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AN INCENTIVE-ROBUST PROGRAMME FOR FINANCIAL REFORM

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Leading up to the recent crisis, government encouraged risky lending, and failed to measure banks' risks credibly or to require sufficient capital. Regulators also failed to recognize losses or enforce intervention protocols for timely resolution. This paper proposes radical policy changes to prevent a recurrence. The need is not for more complex rules and more supervisory discretion, but rather for simpler rules that are meaningful in measuring and limiting risk, hard for market participants to circumvent and credibly enforced by supervisors. Ten 'incentive-robust' regulatory reform proposals are developed that together would constitute the beginning of an effective new regime.

1 Introduction

The world has just been through the most disruptive global banking crisis since the Great Depression. Not only did the fiscal burdens of the crisis impose significant costs and risks on taxpayers related to shoring up weak banks, the collapse of bank credit in the wake of large losses of bank net worth deepened the recession and prolonged the recovery. Throughout the world, outraged citizens are demanding that steps be taken to reduce the risks of another crisis.

They are justified in that demand. The global banking crisis was not the result of bad luck, but rather grew out of deeply flawed government policies towards the financial system. Those flawed policies can be divided into two primary categories of government errors, those of commission and those of omission.

The two errors of commission were government housing credit subsidies (especially in the USA, but also in some other countries, including Spain) and loose monetary policy. There is strong evidence that loose monetary policy tends to encourage the underpricing of risk, and that it did so leading up to the current crisis (see Calomiris 2009a, 2009b; Bekaert *et al.*, 2010), thus contributing to the housing bubble. But financial history teaches that monetary policy errors alone—even one as extreme and long-lived as the Fed's loose money during 2002–5—are rarely enough to produce the high leveraging of the banking system that is necessary for a severe *banking* crisis, as opposed to simply an asset pricing boom and bust (Calomiris, 2011). The more important

Note: Correction added on 31 January 2012 after first publication online on 1 September 2011. On Abstract, the word 'recognize' before 'losses' was omitted. On page 59, the words 'strict prior' should read 'strict priority' and on page 66, the word 'regulatory' should be changed to 'regulator'. The errors have been corrected in this version of the article.

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influence on leveraging during asset price bubbles tends to be microeconomic policies that distort incentives towards risk in the banking system.

US government housing finance policies that encouraged excessive mortgage financing leverage and poor underwriting of risks were likely the most important single policy error leading up to the subprime crisis. Those policy choices reflected the political usefulness of 'affordable housing' mandates, which were imposed on Fannie Mae, Freddie Mac, the Federal Housing Administration (FHA) and commercial banks in the USA by a series of government initiatives that escalated from the 1990s to the 2000s (Pinto, 2010a, 2010b; Wallison, 2011). Fannie Mae and Freddie Mac, in particular, played huge and highly politicized roles in the deterioration of underwriting standards, especially after 2004 when they aggressively entered no-docs lending, despite opposition from risk managers who advised against it (Calomiris, 2008).

The second category of policy errors were errors of omission related to ineffective prudential regulation of banks, which allowed banks to behave imprudently. Given the protection enjoyed by banks through deposit insurance and other government safety net policies (access to central banks, and the potential for additional protection to be provided by the state), there was little role for bank depositors to impose traditional market discipline on banks through the corrective withdrawal of funds from excessively risky banks (as described by Calomiris and Mason, 1997, 2003a; Calomiris and Powell, 2001; Calomiris and Wilson, 2004). Once government protects banks from market discipline it must establish credible prudential regulation to limit banks' risk taking; failing to do so will encourage excessive risk taking by banks who are able to enjoy the profits of risks that pay off well, but share with taxpayers the losses of risks that do not work out well.

