

Article:

**Financial policymaking in the context
of the known, the unknown and the unknowable**

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Executive summaries

Financial policymaking in the context of the known, the unknown and the unknowable
by **Richard J. Herring**, Jacob Safra Professor of International Banking, The Wharton
School, University of Pennsylvania

This paper examines the challenge of financial policymaking from the perspectives of what is known, unknown and unknowable about the financial system. It focuses on policy challenges during the Great Recession and changes in regulations in response to lessons drawn from the global financial crisis. The paper suggests that while improving the effectiveness of prudential policy should be an important priority, it requires an honest assessment of what we actually know about the risks assumed by systemically important institutions and, indeed, what the managers themselves know. Since many of these risks are unknown and some are unknowable, supervisors need to place much greater emphasis on increasing the resilience of the system. Rather than imposing increasingly prescriptive regulations, a wiser course may be to devise simpler rules that can be defined and monitored more easily.

Financial policymaking in the context of the known, the unknown and the unknowable

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Abstract

This article examines the challenge of financial policymaking from the perspectives of what is known, unknown and unknowable about the financial system. It focuses on policy challenges during the Great Recession and changes in regulations in response to lessons drawn from the global financial crisis. The article concludes that since many of the risks to the financial system are unknown and some are unknowable, regulators and supervisors need to place much greater emphasis on the resilience of the system. Rather than imposing increasingly prescriptive regulations, a wiser course may be to devise simpler rules that can be implemented and monitored more easily.

¹ This essay is based on a book that I co-edited with Frank Diebold and Neil Doherty, *The known, the unknown and the unknowable in financial risk management*, Princeton University Press, 2010. I am grateful to my co-editors, the authors of chapters in this book, and Ralph Gomory for stimulating many of the ideas in this essay and to the editor of this journal, P. Jackson and A. Clifford for comments on an earlier draft. Some of these ideas were presented earlier in the *Yale Journal of Regulation* [Herring (2009)].

The financial crisis of 2007-08 has caused a massive reassessment of what we thought we understood about financial markets and financial policymaking. Many of these issues can be usefully examined within a conceptual framework developed in a classic essay by Ralph Gomory (1995). This framework can be applied to financial policymaking by distinguishing the known from the unknown and the unknowable. The “known” (K) refers to a situation where we know the probability of a future event with sufficient certainty that we can specify all the parameters of the probability distribution with a high degree of confidence. This may occur because we have extremely powerful *a priori* knowledge – for example, a theory of what determines the event about which nearly all experts agree – or because we have data collected over a sufficient range of conditions under which the underlying structure has remained stable so that we can estimate the distribution with a high degree of confidence.

The “unknown” (u) refers to a situation in which we can specify an event, but there is considerable uncertainty about when or whether it may occur because we have a variety of alternative theories without consensus among experts about which is correct, or because we lack adequate data or sufficiently powerful statistical techniques to estimate a distribution with even negligible levels of confidence. The “unknowable” (U) refers to shocks that we have not even identified because they have not happened or because we have no widely accepted theory that leads us to expect they might happen. To some extent, U may simply be the result of a failure of imagination. Much of the history of financial policymaking can be viewed as converting U to u to K, although it would be a mistake to infer that we have enjoyed continuous progress to K. The abrupt transition from the Great Moderation to the Great Recession serves as a recent reminder. The boundaries are not fixed and behavior is dynamic. We may find that K has become u and that an entirely new U has erupted to become an important u. Indeed, if shocks are subject to fractile distributions instead of well-behaved Gaussian distributions, K may contain much more u than is commonly acknowledged [Mandelbrot and Taleb (2010)]. The past is never a perfect predictor of the future. New factors may become important and relationships estimated in times of normal market functioning tend to break down at times of market stress. What was thought to be mild randomness often proves to be wild randomness – or at least more often than it should if it were governed by a well-behaved Gaussian distribution.

In Will Roger’s phrase, one of the key risks may be what we think we know “that just ain’t so.” Undue dependence on ratings by a wide variety of financial market participants preceding the financial crisis illustrates this problem clearly, as did the reliance of regulators on the Basel II capital adequacy regulations² to protect the safety and soundness of the banking system.

Information challenges for financial policymakers

Financial policy becomes most relevant when a shock that was unknown or unknowable shifts the financial system from the domain of K into the domain of u. Financial policymakers are charged with limiting the vulnerability of the financial system to such shocks and mitigating the consequences of such shocks once they occur. Financial policymakers aim to promote monetary and financial stability, but virtually every aspect of financial policymaking is subject to substantial uncertainty. For example, how precisely should these objectives be defined? With regard to monetary policy, what amount of inflation is consistent with achieving stable, sustainable growth? For that matter, what measure of inflation is appropriate? After the monetary authorities have lowered real interest rates to negative levels, can they continue to have an impact on economic activity by flooding markets with liquidity? Is it feasible, both technically and politically, for the monetary authorities to prevent asset bubbles during periods of low and stable inflation?³ Moreover, the monetary authorities must operate with incomplete knowledge about the current state of the economy and how their actions (or inaction) may affect economic activity. Monetary policy operates with long and variable lags and it is difficult to anticipate market responses to shocks. Yet, the monetary authorities must immediately determine whether the financial system has adequate liquidity and whether monetary policy needs to be adjusted to counter the effects on the economy of a crisis-induced tightening of credit [Kohn (2010)].

2 The U.S. had not implemented Basel II for banks in 2008, but the five large investment banks, which were heavily involved in the crisis, had adopted a form of the Advanced Internal Ratings System as “Consolidated Regulated Entities” overseen by the Securities Exchange Commission (SEC). Outside the U.S. many of the large banks had adopted Basel II by 2008.

3 Jacob Frenkel, former Governor of the Bank of Israel, has expressed doubt about whether the monetary authorities know enough to deflate bubbles before they become dangerous [Michaels and Thornhill (2008)]. He asserts that the real choice is “Which system do you want: one in which the [monetary authority] pricks three bubbles out of five or five out of three bubbles? Because we know for sure that it will not be able to solve four out of four.”

