4 Risk and Uncertainty in Finance

Based on reams of data, economic forecasts share one thing: they are almost always wrong. The median Wall Street annual forecast for the period 2000–23 was off by an average of 13.8 percent, more than twice the annual performance of the stock market.[1] At the beginning of each year there existed a strong consensus about the market that proved to be entirely wrong.[2] It is not only the stock market that is difficult to predict. For January 2023, forecasters had estimated 187,000 new jobs. The actual number, seasonally adjusted, ran almost three times higher.[3] In the summer of 2024 the needle pointed the other way. In calendar year 2023 the economy added far fewer jobs than had been reported previously, a shortfall of about 800,000 over the previous twelve months, a downward revision of 28 percent.[4] Convinced that the next big financial crisis was inevitable because of a global economy awash in tens of trillions of dollars of public debt, the authors of an exhaustive 2017 survey of possible triggers focused on a long list of economic and political causes; but they failed to mention the pandemic that brought the world to the brink of collapse three years later. Complicating matters further, disagreements of economists about what will happen in the future spill over into disputes over what happened in the past.[5] Undeterred, two German writers predicted in 2019 that the greatest global crash in history would happen by 2023. In their win-win world, should the forecast be wrong, their earnings from writing a bestseller would permit them to celebrate the wrong prediction by "opening a bottle of whiskey."[6] My Cornell colleague David Mermin is not surprised by this collective failure in probing the future. After he had listened to a Nobel Prize economics lecture, he remarked sardonically that with its integrals and derivatives, economics was just like physics, "except physics works."[7]

[1] Sommer 2023: B8; 2024. [2] Mackintosh 2023. Smialek and Casselman 2024.
[3] Harrison 2023. [4] Casselman 2024. [5] Peterson 2016.
[6] *DER SPIEGEL* 2019, 2020. [7] Mermin 2016: 132.

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Between 1980 and 2005 the world experienced about one noteworthy financial crisis per year.[8] But the Great Recession of 2007/08 was different. In its impact it was surpassed only by the Great Depression of the 1930s. Some of the lessons of history were learned well, which helps explain a relatively better outcome after 2008. But other lessons were not learned. The question remains – why did the US not do better?[9] The near-collapse of the American financial system in 2008 wiped out over $11 trillion in household wealth.[10] Millions lost their homes. Major banks and financial institutions went bankrupt or were rescued by enormous government-financed bailouts. The crisis came out of the blue even though it was the consequence of prior political decisions: the 1980s Republican party's strident renunciation of fiscal responsibility; the 1990s Democratic party's resolute embrace of financial deregulation; and after the 9/11/2001 attack the relative decline of American power drained by two losing wars fought in Afghanistan and Iraq. The financial crisis of 2008 mattered greatly. It created a strong populist backlash and has reinforced illiberal and authoritarian politics in the US and abroad.[11]

The broader context of the Great Recession of 2008 and other less cataclysmic financial crises lies in the changing structure of the US economy since the 1970s.[12] The American state responded to a variety of economic, social, and political challenges of the 1970s –"stagflation" at home and defeat in Vietnam abroad – with improvisational policies that unburdened the state and shifted the economy toward finance. This was not only a planned transition but also the unintended consequence of policies designed to solve unrelated problems. The outcome was to shift profit making in the economy from productive to financial activities. Three policy changes mattered: deregulation of financial markets, the influx of foreign capital, and a radical change in monetary policy in the early 1980s. Financialization was the fuse and speculation in mortgage became the match for blowing up the entire economy in 2008. Political choices were determinative. The point of this chapter is not to adjudicate among the different causes of the Great Recession but to use that event as a lens to see how the complementarity of risk and uncertainty shapes a vital political domain.

When it comes to money, in common parlance luck is the preferred idiom. In America rich people are believed to have won "the world's lottery," and life is "a game of chance." With chance understood as luck, conceptual and deliberative metaphors are mixed; so are probability

[8] Litzenberger and Modest 2010: 74–75. [9] Eichengreen 2015: 378.
[10] Financial Crisis Inquiry Commission 2011: xv.
[11] Tooze 2018. Kirshner 2014. Cohen 2022: 87–91. [12] Krippner 2011.

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and possibility. In politics luck often trumps skill, argues one observer as he reflects on the fortunes of various leaders in modern British politics. Labour's lead over the Conservatives in 2023 was due mainly to "damned" luck.[13] Bill Gross, one of the rock stars of the American bond market, had run Pimco for over forty years, building one of the strongest earning records in the industry. When he joined a rival company, returns in his first year plummeted. Luck had deserted him, it seemed.[14] In finance, as in war and sports, skill and luck are difficult to parse. Napoleon wanted his generals to be smart, but he was partial to the lucky ones. Making the cover of *Sports Illustrated* often leads to the "SI-jinx," a decline in the fortunes of the featured star athlete.[15] Underlining luck's vast domain, the secular combines with the religious: the "rise to the top" is followed by the "fall from grace." It seems that the mysterious has no rhyme or reason. Good and bad luck occur in the world's fold where probability meets possibility on the risk-uncertainty conundrum.

All too easily we forget the sensible question Queen Elizabeth II posed to a group of experts after the immediate crisis of 2008 had passed: "Why did no one see it coming?" Six months later a group of eminent economists sent a letter apologizing to the Queen for their "failure of collective imagination."[16] And when Ben Bernanke was asked, after the crisis had passed, what most surprised him about the crisis, he answered "the crisis." Bernanke knew that financial crises recur throughout history. They are the product of human emotions and perceptions and of the evolution of complex, dynamic chains of contingencies generating "polycrises." For all his formidable, life-long experience writing about and managing financial crises, Bernanke suffered from the same failure of imagination as his British colleagues.[17] This is not to cast blame on smart people. Like the rest of us they can be overconfident, confused, and forgetful of the last crisis. And as with death, so with financial crises: their timing and circumstances are uncertain, their recurrence is not. The Queen might better have kept counsel with her corgis rather than her experts.

Like medical malpractice, negligent financial practice can kill a banker's client prematurely. Stoking the fury of many, in the 2008 crisis some bankers were rewarded handsomely while millions lost their homes. Bankers rely on sophisticated risk models when they place their bets, informed by what they understand to be the rational beliefs they and others hold about the world. In a financial crisis, however, on a moment's notice those beliefs can morph into panics, revealing unacknowledged

[13] *The Economist* 2023f. [14] Mackintosh 2015. [15] Harford 2019.
[16] Eichengreen 2015: 3. [17] Bernanke *et al.* 2019: 24–25.

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uncertainties that had existed all along. This orthodox view imagines the world to be small and marked by risk. Since differences in context do not matter, models of the financial sector can be general and financial processes tend to be invariant. Cleverly, bankers mask uncertainty in the language of risk. Willfully, they ignore uncertainties they do not want to face. But despite their best efforts, in the end, they cannot escape the risk-uncertainty conundrum (section 1).

What bankers, traders, government officials, and many of us do all too rarely is to acknowledge the pervasiveness of an uncertain future that we may intuit but cannot know. As the Austrian poet Rainer Maria Rilke wrote, "the future enters us ... in order to be transformed in us, long before it happens."[18] Like Rilke, heterodox people of different persuasions do include uncertainty in their thinking. For them, the difficulty an actor has of fully knowing another person's thinking and unavoidable social contingencies are tell-tale signs of the impossibility of knowing the future.[19] In the frenzy of speculative bubbles, many financial practitioners are also fully aware of uncertainty. Unlike others whom they believe to be less smart, they plan to sit down before the music stops playing. Some of them do. Many don't. Without firm knowledge about the future, actors are guided by confidence-instilling conventions. "Nobody knows anything, but everyone knows someone" is a *bon mot* that captures the social element of economic life. The financial crisis of 2008 was not an exogenous event disrupting a world of calculable risk. Social conventions, such as risk-management models, were widely believed in and adopted to control uncertainty. These models were not representing reality but they were productive in generating endogenously a systemic crisis that revealed the risk-uncertainty conundrum (section 2). Often in plain sight, the complementarity of the small world of risk with the large world of uncertainty is reflected in economic practices such as accounting and arbitrage (section 3).

In the world of finance, language matters in different ways. In developing and testing their causal theories or models economists typically assume that language mirrors reality in "representing" the world. But all causal arguments depend on counterfactual reasoning, fictitious, world-making narratives that "re-present" realities that do not exist.[20] Based on a very different theory of language, Philip Tetlock's and Aaron Belkin's "fictions of what would have been" are the unacknowledged companions of economists interested in causal identification.[21] Furthermore, the uncertainties in finance make language a very public

[18] Rilke 1993: 94. [19] Berenskoetter 2011: 650. Iida 1993. [20] DeMartino 2021.
[21] Tetlock and Belkin 1996: 4.

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instrument for "re-presenting" the world and, in so doing, changing it. Unlike most economists, central bankers are very much aware of the power of talk. They do not view language as a passive instrument of communication that mirrors the real world. The Federal Reserve has relied heavily on story-telling to nudge financial markets away from the large world of uncertainty toward the small world of risk (section 4). Going beyond the analysis of finance this chapter ends by discussing the denial of the risk-uncertainty conundrum by the reigning theory in the field of international political economy (section 5).

1. Risk and Rationalism

Despite their many disagreements, at the beginning of the twentieth century Frank Knight and John Maynard Keynes agreed on the difference between risk and uncertainty. Among economists the reaction to Knight's and Keynes's work has followed two tracks. The first is to ceremonially invoke the distinction and then ignore it as uninteresting or trivial.[22] The second rejects outright the existence of unquantifiable uncertainty and assumes that agents live only in a world of calculable risk. Jack Hirshleifer and John Riley, for example, referred to Knight's distinction as "sterile."[23] They were dismissive of critics who catalogued choices that deviate from the postulates of rationality based on subjective probability calculations. For them such anomalies are akin to "mental illusions" which are "only a footnote to the analysis of valid inference."[24] After all, in economies with complete markets, inconsistent beliefs are unsustainably costly. As Mark Blyth puts it: "since being deluded all the time is very expensive, especially when making margin calls," one would expect agents operating in competitive markets to correct their mistakes.[25] Competitive pressures weed out actors who fail to adhere to the axioms that underpin rational decision theory. Most mainstream economists have therefore closed ranks around the assumption that uncertainty is indistinguishable from risk.[26]

Frank Ramsey and Bruno de Finetti were the first to eliminate uncertainty theoretically by developing a broadened concept of subjective probability. They won the battle with Knight and Keynes over the

[22] Hamouda and Smithin 1988: 159. Hirshleifer and Riley 1992. LeRoy and Singell 1987: 395. McKenna 1986. Granger 2010: 32–34, 38, 45. Zeckhauser 2010: 307.
[23] Hirshleifer and Riley 1992: 10. [24] Hirshleifer and Riley 1992: 34, 39.
[25] Blyth 2003: 243.
[26] Reddy 1996: 229. Maechler and Graz 2022: 625–28. LeRoy and Singell (1987: 398) went as far as reinterpreting Frank Knight posthumously as a Bayesian. Kay and King 2020: 74.

