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Governing Risky and Uncertain Financial Markets

Stephen C. Nelson

Have the post-crisis regulatory efforts made financial systems safer? The regulatory agenda is incomplete and therefore insufficient because it does not adequately deal with the fact that financial markets are characterized by both risks and uncertainties. When risks cannot be measured, because of lack of experience or incompleteness in our knowledge about the forces that shape financial markets, decision makers are in the world of uncertainty. The effectiveness of widely used risk management models is inversely related to the degree of uncertainty and complexity in financial markets. Financial systems remain more unstable and dangerous than they should be because policymakers continue to delegate risk assessment and management to the members of the financial community without asking hard questions about the conditions under which risk models can work. The “macroprudential” approach to financial governance takes both uncertainty and risk seriously and thus is a better route to more robust financial systems.

We are now four years into the post-Lehman Brothers era. Two serious crises – the meltdown in the American financial system and global credit crunch, and the ongoing sovereign debt crisis in the Eurozone – have spurred a flurry of regulatory initiatives. Regulators continue to face a very difficult balancing act. On one hand, they must try to ward off socially destructive decision making by financial market actors. The pre-crisis regulatory environment failed to prevent traders from taking excessively risky positions that were covered by implicit insurance contracts written by governments and paid for by

taxpayers. On the other hand, regulators do not want to stifle the kinds of activities that enable financial markets to contribute to economic growth – namely, markets’ roles in channeling funds from savers to spenders and enabling participants to pool and trade risks.

Many observers argue that the crises reflect a collective failure of governance. Prior to the September 2008 collapse of Lehman Brothers, the widely held view was that market insiders knew best how to regulate the financial sector. The International Monetary Fund (IMF), for example, endorsed the views of policymakers like

the former head of the U.S. Federal Reserve, Alan Greenspan, approvingly quoting from one of his speeches in its 2006 *Global Financial Stability Report*: “increasingly complex financial instruments have contributed to the development of a far more flexible, efficient and hence resilient financial system than one that existed just a quarter of a century ago.” Among the policymakers, bankers, and economists that shaped the pre-crisis regulatory environment, nearly all converged on the view that financial actors were rational, profit-maximizing agents operating in a world of controllable risks and efficient markets. If that was true then the risk management techniques employed by major financial institutions could not lead the participants to blow the markets, and themselves, up. If the pendulum had swung too far toward self-regulation by markets in the pre-Lehman period, the thrust of regulatory policymaking in many countries since the crisis has been the effort to swing the pendulum back toward the state. Many of the initiatives involve reasserting the authority of national and supranational officials over what goes on in markets for financial assets.

The regulatory initiatives go some of the way toward preventing a recurrence of the events of the last four years. To take but one example, the Basel III banking standards, which will be voluntarily adopted by signatories and their financial institutions over the next decade, intend to reduce the fallout from excessive risk taking by raising capital requirements and clarifying how banks can construct risk-weighted measures of capital adequacy, capping leverage ratios, and setting liquidity requirements to ensure that banks can withstand short periods of extreme stress. These are all good things, but Basel III, like other regulatory efforts, is incomplete (and therefore insufficient) because it does not deal with the fact that financial markets are characterized by both risks *and* uncertainties.

The conceptual distinction between risky and uncertain decision settings is at least

ninety years old. Two eminent economists, Frank Knight and John Maynard Keynes, working separately, developed the distinction and elaborated on the economic consequences of that distinction in the 1920s and 1930s. The distinction remains of fundamental importance for the analysis of financial markets. The comment made by former U.S. Secretary of Defense Donald Rumsfeld at a 2002 press conference remains the best known attempt by a public official to articulate the difference between risk and uncertainty: “There are known knowns, there are things we know we know. We also know there are known unknowns; that is to say we know there are some things we do not know. But there are also unknown unknowns, the ones we don’t know we don’t know.”

In environments characterized by risk a decision maker can attach a probability distribution to the range of plausible outcomes resulting from a decision. Auto manufacturers, for example, can estimate the chance that a car’s brakes will fail after a certain number of miles based on known probabilities of failure under different conditions (climate, traffic patterns, etc.) generated from many repeated tests in a laboratory setting. This is the world of risk. In the world of uncertainty, by contrast, probabilities are unavailable, because history has not supplied enough events that were sufficiently similar to allow us to group events together and estimate their frequencies. If the answer to the question “can we reliably forecast future events based on known probabilities of past occurrences?” is yes, then we are squarely in the world of risk. If the answer to that question is no, then we may be in the world of uncertainty.