Prudential supervision focuses on safety and soundness issues. Micro-prudential supervision focuses on the safety and soundness of individual institutions. In contrast, macro-prudential supervision focuses on the safety and soundness of the financial system. Most supervisory resources have traditionally been allocated to micro-prudential supervision, but that does not ensure macro-stability goals will be achieved. Indeed, sometimes an action taken to make an individual institution safer can undermine macro-financial stability. Demanding that individual institutions hold more capital and reserves can appear to make those institutions safer, but banks in turn may restrict credit and refuse to roll over loans to other institutions, thus reducing aggregate demand at a time when the economy is already weakened.

With regard to prudential policy, the primary goal of financial stability must be to protect the functioning of the financial system to ensure the provision of payments services and facilitate the efficient allocation of resources over time and across space. This may be threatened by a loss of confidence in key financial markets or institutions, as we have seen in the recent financial crisis and the still more recent sovereign debt crises in the Eurozone. But how safe should financial institutions be? Should all failures be prevented? Would the restrictions on risk-taking necessary to achieve that goal reduce the efficiency of financial intermediation and reduce investment? Would this deprive the economy of the dynamic benefits of creative destruction? Or would it shift risk-taking and innovation to unregulated entities in the shadow banking system where it would be less well monitored and more difficult to control? What tools should be used to achieve these objectives? And what governance structure is most likely to motivate policymakers to act in the public interest?

Public-sector compensation contracts are much more highly constrained than compensation contracts for senior executives in financial services firms. Yet even private institutions, which have had complete freedom of contracting, have failed to devise incentives to manage risks effectively. During the Great Recession, we learned that several firms had adopted incentive systems that led executives to take on much more risk than their shareholder principals or taxpayers, who were called upon to provide a bailout, would have wanted them to do. More fundamentally, when objectives are not crisply defined, it is difficult to establish and enforce accountability. Blame avoidance is, by default, the primary objective of most bureaucrats [Kane (1980)].

Although the prudential supervisory authorities have enormous leverage over fragile institutions that require liquidity assistance, they have relatively little influence over well-capitalized, apparently profitable institutions that they may nonetheless believe to be taking on excessive exposures to uncertain shocks.

In order to guard against the arbitrary use of regulatory and supervisory power, most countries subject disciplinary decisions by officials to some sort of judicial or administrative review. The result is that in order to discipline a bank, a supervisor must not only know that a bank is taking excessive risk, but it must also be able to prove it to the satisfaction of the reviewing body – perhaps beyond a reasonable doubt. This leads to a natural tendency to delay disciplinary measures until much of the damage from excessive risk-taking has already been done. The U.S. has tried to limit the scope for forbearance through Prompt Corrective Action measures contained in the Federal Deposit Insurance Corporation Improvement Act of 1991.⁴ This attempted to remove a substantial degree of supervisory discretion by triggering mandatory regulatory interventions when an institution's capital ratio falls below prescribed levels. The implementation of Prompt Corrective Action measures, however, has often been less than prompt. For example, Indy Mac lost nearly U.S.\$9 billion [see Adler (2009)] before it was closed. A basic problem is that the triggers for Prompt Corrective Action are defined in terms of accounting ratios and experience has shown that accounting values systematically lag real economic values when markets turn down [Herring (2012)]. Moreover, during times of crisis even explicit rules may be insufficient to limit forbearance.

A more fundamental problem is that both bankers and supervisors have strong motives to withhold unfavorable information as long as possible. For example, frontline risk-takers will sometimes try to conceal losses from their supervisors in the hope that they can recoup their losses before they are discovered. Higher-level executives, in turn, may try to conceal losses from security analysts and regulators. Executives may believe that they can protect their compensation (or jobs) by withholding adverse information. Equally importantly, they may wish to protect their scope for dealing with the problem before it must be disclosed.

⁴ See <http://thomas.loc.gov/cgi-bin/query/C?c102:./temp/~c102W0r4Ch> for details of the FDICIA legislation.

Supervisors may have similar incentives for withholding unfavorable information. They may hope to remedy the problem before it needs to be publicly disclosed and, especially, they may want to protect their scope for making decisions if adverse information was shared with other regulators who might take preemptive action. In addition, if the negative information leaked to the public and precipitated a run, the regulators might be forced to take actions they would prefer to avoid.

Review of supervisory actions also leads officials to react mainly to what has already happened (and is, therefore, objectively verifiable) rather than to act on the basis of expectations about what may happen (which are inherently disputable).⁵ Moreover, supervisors are seldom, if ever, held accountable for the misallocation of resources that occurs when an insolvent institution is permitted to continue operations because there is no official scrutiny of opportunity costs. Unfortunately, supervisors are criticized mainly for taking action even when it is justified, rather than for not taking action, even though earlier action might have prevented financial disorder.

Charles Goodhart (2010) has suggested that K should be partitioned into actual past data and expected values. Supervisors generally react to past actual losses rather than mean expected losses, much less unexpected losses, even though they believe they know the probability distribution that governs outcomes. Greenspan (2008) has expressed doubt about whether regulators know enough to act preemptively.

Information issues present a fundamental challenge to supervisory authorities who must evaluate the solvency of regulated financial institutions. Neither actual past data nor expected values can be relied upon in times of crisis when markets become illiquid and difficult supervisory decisions must be made. Bank accounting has traditionally been a mix of historical cost accounting, accrual accounting and mark-to-market accounting that can obscure the true financial condition of a bank. This has sometimes undermined incentives for hedging risks by requiring that a risky position and the offsetting hedge be valued differently. Thus, the volatility of reported earnings may increase, even though risk has been reduced.

⁵ An encouraging post-crisis trend in prudential supervision has been a greater emphasis on supervised simulations to evaluate capital adequacy under a variety of scenarios.