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difference between uncertainty and risk. Disregarding Ramsey's insistence that subjective probabilities were only a theoretical idea, putting aside doubts about the possibility of precisely measuring degrees of belief, and neglecting the inconceivable events lurking in the domain of uncertainty, Milton Friedman and other adherents of the Chicago School argued that people could be treated as if they assigned numerical probabilities to all conceivable events.[27] This powerful idea was first developed in thinking about consumer choice. It was later extended to cover all decision making under uncertainty.[28] Economists thus came to deal with the complementarity of risk and uncertainty by relying on guesses about the future and the formalization of subjective probabilities. Actors' subjective beliefs are based on past experience. As they learn more about the world, actors change their beliefs about the likelihood of different outcomes.[29] And as the world evolves, people update their prior probabilities continuously in light of new information.[30]

Developed and tested in controlled laboratory settings, the idea of subjective probability was applied to the real world. Differences in context were thought to be unimportant.[31] It turned out that people made obvious errors in calculating opportunities for gain or loss in uncertain situations that differed systematically from how probabilities "should" be updated. Economists and psychologists explained such deviations from theoretical expectations as "biases" or "heuristics" that impair human judgment. Human beings simply lack the "correct" intuition about how to estimate probabilities. The error was "dispositional" and located in the actor's perception of a risky world; it was not "situational" in the state of an uncertain world. For the better part of half a century economists thus have made the concept of uncertainty all but disappear from mainstream analysis. A major reason was the theory of rational expectations that took the economics profession by storm.[32]

In its strong form the rational expectations hypothesis holds that an economic agent makes no systematic error in processing information and, writes economist Bill Gerrard, "has a complete information set on the 'true' deterministic component of the relevant economic structure."[33] Lars Peter Hansen and Thomas Sargent stipulate that there exists no difference "between agents' subjective probabilities and the probabilities emerging from the economic model containing those agents" in the

[27] Kay and King 2020: 72–74, 84. Buchanan 2013: 112–14. Stein 2024: 4–6. I discuss objective and subjective probabilities in Chapter 1, section 3.
[28] Kay and King 2020: 110–14. [29] Dequech 2000.
[30] Kay and King 2020: 60–61, 66–68, 117–20.
[31] Stein 2024: 5–6. Tversky and Kahneman 1992.
[32] Muth 1961. Lucas 1972. Sargent and Wallace 1976. [33] Gerrard 1994: 329.

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world.[34] Wrapping model and worldview into one, everyone's expectations contained the same view of the world. This 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" writes Mark Blyth, "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 from their fundamental value. As Edward Leamer puts it, "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] Put bluntly, the rational expectations hypothesis offered a "reductive translation" of uncertainty into risk, of large world into small world, and of real world into model world.[37]

Quantitative finance models and much of decision theory circumvented uncertainty by focusing on volatility as a key indicator of risk. This became the main focus of the important work of Fischer Black, the co-inventor of the Black–Scholes option pricing formula, the heart of modern finance theory. Bridging theory and practice, Robert Rubin, partner and eventual co-chairman of Goldman Sachs, hired Fischer Black. His job was to introduce these new financial techniques into trading and investment banking. Option pricing distinguishes random volatility from directional risk. It succeeded in isolating and pricing directional risk by continuously deriving the value of an unknown asset (the option) from the value of a better-known asset (the stock). "To access and play with the 'upside' of volatility, you have to hedge away, neutralize, or buffer out directional risk."[38] Black's success eventually led to the massive growth of deregulated derivative markets. The artificial suppression of volatility in the name of stability turned out to be profoundly destabilizing.[39] Attaching precise numerical values drawn from the domain of risk to describe unpredictable swings occurring in the domain of uncertainty concealed a crucial fact: observed changes were shaped in part by unforeseeable and unforeseen uncertainties that escaped the calculation of risk.

[34] Hansen and Sargent 2010: 4. See also Dow 2004: 544. [35] Blyth 2003: 243.
[36] Leamer 2010: 38. [37] Holzer and Millo 2005: 228. Kirshner 2022: 58–62.
[38] Lee 2016: 4–5. [39] Taleb 2007.

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The risk-uncertainty conundrum was very much in evidence in the financial crisis of 2008. In a Gaussian distribution – the familiar normal curve – sigma is defined as a single standard deviation away from the average. If returns were Gaussian, we would observe an event that is five sigmas away from the mean about once every 14,000 years. "The waiting period associated with a 20-sigma event is a number, in years," write Dowd and Hutchinson, "that considerably exceeds recent estimates of the number of particles in the known universe."[40] Yet in August 2007 David Viniar, Goldman Sachs' Chief Financial Officer, declared that his risk-management team was "seeing things that were 25-standard deviation moves, several days in a row."[41] Such an event is as likely as winning a one-in-a-million lottery jackpot more than twenty times in a row.[42] The chances of exceeding 22 sigmas are one in a googol – a googol being 1 with 100 zeroes after it.[43] Put differently, Viniar's statement implied that "Goldman Sachs had suffered a once-in-every-fourteen-universes loss on several consecutive days."[44] Delegating the work to risk model professionals, this senior executive of Goldman Sachs had run into the risk-uncertainty conundrum by mistaking the small model world in which risks can be calculated for the large world with its unmeasurable uncertainties.[45]

The conventional risk-only view of the world discounted and disregarded contrary evidence and arguments. Experimental evidence about lotteries showed that subjects were not always maximizing expected utilities (as the conventional wisdom held they would).[46] Daniel Ellsberg, for example, conducted a simple experiment showing that subjects had an aversion to uncertainty, thus violating the postulates of subjective expected utility theory. Adding a small dose of uncertainty in the experimental set-up induces choices that seek to protect subjects from the disliked unknown. People appeared to prefer choosing the sure thing of a known probability, even when doing so violated maximizing subjective expected utility.[47]

The emotional experiences of actors confronting uncertainty also cut against the grain of the rational expectations theory with its emphasis on cool calculation.[48] Psychologist David Tuckett reports the enormous emotional stress that the top financiers, bankers, and traders he interviewed experienced in confronting uncertainty day in and day out in their

[40] Dowd and Hutchinson 2010: 89. [41] Quoted in Chinn and Frieden 2011: 91.
[42] Buchanan 2013: 78–79. [43] Mandelbrot and Taleb 2010: 50–51.
[44] Skidelsky 2009: 6. Danielsson 2008. [45] Kay and King 2020: 6, 9, 68, 202.
[46] Kay and King 2020: 134–36.
[47] Tversky and Kahneman 1992. Zeckhauser 2010: 331–23. Ellsberg 1961.
[48] Barbalet 1998: 85. Pixley 2004.

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working lives. Financial markets, he reports, "create dangerously exciting stories, problematic mental states, and strange group processes in which realistic thinking is fundamentally disturbed."[49] His subjects described "trying to decide what they thought were the various uncertain futures that might unfold for the future price of various financial assets ... the information they had was always *both* too much to be examined exhaustively and never enough to give any certainty about choices."[50] This condition can be emotionally and physically very taxing, as is well illustrated by the autobiography of Hank Paulson, which focuses on the crisis of 2007–08. The former Secretary of the Treasury and head of Goldman Sachs gives a head-spinning account of the biggest financial upheaval since the 1930s, charting the spread of a small housing problem to a global financial crisis. What he calls at one point an "economic equivalent to war"[51] took a heavy toll on Paulson's sleep,[52] intensified the dry heaves from which he had suffered since his youth,[53] and occasionally created fears so strong that Paulson answered them with prayers.[54] When uncertainty is rampant, actors yearn for unobtainable certainty.[55]

Herbert Simon's concept of "bounded rationality" nodded its head in that direction.[56] In an uncertain world not subject to risk calculation people do not follow the axioms of optimization. Rules of thumb and searching for a good-enough outcome trump optimization. Simon called that behavior "satisficing" and found that it worked well in the large world of uncertainty. Economists, however, reinterpreted the concepts of bounded rationality and satisficing to describe the cost of processing information which acts as an additional constraint on optimization. Misusing Simon's terminology they neglected his core insight. In the world of uncertainty people do not try to optimize. Instead, they rely on practical reasoning and satisfice with the first good-enough choice. Contra the rational choice hypothesis, decision making does not necessarily follow the dictates of subjective expected utility.

The rating industry in financial markets illustrates the failure of the rational expectations hypothesis during the financial crisis of 2008. The three largest rating firms – Moody's, S&P, and Fitch – are indispensable for contemporary finance.[57] The ostensible purpose of rating is to mitigate risk. This is the official story. The unofficial one differs.[58] Rating

[49] Tuckett 2011: x. See also Widmaier 2009, 2010. [50] Tuckett 2011: xvi, 51.
[51] Paulson 2010: 254. [52] Paulson 2010: 97, 207, 223, 249, 331, 404–05.
[53] Paulson 2010: 242, 290, 313. [54] Paulson 2010: 207, 215–16.
[55] Paulson 2010: 118–20, 130. [56] Kay and King 2020: 149–51.
[57] Carruthers 2011. Dittrich 2007. Hill 2004. White 2010. Caprio *et al.* 2010. Sinclair 2005.
[58] Abdelal and Blyth 2015.

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agencies exist to transform uncertainty into risk. This industry is a child of government regulations. By law, institutional investors can only hold securities that have been rated. In terms of pure smarts, regulators are no match for raters. The same holds for the relation between raters and bankers and traders. Reflecting great differences in training, skills, and reputation, bankers and traders make ten, twenty, or thirty times as much money as agency analysts do. In their rating work, analysts do not come up with new information. They merely codify authoritatively what is already known. But credit rating analysts are not passive recorders of events. They are active participants in markets and help drive market developments. In fact, ratings helped hedge funds game the system. For example, once traders realized that some junk bonds were rated as AAA, they used that information and shorted the stock of banks holding these securities. Rather than stabilizing markets, rating agencies helped trigger market instability.

Based on erroneous assumptions and misleading simplifications, in the financial crisis of 2007–08 ratings proved to be spectacularly wrong in assessing the creditworthiness of various financial products.[59] The industry had a prior record of similar failings – during the devastating Asian Financial Crisis of 1997 and the collapse of Enron in 2001. Deeply flawed ratings have not diminished the hunger of the industry's clients and governments for dubious metrics in an uncertain world. For without those metrics markets might cease to function. A history of failures has done next to nothing to undermine the importance of rating agencies in financial markets. If they did not exist, rating agencies would have to be invented. Right or wrong, their main purpose is to turn uncertainty into risk. Rating agencies provide authoritative knowledge on which economic actors rely – most of the time. Converting uncertainty into risk is essential for financial markets to operate. Accuracy is not the issue – authoritative estimates of risk in an uncertain world are.

At their best, rating agencies provide information that enhances rational decision making and makes markets more efficient. At their worst, they pretend to do the impossible – rate uncertainty. Most of the time, they convert uncertainty into risk. Since the middle of the nineteenth century, firms rated the credit of counterparties in financial transactions: bonds, mortgages, and, more recently, a broad range of financial products embodying different kinds of risks. In the case of corporate bonds, the data showed that ratings predicted actual defaults reasonably well.[60] Unavoidably, however, the rating process required simplified information. The financial crises that have rocked markets in the last

[59] Silver 2012: 26–30, 45. [60] MacKenzie 2011: 1811.

