie, Donald. 2006. *An Engine, Not a Camera: How Financial Models Shape Markets*. Cambridge, MA: MIT Press.

———. 2011. The Credit Crisis as a Problem in the Sociology of Knowledge. *American Journal of Sociology* 116 (6):1778–841.

MacKenzie, Donald, Fabian Muniesa, and Lucia Siu. 2007. Introduction. In *Do Economists Make Markets? On the Performativity of Economics*, edited by Donald MacKenzie, Fabian Muniesa, and Lucia Siu, 1–19. Princeton, NJ: Princeton University Press.

Mandelbrot, Benoit, and Nassim Nicholas Taleb. 2010. Mild vs. Wild Randomness: Focusing on Those Risks That Matter. In *The Known, the Unknown, and the Unknowable in Financial Risk Management: Measurement and Theory Advancing Practice*, edited by Francis X. Diebold, Neil A. Doherty, and Richard J. Herring, 47–58. Princeton, NJ: Princeton University Press.

Marmor, Andrei. 2009. *Social Conventions: From Language to Law*. Princeton, NJ: Princeton University Press.

McNamara, Kathleen. 2002. Rational Fictions: Central Bank Independence and the Social Logic of Delegation. *West European Politics* 25 (1):47–76.

Meltzer, Allan H. 1982. Rational Expectations, Risk, Uncertainty, and Market Reactions. In *Crises in Economic and Financial Structure*, edited by Paul Wachtel, 3–22. Lexington, MA: Lexington.

Meseguer, Covadonga. 2006. Learning and Economic Policy Choices. *European Journal of Political Economy* 22 (1):156–78.

Millo, Yuval, and Donald MacKenzie. 2009. The Usefulness of Inaccurate Models: Towards an Understanding of the Emergence of Financial Risk Management. *Accounting, Organizations and Society* 34 (5):638–53.

Mosley, Layna. 2006. Constraints, Opportunities, and Information: Financial Market—Government Relations around the World. In *Globalization and Egalitarian Redistribution*, edited by Pranab Bardhan, Samuel Bowles, and Michael Wallerstein, 87–119. Princeton, NJ: Princeton University Press.

Muth, John F. 1961. Rational Expectations and the Theory of Price Movements. *Econometrica* 29 (3):315–35.

Partnoy, Frank. 2006. How and Why Credit Rating Agencies Are Not Like Other Gatekeepers. In *Financial Gatekeepers: Can They Protect Investors*, edited by Yasuyuki Fuchita and Robert E. Litan, 59–102. Washington, DC: Brookings Institution Press.

———. 2009. Overdependence on Credit Ratings as a Primary Cause of the Crisis. Research Paper No. 09-015 (July). San Diego, CA: University of San Diego.

Pauly, Louis W. 2011. The Political Economy of Global Financial Crises. In *Global Political Economy*, edited by John Ravenhill, 244–72. New York: Oxford University Press.

Perignon, Christophe, and Daniel R. Smith. 2010. The Level and Quality of Value-at-Risk Disclosure by Commercial Banks. *Journal of Banking and Finance* 34 (2):362–77.

Posner, Richard A. 2009. *A Failure of Capitalism: The Crisis of '08 and the Descent into Depression*. Cambridge, MA: Harvard University Press.

———. 2010. *The Crisis of Capitalist Democracy*. Cambridge, MA: Harvard University Press.

Power, Michael. 2005. Enterprise Risk Management and the Organization of Uncertainty in Financial Institutions. In *The Sociology of Financial Markets*, edited by Karin Knorr Cetina and Alex Preda, 250–68. Oxford, UK: Oxford University Press.

Rajan, Raghuram. 2010. *Fault Lines: How Hidden Fractures Still Threaten the World Economy*. Princeton, NJ: Princeton University Press.

Rathbun, Brian. 2007. Uncertainty About Uncertainty: Understanding the Multiple Meanings of a Crucial Concept in International Relations Theory. *International Studies Quarterly* 51 (3): 533–57.

Rogoff, Kenneth S. 1985. The Optimal Degree of Commitment to an Intermediate Monetary Target. *Quarterly Journal of Economics* 100 (4):1169–89.

Romer, David H. 2010. A New Data Set on Monetary Policy: The Economic Forecasts of Individual Members of the FOMC. *Journal of Money, Credit, and Banking* 42 (5):951–57.

Rosendorff, B. Peter, and Helen V. Milner. 2001. The Optimal Design of International Trade Institutions: Uncertainty and Escape. *International Organization* 55 (4):829–57.