Many external observers question whether this mix of valuation approaches conveys a true and fair account of the current position of a financial institution. New financial accounting standards introduced more or less simultaneously by the International Accounting Standards Board and the Financial Accounting Standards Board require that assets held at fair value be classified in three different categories: (1) assets that can be marked to market based on prices in active markets for identical instruments; (2) assets that are marked to matrix, based on observable market data for similar assets and (3) assets that are marked to model, based on judgment regarding how the market would price such assets if they were traded in active markets.⁶ (This is sometimes referred to as marking to model, or more cynically, marking to myth.)

This third category presents significant difficulties for regulators, who face a severe asymmetric information problem vis-à-vis the regulated institution. How can the regulatory authorities comfortably rely on the estimated values of category three assets?⁷ Yet the question of the correct price for such assets is critical for implementing policies, such as the original version of the Troubled Asset Relief Program (TARP) in the U.S., asset guarantee programs deployed in the U.S. and other countries, and numerous bad bank resolutions implemented in many countries. If the price is set too low, banks will not participate willingly. Yet if the price is set too high, it can be the source of enormous concealed taxpayer subsidies. Elizabeth Warren, then the independent monitor appointed by Congress to scrutinize the bank recapitalization program, concluded that the Treasury overpaid U.S.\$78b of the U.S.\$254b spent in TARP transactions [Guha (2009)].

Part of the problem is that financial theory offers only two kinds of tools for valuing assets that are not traded in active markets: (1) the present value of discounted cash flows, which works well in a world of K, where cash flows can be predicted and risks estimated; and (2) real option theory, which works well only

⁶ For additional discussion of fair value standards see Herring (2012).

⁷ For example, S&P studied one bond, formerly rated AAA, backed by 9,000 second mortgages. Nearly one-quarter were delinquent and losses on those that had defaulted were 40%. One financial institution carried the bond on its books at 97 cents on the dollar. S&P ran a favorable scenario and concluded the bond was worth 87 cents on the dollar, but under a less favorable scenario it was worth only 53 cents on the dollar. At the same time, the bond traded in the secondary market at 38 cents on the dollar [Bajaj and Labaton (2009)].

if you can write a decision tree that captures most of the key uncertainties and decision points in the future and assign them plausible probabilities. When shocks occur, these fundamental prices move from the realm of K to u . Thus, during a crisis, fundamental values rest on relatively infirm foundations.

Even category 1 assets may become a problem in a crisis. Setting aside the issue of asset price bubbles, market values can be relied upon so long as assets are traded in broad, deep resilient markets. In such markets, however, assets tend to be priced on the basis of comparisons to their own past prices or to the prices of comparable assets. When a shock undermines confidence in these relative values and causes losses, traders tend to withdraw from markets until they regain confidence in their valuation models. Concerns may arise about counterparties who may have had excessive exposures to the shock and markets become thin. A flight to quality may occur and liquidity will be restored only when confidence in valuation models and counterparties is restored.

This dynamic has been very much in evidence during the recent crisis and led to the destruction of much of the endogenous liquidity in the system. Two channels of contagion have been identified [Brunnermeier et al. (2009)]. First is the tendency of counterparties to demand more collateral or larger "haircuts." This reduces the leverage that their counterparties can obtain by borrowing against their assets and they must either raise more capital (which is expensive and difficult to do during a crisis) or deleverage by selling assets. If several institutions are selling assets at the same time, prices will drop and the market will become less liquid. This is likely to lead counterparties to demand still more collateral and still larger haircuts until the market simply evaporates. The second channel is driven by the losses that occur in institutions that hold long positions in the assets that decline in value. They too will be forced to try to raise additional capital or to attempt to deleverage by selling once liquid assets into an increasingly illiquid market.

Efforts by central banks to add liquidity to the system to revive these markets have had little effect so long as concerns persist regarding the solvency of key counterparties. Indeed, during the crisis and the agonizingly slow recovery, many U.S. banks have chosen to hold excess reserves at the central bank rather than participate in interbank markets. On occasion, the flight to quality has been so extreme that Treasury bill yields have turned negative.

Crisis prevention

Most policymakers would agree that it is better to prevent such crises than to try to manage and mitigate them once they have occurred. Crisis prevention is an enormous burden, however, which falls mainly on the shoulders of the prudential authorities. Prudential regulation attempts to establish rules for the sound operation of financial institutions and critical elements of the financial infrastructure, such as clearing and settlement arrangements. Ideally, prudential policymakers should be looking beyond the known to anticipate emerging sources of systemic vulnerability in order to calibrate appropriate prudential policies. In the dynamic world of modern finance, this requires trying to understand how changing institutions, products, markets, and trading strategies create vulnerabilities to new kinds of shocks and new channels of contagion, such as the margin/haircut spiral and the loss spiral just described. But K cannot be neglected. Institutions still fail in familiar ways by taking excessive concentrations of credit risk, such as Wachovia, or by imprudently borrowing short and lending long as did Northern Rock and dozens of structured investment vehicles.

Prudential supervisory authorities confront a number of trade-offs that must be made in uncertain terms. How safe should banks be? Scott (2010) has argued that a central feature of corporate governance is aligning the risk neutral preferences of well-diversified shareholders with risk-averse managers. This calculus is unlikely to take account of the systemic costs of an institution's failure and so the prudential authorities will presumably prefer a higher degree of safety, but how much higher? Goodhart (2010) has observed that it is relatively easy to establish a set of penalties that would make the banking system perfectly safe, but largely irrelevant in intermediating between savers and investors.