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two decades show the industry failing badly in the rating of new financial instruments such as collateralized debt obligations (CDOs).[61]

While the technologies of simplification have changed, the upshot has been the same. Large world uncertainties were "domesticated" into manageable small world risks, and thus were believed to have been "conquered."[62] Furthermore, by loosening the links between creditors and debtors, since the 1980s financial innovation had changed the context for and processes in finance. Personal relationships were replaced by disembodied ones. This facilitated the marketing of a dizzying array of new, highly liquid and easily traded products. Unfortunately, many of them were obscure and difficult to understand. This change enhanced the importance, size, and profitability of rating agencies.[63] The mortgage industry boom before 2008 doubled the profits of the three main rating agencies from $3 billion in 2002 to $6 billion in 2006. For five years in a row, Moody's profit margin was larger than that of any company in the S&P top 500 corporations.[64] The spread of the securitization of risk across an ever-growing range of products made the information provided by rating agencies a gold mine.[65]

So as to better assess the inherent degree of risk of new, complex products like CDOs, investors were eager to have them rated. Rating agencies applied to the new products the well-known labels with which they had classified corporate and government bonds for decades. New financial products were created by slicing, pooling, and re-packaging, thus creating complex, new, hybrid products. This led to a growing discrepancy between the risk that was being securitized and the quality of the underlying assets. In general, the mixing of different credit risks contained in the different tranches pooled in new products resulted in substantially higher credit ratings than the value of the underlying assets warranted. Reminiscent of radio host Garrison Keillor's mythical Lake Wobegon, where all the children are above average, by 2007 more than half of the bundled subprime securities were rated AAA rather than just the 10–20 percent of the total package that might have deserved such ratings.[66] Another study reports that 70 percent of the securitized assets

[61] Securitization produced an array of products. Mortgage-backed securities were created from pools of loans purchased from originators. CDOs involved packaging tranches of the asset-backed securities (ABS) into new instruments that could be sold by the CDO manager to outside investors.

[62] Carruthers 2011: 4. Hill 2010: 14.

[63] The number of analysts employed by Standard and Poor's, for example, increased fifty-fold between 1986 and 2000 (from 40 to 2,000). Rona-Tas and Hiss 2010: 125.

[64] Waxman 2008: 2. [65] Sinclair 2005.

[66] Willett 2012: 47. Early on in the crisis, in October 2008, the IMF estimated that of the total loss of $1.4 trillion more than half ($770 billion) was in mortgage-backed securities

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in the sample studied were rated AAA while 93 percent of the underlying assets had a credit rating of B or lower. The authors of that study use the term "alchemy" to describe the mismatch between the credit ratings of the securitized products and the credit quality of the underlying collateral. They speculate that the mismatch is driven by a boilerplate model that targeted "the highest possible credit rating at the lowest cost."[67] The compounding of risks in pricing these new products was exploited by highly knowledgeable investors and disregarded by market players with short memories. This dynamic further enhanced the profits and clout of the rating agencies.[68] Furthermore, the deregulation movement was driven by the belief that new securitizations and rating technologies made government supervision unnecessary. In 1996, the renegotiation of an international agreement transformed into soft law the conventional belief that risk analysis could be safely left to the models employed by the rating agencies and large banks.[69] The social context of finance was transnational, bipartisan, and hurdled the constitutional separation of powers in the United States. Thus, straw was spun into gold.[70]

Rating agencies were stymied by the complementarity of risk and uncertainty. After the boom years, subprime mortgages based on CDOs defaulted or were downgraded. The rating of asset-backed securities (ABS) and CDOs showed the futility of all attempts to domesticate uncertainty. In the end, behind a veil of highly technical analysis the agencies were simply part of the conventional view, widely shared among homeowners, bankers, media, government bureaucrats, and politicians of all stripes: house prices could only go up. Everyone thought of their home as a personal ATM machine. Providing high-risk mortgages was deemed safe. With house prices assumed to only increase, within a few years homeowners would acquire considerable equity which would diminish the risk of default. Furthermore, processes were thought to be invariant since the models from which default risk was estimated were based on relatively recent and brief time-series data.[71] The assumption that the structure underlying mortgage markets was stationary and stable was just that, an unexamined assumption lacking supporting evidence. Furthermore, some models had technical flaws introduced for the convenience of making the models behave better rather than become more

and the single largest category ($290 billion) was in asset-based CDOs. MacKenzie 2011: 1179.

[67] Benmelech and Dlugosz 2009: 3–4. [68] Carruthers 2010: 10.

[69] Lockwood 2013a, 2013b. [70] Porter 2010.

[71] Models did not extend back beyond 1995, the date when personal FICO credit scores became available for most mortgage holders. Thus, the time series only included data from a period in which house prices had increased. See Rona-Tas and Hiss 2010: 130, n 23.

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accurate.[72] Finally, the rating agencies were not cognizant of one aspect of the context they tried to capture – potentially high correlations across different asset classes. When interest rates increased after a prolonged period of easy credit and growing market mania, a cascade of defaults in the subprime market spread quickly. In short order that led to a panic which suppressed lending throughout the economy.[73]

After the financial crisis of 2008 Lawrence Summers, former chief economist of the World Bank, Secretary of the Treasury during the tenure of President Clinton, and former president of Harvard University, insisted that textbook macroeconomics had stood up very well despite the crisis. "Market breaks are inherently unpredictable" he argued. This claim overlooks the deregulation Summers had himself helped bring about in the 1990s. The changes were not external shocks but endogenous to the world of finance that made the crisis an accident waiting to happen. Heterogeneous contexts mattered, not only in the laboratory tests of the rational expectations hypothesis and its application in the real world but also in different market segments. Underlying processes were not invariant but dynamically changing. And in the development and application of economic models, language played a complex role that went well beyond the conveying of information.[74] Kay and King conclude that modern finance theory "not only failed to prevent the 2007–08 crisis, but actively contributed to it."[75]

2. Uncertainty and Convention

Since knowledge of the future is fluctuating, vague, and uncertain Keynes argued that no one can ever know fully the price of future assets.[76] "Knowing that our own individual judgment is worthless, we endeavor to fall back on the judgment of the rest of the world which is perhaps better informed ... [this] leads to what we may strictly term a conventional judgment."[77] As a matter of practice, in Keynes's view actors have no choice but to rely on "conventions, stories, rules of thumb, habits, traditions in forming our expectations and deciding how to act."[78] Rumors, norms, and social life are indispensable for understanding financial markets.[79] Keynes distrusted rationalism in financial matters. In the words of political economist Jonathan Kirshner, for Keynes rationalism was grounded in a "pseudo-rational view of human nature" and he likened it to skating on thin ice or "skipping on the crust of the lava."[80] For Keynes

[72] Derman 2011. [73] Gorton 2010. [74] Kay and King 2020: 252.
[75] Kay and King 2020: 319. [76] Keynes 1937. Gerrard 1994: 331.
[77] Keynes 1937: 214. [78] Skidelsky 2009: 87. Nelson 2015. [79] Sinclair 2009: 451.
[80] Kirshner 2015a: 404, 406.

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financial markets operate in a world riddled with uncertainty that can be stabilized only by social processes. Updating rational expectations is simply insufficient to deal with the risk-uncertainty conundrum. Rationalism's failure in encountering the crisis of 2007/08 and other unexpected events is not due to a good theory encountering a black swan. The problem is not black swan events but lame duck theory.

Social processes instill confidence, an essential part of Keynes's view of decision making under uncertainty.[81] According to Bill Gerrard, for Keynes confidence "is not a statement about the future to be checked against actual outcomes . . . [it is] a state of mind, a belief or feeling about the adequacy of the knowledge base from which the forecasts of the future are derived."[82] Prevailing levels of confidence are a quicksilver social phenomenon. Financial markets are thus unavoidably prone to unpredictable bouts of euphoria and panic. Keynes did not see rational agents maximizing their subjective utility. Instead, he emphasized the role of "animal spirits" – of daring and ambitious entrepreneurs placing bets in an environment characterized by uncertainty.[83] Rather than use fixed decision rules, actors rely on social devices as a way of "getting by."[84] Under conditions of uncertainty confidence-boosting conventions are central.[85]

Over decades of investing, thinking, and writing about financial markets, one of the world's most successful financiers, George Soros, when making a financial bet, always looked for evidence that might prove his initial theory wrong.[86] And he also grappled with the behavioral consequences of the uncertainty he experienced first-hand.[87] Most notably in 1992, he succeeded in breaking the Bank of England, forcing a devaluation of the British currency, and making Britain leave the European Exchange Rate Mechanism (ERM).[88] For Soros, market participants seek to impose some order on an unknowable future. The mental constructs that inform their expectations do not mirror underlying economic fundamentals. Instead, markets are shaped by the partial and distorted views that market participants impose on the world. Such views drive markets, which subsequently shape beliefs and thus can generate far-from-equilibrium outcomes. This social character of financial markets gives actors in markets the power to shape underlying economic fundamentals.[89] Soros's analysis is harshly critical of the work of conventional economics, which he regards as narrow-minded, devoid of practical reason, and utterly ignorant of the manipulative

[81] Nelson 2017. [82] Gerrard 1994: 332. [83] Kirshner 2009: 532.
[84] Lawson 1985: 916.
[85] Abdelal *et al.* 2010: 12. Woll 2008: 12. Seabrooke 2006: 12. Beckert 1996. Blyth 2002.
[86] Taleb 2007: 59. [87] Soros 2009, 2008, 1998, 1987. [88] Wen 2009.
[89] Soros 2009: 59, 71.

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effects of market participants on the real economy.[90] Based on investment strategies derived from his model of the world, Soros regards the fortune he amassed to be incontrovertible proof that the rational expectations hypothesis is wrong. It is, he writes, "so far removed from reality that I did not even bother to study" it.[91]

Soros's scorn of economics has been amply returned. Economists have tended to either ignore his ideas altogether or comment on them with a mixture of barely concealed condescension and suppressed envy. As a stand-in for many others, Nobel laureate Robert Solow takes Soros to task for a multiplicity of sins and calls his work "embarrassingly banal."[92] Reading Soros's work and Solow's review is like watching two proverbial ships of practical and theoretical financial economics passing in the night. Solow's review glosses over the central point of Soros's argument. Unlike the rationalist economic models that Solow references, Soros assumes that knowledge in and about financial markets runs up against fundamental uncertainty, "unknowable unknowns."[93] Soros's central insight is the power of collective beliefs, especially of traders. Justin Fox has shown in great detail how the creation of shared beliefs about the world of risk is a complex historical and deeply social process involving scholars, market players, and policy makers.[94] It is not captured by models of the small world of risk that are believed to hold in all contexts everywhere, be exposed to invariant processes at all times, and be expressed in language that mirrors reality.

Keynes and Soros agree that under conditions of uncertainty we fall back on robust stories or "reference narratives," unspoken premises that express realistic rather than rational expectations.[95] Generally speaking, more or better general information is not central for generic individuals, households, corporations, and political actors. The meaning of risk is specific to each of them and so is the reference story they rely on and seek to protect. Since people assess risk and uncertainty with different reference narratives, they will deal with the same risk differently. Risk is the prospect that a projected story will fail to unfold as envisaged. The difference between expectation and outcome may be narrow or large. But it is not quantifiable. For stories rest on language that "re-presents" the uncertainties of the world we describe, explain, and must act on.[96] Economists Akerlof and Shiller describe the collective belief that home prices could only increase as "new era stories."[97] That belief was shared by homeowners, investors, economists, and policy makers alike. As Nobel

[90] Soros 2009: 6–9. [91] Soros 2009: 58. [92] Solow 1999: 29. [93] Dequech 2000.
[94] Fox 2009. [95] Kay and King 2020: 122–24. [96] Kay and King 2020: 100.
[97] Akerlof and Shiller 2009: 55.

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Prize winning economist Edmund 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."[98] James Shinn's analysis of the reference models of traders in the global macro hedge fund world expresses a related view. All traders focus on the same small number of major events and trends, and all of them are ready to change their stories provided others do so as well.[99]

In the run-up to the crisis, banks and credit rating agencies employed sophisticated risk-management techniques. Risk calculation had gradually merged with risk management and thus appeared to have created a systematic operational capacity for a well-organized minimization of risk. In their practical application, however, risk-management models proved to be social conventions offering the dangerous illusion that uncertainty could be transformed into risk.[100] The usefulness of these models was rooted less in their predictive accuracy and more in their provision of clearer communications within trading organizations. The models solved operational challenges for calculating risk-based deposits of traders and providing regulators with greater legitimacy for their decisions.[101] Inside banks, risk measurement and risk management reinforced a normative commitment to the notion of shareholder value that had come to define the culture of global finance.[102] But the financial crisis revealed deep flaws in the assumptions upon which risk models were built. On average, they underestimated the actual default rates for collateralized debt obligations (CDOs) of mortgage-backed securities by 20,155 percent.[103] In light of this yawning gap between the predicted and the actual outcome, 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 safe.[104] Looking for the best solution turns out to be irrelevant and irrational in large world uncertainty.[105]

[98] Phelps 2009. [99] Shinn 2011.