Models Behaving Badly

Why does the conceptual distinction between risk and uncertainty matter for our understanding of behavior in financial markets? After all, most financial economists based in the U.S. rejected the dis-

inction. The problem lies in the fact that models designed for a fantasy world characterized solely by risk will always run into problems when they are taken to the real world in which markets are characterized by both risk *and* uncertainty.

We see evidence of uncertainty in extreme events in financial markets. In very short time periods, asset prices can wildly veer away from their historical benchmarks. For example, during the October 1987 collapse of prices in the American stock market, the Dow Jones index of stock prices plunged by 300 points in under an hour of trading. The collapse was three times larger than the biggest decline to that point. The U.S. stock market has become more volatile in recent years: eleven of the twenty largest daily drops since 1980 have occurred in the past three years. On September 6, 2011, the Swiss Franc fell by eight percent against the Euro. The change in the Franc/Euro exchange rate exceeded all previous daily moves by more than 20 standard deviations (sigmas). Moves of this size defy the laws of normality. In a Gaussian (normal) distribution, an event that is five sigmas away from the mean is observed about once every 14,000 years. Kevin Dowd and Martin Hutchinson, in their 2010 book *Alchemists of Loss*, point out that, “the waiting period associated with a 20-sigma event is a number, in years, that considerably exceeds recent estimates of the number of particles in the known universe”. When the value of mortgage-backed securities began to collapse in August 2007 David Viniar of Goldman Sachs told the *Financial Times* that his risk management team was “seeing things that were 25-standard deviation moves, several days in a row.”

When markets are unsettled even the longest time series of historical returns provide little guidance for current decisions. As the Eurozone sovereign debt crisis accelerated in the summer of 2012, yields on long-dated bonds for several “safe” countries fell to their lowest points in history. In July 10-year U.S. Treasuries hit their

lowest point (1.4%) since they were first brought to market in 1790. Belgium’s borrowing costs were even more unprecedented: yields on long-dated bonds were lower than at any point in the past 495 years. The Deutsche Bank report (*LT Asset Return Study* 3 September 2012) in which the history of bond yields was mined concluded that forecasting in the present environment is a “Journey into the Unknown.” Members of the financial community recognize the degree to which markets are characterized by pervasive uncertainty. The world’s third largest money manager, State Street Global Advisors, recently administered a survey to 300 global investors. Over 70 percent reported that they expect a “tail risk event” on par with the collapse of Lehman Brothers to occur in the next twelve months. “Tail risk” denotes low probability, high impact events. Only 20 percent told State Street that they were confident that they were protected against such an event.

Given that extreme events of low but immeasurable probabilities occur in financial markets, it is not surprising that models built on the assumption that all risks can be accurately quantified perform poorly. In the years before the crisis the main credit rating agencies devised models to assess the likelihood that instruments created from pools of mortgage-backed securities (“collateralized debt obligations,” or CDOs) would default. Data collected by sociologist Donald MacKenzie show that the actual default rate for CDOs constructed between 2005 and 2007 exceeded the predicted rate by, on average, 20,155 percent. In light of the yawning gap between the raters’ models and the actual default rates, the three main agencies (Moody’s, Standard and Poor’s, and Fitch) downgraded huge quantities of the CDO that they had initially regarded as relatively safe.

In addition to relying on the agencies’ seal of approval for CDOs, which reassured prospective investors that the risks in the underlying pool of mortgages were well understood, banks had developed their own

techniques for measuring and controlling risk. Bankers relied on a class of models based on the concept of Value-at-Risk (VaR). The idea behind VaR is straightforward: analysts use data on the distribution of profits and losses over some pre-specified period to estimate loss thresholds on trading current positions.

National and international regulators endorsed VaR-based models as effective tools for managing risk. In the 1996 amendment to the Basel accord, banks were allowed to use their internal VaR models to calculate the limits of their market exposure. In the second Basel Accord hashed out in 2004, the governments that signed the accord agreed to make banks' own VaR models the cornerstone of risk assessment. Investment banks are still using VaR models to assess the riskiness of their trading positions despite the evidence that the models often fail and may even exacerbate volatility in financial markets. After it was revealed that a unit of JP Morgan Chase lost more than \$2bn in dodgy credit-related positions its daily average Value-at-Risk was raised overnight by 92 percent (from \$67 million to \$129 million).