In the decades leading up to the current crisis, regulators and supervisors consistently failed in three key areas: (i) they did not measure banks' risks credibly or accurately, and they failed to set sufficient minimum equity capital buffers in accordance with those risks so that banks would be able to absorb potential portfolio losses reliably, (ii) they failed to enforce even the inadequate capital requirements that they did impose because supervisors consistently failed to identify bank losses as they mounted, and thus allowed banks to overstate their levels of capital, and (iii) they failed to design or enforce intervention protocols for timely resolution of the affairs of weakened banks to limit the exposure of taxpayers to protecting the liabilities of feeble, 'too-big-to-fail' banks.

Government encouragement of risk taking in the mortgage market, loose monetary policy and prudential regulatory failure distorted incentives towards risk, which led the global financial system into the worst crisis since the Great Depression. It is important to emphasize that these failures of policy were not invisible prior to the crisis; they were the subjects of substantial discussion in the USA and elsewhere years before the collapse of 2007–9.

Warnings about the risks of the politically motivated relaxation of mortgage underwriting standards and the potential systemic financial risks posed by Fannie Mae and Freddie Mac were common in the 1990s and 2000s. Many economists, including John Taylor, Allan Meltzer and members of the independent Shadow Open Market Committee, noted prior to the crisis that the Federal Reserve had departed dramatically from the Taylor rule that seemed to have had seemed to guide it for many years prior to the visible departure from that rule in 2002–5 (Calomiris, 2009b).

The failures of prudential bank regulation have been visible for decades and have motivated many regulatory reform proposals by financial economists. The reason for the constant drumbeat of calls for reform is easy to identify: the last 30 years have seen worse banking system instability worldwide than any other period of human history, and the consensus of research about the sources of this unprecedented banking system instability clearly points to the deadly combination of new governmental protections for banks and failed prudential regulation (Calomiris, 2011).

In this paper, I will show that there are credible solutions to the key microeconomic policy challenges that the government faces. For the most part, my proposed solutions to those problems are not new; they have been known and advocated by financial economists for some time. Thus, the failure to prevent the crisis was not a failure of thinking, but a failure of will on the part of our political system. Our politicians and regulators have found it expedient to offer hidden subsidies for risk taking both to low-income homeowners through affordable housing mandates, and to bankers through the combination of safety net protection and ineffectual prudential regulation. Attempts to identify and rein in those subsidies have been defeated politically time and time again.

Will proposed reforms in response to the crisis this time be effective? Will reformers succeed in implementing changes in the rules of the game that would reduce the change of a repeat of the recent crisis? The experience with previous post-crisis reforms in financial history offers a mixed record of responses (see Calomiris, 2010, 2011). The key ingredients that produce an effective response—(i) a proper diagnosis of the source of the crisis, and (ii) an allocation of political power that is favourably disposed towards creating effective reforms—are rarely found, particularly in the crisis-prone era of the past three decades, which has seen a historically unprecedented frequency of severe banking crises, a large proportion of which are of unprecedented severity (Calomiris, 2011).

It is hard not to be cynical about prudential banking reform after the last three decades of experience. After each crisis, regulators and politicians respond in a manner that is predestined to fail. Their actions give the appearance of diligence, as they assemble a laundry list of the things that went wrong in the crisis—typically defined with reference to the specific symptoms of

poor policies, not the deeper incentive problems that policy errors have produced. That laundry list then gives rise to a new, more complex set of regulatory initiatives, and these laws and rules are advertised as preventing a recurrence of the problems.

Deficiencies are supposedly remedied by ever-more complex sets of rules for measuring risk, by the granting of increased supervisory discretion to a variety of new government officials with varying mandates, by scores of new research initiatives pursued by increasingly fragmented research and supervisory divisions at central banks and supervisory agencies, by the creation of new international study groups. Is it too cynical to see this exponential increase in complexity of rules, and of the regulatory and supervisory authorities charged with designing and enforcing them, as purposely designed to reduce accountability by dividing responsibility and by making the regulatory process less comprehensible to outsiders?