This is closely related to the degree of competition in the financial system. Competition is generally viewed as a positive feature. It stimulates innovation and lowers the cost of financial services. But, it also reduces the charter values of incumbent institutions and may lead to increased risk taking [Herring and Vankudre (1987)]. Should financial innovation be encouraged? Securitization has facilitated diversification of risk, reduced costs and liberated borrowers from dependence on particular lenders, but the subprime crisis showed that the fragmentation of responsibility in the securitization process

can also undermine credit standards and enable banks to achieve higher leverage by evading capital requirements. Derivatives had enabled financial institutions to partition and manage risks much more efficiently, but they can also be used to assume enormous, highly leveraged risks. The growing sophistication of risk management techniques has enabled institutions to push out the boundaries of the known, but the very complexity of these techniques presents a challenge in the event of a crisis because it is very difficult for the authorities and potential investors and counterparties to comprehend the full range of risks and how they should be managed.

The supervisory authorities have a number of tools. These include licensing requirements, restrictions on certain kinds of activity deemed to be excessively risky, liquidity requirements, capital requirements and disclosure requirements. The authorities may also try to identify and encourage the widespread adoption of best practices in risk management, in effect urging the private sector to convert u into K.

Before the crisis, by far the most ambitious effort at prudential regulation was the development and implementation of the Basel II standards for capital adequacy and their successor Basel III, which try to emulate “economic capital”,⁸ that was used by many sophisticated institutions to measure and aggregate risks. But the concept is firmly rooted in the world of K. It depends on the bank being able to assess the expected loss and the equations provided by the Basel Committee being prudent in converting this into unexpected loss at a high level of confidence. This then provides at least one basis for the firm’s assessment of how much capital it needs to retain a given credit rating.

The original Accord on capital adequacy made a very crude attempt to reflect credit risk in the banking book by applying risk weights to on-balance-sheet assets and off-balance-sheet positions set capital requirements that formed the denominator of the required ratios. The concept of economic capital made clear that the role of capital should be to absorb unexpected losses, while reserves should be established to absorb expected losses. Banking supervisors from the 13 countries that then comprised the Basel Committee on Banking Supervision began

to take note of the evolving concept of economic capital, and so when they expanded the original Basel Accord to include market risk, they permitted banks to employ their own models of market risk (usually some variation of Value at Risk (VaR)) under certain conditions designed to assure the regulators that the models were reasonably accurate and maintained with integrity. The 1996 Market Risk Amendment [Basel Committee on Banking Supervision (1996)] provided an entirely new approach to setting capital requirements that relied on the way that leading banks were measuring and managing this risk, although banks were also provided with the alternative of applying mechanical asset price haircuts to compute their regulatory capital requirement for market risk.

The market risk internal models approach was expected to deliver several benefits. First, it would reduce or eliminate incentives for regulatory capital arbitrage because the capital charge would reflect the bank’s own estimate of risk. Second, it would reward diversification to the extent that a bank’s internal models captured correlations across risk positions. Third, it would deal more flexibly with financial innovations, incorporating them in the regulatory framework as soon as they were incorporated in the bank’s own risk management models. Fourth, it would provide banks with an incentive to improve their risk management processes and procedures in order to qualify for the internal models approach. And fifth, compliance costs would be reduced to the extent that the business was regulated in the same way that it was managed. By and large, the internal models approach for market risk proved to be highly successful, even when it was severely tested by the extreme market disruption in 1997, 1998 and 2001 [Herring (2005)]. But the VaR internal models failed spectacularly during the recent crisis when several banks experienced 25 standard deviation movements in prices several days in a row.⁹

Nonetheless, this early success, in combination with the progress made in modeling credit risk, led to calls from industry to revise the original Basel Accord to incorporate an internal models approach to capital regulation of credit risk. Basel II attempts to extend this new approach to setting capital requirements to credit risk and operational risk [Basel Committee on Banking Supervision (2006)].

⁸ Economic capital is the amount of capital that a firm needs to ensure that it remains solvent over a specified period of time with a specified degree of confidence.

⁹ Haldane (2009) observed that a 25s event would be expected to occur once every 6×10^{124} lives of the universe.

The Basel II structure rests on three pillars: Pillar 1 specifies capital charges for exposure to credit, market and operational risks; Pillar 2, the supervisory review process; and Pillar 3, market discipline. Although the supervisory authorities were convinced that credit scoring models had significantly expanded the amount of credit risk that could be regarded as falling in the domain of the known, they were skeptical that internal models of credit risk were as reliable and verifiable as models of market risk. While some kinds of credit risk, such as retail lending, have rich and granular datasets comparable to market risk, other kinds of credit risk are less amenable to empirical analysis because data is sparse relative to past credit cycles and distinctly non-granular.

In the end, the regulators rejected the unconstrained use of internal models, but permitted qualifying banks to use their estimates of inputs in their own internal models. For the Advanced Internal Models approach, qualifying banks may use their own estimates of probabilities of default, losses given default, exposures at default and durations of exposure – as inputs in the regulatory model determining capital requirements. Thus, Pillar 1 capital requirements recognized (to a limited extent) the analytical and empirical advances banks had made in expanding the domain of K to include credit risk. Unfortunately, the losses experienced by the institutions most heavily engaged in packaging and selling subprime-related debt have cast considerable doubt on the reliability of such models.¹⁰ And the Standardized version of Basel II, which relies on ratings issued by Nationally Recognized Statistical Ratings Organizations did not fare much better. In many cases, more than half the tranches of subprime-related securities were subjected to triple notch downgrades, which are extraordinarily rare in corporate issues.

Because Basel II is an agreement negotiated among the members of the Basel Committee on Banking Supervision, it reflects a number of political compromises that undermine its aspirations for technical precision. This is most evident in the definition of regulatory capital, which is based on accounting values and includes a number of items that do not reflect an institution's capacity to bear unexpected loss. This undercuts the link to economic capital and the logic of the approach.

¹⁰ U.S. banks remained on the Basel I standard, but the five major investment banks, which were heavily involved in structuring subprime debt, had adopted a variant of the Basel II advanced internal models approach as "Consolidated Supervised Entities." Most securitized assets were held in trading books rather than banking books.

Pillar 1 capital charges are intended to deal with known risks. Pillar 2, the supervisory review process, is intended to deal with unknown risks that can be identified, but are not sufficiently well quantified to establish Pillar 1 capital charges. Presumably, as theoretical and empirical advances succeed in moving some of these risks into the domain of K, Pillar 1 capital charges will be established for them as well.