The post-crisis regulatory agenda has not jettisoned the idea that market participants can self-regulate with the help of risk management models. Policymakers should probe the limits of risk models before implicitly endorsing their continued use. Risk models can be very useful, but that does not mean that they are *always and everywhere* effective. Two dimensions might help policymakers identify domains in financial markets for which risk-based models are appropriate and situations where they are less useful (or perhaps even destructive).

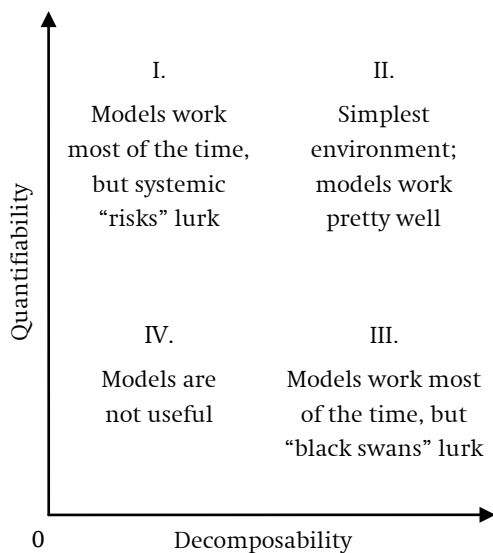
Dimensions of Risks and Uncertainties

The first dimension, which appears on the vertical axis of the figure, concerns the measurability of risks; as we move up the axis, we travel from settings marked by radical uncertainty (in which risks cannot

be measured at all) to settings in which risks can be reliably quantified. The closer we are to the origin on the vertical axis, the more that important decisions are taken in the presence of Donald Rumsfeld's "unknown unknowns." As we move up the vertical axis, risks become measurable; financial markets come to resemble markets for life and property insurance where, thanks to copious information and relatively stable parameters, risks can be reliably quantified.

The second dimension is characterized by the "decomposability" of the sources of risk. At low levels of decomposability, the constituent parts cannot easily be broken apart and analyzed separately. Linkages between units within markets are extensive and sometimes hidden. Decomposability is inversely related to complexity; when systems are non-decomposable, it can be hard (or even impossible) to know how dynamics and decisions in one or a few parts of the system might affect the other parts. This dimension captures what former hedge fund manager (now senior adviser in the U.S. Securities and Exchange Commission) Richard Bookstaber calls "tight coupling" in financial markets. In systems characterized by tight coupling, an event triggers nearly simultaneous responses by each link in the system, making it impossible for managers and regulators to intervene and stop the process. The advent of automated, algorithmic trading strategies exacerbated this problem in financial markets. If financial institutions employ the same risk models that automatically dump assets once the program detects that prices have fallen below some threshold, prices will fall still further, causing the program to order more selling. With advanced computing power behind it, a panic in the market can proceed through the stages at speeds that exceed human cognition. Ordinarily stable and predictable markets can implode in minutes, if not seconds.

Variation in the degree of decomposability can be driven by the design of the financial products. Securitized assets that were widely purchased in the years before



the 2008 crisis made the risks in the global financial system less decomposable. By combining and recombining mortgages into many products (and then designing complicated insurance contracts for each of those products), defaults on a small number of mortgages negatively impacted the portfolios of many asset managers. Problems in one small part of the system ended up threatening the stability of the system as a whole.

Combining the two dimensions gives us a way to illustrate the environments in which risk-based models will perform well and the areas in which they will perform poorly. When it is reasonable to draw a distribution from past observations *and* the system is decomposable – that is, we can finely slice up the system into its constituent units and analyze how risks are transmitted within and across the units – then models are most useful for managing risk (quadrant II). Models could be misapplied, of course, but in general they would enable participants and regulators to actively manage and reduce risks. When risks are quantifiable but the system is highly complex, the models may not predict systemic problems that spring from the tight coupling between the constituent parts of the system (quadrant I). In quadrant III, the system is not very complex but the market

is closer to the realm of uncertainty than risk. In this setting, what financier and writer Nassim Taleb calls “black swans” – high-impact events of presumably low (but actually incalculable) probability – may be present and cannot be predicted by risk models.