[100] Bernhard and Leblang (2006: 7, 60), for example, build from the assumptions that "market actors engage in economic activity in efficient markets" and "that economic actors have rational expectations." Armed with those assumptions, the authors build models of investor behavior rooted in portfolio theory. See also Latsis *et al.* 2010 and the criticism of Taleb (2007: 277–79).

[101] Millo and MacKenzie 2009: 639. [102] Power 2009.

[103] Nelson and Katzenstein (2014: 377) averaged the percent difference between estimated and realized default rates across ten ratings classes (BBB- to AAA) for CDOs issued in 2005–07; the data were supplied by Donald MacKenzie and reported in *The Economist* 2010: 6. Coffee (2011: 232) estimated that 36 percent of all CDOs built from US asset-backed securities had defaulted by July 2008.

[104] 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).

[105] Kay and King 2020: xv, 133–36, 140–44, 147, 149.

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Securitization as Convention

Conventions are shared templates of understandings. They illustrate that "behavioral finance" is embedded in "social finance."[106] Sometimes tacit and sometimes explicit, conventions coordinate actions in predictable ways, serving, in the words of sociologists Nicole Biggart and Thomas Beamish, as "agreed upon, if flexible, guides for economic interpretation and interaction."[107] Conventions simplify uncertain situations by enabling agents to impose schemas on the world that can serve as a guide.[108] They can also have prescriptive force, telling actors what decisions are reasonable.[109] For economists Michael Storper and Robert Salais conventions are "attempts to order the economic process in a way that allows production and exchange to take place according to expectations which define efficiency."[110]

A 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 try to understand and effectively manage the risks created by the buying and selling of new financial products. The most prominent supporter of financial innovation was Alan Greenspan, long-time Chair of the Federal Reserve. He became convinced that highly profitable but enormously complex bets placed by market actors made the whole financial system safer. "These increasingly complex financial instruments," he said in 2005, "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."[111] The modern risk-management paradigm evolved over decades, developed by leading mathematicians and finance experts. A Nobel Prize was awarded for the pricing model that supported the development of derivative markets. The entire edifice, however, collapsed in 2007–08. In humbling Congressional testimony after the crash, Greenspan acknowledged that the derivative market was sustained not by economic science but by free market ideology. The flaw he found in his model of how the world works was neglect of the risk-uncertainty conundrum.[112]

Securitization describes the process by which credit derivatives are built from an underlying pool of collateral. Between 1999 and 2008 the

[106] *The Economist* 2021. [107] Biggart and Beamish 2003: 444.
[108] Kratochwil 1984: 688.
[109] Steinbruner 1974: 65–71. Herrigel 2005: 560, 565; 2010: 17–23. Daase 1999: 233–34.
[110] Storper and Salais 1997: 16. [111] Greenspan 2005. Kay and King 2020: 317–18.
[112] Lee 2016: 2.

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notional value of highly profitable derivatives jumped from 70 to 700 trillion dollars.[113] And between 2002 and 2007 there was a threefold increase in new issuance of securitized assets, the bulk of them backed by mortgages.[114] Banks searched for risky assets that, with securitization, would create highly rated fixed-income financial instruments with attractive yields.[115] The assets that bankers and traders turned to were mortgages of increasingly dubious quality. In order to originate loans packaged into securitized assets that could be sold to investors or held by themselves, banks borrowed heavily in short-term money markets.[116] On the eve of the crisis, leverage ratios for many banks exceeded 40 to 1.[117] By 2007 at least $3.8 trillion of assets from "unconventional" mortgage securitization had spread around the world.[118] This was a highly profitable strategy as long as banks could borrow cheaply and the collateral backing the securitized assets remained unimpaired.

Bank behavior was shaped by intense market competition. Individual financial managers were handsomely rewarded for producing returns that beat benchmarks.[119] One strategy for outperforming the market is to take on "tail risk": bets that in the short-run offer high returns and have a low probability of catastrophic loss in the long-term.[120] Funds will flock to a manager who produces excess returns. This changes the payoff for competitors who are encouraged to take on similar risks, even when they are aware that catastrophe lurks in the tails of the probability distribution.[121] Securitization thus tried to spin low-quality mortgages into gold – a story with an unhappy ending.[122] We now know that the business model adopted by many of the world's largest financial institutions prior to the crisis was extremely dangerous. "If problems emerged with the asset-backed securities" writes a former chief economist of the IMF, Raghuram Rajan, "financial firms would have immense problems rolling over their debt."[123]

Securitization was driven by "intelligent businessmen rationally responding to their environment"; yet by doing so they had created, in the words of economist and judge Richard Posner, "the preconditions for

[113] Kirshner 2014: 54. MacKenzie 2009a: 5.
[114] Acharya and Richardson 2009: 199–200. [115] Partnoy 2009: 5.
[116] As Fligstein and Goldstein (2011: 38–39) 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.
[117] FCIC 2011: xix. [118] Fligstein and Goldstein 2011. [119] Clark 2011: 14, 15.
[120] Rajan 2010: 138–39. [121] Simmons *et al.* 2006.
[122] Fligstein and Goldstein 2011. MacKenzie 2011. Tett 2009. [123] Rajan 2010: 136.

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a terrible crash" avoided only by those who knew to sit down before the music stopped playing.[124] 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.[125] In the words of one market participant, "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."[126] By 2006 fees for churning out structured financial products had become the major source of profits garnered by large financial institutions.[127] Most actors did not think that the bets they were placing with securitized mortgages were bad ones.[128] Their expectations about future prospects were crucially shaped by convention – widely shared but inaccurate beliefs justifying securitization. "The claim that uncertainty was finally transformed into calculable risk," writes Ewald Engelen, "was powerfully refuted" when confidence in the quality of the collateral backing securitized assets collapsed.[129]

In 2006 the erosion of house prices across the US badly impaired the collateral underpinning securitized assets. Bankers and traders who had loaded up on risky assets lost badly when securitized assets turned "toxic."[130] Banks that owned securitized assets were forced to write down massive losses.[131] Leveraged institutions that relied on short-term commercial paper found it much more difficult to roll over their debts.[132] With credit markets at a standstill and cascading losses realized, the portfolios of many of the world's leading banks moved close to, or beyond, insolvency.[133] Since the value of asset-backed CDOs held by banks and hedge funds depended on the continued flow of cash payments, the illiquidity of homeowners meant insolvency for banks and other financial institutions.[134] In October 2008 the IMF estimated that losses in mortgage-backed securities (MBS) and CDOs of asset-backed securities amounted to $770 billion.[135] Many large financial institutions

[124] Posner 2009: 100. [125] Keys *et al.* 2010. [126] MacKenzie 2009b.
[127] Fligstein and Goldstein 2011.
[128] MacKenzie 2011: 1827–30. Johnson and Kwak 2011: 126. [129] Engelen 2009: 128.
[130] Rajan (2010: 141) points out that the 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."
[131] MacKenzie 2011: 1825.
[132] As the head of a large European money market fund explained, "the problem is that people just don't know quite what to trust, or not. Probably everything in those portfolios is fine, but people don't know for sure, and people don't want to take that risk." Quoted in Tett 2009: 177.
[133] MacKenzie 2011: 1829. [134] Schwartz 2009: 183. [135] MacKenzie 2011: 1779.

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were brought to the brink of collapse. And insurers that had sold protection against losses suffered by CDOs suddenly found themselves on the hook for hundreds of billions of dollars owed to the few traders who had bet against the securitization machine.

That machine hinged on the belief in continuously increasing home prices. Historically, average home prices have appreciated by about 1 percent annually.[136] But for the bets banks and borrowers had placed housing prices had to continue to rise at an annual rate of 10 percent.[137] Indeed, market actors expected that the explosive growth in prices after 2000 (home prices climbed by 11 percent each year between 2002 and 2007) would continue unabated. They largely discounted the possibility of a widespread collapse in home prices. In 2005, in a confidential internal report, one of the major investment banks assigned probabilities to future housing prices. The bank guessed that there was a 5 percent chance of what its analysts called a "meltdown" scenario over the next three years. The workhorse model employed by analysts at Moody's 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."[138] Banks thus replicated a widespread social consensus on the nature of the housing market. Lawrence Lindsey, former member of the Federal Reserve's Board of Governors, observed later: "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."[139]

Policy makers were thus 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 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. When the smoke began to clear in early 2009, the average home price in the US had fallen by more than 30 percent.[140] Perhaps people knew that prices of homes and the securities backed by home mortgages had deviated from their fundamental value, and rationally chose to surf the bubble anyway. But if agents had perfect foresight, as rational expectations theory assumes, then lots of

[136] Housing price data were taken from Robert Shiller: www.econ.yale.edu/~shiller/data.htm, accessed 05/28/24.
[137] Schwartz 2009: 188. Chinn and Frieden 2011: 44–45. [138] FCIC 2011: 121.
[139] FCIC 2011: 61. [140] Posner 2009: 105.

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canny investors should have shorted the housing bubble.[141] If this had happened housing prices would have never reached the heights that they did. Kenneth 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 born every minute, it will be game over when house prices exceed world income. Working backwards from the inevitable collapse, investors should realize that the chain of expectations driving the bubble is illogical and therefore it can never happen."[142] On this point Phelps goes further: "the expectations underlying asset prices cannot be 'rational' relative to some known and agreed model since there is no such model."[143] Rational expectations theory simply does not square with large world uncertainty.[144]

In addition, 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 a specified period to estimate loss thresholds on current trading positions within some confidence interval.[145] By observing daily returns on trading positions over, for example, the past 365 days and assuming that the data-generating process fit the normal, Gaussian distribution, risk managers within investment banks could give senior management a precise dollar figure of the firm's losses under a worst-case scenario.[146] Believing in the existence of a normal statistical distribution of events is central in a small world of risk – not so, however, in a large world of uncertainty marked by wild jumps best captured by power laws.[147] The VaR procedure was used by banks 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 in the morning that the chances of losing more than, say, $25 million that day were less than 1 in 20 (if the confidence interval was set at 95 percent). When the Swiss bank UBS applied its variant of the VaR technique to mortgage-backed

[141] 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.

[142] Rogoff 2010. [143] Phelps 2009. [144] Kirshner 2015a: 406–07.

[145] Blyth 2003: 248–51. Cassidy 2009: 274–79. Litzenberg and Modest 2010. Tett 2009: 33–34. Turner *et al.* 2009.

[146] Cassidy 2009: 274. [147] Taleb 2007. Chapter 1, section 3.

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securities, the models suggested that AAA-rated CDOs could never lose more than 2 percent of their value.[148]

Originally developed by J. P. Morgan to calculate VaR, the public release of RiskMetrics software established a new convention and one of the most important learning mechanisms 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 a second international agreement negotiated in 2004, most advanced countries agreed to incorporate VaRs into their regulatory systems.[149] The broad diffusion of VaR and its endorsement by regulators are surprising given the litany of problems associated with the approach.[150] The Value-at-Risk methodology makes sense as an efficient mechanism for handling risk only in the absence of the risk-uncertainty conundrum. Otherwise VaR is illusory. It was in fact a recipe for disaster as banks were making bets with hidden risks and uncertainties, as the crisis of 2007–08 illustrated.[151] The past is not a good predictor of what happens during extreme crises.