The principal tools of supervisory analysis in the domain of the unknown are stress testing and scenario analysis. Stress testing requires economic judgment to formulate and calibrate scenarios that expose potential vulnerabilities. It requires a careful consideration of which relationships will continue to hold and which relationships will break down in time of stress. Mandelbrot and Taleb (2010) have cautioned that traditional stress testing, which relies on selecting a number of worst-case scenarios from past data, may be seriously misleading because it implicitly assumes that fluctuations of this historical magnitude would be the worst that should be expected. They note that crashes happen without antecedents. Before the crash of 1987, for example, stress testing would not have included a 22% drop in share prices within a single day or that 63% of the returns on the stock market over the past 50 years occurred in just 10 trading days. If shocks are subject to wild randomness, risk managers and prudential supervisors must evaluate the robustness of a portfolio over a broad spectrum of extreme risks.

Goodhart (2010) has emphasized a different concern regarding stress testing and scenario analysis. What may matter most in a crisis are interactive effects that occur when many institutions attempt to adjust their portfolios in the same way at the same time. These are critical to understanding an institution's vulnerability in a crisis and the impact on the financial system, but are omitted from most scenarios.

Stress testing and the simulation of crises may be of value even if such crises never occur. The data necessary to simulate a crisis may prove useful in monitoring vulnerability and a careful consideration of the consequences of such a crisis may lead to changes in strategy and/or risk management. Crises seldom unfold according to the anticipated scenario, but strategies for responding to one kind of shock may prove useful when a different kind of shock occurs. For example, evacuation procedures that Morgan Stanley established after the bombing

of the World Trade Center in 1993 enabled the firm to safeguard all of their employees in the much more severe terrorist attack on 11 September 2001. Learning from close calls or near misses may be as important as learning from actual losses.

The key element of regulatory discipline under Pillar 2, however, is the ability of the prudential supervisor to impose an additional capital charge on an institution if they are uncomfortable with the results of its stress tests. This places supervisors in the role of imposing discipline on an institution thought to be vulnerable to a shock of unknown probability. This will inevitably prove challenging for supervisors who are usually much less well paid and less well informed than bank managers. The history of bank supervision does not provide much basis for optimism that they will succeed. Indeed, Northern Rock provides a recent example to the contrary. In June 2007, just before the near collapse of the bank, the British Financial Services Authority [FSA (2008)] authorized Northern Rock to apply the Pillar 1 internal-ratings-based risk weights, which reduced its required regulatory capital by nearly 30%. Northern Rock, in turn, planned to increase its dividends to shareholders by 30% [FSA (2008)]. The FSA made no attempt to offset the reduction in Pillar 1 capital charges with an increase in capital charges under Pillar 2, nor did it require Northern Rock to conduct a stress scenario that would have shown that it was fatally exposed to a liquidity shock because of its heavy reliance on wholesale markets to fund large portfolios of mortgages while they were being seasoned for securitization. The collapse of the market for securitized debt left Northern Rock with an inventory of mortgages that it could not sustainably finance. But in some cases, the authorities have found it impossible to even imagine the shock that may occur.¹¹

How should prudential supervisors deal with U? As Scott (2010) has noted, firms can limit their leverage and maintain enough capital and liquidity to absorb unknowable losses if they should occur. But how much financial slack is sufficient? By assumption that is unknowable, but almost all of the things that banks could do to cope with the unknowable are very costly, and competitive pressures may make it very difficult to sustain such precautions. Should regulators, therefore, require that banks hold capital substantially in excess of the regulatory minimum as

a safeguard against unknown and unknowable shocks? Andrew Crockett [Herring (2009)] has observed that policymakers find it inherently difficult to strike the proper balance between the efficiency losses associated with excessively onerous preventative policies and the cost-effectiveness of responding ex-post to adverse events. For regulators as well as firms, the appropriate amount of financial slack is an unknown.

Pillar 3 of the Basel II approach was intended to enhance market discipline by improving disclosure. The authorities may collect and publish data that helps market participants understand the current state of the economy and financial markets, and the condition of regulated financial institutions. But growing reliance on dynamic trading strategies to manage risk has made it increasingly difficult to provide a meaningful picture of risk exposures. Positions may change so rapidly that information is out-of-date before it can be published. Moreover, the chief motive for market discipline – the fear of loss – is often undermined by the reluctance of the authorities to permit the creditors and counterparties to suffer loss. Sometimes, even shareholders of systemically important financial institutions have been shielded from the full cost of an institution's losses. The extraordinary bailouts of a number of major global financial institutions are recent cases in point. The exception, the bankruptcy of Lehman Brothers, proved so disruptive that the heads of state who comprise the Group of 20 vowed that it should never happen again.

The ambitious Basel II approach attempted to incorporate in capital regulation what is known about risk management, but it generated several unintended consequences that made the system more vulnerable to a sudden shift into the domain of the unknown. The attempt to force all major firms to adopt one version of "best practice" and especially the imposition of a regulatory model of credit risk increased the likelihood of herding so that banks were more likely to attempt to move in the same direction at the same time, which undermines the liquidity of markets and increases price volatility.

To the extent that Basel II succeeded in making capital requirements more risk sensitive, it also made bank lending more procyclical. This tendency was reinforced by the fact that banks increasingly hold marketable assets that must be fair valued. In a boom, measures of risk are likely to decline and prices of assets are likely to rise and so, in combination with higher retained

¹¹ See FSA (2008) for the FSA's assessment of its failings with regard to the supervision of Northern Rock.

earnings, measured capital will rise just as required capital falls, thus facilitating additional lending and accentuating the boom. In a recession, internal ratings will migrate downward, thus increasing required capital. In addition, asset prices will fall, increasing the erosion of the bank's capital position caused by credit losses. This will exacerbate the constriction of the supply of loans. This interaction of more risk-sensitive capital requirements with a higher proportion of fair-valued assets tends to accentuate booms and busts. This is a clear instance in which micro-prudential and macro-prudential objectives conflict. Basel II aimed to make individual banks safer, but may have inadvertently weakened the banking system. More fundamentally, Basel II failed to deal with systemic risk.