Regulatory authorities can deal with the flaws of model-based risk management in the figure’s first three quadrants. They can try to identify the highly interconnected, “systemically important” financial institutions and subject those institutions to closer scrutiny or impose limits on their size. If the problem is limited to the inability of existing models to accommodate massive price swings associated with “black swan” events, risk managers can try to build new models based on different distributional assumptions.

Model-based risk management does not work in the environment of quadrant IV. Perhaps one reason that quantitative models are still widely used is that to this point few market participants and regulators have acknowledged the quadrant’s existence. The cost of ignoring quadrant IV, however, is severe. When risks cannot be measured and the system is highly complex, quantitative models, such as those used by the credit rating agencies to rate collateralized debt obligations and the variants of VaR that big banks continue to use, will perform poorly. If financial decisions are rarely made in situations characterized by uncertainty and systemic complexity, then relying mainly on quantitative risk models is a reasonable strategy. But if some financial markets are environments with the characteristics of the fourth quadrant (non-decomposability and non-quantifiable risks), the models are no substitute for subjective judgments.

To effectively govern markets that lie in the fourth quadrant, regulators will have to wade into the murky waters of market psychology. John Maynard Keynes recognized in 1937 that in the face of uncertainty members of the financial community tend to rely on “conventions” to guide their

decisions. Conventions are not calculated on the basis of probabilities; rather, they bubble up from the social settings in which market participants operate. Beliefs, opinions, rumors, and “animal spirits” are the factors that drive financial markets operating in uncertainty. Because market conventions rest on “so flimsy a foundation” (in Keynes’s words), they can change very quickly. In modern financial markets characterized by non-decomposable risks, rapid and dramatic changes in an asset’s market valuation can trigger unexpected problems that reverberate throughout the system. For example, the sudden and dramatic decline in the market’s valuation of CDOs built from mortgage-backed securities implicated not only the holders of those assets but also the complex of contingent claims written on those assets and the overnight funding markets for highly-leveraged financial institutions in which the impaired assets were used as collateral.

Professional economists also express reservations about the usefulness of risk modeling. In September 2010 the author sent an online survey to 1,156 economists from the departments ranked in the global top 30 economics departments. The response rate was low (20 percent) but the respondents, based on their self-reported biographical details, were broadly representative of the larger sample of economists that received the survey. 74 percent of the respondents reported that they disagreed with the following claim: “analysts know enough about the data-generating process in financial markets to devise robust quantitative techniques for managing risk.”

Where Regulators Fear to Tread: Financial Markets in Worlds of Risk *and* Uncertainty

The accomplishments of the regulatory agenda pursued at the national, regional, and global levels over the past four years are significant and should not be dismissed. Policymakers have reclaimed some of the governing authority they surrendered to

markets in the years before the 2008 crisis. The Basel III regulations, approved by the G20 in November 2010, were negotiated in near-record time by the tortoise-like standards of regulatory harmonization in the financial sector (it took only two years of discussion for this round compared to six years to reach agreement on the Basel II rules). Private financial interests have resisted the loss of authority over governance in their sector. The regulatory authorities in charge of the Basel standards faced unprecedented opposition from top executives in the financial sector; the head of JP Morgan Chase, Jamie Dimon, even called the Basel Committee’s proposals “blatantly anti-American”. The changes will go part of the way toward the goal of making finance a safer industry.

Financial systems remain more unstable and dangerous than they should be, however, because policymakers continue to delegate risk assessment and management to the members of the financial community without asking hard questions about the conditions under which risk models can work. The flawed models that failed in 2008 and in 2010 (when the Eurozone debt crisis exploded) are still in use. Episodes such as the major trading losses revealed by JP Morgan Chase in May 2012 suggest that not much has changed in American financial circles. Quantitative models built for worlds of risk do not perform well in environments characterized by uncertainty, and recent events indicate that financial markets are if anything more uncertain now than they were before the crisis erupted.

Macroprudential Regulation

The “macroprudential” approach to financial governance takes uncertainty *and* risk seriously and thus is a route to a more robust financial system. Led by officials such as William White at the Bank for International Settlements, Andrew Haldane at the Bank of England, and Lord Adair Turner of Britain’s Financial Services Authority, macroprudential regulation rejects tenets

that are the glue of the existing regulatory system – market players are always rational risk-calculators, markets are on average efficient, and modern risk management models make the system safer. Advocates of the macroprudential approach believe that financial systems are unstable and that regulators have to proactively address problems rather than react to crises after they erupt. The macroprudential approach accepts that financial innovations may make the system more dangerous by creating complex, possibly hidden system-wide linkages. Macroprudential regulation is critical of over-reliance on risk management models, such as Value-at-Risk, which the mainstream of financial market regulation continues to endorse.