This was not the first time. The 1997 Nobel Prize winners Robert Merton and Myron Scholes, who, together with the late Fischer Black, had invented the model of pricing options, were at that time working for the hedge fund Long-Term Capital Management (LTCM), which was earning outsized returns. In August 1998 existing VaR models dramatically underestimated the riskiness of LTCM's positions.[152] Reflecting on LTCM's dramatic collapse, George Soros observed, "the increasing skill in measuring risk and modeling risk led to the neglect of uncertainty at LTCM."[153] The model could not handle events – in this case, the Asian Financial Crisis and the Russian government's decision to default on its debts – that lay in the realm of uncertainty.[154] Financial crises are often treated as exogenous "bolts from the blue." Mark Blyth makes

[148] Tett 2009: 136. [149] Cassidy 2009: 275.

[150] Kay and King (2020: 366–67) stress the importance of unavoidable uncertainty in the application of VaR models. Three major problems are discussed in the *Turner Review* (Turner *et al.* 2009: 44–45): (1) VaR was calculated on the basis of very short time series 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."

[151] Patterson 2023: 60–61, 105. [152] Dowd and Hutchinson 2010.

[153] Quoted in Patterson 2010: 99. [154] Szpiro 2011.

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a convincing case that VaR was instead 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."[155] As noted in the *Turner Review*, VaR "can generate procyclical 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."[156]

Why then did banks, hedge funds, credit rating agencies, and regulators all come to rely on quantitative risk models that were deeply flawed? Keynes offers a compelling answer. In the presence of uncertainty, financial market actors evolved new ways of coping. Regarded as evidence of the emerging science of financial economics, risk-management models were actually operating like social conventions. They offered the illusion that uncertainty had been transformed into manageable risk, thus laying the risk-uncertainty conundrum to rest. These conventions were supported by a powerful, collectively held belief: financial actors were rational agents operating in a world of measurable risk and efficient markets. As Gordon Clark notes, "myopia was justified by a panoptic theory of market behaviour and efficiency where any market distortions would be automatically 'corrected' by self-interested principals and agents."[157] These models could not lead participants to blow up markets and themselves. But since the efficient market hypothesis was based on the assumption of time-independent markets with single equilibrium states, there was good reason to doubt the veracity of the models. The evolution of markets is time- or path-dependent and thus generates multiple equilibria, none of which is completely stable. Human agency matters, and it is impossible to anticipate most contingencies in what is an open and complex system.[158] Subsequent events belied the models spectacularly during the crisis of 2008 and also in subsequent multi-billion losses sustained by trading units of UBS in 2011 and J. P. Morgan in 2012.[159] Focusing on 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 freed from the risk-uncertainty conundrum. Financier David Einhorn was on the mark when he belittled these models as airbags that work all the time except when the car has an accident.[160]

[155] Blyth 2003: 251.
[156] Turner 2009: 58. www.actuaries.org/CTTEES_TFRISKCRISIS/Documents/turner_review.pdf, accessed 01/14/25.
[157] Clark 2011: 7. [158] Smolin 2013: 258–63. [159] Protess *et al.* 2012.
[160] Lockwood 2015: 719.

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Relying on conventions, interpretive capacities of individual or collective actors can, at best, stabilize uncertainty contingently.[161] They cannot eliminate uncertainty. Social conventions are important because they feign that we can control an uncertain future.[162] In the 2008 American financial crisis, social conventions evolved from the widely shared belief in the inevitably upward movement of prices in the housing market and from the unqualified trust of bankers and traders in the quantitative, tractable models of market risk employed by financial institutions and credit rating agencies.[163] Rational expectations ruled out the possibility that the vast majority of informed people in deep, liquid, and competitive markets could make costly errors. Keynes, contrarily, is reputed to have observed that "markets can stay irrational longer than you can stay solvent."

Ironically, as money manager Keynes contradicted this aperçu. Misguided speculation almost cost Keynes his shirt in the 1920s. And between 1927 and 1932 returns on his investments slightly underperformed British stock markets. Around 1933 Keynes integrated his earlier work on risk and uncertainty with the general economic theory he was then developing. Thereafter his investments vastly outperformed British markets until his death in 1946. Taking heed of his own argument, Keynes abandoned speculation and adopted a "buy and hold" philosophy. Cleverly sidestepping the complementarity of risk and uncertainty, this investment strategy provided the model for Warren Buffett, the icon of American investment success in recent decades.[164]

3. The Hybrid World of Risk and Uncertainty

Financial markets, writes banker-lawyer Charles Morris, "occupy an ambiguous position between the world of hard science and the reflexive world of humans. In settled times, markets frequently do appear to be governed by law-like statistical rules, which enamor economic modelers. But those regularities break down dramatically in times of stress because of the reflexive, or mutual, interaction between human expectations and actual market behavior."[165] When actors calculate to cope with conditions of risk and uncertainty they cannot help but be embedded, cognitively and socially, in contexts filled with tacit knowledge that is informed by their worldviews, routines, and shared interpretations that seek to cope with the complementarity of risk and uncertainty. As is true for theories, models, and methods more generally, depending on how the question is

[161] Latsis *et al.* 2010. [162] Langley 2008: 481. [163] Millo and MacKenzie 2009: 641.
[164] www.maynardkeynes.org/keynes-the-investor.html, accessed 08/25/23. Zeckhauser 2010: 305–12, 341–43.
[165] Morris 2009: 13–14.

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posed at different times rational expectations and social conventions can clinch or vouch for their arguments.[166] Episodes in the history of financial accounting and trading illustrate this point.

The history of accounting reveals stable periods when risks are clearly calculable, information objectives are uncontested, and accounting is reduced to providing answers through technical and professional practices. In times of crisis, however, accounting is marked by profound uncertainties. When markets turn illiquid or disappear altogether and the very standard of measurement by which accounts are kept collapses, as it did in 2008 and 2009, how can accounting practices assess the value of assets? For one simple reason there is no clear answer to this question.[167] The standard of accountability by which actors assess value and risk is a variable story of evolving epistemic conflicts, claims, and consensus that shape and are shaped by the economy. Far from a mechanical exercise in counting, accounting is often an interpretive art of reading and manipulating accounts.[168] It consists of historically contingent practices of calculation that allow us "to describe and act on entities, processes, and persons."[169] Like language, theory, and models accounting has a performative side to it. It does not merely represent economic reality. It also shapes it.

Spurred by and reflective of the global rise of the American economy in the twentieth century, the social purpose of accounting practices has shifted from the protection of creditors and the guarantee of prudent stewardship to the provision of information for investors. This shift entailed dealing with a difficult issue – finding an appropriate measure of value. For many decades the standard had been historical costs. But since it was so inaccurate, cost remained a default standard that yielded to a series of piecemeal solutions and a multitude of incommensurable measurement conventions. Starting in the 1960s the push for a uniform asset-liability measure of balance sheets and market valuation was particularly strong in the United States. Subsequently this innovation spread to many other economies. As a consequence, the very nature of the firm was reimagined as a set of tradable rather than specific assets. In the wake of the 2001 Enron bankruptcy, the terminology of "creative accounting" entered conventional language. Such accounting overstated assets, inflated earnings reports, and led to a crisis for the accounting profession.[170] The rise of financial economics, with its presumption of the absence of uncertainty, created a growing distance between the analytical abstraction of finance economics and the empirical complexity of

[166] Cartwright 2007. [167] Miller 1998. [168] Veron *et al.* 2006.
[169] Chapman *et al.* 2009: 1. Power 2012. [170] Veron *et al.* 2006: ix–xiii.

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accounting practices. Yet investors found that the usefulness of abstracting from the world, of capturing complex issues of valuation in a few simple numerical ratios, was simply too attractive. Business schools taught the new models. MBAs implemented them in the world.

The "fair value" controversy during the 2007–08 financial crisis raised to renewed prominence the issue of how to measure value. Fair value is an imaginative construct that is deeply embedded in finance economics but only coincidentally observable in market prices. When markets were flush with liquidity "fair market value" had established itself quite readily and diffused internationally. "Idealists" championing the simplicity and coherence of the new standard prevailed over "pragmatists" who pointed to variegated practices on the ground.[171] With markets turning down sharply or illiquid in 2008, should mark-to-model valuation take the place of no longer operative mark-to-market valuation?[172] The central question about the relation between an abstract model world and a world grounded in specific practice was not settled by the financial crisis. Financialization strengthened the trend toward abstraction and quantification, illustrated by the fair market value movement and its implicit politics.[173] "The management of organisations," one study concludes, "is rapidly being transformed into and formalised around the management of risk, while much of the management of uncertainty occurs through a variety of hybrids that reside beyond the formalized practices of risk management."[174] In short, accounting is both a unifying interpretive exercise in the small world of risk and a highly variable set of contested practices in the large world of uncertainty – another instance of the risk-uncertainty conundrum.

More than anybody else arbitrage traders are experiencing these two worlds first-hand. This starts with the financial sector's difficulties in measuring accurately the risks of their products. In times of crisis that difficulty threatens the viability of banks because it increases uncertainty about the size of bank assets.[175] Furthermore, just as traditional value investors and momentum investors have different ways of determining economic value, so modern arbitrage depends on the possibility of interpreting securities in multiple ways. In the words of sociologists Daniel

[171] Power 2012: 300–05.
[172] "Mark-to-market" is an accounting rule stipulating 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, 130–01.
[173] Perry and Nölke 2006.
[174] Miller *et al.* 2008: 683. Similarly, the brief 2022 crisis of regional banks saw many panicking over how to value deposits.
[175] Lepinay 2007: 88.

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Beunza and David Stark "like a striking literary metaphor, an arbitrage trade reaches out and associates the value of a stock to some other, previously unidentified security."[176] Risk does not inhere in the value of assets but is created by subjective and social processes that cultivate and tax the cognitive flexibility of traders. In the Wall Street trading room of a major international investment bank this aspect of entrepreneurship is re-expressed in the institutionalized ability to keep multiple evaluative principles in play. This is accomplished through organizing traders into multiple teams with different tasks that constitute different communities of practice committed to different evaluative principles.[177]

The same principle operates also outside of trading rooms. Traders engage in reflexive modeling.[178] They compare their best principle of evaluation and bet against markets as reflected in price spreads. When spreads narrow other traders share their assessment and the trader is going to make money; when spreads do not narrow, the trader is going to lose money and will have to reevaluate her initial assessment or take the loss.[179] Successful trading can move markets and thus create self-fulfilling prophecies, bubbles, and, eventually, spectacular crises.[180] In the words of Roland Bénabou "market bubbles and manias exhibit the same pattern of investors acting 'colorblind in a sea of red flags,' followed by a crash."[181] In the run-up to the creation of the European Monetary Union (EMU), for example, traders recognized that the prices of southern European and German bonds were bound to converge, with Spanish, Italian, and Greek prices falling as those countries would benefit from the reputation and practice of German fiscal rectitude. As a consequence, southern European bond prices increased and yields fell. Everybody gained as risk taking led to rewards for traders, governments, and financial markets – until the music stopped in early 2010 with the onset of the Eurozone sovereign debt crisis.