Crisis management

Because it is so difficult for prudential supervisors to fulfill their responsibilities ex-ante, policymakers must often shift into crisis management mode to mitigate, ex-post, the consequences of a shock. In a financial crisis, the ratio of u and U will be especially large relative to K [Kohn (2010)]. Policymakers must deal with unknowns, such as the size of the disruption. How large will it be? How many firms will be involved? How long will it last? How likely is it to have serious spillover consequences for real economic activity?

Part of the problem is the challenge of anticipating the channels of contagion. Which firms have direct exposure to the shock? Which firms have indirect exposure because they are counterparties or creditors of the firms that sustain the direct impact or because they have similar exposures and could lose access to external financing? Which other firms might be placed in jeopardy because of the forced liquidation of assets in illiquid markets as risk-averse lenders and counterparties demand larger haircuts and/or more collateral? Risk preferences and perceptions of risk are dynamic and so a flight to quality often occurs. Market participants may sell assets whose prices are already declining to close-out positions. Moreover, they will avoid any counterparty that might be impaired. During the recent crisis and its aftermath, policymakers have learned that their ability to substitute central bank liquidity for endogenous liquidity created by the financial system is less effective than was once believed.

In a crisis, policymakers must try to convert u into K as quickly as possible. This requires close cooperation across regulatory

authorities within a country and, increasingly, across borders. Inevitably, the authorities must rely on major market participants for much of their information about current conditions. But conflicts of interest may corrupt flows of information. Information may be selectively communicated to serve the self-interests of market participants who might be the beneficiaries of crisis management policies.

Does this argue for a direct role of the crisis manager in supervising systemically important institutions? The Fed insists that it does, but central banks lack such authority in many other countries [Herring and Carmassi (2008)]. After the crisis, the prudential supervision function has been moved back into the Bank of England and the Financial Services Authority has been abolished. More recently, the E.U. has agreed to establish a separate banking supervision function inside the European Central Bank. Nonetheless, how best to organize prudential supervision and crisis management remains a significant unknown.

In addition to gathering information during a crisis, policymakers must also convey information. They may urge firms to do what the policymakers believe they should do in their own self-interest, as happened in the LTCM crisis in 1998 and was attempted again in the two days preceding the Lehman bankruptcy. But when is it appropriate to be reassuring? And when might reassurance prove counterproductive by leading market participants to expect outcomes that cannot be assured?

Ironically, crisis management that is successful in the short run may inadvertently lead to larger future crises. If risk-takers are protected from the full negative consequences of their decisions, they may be likely to take greater risks in the future. This presents a difficult dilemma for crisis management. The costs of inaction are immediate and obvious. It is easy to imagine damaging outcomes and self-interested market participants will press for official support and can easily muster political support. Inaction in a crisis is likely to be subject to blame even when it is not appropriate. This may contribute to an inherent tendency to oversupply public support. Once it has been provided, entrenched interests will lobby to keep it and new additional activity may depend on it. Moreover, moral hazard manifests itself slowly and may be difficult to relate to any one particular policy choice. The history of crises teaches us that it is very difficult for the

authorities to exit from guarantees issued in a crisis once normal conditions are restored, although the FDIC's successful removal of extraordinary guarantees for large transactions accounts provides an encouraging example to the contrary.

The evolving policy response to the crisis: attempting to extend the domain of K

Even before the crisis was fully resolved, policymakers attempted to patch some of the more obvious gaps in the supervisory network and to apply lessons learned during the crisis. Basel II had proved to be a comprehensive failure. The denominator did not fully reflect the banks' exposures to risk, the numerator did not accurately portray an institution's ability to absorb loss and remain a going concern, and the required minimum ratio was much too low. Indeed, banks that failed tended to have higher Basel II ratios than banks that encountered less serious troubles. For example, Citibank reported a Tier-1 capital ratio of 11.8% when its stock market capitalization fell to about 1% of its accounting assets [Citicorp (2008)].¹² Surprisingly, despite the emphasis on making capital requirements more risk sensitive, reported regulatory capital ratios scarcely moved, even though banks were experiencing the worst crisis since the Great Depression.

An independent observer might have been tempted to jettison the Basel II approach in favor of a much simpler system. Indeed, simple leverage ratios tended to be much better predictors of banking strength during the crisis than the much more complex Basel II ratios. But the Basel Committee, instead, attempted to salvage and extend the Basel II approach. They began by trying to adjust some of the risk weights that were more out of kilter. The Basel Committee tried to discourage resecuritizations by raising the capital charge on BB-rated tranches of resecuritizations from 350% to 650% and raising the capital charge on AAA-rated tranches from 20% to 40%. The market response to this change in regulations illustrates the difficulty that supervisors have in predicting the impact of what would seem to be a very straightforward increase in the stringency of regulations. Within months, financial engineers had found a way to work around the increased risk weights. They developed a new financial structure called a Re-Remic that enabled banks to reduce their regulatory

capital charges on existing downgraded securities by swapping portfolios of newly tranced securities [IMF (2009)].

Ultimately, the Basel Committee produced a sweeping revision of Basel II known as Basel III, which continued the pattern of increasing complexity in the framework for the regulation and supervision of capital standards for internationally active banks. The Basel I framework was set out in a mere 28 pages. Basel II required 347 pages and Basel III, 616 pages. This rough measure grossly understates the increasing complexity of the international regulatory framework. This has imposed burdens on both banks and regulators. Basel I required six to eight calculations for a bank to determine its regulatory capital requirement. Haldane (2011) has estimated that a large complex bank using the Advanced Internal Ratings Based models for Basel II would have over 200,000 risk buckets and would require more than 200 million calculations to determine its regulatory capital ratios. The costs of implementing Basel III will be even larger and are estimated to require that banks hire an additional 70,000 full-time employees to comply.