Sargent, Thomas J., and Neil Wallace. 1976. Rational Expectations and the Theory of Economic Policy. *Journal of Monetary Economics* 2 (2):169–83.

Schelling, Thomas. 1960. *The Strategy of Conflict*. Cambridge, MA: Harvard University Press.

Schonhardt-Bailey, Cheryl. 2013. *Deliberating American Monetary Policy: A Textual Analysis*. Cambridge, MA: MIT Press.

Schotter, Andrew. 1981. *The Economic Theory of Social Institutions*. New York: Cambridge University Press.

Schwartz, Herman M. 2009. *Subprime Nation: American Power, Global Capital, and the Housing Bubble*. Ithaca, NY: Cornell University Press.

Seabrooke, Leonard. 2006. *The Social Sources of Financial Power: Domestic Legitimacy and International Financial Orders*. Ithaca, NY: Cornell University Press.

Sil, Rudra, and Peter J. Katzenstein. 2010. *Beyond Paradigms: Analytic Eclecticism in the Study of World Politics*. London: Palgrave Macmillan.

Silver, Nate. 2012. *The Signal and the Noise: Why So Many Predictions Fail—But Some Don't*. New York: Penguin.

Simmons, Beth A., Frank Dobbin, and Geoffrey Garrett. 2006. Introduction: The International Diffusion of Liberalism. *International Organization* 60 (4):781–810.

Sinclair, Timothy. 2005. *The New Masters of Capital: American Bond Rating Agencies and the Politics of Creditworthiness*. Ithaca, NY: Cornell University Press.

———. 2009. Let's Get It Right this Time! Why Regulation Will Not Solve or Prevent Global Financial Crises. *International Political Sociology* 3 (4):450–53.

Skidelsky, Robert. 2009. *Keynes: The Return of the Master*. New York: PublicAffairs.

Sobel, Andrew C. 1999. *State Institutions, Private Incentives, Global Capital*. Ann Arbor: University of Michigan Press.

Steinbruner, John D. 1974. *The Cybernetic Theory of Decision: New Dimensions of Political Analysis*. Princeton, NJ: Princeton University Press.

Storper, Michael, and Robert Salais. 1997. *Worlds of Production: The Action Frameworks of the Economy*. Cambridge, MA: Harvard University Press.

Sugden, Robert. 1989. Spontaneous Order. *Journal of Economic Perspectives* 3 (4):85–97.

Swedberg, Richard. 2012. The Role of Confidence in Finance. In *Oxford Handbook of the Sociology of Finance*, edited by Katrin Knorr Cetina and Alex Preda, 529–45. New York: Oxford University Press.

Tett, Gillian. 2009. *Fool's Gold: How the Bold Dream of a Small Tribe at J.P. Morgan Was Corrupted by Wall Street Greed and Unleashed a Catastrophe*. New York: Free Press.

Thévenot, Laurent. 2001. Organized Complexity: Conventions of Coordination and the Composition of Economic Arrangements. *European Journal of Social Theory* 4 (4):405–25.

Turner, Adair. 2009. *The Turner Review: A Regulatory Response to the Global Banking Crisis*. London: Financial Services Authority. Available at <http://www.fsa.gov.uk/pages/Library/Corporate/turner/index.shtml>. Accessed 10 January 2013.

Wagner, Peter. 1994. Dispute, Uncertainty, and Institution in Recent French Debates. *Journal of Political Philosophy* 2 (3):270–89.

Wendt, Alexander. 2001. Driving with the Rearview Mirror: On the Rational Science of Institutional Design. *International Organization* 55 (4):1019–49.

Widmaier, Wesley W., Mark Blyth, and Leonard Seabrooke. 2007. Exogenous Shocks or Endogenous Constructions? The Meanings of Wars and Crises. *International Studies Quarterly* 51 (4):747–59.

Woll, Cornelia. 2008. *Firm Interests: How Governments Shape Business Lobbying on Global Trade*. Ithaca, NY: Cornell University Press.

Zeckhauser, Richard. 2010. Investing in the Unknown and Unknowable. In *The Known, the Unknown, and the Unknowable in Financial Risk Management: Measurement and Theory Advancing Practice*, edited by Francis X. Diebold, Neil A. Doherty, and Richard J. Herring, 304–46. Princeton, NJ: Princeton University Press.

Zuckerman, Ezra W. 2012. Market Efficiency: A Sociological Perspective. In *Oxford Handbook of the Sociology of Finance*, edited by Karin Knorr Cetina and Alex Preda, 223–49. New York: Oxford University Press.