Unwittingly, traders can also create the very uncertainties that their trading in risk is supposed to mitigate. This was the case in the near-collapse in 1998 of one of the largest and most successful hedge funds of the day, Long-Term Capital Management (LTCM).[182] Across diverse asset classes held worldwide, the unwinding of arbitrage positions caused very large, highly correlated price movements. For the very success of LTCM had led to widespread imitation, which created partially overlapping arbitrage positions and much higher rates of correlation among diverse asset classes than the traders at LTCM were aware of. When

[176] Beunza and Stark 2005: 87. [177] Beunza and Stark 2005: 90–92. [178] Buck 1963.
[179] Beunza and Stark 2012a. [180] Hardie and MacKenzie 2012: 189.
[181] Quoted in Sorkin 2017: F2.
[182] de Goede 2001. Lowenstein 2000: 143–60. Holzer and Millo 2005: 235–39.

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Russia defaulted on its ruble-denominated bonds and then devalued the ruble, the ensuing market preference for safe and liquid investments led to a self-reinforcing downward spiral of asset prices in various markets that required a massive bailout of LTCM by some of the world's largest banks.[183] LTCM's risk-management models were conservative and profitable. The fact that they were open to imitation proved to be the undoing of the fund. Imitation led to cognitive interdependence, overconfidence, and, ultimately, collective failure.[184] This social dimension of trading can be reinforced by the importance of common social and educational backgrounds and geographic proximity, which encourages herding and hubris.[185] Arbitrage could not remain a self-contained, economically rational strategy. It was firmly embedded in a larger social context that linked risk and uncertainty. And what is true of arbitrage is true generally. In this example risk is subjective, social, and of course tethered tightly to uncertainty.

Since in trading the small world of risk and the large world of uncertainty are deeply entangled, it is no surprise that the boundaries separating arbitrage (risk-free trading), hedges (risk-reducing trading), and speculation (risk-seeking trading) are porous – and not only on Wall Street. In his analysis of Japanese traders Hirokazu Miyazaki was struck by "the ambiguous and constantly shifting conceptual boundaries of the category of arbitrage vis-à-vis the broader category of speculation."[186] What is true of practice is true of product. Vincent Lepinay's research on the trading of new financial products in a French bank reports that "no one knows for sure how best to describe these products. The problem is not a paucity of descriptions, but rather an embarrassment of riches."[187] Managers who intervene because traders are incurring losses are doing so even when traders try to convince them that the losses are temporary and will soon turn into gains. Yet managers often cannot discern when traders have stopped acting as hedgers and started acting as speculators on the rise or fall of prices. The limits of arbitrage arise when differences in subjective risk expectations create opportunities for arbitrage. And they arise also when a rational and prudent trader faces uncertainty regarding whether, when, and to what degree peers will join in exploiting a common arbitrage opportunity that the trader has spotted.

Caitlin Zaloom provides an ethnographic account of the inseparably intertwined risk taking and speculation of traders. "Rationalized risk-management markets," she writes, "establish the conditions for speculation

[183] MacKenzie 2005: 65, 69–74. [184] Beunza and Stark 2012b.
[185] Carruthers 2010: 17–20. [186] Miyazaki 2013: 8; see also 2007: 399.
[187] Lepinay 2011: xix.

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in financial contracts."[188] Indeed, the very perspective on the management of risk diverts our attention away from the untoward consequences of uncertainty that can upend even the most nimble, attentive, and disciplined trader. In futures markets, traders often run up against the inherent limits of fully objectifying and containing uncertainty.[189] The institutionalization of imitation in the world of traders is an existential condition in the unending search for what often turns out to be fool's gold.[190]

Kay and King venture the guess that historical rather than theoretical developments have provided the foundation for the coping rationality of "fast and frugal" heuristics in a world of risk and uncertainty. Evolution helped along ecological forms of rationality that differ from the rationalist optic favored by economists.[191] The human history of alchemy surely will continue in the future concealed by always changing information technologies. Improving on the narrow economic rationality believed to be operating in the small world of risk, evolutionary history has endowed humanity with ways of knowing and coping that may be more appropriate for living with the risk-uncertainty conundrum.[192]

4. Central Bankers Talking to Markets

In a famous essay on the methodology of positive economics published in 1953 Milton Friedman compared economics with physics.[193] Both construct abstract models, physics of bodies falling in perfect vacuums and economics of actors rationally calculating their interests, based on perfect information. The realism of the assumption, Friedman famously argued, did not matter in either case. What mattered was the accuracy of the predictions these models generated. Often not exceeding educated guesswork, economic prediction has an accuracy that falls far short of Newtonian physics. To date, specialization in financial economics has not succeeded in affixing credible probabilities to possible futures. In fact, computers running crude extrapolation algorithms rather than sophisticated statistical models have bested economic experts.[194] But more than half a century of predictive failure has done nothing to undermine the stature of economics as "the queen" of the social sciences. Friedman implicitly shared with his audience a Newtonian humanism that informed his theorizing and helps explain a PR success that has been nothing short of spectacular. The metaphor of the free market as a spontaneous, self-correcting machine updated Adam Smith's "invisible hand" for twentieth-century capitalism.

[188] Zaloom 2006: 93, 94. [189] Zaloom 2006: 95. [190] Rao *et al.* 2001.
[191] Kay and King 2020: 152–53, 154–77, 268–76, 402–17.
[192] Kay and King 2020: 16. [193] Friedman 2008: 153. Blakely 2020: 13–18.
[194] Tetlock 2005: 59, 247.

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It established the authority of economics as an important part of public culture. Performing before the audience of government regulators, the general public, and markets has made smooth-talking economic commentators look like knowledgeable, responsible, and authoritative interpreters of our financial future. Despite their recurring "predictive" failures, their rhetoric displays an astonishing amount of "productive" power in shaping the political economy of the day.

Although central banks matter greatly, in recent decades their conventional policy tools have been found wanting.[195] The spotlight thus has shifted to their world-making and story-telling powers. Put simply, these days the most important task for central bankers is to "talk" to markets.[196]

Rather than being "represented," language enacts or "re-presents" the economy.[197] For several decades before the financial crisis of 2007–08 revealed their flaws, central bankers relied on "econometric allegories" to shape market expectations.[198] The allegories of rational expectations theory came to provide the only language in which central bankers and monetary economists could speak with confidence and credibility.[199] Finance theory was incorporated into markets as a legitimating linguistic device.[200] A trader for Solomon described some of the downsides of this practice. The Gaussian assumption of a normal distribution of risk was occasionally built into some of the models simply for convenience's sake: "sometimes we'd assume normal just to make it even more simple."[201] In the words of Alan Blinder "economists ... have bent reality (at least somewhat) to fit their models."[202]

His qualification – "at least somewhat" – speaks to the importance of markets as Michel Callon's "calculative collective devices."[203] Financial goods and services are often extremely uncertain in their values, and the number of actors involved in financial markets is often very large and highly dispersed. "How can agents calculate when no stable information or shared prediction on the future exists?"[204] Markets are effective institutions because they make possible complicated calculations that yield practical solutions that could not be reached only by theoretical reflection.[205] Calculative behavior goes beyond numerical calculations. It is a hybrid of calculation, judgment, and imagination. In moments of crisis, it relies on interpersonal trust to keep the system running. At the height of the 2008 crisis, for example, the Federal Reserve stepped into

[195] Pigeon 2011: 255. [196] Blinder 1998, 2004. Blinder and Reis 2005. Swanson 2023.
[197] MacKenzie 2006. [198] Blinder and Reis 2005: 5. [199] Hall 2008: 183.
[200] MacKenzie 2006: 29–30, 32–33, 255–59. MacKenzie *et al.* 2007: 4–5.
[201] MacKenzie 2006: 215. [202] Quoted in MacKenzie 2006: 25.
[203] Callon and Muniesa 2005: 1229–31. [204] Callon 1998: 6.
[205] Callon 1998: 23–32.

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the role of an international lender of last resort by injecting $600 billion in emergency funds to shore up the position of some central banks but not others.[206] The laws of the market are neither discoveries revealing hidden truths nor pure constructions illuminating an opaque reality. Economic laws are better thought of as "regularities progressively enforced by the joint movement of the economy." Such regularities in practice connect the obduracy of the world with the contingency of the artifact of reason conveyed through multivalent language.[207]

Resonating with post-Newtonian and para-humanist worldviews, from the vantage point of language, a financial crisis is not an event "out there" but a set of interpretive and rhetorical acts "in here." These acts have different effects in different places and at different times. The ideas of economists are part of a social performance of localized practices. They are assimilated by experts and policy makers who, sometimes against their better knowledge, pretend that these ideas are true. Cast in the form of stories, economic ideas are thus put into the service of re-presenting rather than representing reality. Furthermore, these ideas are built into the operation of both the financial system and the system of government regulation.[208] Beyond all calculative tools, judgment devices and cultural frames are central for decisions made under conditions of uncertainty.[209] A fictional future is not disclosed as such and regarded as separate from the world. Instead, it is perceived as a natural though contestable story about the future that emerges in the process of social interaction. When calculation-based expectations under conditions of uncertainty are beyond reach, fictional rather than rational expectations are the foundation for non-capricious action.

This is the view of one of the leading "quants" in the world of finance. Evoking Newton's unsuccessful experience as a speculator, Emanuel Derman views his models as "imaginary" inquiries.

> In physics you're playing against God . . . When you've checkmated Him, He'll concede. In finance, you're playing against God's creatures, agents who value assets based on their ephemeral opinions. They don't know when they've lost, so they keep trying . . . The right way to engage with a model is, like a fiction reader or a really great pretender, to temporarily suspend disbelief, and then to push it as far as possible.[210]

And it is not only the world of models that has fictitious elements. In the social world we all inhabit, "the imagined future can affect the present, and thereby the actual future too."[211] Financial stability and instability

[206] Sahasrabuddhe 2024. [207] Callon 1998: 46. [208] Riles 2011. Hjertaker 2011.
[209] Beckert 2010: 2, 7, 9, 25, 30. [210] Derman 2004: 266–69.
[211] Derman 2011: 142.

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are not the outcomes of autonomous market dynamics as much as they are deeply intertwined with imagined futures.[212] This is not a recent development. It was as true of the commercial law for merchants that developed in Europe over several centuries as of the legal fictions sustaining neoliberal ideas during the last several decades.[213]

Decision making in the Federal Reserve confirms the importance of stories fashioned in the shadow of the risk-uncertainty conundrum.[214] The economic crises of the late 1970s, early 1980s, and early 2000s left members of the Federal Open Market Committee (FOMC) perplexed and conflicted. Transcripts of their meetings point to "the existence of confusion and uncertainty" that were strategically obscured from the public "to maintain the mythic view of technical rationality."[215] Policy makers needed both to make sense out of new economic environments and at the same time come up with stories that would shape the views of others who were watching and listening. The process was inherently conflictual, both within the Federal Reserve and also between the Federal Reserve and market actors. It was a conflict less over discrete preferences and more over shared understandings and the meaning of different stories.

The transcripts of the 1982 FOMC meetings, for example, show how Chairman Paul Volcker helped break the way conventional economic analysis had framed policy in the midst of a deep recession. Confusion and the lack of viable alternatives led to a collective questioning by members of the FOMC of what to do. Volcker reframed the issues by denigrating the importance of conventional monetary targets, evoking the memories of 1929 as the relevant comparison for the worldwide recession of 1982, pressing for a lowering of interest rates, and underlining the importance of uncertainty in an era of transition. In short, he came up with a different story.