The challenges in dealing with the crisis have caused fundamental change in banking regulation in the U.S., the U.K., and the E.U., but focus will be on the changes in international institutions and regulations. World leaders were keenly aware of the massive resources required to support the international banking system. Haldane (2009) has estimated that the authorities in the Eurozone, the U.S., and the U.K., committed over U.S.\$14t (approximately one-quarter of world GDP) to support their banking systems. Moreover, the loss of GDP rivaled that lost in major wars. Since this crisis had worldwide ramifications, the infrastructure for making economic policy decisions was expanded. Instead of the G-7, G-8 or G-10, the new policy commitments were made by the G-20 that included representation from the emerging powerful economies of Africa, Asia and Latin America.¹³ In addition, the G-20 transformed the Financial Stability Forum into the Financial Stability Board and gave it the mandate to make sure that the policy decisions by the G-20 were implemented.

The G-20 recognized several major gaps in pre-crisis oversight

¹² Citicorp continued to report Basel I capital ratios because the U.S. had not yet implemented Basel II.

¹³ Membership in the Basel Committee has been similarly augmented to better reflect the dispersion of financial power since the Committee was originally formed.

of the financial system. First, policymakers realized that Basel II had failed to promote safety and soundness. Second, they wanted to mitigate the procyclical dynamics of Basel II. Third, they concluded the incentives built into Basel II to encourage the largest banks to adopt more sophisticated risk management techniques in exchange for lower required capital ratios was perverse. Fourth, they wanted to limit leverage more effectively. Fifth, they believed that the regulators had failed to oversee liquidity risk adequately. Sixth, they wanted to make the derivatives more transparent by shifting as much activity as possible from over-the-counter markets to exchanges or central clearing parties where derivatives activity could be more easily monitored. Finally, they recognized that some institutions had become not only too big (or too complex or too interrelated) to fail, but also that some institutions had become too big (relative to home country resources) to save.

Revisions in Basel III were intended to address the first six issues. In addition to tinkering with the risk weights and making some of the assumptions in the regulatory model more conservative, they increased capital charges on credit risk in the trading book, took account of wrong-way counterparty risk and penalized holdings of derivatives that continued to be traded over-the-counter relative to derivatives that were traded on exchange or cleared through a central clearing party.

The most important change, however, involved the numerator in the capital adequacy ratio. Indeed, the main thrust of Basel III was more and higher quality capital. Basel I had begun with a fairly clear-cut distinction between Tier-1 capital (shareholder's equity and instruments, such as non-cumulative perpetual preferred that were virtually indistinguishable from equity in times of stress) and Tier-2 capital, which contained a wide variety of instruments and allowances that included a concession to virtually every major country that had been reluctant to sign the Basel Capital Accord. Over time, Tier-1 capital was diluted by the introduction of a number of hybrid instruments that were not only enough like debt to satisfy the tax authorities that banks should be permitted to deduct interest payments on these instruments, but also enough like equity to satisfy the regulators that they would be the functional equivalent of equity in a downturn. Hybrid instruments eventually grew to become half of the Tier-1 requirement.

The crisis, however, clarified thinking about what should

count as capital. The Basel Committee realized that many of the hybrid instruments were not useful for sustaining confidence in a crisis. They made an analytical distinction between going-concern capital - capital that would enable the firm to continue operating even though it was suffering losses - and gone-concern capital - capital that would buffer other creditors from loss only after the bank had gone through some sort of bankruptcy or resolution process.

On the basis of this distinction, the Basel Committee redefined Tier-1 capital. Unfortunately, they chose to complicate this straightforward distinction by distinguishing two types of Tier-1 capital - "common equity" Tier-1, which is what most analysts focused on in the crisis, and "additional" Tier-1 that permitted the inclusion of some of the most rigorous forms of hybrid capital.¹⁴ The following discussion focuses on the Tier-1 common equity requirement because it is likely to be the binding constraint.

Basel III requires a new higher minimum of 4.5% Tier-1 common equity ratio. In order to reduce the extent to which capital requirements exacerbate business cycles, the Basel Committee has introduced an additional "capital conservation buffer" of 2.5% Tier-1 common equity. The Basel Committee seems to be a bit conflicted about how this should work. The principal purpose of this buffer is to encourage the bank to reduce its capital in hard times rather than to reduce its lending. But at the same time, the Basel Committee has provided disincentives for banks to use this flexibility by imposing constraints on a bank's ability to make discretionary distributions if it does draw down the buffer.

The Basel Committee has also attempted to provide a tool for regulators to attempt to prevent bubbles. Under Pillar 2, the supervisor may negotiate an additional 0-2.5% of Tier-1 capital to dissuade banks from excessive lending that might fuel an asset price bubble. In order to make the regulation effective, however, the Basel Committee has ruled that the same add-on must apply to all foreign banks in the country. Thus, the counter-cyclical buffer must be announced at least 12 months in advance

¹⁴ Additional equity will include only hybrid capital that is issued and paid in, subordinated to depositors, general creditors, and subordinated debt, neither secured nor covered by a guarantee of the issuer, a perpetual maturity, with no step-ups or other incentives to redeem and non-cumulative. While these constraints are reasonable, creating yet another ratio: a Tier-1 common equity ratio and a Tier-1 ratio. This has introduced yet another ratio in an already very complicated system.

to provide time for foreign banks to comply. This seems to take a remarkably optimistic view of the ability of the regulatory authorities to forecast bubbles and to time their interventions with such precision that they prevent the bubble from forming rather than exacerbating financial conditions after the bubble has burst.