Macroprudential ideas experienced a brief moment in the sun in 2008-2009. The trajectories of macroprudential regulatory ideas and the G20 forum dovetail. Macroprudential ideas found strong support among some members of the G20. The breakdown of consensus within the G20 during the Toronto meeting in 2010 and the subsequent obsolescence of the forum meant that macroprudential policies, which were always opposed by powerful financial interests, dropped from the agenda. Policymakers involved in the effort to construct more robust financial systems should resuscitate these ideas because they address some glaring gaps in the current regulatory agenda. The sovereign debt crisis in Europe provides another moment to make good on the advice given by President Barack Obama's former chief of staff, Rahm Emanuel: "you never want a serious crisis to go to waste."

Pre-crisis regulation mainly focused on the ability of individual banks and money managers to survive adverse events that damage the value of their assets, thereby increasing the likelihood that a panic in the market could be resolved relatively quickly and cheaply. The crisis of 2008 revealed that this approach was inadequate. Regulators in the pre-crisis period focused much of their attention on setting and

enforcing capital adequacy requirements. The layering of risk throughout the system due to complex linkages between market players meant that when the crisis hit, the insurance that many financial institutions believed would offer them protection turned out to be a fig leaf. Capital requirements did not protect banks from the huge losses they incurred, and, paradoxically, they may have lengthened the duration of the crisis by forcing banks to deleverage further to meet the requirements. Macroprudential regulation, by contrast, recognizes that capital requirements should be dynamic: when times are good, financial institutions should be obliged to build larger buffers to cushion the blow to their balance sheets when the good times end and the next crisis arrives. Capital adequacy requirements can then be loosened as banks try to pull themselves out of the crisis. Rather than focusing on individual market players, macroprudential regulation tries to limit the *systemic* fallout from a crisis by tightening the reins during periods in which credit is expanding and asset prices are rising.

It is not reasonable to expect market players to completely jettison the risk models that they have cultivated and used over the past two decades. It is necessary, however to devise regulatory standards that would supplement quantitative risk management models with qualitative judgments. The credit rating agencies that estimated the default risk of CDOs constructed from mortgage-backed securities simulated the performance of the assets under many different market conditions, including the possibility of a severe downturn in housing prices. Standard & Poor's (S&P), one of the largest credit rating agencies, believed that the damage to the securities it had rated would be limited even in the event of a major downturn in the U.S. residential housing market. S&P used a sophisticated model to generate its estimates. The model failed badly because the events that triggered the crisis lay in the realm of uncertainty. There was no

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attempt to forecast how the assets would perform when home prices in many parts of the country fell by thirty percent because the probability of such an event was unknown. How such an event would impact other asset classes was also unknown. An important part of the macroprudential policy package is greater attention to new methods for simulating the performance of models in worst-case scenarios. Stress testing can help regulators and market players identify how bad a crisis could be and to take steps to reduce the impact of such adverse market conditions. The broader point, however, is that risk models are no substitute for practical judgment, rooted in analysis of the broader political economy within which financial markets are embedded.

Regulators on both sides of the Atlantic face a difficult task. Ultimately, the culture of risk management in the financial sector must be reengineered so participants recognize that markets are environments characterized by risks *and* uncertainties. The macroprudential agenda invites a more active role for regulatory authorities and, if it is resuscitated, it will in all likelihood spur even more intense resistance from industry representatives. The infrastructure for implementing macroprudential policies is in place: in the wake of the crisis a number of new regulatory agencies were created, including the Financial Stability Oversight Council (FSOC) in the U.S., the European Systemic Risk Board (ESRB), and, most importantly, the multilateral Financial Stability Board (FSB), established after the 2009 G20 Summit held in London and tasked with coordinating the diverse regulatory agendas of national financial authorities and global standard-setting bodies. Implementing macroprudential oversight of financial systems will require cooperation between the various regulatory bodies and the support of influential national policy-makers. The crisis of 2008 was severe, but myopic behavior by market players (exemplified by continued overreliance on flawed models such as VaR) persists. The macro-

prudential regulatory agenda will not solve the problem of financial market instability, but it contains the best ideas about how to make financial systems less fragile.