Judging by the published transcripts of their meetings between 2003 and 2005, members of the FOMC were aware of both risk and uncertainty.[216] The 2003 meetings, for example, were held just prior to the invasion of Iraq when the prospect of war and its uncertain effects on oil markets were all-pervasive. The 2005 meetings occurred in the context of skyrocketing housing prices. The discussions show that central bankers

[212] Dobbin 2004. [213] Riles 2011. Swedberg 2004.
[214] Smialek 2023a. Leonard 2022. Blinder 2013. Greider 1987. [215] Abolafia 2012: 94.
[216] It is noteworthy that Alan Greenspan's (2010) lengthy reprise of the crisis refers frequently to the concept of risk and has virtually nothing to say about uncertainty. In contrast, in 2004 Greenspan (2004: 38) acknowledges the existence of uncertainty: "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."

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were framing their policy choices in terms of both risk and uncertainty. Peering into a dense fog, FOMC members were acutely aware that the Federal Reserve's guesses had the power to move markets. Hoping to stabilize expectations, with their stories they tried hard to build common understandings under conditions of uncertainty.

Discussions of the FOMC during the financial crisis of 2007–08 show an even greater emphasis on story-telling during uncertainty. Surprise, confusion, groping forward, and sense making is how economic sociologist Mitchel Abolafia summarizes how members of the FOMC coped with totally unexpected conditions. Their interpretations sought to mend the jarring tears in the fabric of accustomed expectations.[217] Sense making was helped by reams of statistical and qualitative information and the conventions of macroeconomics and central banking practices at which FOMC members excelled. The existing tool kit of policy enhanced the group's learning, innovation, and improvisation. Analytic discretion was its preferred option – for Abolafia "a synthesis of conventionalized economic facts, constructed narratives, and pragmatic experimentation."[218] Sense making by the FOMC was based not on the aggregation of individual opinions but on an adaptive group process of deliberation shaped by a shared story told in a specific cultural context. FOMC members were deeply steeped in the logic of modern finance theory and imbued with an abiding faith in the resilience of finance. Their initial discussions in August 2007 revealed a trained incapacity to sense the frailty of financial markets. At first, the narrative of self-correcting markets made the contagion narrative of out-of-control markets unpersuasive. Over the course of the crisis the FOMC gradually let go of the traditional way of framing issues and moved to a new story reflecting a pragmatic mode of experimentation in new circumstances. The creation of plausible stories takes up the largest part of the transcripts of the FOMC meetings.[219] Narration as part of sense making eschewed decontextualized and conveniently calculable facts that proved simply unhelpful in dynamically changing markets sending ambiguous signals.

Members of the FOMC thus learned gradually that statistics were of limited use in predicting the future. Instead of trusting standard scientific tools they created stories and matched them with patterns familiar from prior experience.[220] Used almost as frequently as the term "uncertainty," in the fall of 2007 the term "risk" generally referred to the costs of the uncertain. It betrayed the view of a concrete and fully knowable world. But the FOMC also articulated a pragmatic approach which focused less

[217] Abolafia 2020: 1–3. [218] Abolafia 2020: 3. [219] Abolafia 2020: 9, 27–29, 155.
[220] Abolafia 2020: 160–61.

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on the cause of the crisis and more on learning from the effects of the FOMC's actions themselves. Knowing, acting, and understanding became inseparable in a creative merging of positivist and interpretive epistemologies. In the domain of risk and uncertainty scientific knowledge, Abolafia concludes, was vital but not sufficient.[221] Scientific epistemologies were "archaic." They failed to acknowledge that financial contagion was not a manifestation of hysteria but of a systemic weakness that new financial instruments and practices had introduced into markets. And this required the fashioning of new stories.[222]

Language is a powerful weapon in the arsenal of the Federal Reserve. Aided by an attentive public that is informed by influential institutions – print, electronic and social media, hedge funds, banks, and governments – central banks have sought to create self-fulfilling policies to suit their purposes. This can raise novel issues. As Abolafia writes, "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."[223] Compelling and widely shared central bank narratives are an important resource for strategically influencing the expectations and practices of market participants. For markets are Alan Blinder's "giant biofeedback machines" that monitor and publicly evaluate Fed policies.[224] Secrecy and insularity have given way to openness and transparency as a way of increasing the efficacy of central bank policies. As Blinder has noted, "the best a central bank can do is to 'teach' the market its way of thinking."[225] During his long tenure Chairman Greenspan perfected his talking skills.[226] The combination of frank admission of complexity with seasoned judgment made his legendary obfuscation a linguistic art form. He once reminded an audience of businessmen that "if I've made myself too clear, you must have misunderstood me."[227] In moments of crisis, his stories generated faith in the Fed's ability to cope with an unknown future. Stories helped stabilize the "contingent expectations" of market actors that govern decisions under uncertainty.[228] In short, the social power of central banks rests not only on shaping information about prices in risky markets but also on skill in negotiating with markets over the interpretation of indeterminate situations under conditions of uncertainty – a good description of the complementarity of risk and uncertainty.[229]

[221] Abolafia 2020: 157. [222] Abolafia 2020: 45–47, 111–12.
[223] Abolafia 2012: 110–11. [224] Blinder 1998: 62. [225] Blinder 2004: 25.
[226] Blinder and Reis 2005: 6–9. [227] Cornwell 1996. [228] Beckert 2012: 18–19.
[229] Hall 2008.

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Twenty-four-hour news cycles, ever-present social media, and AI have made central bankers increasingly aware that their statements have profound effects on markets and the economy. But how, precisely, does the talk of central bankers affect the economy? In the conventional view of language as a mirror, the economy can be captured by knowable laws and statistical regularities. Language matters only as an instrument that represents economic objects and processes. Disagreements over economic issues, accordingly, are not differences over which stories best capture laws or regular economic behavior. Central bankers know market dynamics and represent their knowledge through language.

Often, however, and especially in crisis conditions, central bankers generate economic outcomes by the stories they tell. Like actors on a stage, central bankers perform by telling stories designed to nudge markets in a preferred direction. Financial markets and the economy are for economist Douglas Holmes "communicative fields" that are a function of language.[230] They are abstract metaphors of complex patterns of social action undertaken by individuals, groups of actors, corporations, and institutions. All of these actors have different pictures of what everyone else is thinking, doing, and planning. And central bankers can shape the pictures market participants hold of the airy abstraction called "the economy." Since the mid-1990s the Federal Reserve has become increasingly aware of its communicative power and has used it strategically to help produce its preferred outcomes. The seemingly incoherent mumbling of Federal Reserve chief Alan Greenspan was deliberately tailored to create images of the future economy that helped shape expectations and thus move the economy in the direction the Federal Reserve deemed desirable. Aiming to bring into being a specific state of the economy, the Federal Reserve's language was performative.[231] This productive use of language creates the context for statistical data and econometric predictions. Thus, the shifting and fugitive dynamics of the economy are made available to all market participants through language.[232] Put differently, acting in the large world of uncertainty the Federal Reserve has tried to talk the economy toward the small world of risk.

5. Extensions and Reflections

Economics, writes political scientist James Scott, has "incorporated calculable risk while exiling those topics where genuine uncertainty prevails."[233] Beyond finance, on general questions of political economy

[230] Holmes 2014: 15, 32–35. [231] Holmes 2014: 11, 15, 26. [232] Holmes 2014: 25.
[233] Scott 1998: 322.

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students of world politics have imitated economics and also ignored uncertainty. The paradigmatic American approach to the study of International Political Economy – "Open Economy Politics" (OEP) – moves entirely in the world of risk. In a paper addressing the effects of uncertainty, David Lake and Jeff Frieden concede that uncertainty increases in crises and then proceed to argue that risk and uncertainty "are similar enough to be conflated for our purposes."[234] In this way they and many scholars of international political economy follow the long line of economists who treat the difference between risk and uncertainty as semantic rather than substantive.[235]

In OEP economic actors have clear preference orderings. Interests are deduced from an actor's position in markets. Policies and outcomes are ranked according to how they affect an actor's expected future income stream. Interests are aggregated by institutions, which in turn structure the bargaining that occurs. The main advantage of OEP is its deductive argument about preferences. OEP scholars start with sets of actors who "can be reasonably assumed to share (nearly) identical interests ... Deducing interests from economic theory was the essential innovation of OEP."[236] This approach has stunted political analysis. Political potentials, innovation, and creativity are made invisible in a static framework that assumes that the preferences of actors are determined by their structural position. OEP derives parsimonious theories of politics from sparse economic theory. The flow is from micro to macro in an orderly, linear progression. To simplify analysis, work in the OEP tradition adopts a partial equilibrium analysis by focusing, at most, on one or two steps in this causal chain and treating the others in reduced form, a simplification that reduces complexity by holding constant many elements that otherwise would make analysis more complicated and perhaps numerically intractable. In principle though all partial analyses can be assembled into one integrated whole. Entangling processes are absent in this mechanistic approach grounded in Newtonianism.

[234] Lake and Frieden 1989: 6–7.

[235] Ahlquist 2006. Bernhard and Leblang 2006. Bernhard *et al.* 2002. Koremenos 2005. Koremenos *et al.* 2001. Mosley 2006. Rosendorff and Milner 2001. Sobel 1999. For dissents without repercussions in OPE, see Blyth 2002, Oatley 2011, and Nelson and Katzenstein 2014. Rathbun (2007) argues that while "uncertainty" is a central concept in the study of international relations, competing research traditions in the field (realism, rationalism, cognitivism, and constructivism) define the term differently.

[236] Lake 2009b: 50; 2009a: 226–27, 230–31; 2006. OEP rests on two core assumptions: (1) economic policies produce income effects that are driven by an agent's position in the domestic and international division of labor and (2) economic agents, once they know what they want, make rational decisions as if they knew the relevant probability distributions.

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The "rational expectations revolution" had a profound effect on OEP and the field of International Political Economy. According to Jonathan Kirshner, a central tenet of IpE (the lower-case "p" underlines the unimportance attached to politics in this formulation of political economy) is "that if rational agents have access to the same information, they will reach the same conclusions about expected outcomes."[237] Informed by rational expectations theory, OEP thus moves exclusively in the world of risk.[238] The assumption that interests can be read off the agents' situation in the international division of labor constitutes the "hard core" of the OEP paradigm.[239] Strategic decision making is modeled as unproblematic because analysts do not know how to model uncertainty. OEP transposes uncertainty into risk even though the rules of the game are unclear, and their future trajectory is pure guesswork.[240] This is an important reason why the collective performance of the field of political economy in the years around the financial crisis of 2008 was, in the words of Benjamin Cohen, a leading scholar of international political economy, "embarrassing" and "dismal."[241] To be sure, OEP specialists were not alone in missing the signs of the gathering storm. It is nonetheless surprising how little scholars of OEP had to say about the financial crisis after it had passed. With the exception of one review essay on financial market regulation, in the five years after the financial crisis broke out in 2007 the subfield's premier journal did not publish a single article on it.[242] This collective silence makes apposite Lawrence Summers' biting criticism of macroeconomics: OEP scholars are unlikely to learn much as long as they put on "the armor of a stochastic pseudo-world before doing battle with evidence from the real one."[243] And most of the time the real world contains a healthy dose of uncertainty.

Sympathetic to OEP, yet insisting on the autonomy of politics, Gourevitch and Shinn make an important modification to address the limitations of an exclusively risk-based analysis. In their view, the assumption of OEP about the origins of preferences is too arbitrary in ruling out the importance of political autonomy and its corollaries – potentialities residing in the domain of the unknown. Structurally induced economic incentives are not determinative on their own. Often, they yield to the complexities of coalition formation driven by an unconstrained politics. "We stress incentives and interests ... the rules of production do influence behavior ... Where we disagree on emphasis is in explaining the

[237] Kirshner 2011: 205; 2014: 46–48. [238] Kirshner 2015a. [239] Lake 2009a: 231.
[240] Holzer and Millo 2005: 228. [241] Cohen 2009: 437.
[242] Helleiner and Pagliari 2011. In personal correspondence (10/2/16), *International Organization*'s then editor, Jon Pevehouse, also expressed his astonishment.
[243] Summers 1991: 146.