Reversing the favoritism extended to large banks under Basel II, Basel III will impose an add-on to capital requirements for “systemically important institutions.” This is in recognition of the fact that large banks posed a more serious risk during the recent crisis than smaller banks. The Financial Stability Board posts a list of such institutions each November. The add-on may vary from 1% to 3.5% of Tier-1 common equity. To date, the largest add-on has been 2.5%, but the 3.5% bucket is held out as a threat to discourage banks from becoming still bigger and more complex.

While many of these changes appear to be improvements in the international regulatory framework, several defects were not addressed. The denominator in the risk-weighted ratios under the standardized option relies on fixed risk weights that are often inaccurate. Moreover, these risk weights do not change over the cycle even though the riskiness of bank assets surely does. Perhaps even more troubling is the internal models-based approaches, which continue to rely on a bank’s own internal models that can be easily manipulated and are difficult to monitor. More fundamentally, the complexity of the risk-weight ratios makes it virtually impossible to compare capital adequacy across banks.

The most striking innovation in the Basel III capital requirements, however, is the introduction of a leverage ratio. This puts a floor on the extent to which banks can manipulate risk weights to lower their capital requirements. Moreover, it is easy to monitor for regulators and facilitates comparisons across banks by the market. It is, moreover, what market participants relied on during the crisis, when it became apparent that risk-weighted capital ratios were misleading at best. The new approach is being introduced under Pillar 2, but it is intended to migrate to Pillar 1 eventually.

Concerns about liquidity are addressed in two new liquidity ratios. The first is intended to ensure that banks have enough high-quality liquid assets to cover total net outflow over a 30-

day period of stress. Unfortunately, this concept has been so weakened in the negotiation process that the numerator contains numerous assets that will be liquid only under the most optimistic of assumptions and the denominator assumes a scenario that is much less stressful than most banks experienced during the recent crisis. The long-term net stable funding ratio is so controversial and the feared consequences so serious, that it seems unlikely to be implemented.

Thus, Basel III has added to the complexity of Basel II while attempting to correct some of the more obvious shortcomings. Stefan Micossi (2013) has observed, “Basel III has made the system even more complicated, opaque and open to manipulation.” This complexity is itself a problem. In addition to the deadweight costs in complying with and monitoring compliance with literally thousands of pages of regulations, the new regulatory initiatives introduce new sources of uncertainty. Banks are uncertain of how the rules will ultimately be implemented and enforced, and the authorities are uncertain about how banks will react to the barrage of new regulations. If the past is any guide, however, the authorities would be wise to expect new and ingenious forms of regulatory arbitrage.

The attempt to deal with the too-big-to-fail issue represents an even more striking innovation in international regulatory and supervisory policy. First, the authorities have realized that their own actions – subsidizing mergers between large, weak institutions with large, strong institutions – have been a major contributor to the growth of such institutions, which have more than doubled their share of banking markets since the mid 1990s. In addition, numerous studies have shown that the perception that such institutions are too-big-to-fail¹⁵ gives them an advantage in the cost of funds that is wholly unrelated to the quality of their services or capital strength. Ultimately, efficient resolution policy may be the best safeguard against this kind of moral hazard, but the crisis revealed that policymakers in most countries lack the appropriate tools to resolve a large, complex financial institution without jeopardizing the rest of the financial system [Herring (2004)]. And large, complex financial institutions have adopted corporate structures that defy efficient resolution.

15 More precisely, they are considered too large to be permitted to cause loss to creditors.

The 28 large, complex financial institutions identified by the Financial Stability Board as systemically important have 2.5 times as many majority-owned subsidiaries as the 28 largest non-financial corporations [Herring and Carmassi (2009)]. Moreover, most of these financial institutions are managed in an integrated fashion, along lines of business with minimal regard for national boundaries or the entities that must be taken through some sort of bankruptcy process in the event of failure.

The regulatory authorities have recognized that to counter the presumption of automatic bailouts created by the response to the crisis, they must devise ways of resolving institutions that will not create intolerable spillovers, but will punish managers, shareholders and, if necessary, some creditors of the faltering institution. The financial authorities could accomplish more by doing less, if they can credibly restore a role for market discipline in the system by devising a credible resolution plan for every systemically important institution.

The Financial Stability Board has been charged with leading this effort. All of the members of the now extended Basel Committee have agreed that each systemically important financial institution must file a recovery and resolution plan. Several countries have already required that their largest banks submit recovery plans – more popularly known as living wills or, more sardonically, as funeral plans. If these resolution plans indicate that the institution cannot be resolved in a reasonable amount of time without causing financial disruptions, the authorities reserve the right to require that an institution restructure or even sell off units to make it easier to resolve.

These countries have also agreed to introduce institutions that will enable them to intervene promptly in a failing bank to ensure that systemically important functions are continued but other parts are sold in whatever way that will maximize returns to creditors. The aim has been to ensure that taxpayers will never again be vulnerable to such potentially massive costs to support their financial systems. This has also led to an agreement that creditors should be bailed-in before deposit insurance funds or taxpayers suffer a loss. This is a dramatic change from practice during the crisis. The first implementation of the bail-in doctrine in Cyprus was not encouraging. Cypriot banks did not have sufficient Tier-2 capital to absorb losses and so it was necessary

to bail-in general creditors. Since uninsured depositors have the same standing as general creditors in much of Europe, this cause ripples across the Eurozone.

Concluding comment

Improving the effectiveness of prudential policy should be an important priority. But this requires an honest assessment of what we actually know about the risks assumed by systemically important institutions and, indeed, what the managers themselves know. Since many of these risks are unknown and some are unknowable, supervisors need to place much greater emphasis on increasing the resilience of the system. Rather than imposing increasingly prescriptive regulations, a wiser course may be to devise simpler rules that can be defined and monitored more easily. As Ralph Gomory (1995) noted, “[A]s the artifacts of science and engineering grow ever larger and more complex, they may themselves become unpredictable.” This may very well be the situation we now face. Rather than heaping still more amendments on the Basel III structure, the Basel Committee might be more effective if it focused on simplifying the system to make it more transparent, flexible, and easier to monitor.

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