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origins of those rules (politics for us [is] not . . . the 'autonomous' economy pure and simple)."[244] The complex politics that Gourevitch and Shinn evoke includes large world uncertainty that OEP disregards at its peril.

Financial markets are frequently rocked by unpredictable and destabilizing events.[245] Yet many scholars and practitioners continue to assume that finance lies squarely in the world of manageable risk, overlooking the risk-uncertainty conundrum.[246] A world that mixes calculable risk with unknowable uncertainty creates ambiguities that have to be acknowledged, unraveled, and circumnavigated rather than denied. Denial creates a hubris that can lead to great harm. Two of the leading "quants" of finance, Emanuel Derman and Paul Wilmott, express caution and humility in reacting to the 2008 crisis. Their Modelers' Hippocratic Oath reads:

> I will remember that I didn't make the world, and it doesn't satisfy my equations. Though I will use models boldly to estimate value, I will not be overly impressed by mathematics. I will never sacrifice reality for elegance without explaining why I have done so. Nor will I give the people who use my model false comfort about its accuracy. Instead, I will make explicit its assumptions and oversights. I understand that my work may have enormous effects on society and the economy, many of them beyond my comprehension.[247]

This oath resonates with cosmologist Andrew Pontzen, who is working with computer simulations. He acknowledges that at present cosmology cannot predict either future or past. "Ultimately galaxies are less like machines and more like animals – loosely understandable, rewarding to study, but only partially predictable. Accepting this requires a shift in perspective, but it makes our vision of the universe all the richer."[248]

After he had presided over an extended boom and the greatest financial crash in two generations, a baffled Alan Greenspan, at the ripe age of 87 published *The Map and the Territory*.[249] The book acknowledges that maps can warp the territory.[250] Greenspan had mistaken the economists' map of the small world of risk as an accurate tool for navigating the large world of uncertain financial markets. He ruefully commented on the existence of levels of risk "many multiples greater" than exist in the physical sciences.[251] Before the universally unanticipated financial crisis of September 2008 hubris was the watchword of Greenspan's "Great Moderation" and his widely celebrated success in taming capitalism's unpredictabilities. Humility came later.

[244] Gourevitch and Shinn 2005: 93.
[245] Taleb 2007. Pauly 2011: 250–51. Blyth 2013: 210–11. [246] Kessler 2011: 2177.
[247] https://jravilab.github.io/post/modelers-hippocratic-oath/, accessed 12/12/22.
[248] Overbye 2023. [249] Greenspan 2013. [250] Clancy 2024. [251] Greenspan 2013: 6.

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Evoking Newton's unhappy assessment of the "madness of people" that cost him a fortune in the 1720 crash of the South Sea Company, Greenspan reflects on irrational behavior that is "hard to measure and stubbornly resistant to any reliable systematic analysis."[252] Moral hazard offers one example.[253] In the insurance business it is a byproduct of turning incalculable uncertainty into calculable risk. Before statistical data became widely available, stereotyping and discriminatory profiling practices were the rule. Moral hazard referred to specific characteristics of insurable individuals that put them in an "uncertain" category, outside of the bounds of socially acceptable risk measurement. Over time "moral hazard" shifted from referring to the intrinsic, unmeasurable, and uncertain character of an individual to the attribute of a population that could be measured quantitatively and assessed in terms of risk.[254]

Insurers now set premiums that take account of predictable risk differences in moral hazard existing within specific populations.[255] Moral hazard obtains any time one party bears the costs of another party's risk. When insurance is available, individuals will create moral hazard by engaging in riskier behavior. The uncertain human element is eviscerated. Calculable risk reigns in the small world. Uncertainty disappears. This shift in the meaning of moral hazard has allowed insurers to adopt a rhetoric of morality while enacting an actuarial view of the world.[256] Government bailouts of financial institutions in the 2008 crisis were widely decried by both Left and Right. But their logic did not differ from the social insurance schemes set up in the past as the core of the welfare state and insurance against climate-induced disasters which will help define business in the future: individuals and institutions are insulated from the consequences of their own actions in the make-belief of a risk-only world. This costs money, a lot of money, measured in the case of the environment in hundreds of billions of dollars in the short term and in social welfare in many trillions of dollars in the long term.[257] Gordon Gekko defined moral hazard in Oliver Stone's movie *Wall Street: Money Never Sleeps*: "moral hazard is when someone takes your money and is not responsible for it."[258] It is one of many uncertainty-denying risk-ruses that Alan Greenspan talked about. Even though they can be managed, "no one can eliminate the risks of hubris,

[252] Greenspan 2013: 9.
[253] Arrow 1968. Baker 1996: 244–51. *Oxford English Dictionary* 2023a, 2023b. Dewan 2012. Summers 2007. Pearson 2002. Dembe and Boden 2000. Grubel 1971. Hale 2009.
[254] Arrow 1963. Gladwell 2005. Rowell and Connelly 2012: 1053–55.
[255] Arrow 1963, 1968. Rowell and Connelly 2012: 1063–67. Dembe and Boden 2000: 263. Pauly 1968. Grubel 1971.
[256] Baker 1996: 269–70, 275. [257] Ip 2025. [258] Saler 2012.

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stupidity, miscalculation, and miscommunication" writes Lou Pauly.[259] Short-term mitigation by some forms of reinsurance is possible. Beyond that lies, on occasion, complex and assertive state intervention and, always, the domain of uncertainty.

The risk-uncertainty conundrum is a general feature of the world. As this chapter has shown, it is a central feature of financial markets. James Shinn has argued that subtle changes such as the growth in hedge fund resources, an expansion and acceleration of news cycles, the diffusion of policy elites, and the consolidation of legal and intellectual regimes in the international economy may be nudging the uncertain world of finance just a little closer toward the world of risk, while global warming may nudge a socially and economically deeply entangled environment a bit further toward uncertainty.[260] This risk-uncertainty see-saw is a clear-and-present danger. The more than half a trillion dollars involved in the failure of three regional banks in 2023 exceeded the twenty-five bank failures during the financial crisis of 2008. Bailouts of smaller by bigger banks increase centralization in financial markets.[261] This all but guarantees that a future crisis, both inevitable and unpredictable, will have even greater consequences.[262]

Charles Schultze once remarked that "when you dig deep down, economists are scared to death of being sociologists." This observation is matched by the condescending terminology of some sociologists who dub economic analysis as "economistic" and inherently flawed.[263] One way or the other, claims of intellectual superiority ring hollow as we aim to understand and engage practically the complementarity of risk and uncertainty.[264] We are better served by marshalling all of our intellectual resources as best we can. In specific contexts economic theories can explain robust regularities in the behavior of actors, modeling individual and collective beliefs in ways that often yield accurate predictions based on past trajectories. Social analysis, however, helps us understand the unpredictabilities of the world. Human agents cope by relying on social conventions and performative story-telling so that they have the confidence to make choices under conditions of uncertainty.[265] Memory is an important ingredient for the stories we tell and believe in. And memory is fickle and changeable. The contentious debates in the 2000s over the repeal of the Glass–Steagall Act and the separation of commercial from

[259] Pauly 2025: 169. [260] Shinn 2011.
[261] Russell and Zhang 2023. Farrell *et al.* 2023. [262] Taleb 2007: 226–27.
[263] Quoted in Beckert 2002: 42.
[264] Benjamin Cohen (2009: 442), a doyen of the field, observes that mainstream IPE scholars by and large failed to even anticipate the crisis – a "myopia" which he blames on the "distinct loss of ambition, reflecting the gradual 'hardening' of methodologies." The counterpoint to Cohen is the more optimistic view of Helleiner 2010.
[265] Nelson 2017.

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investment banking illustrated that with the fading of the memory of the 1930s, the urgent lessons of the Great Depression receded and old stories became contested. The same is likely to happen with the memory of 2008, still remembered as traumatic by the generation that experienced it first-hand and increasingly forgotten by the next generation – which thus may condemn itself to learn anew how to contain financial contagion.[266]

The inadequacies of economic analysis are understandable. Economies are complex. But economists' denial of the risk-uncertainty conundrum is simply a lack of candor. For physicist Mark Buchanan there is a "jaw-dropping discrepancy between economists' claims and reality."[267] One of the main reasons, Buchanan argues, is the fixation on atypical, equilibrium-seeking systems. This disregards the science of non-equilibrium systems with their positive feedback loops and natural instabilities. Such systems fit much better into a post-Newtonian and para-humanist worldview than into Newtonian humanism. Questions of order, disorder, and change are often not well answered with theories leaning on mechanical models first made fashionable in the late nineteenth century. Buchanan's charge resonates with humanists and social scientists who, as objects of economists' "imperialism," have been told that their traditional approaches are "unscientific." Now, economists find themselves the uncomfortable object of another discipline's imperial ambitions. It is true that some physicists have made a lot of money pricing financial instruments on Wall Street. But others have made important contributions to our understanding of financial economics without subscribing to the concept of balanced order and the efficient market hypothesis. Like the weather, the economy often evolves in a highly irregular and unpredictable fashion. An overarching theory of economic weather, such as the efficient market hypothesis, is unhelpful. Working with metaphors like "markets know best," it provides evidence for the deep-seated aspiration of an unobtainable social physics. Markets do not always know best, as the financial crisis of 2007–08 amply illustrates. Forecasting the economic weather without understanding storms is a hopeless enterprise.[268] What is needed is a manual of economic models attuned to specific conditions in highly variable economic climates.

The risk-uncertainty conundrum is not specific to finance.[269] It characterizes many other policy sectors including insurance, weather forecasting

[266] Tett 2024. [267] Buchanan 2013: 13.

[268] Buchanan 2013: 12–23, 28–29, 32–40, 64–69. David Orrell's (2018, 2022) quantum approach to finance shows that money is not a simple, inert, mundane medium of exchange of little consequence for the economy but a complex, contradictory, magical substance with profound effects on the economy. Typically, the economy is not stable and fair, seeking an equilibrium, but unstable and unfair, trending toward disequilibrium.

[269] Pauly 2025.

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and climate change,[270] science and technology,[271] and environmental law.[272] Simply put, it is a general condition affecting most spheres of life. The presumption of regularity and control is recurrently challenged by reminders of the unavoidable limits of prediction. Sheila Jasanoff therefore pleads for an approach to policy that does not hide behind the excuse of defective data and erroneous calculations. Policy needs to accept uncertainty as its foundation and harm mitigation as its main goal. In finance this speaks for rolling back financialization and deregulation based on overconfidence in the predictability of markets, more guard-rails, and less trust in the latest economic models and "killer methods." More generally, Jasanoff suggests, we should aim for more humility understood as a collective practice of societal self-reflection that "occupies the nebulous zone between preparedness and precaution."[273] The world is complex and not made legible only through gathering and manipulating objective facts. The limits of our knowledge should instill modesty. World politics is my own backyard. It, too, continues to surprise and thus invites us to explore unfamiliar and perhaps uncomfortable ways of thinking.[274] As in this discussion of finance, so on questions of nuclear war and global warming: we need to push beyond the conventional belief that humanist Newtonianism offers a secure foundation for our understanding of the complementarity of risk and uncertainty.

[270] The Geneva Association 2009. Lohmann 2010. Daipha 2015. Blinder 2019.
[271] Wong 2011. [272] Farber 2011. [273] Jasanoff 2021a: 14.
[274] Townsell *et al.* 2021: 27. Kurki 2020.

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