The implicit theory behind these sorts of initiatives, to the extent that there is a theory, seems to be that the crisis happened because regulatory standards were not quite complex enough, because the extensive discretionary authority of bank supervisors was not great enough, and because rules and regulations prohibiting or discouraging specific practices were not sufficiently extensive. That theory, however, is demonstrably false. At the core of the recent financial crisis—and the many that preceded it around the world in the past three decades—have been basic incentive problems in the rules of the game set by the government. The pre-crisis environment was one in which regulatory complexity was unprecedented, supervisory enforcement was virtually non-existent, and private risk taking at public expense was unlimited. And yet this is precisely the environment that has produced the most unstable 30 years of global banking history, and the most severe financial crisis since the Great Depression.

The need is not for more complex rules, and more supervisory discretion, but rather for *rules that are meaningful in measuring and limiting risk, hard for market participants to circumvent and credibly enforced by supervisors*. I will show that these qualities are best achieved by constructing *simpler* rules that are grounded in an understanding of the incentives of market participants and supervisors.

In addition to reinforcing the need to fix the three central failures of prudential regulatory policy—the measurement of risk and commensurate budgeting of capital, the timely identification of loss and the resolution of too-big-to-fail banks—the recent financial crisis also highlighted four erstwhile missing aspects of prudential regulation, which the crisis showed could be especially important from the standpoint of financial crisis management and prevention: (i) the scrambling for liquidity by banks and other financial market participants during the recent crisis illustrated the potential usefulness of requiring that financial institutions meet *liquidity require-*

ments in addition to capital requirements. (ii) So-called *macro-prudential regulation* has become the focus of several new initiatives, as advocates have pointed to potential advantages associated with varying capital and liquidity requirements over the business cycle in a way that would mitigate excessive risk taking during lending booms and reduce the extent of credit contraction during crises. (iii) The crisis also focused attention on the potential problems of *managing counterparty risk* in the over-the-counter (OTC) market, which has given rise to new proposals to encourage or require the greater use of exchanges as platforms for clearing or trading. (iv) Finally, the variety of hastily designed and approved *ad hoc measures for providing government support to banks* during the crisis that were either adopted or considered—including various types of loans, guarantees and capital injections—suggests that it could be advantageous to think through in advance what sorts of assistance measures governments should provide to banks and on what terms, and to ensure that these measures are consistent with other government policies, especially resolution policies.

The keys to effective reform in all these categories are, first, recognizing the core incentive problems that have encouraged excessive risk taking and ineffective prudential regulation and supervision, and, second, designing reforms that are 'incentive-robust'—i.e. reforms that are likely not to be undermined by the self-seeking regulatory arbitrage of market participants, or the self-seeking avoidance of the recognition of problems by supervisors. This paper will illustrate that approach to regulatory reform by proposing a programme of measures that meet the criterion of incentive robustness.

Section 2 reviews in more detail the nature of the most harmful and persistent policy failures—mortgage risk subsidization, the failure to measure *ex ante* risk and budget required capital accordingly, the failure to measure *ex post* loss and bailouts to banks that are 'too big to fail'.

Section 3 describes solutions to those and other policy reform challenges in the form of 10 'incentive-robust' regulatory reform proposals that together would constitute the beginning of an effective new regime for limiting excessive risk taking, reducing the chance of crises and protecting taxpayers from bearing the costs of crises (summarized in Table 1). These 10 measures address mortgage risk subsidization, prudential regulation's failure to measure *ex ante* risk and *ex post* loss, the too-big-to-fail problem and the more recently recognized challenges of designing appropriate liquidity standards for banks, setting macro-prudential regulatory rules for varying prudential capital and liquidity standards over time, imposing new rules to encourage the greater use of clearing houses in clearing OTC transactions, and designing appropriate mechanisms for channelling government assistance to banks during crises. Section 4 concludes.

TABLE 1
AN INCENTIVE SCORECARD FOR 10 PROPOSALS FOR REGULATORY REFORM

Proposal	*Market incentives?*	*Incentives of regulators/supervisors?*
1. End mortgage risk subsidies	Better origination/brokerage	Less politically conflicted supervision and regulation (no more conflict between prudential regulation and 'affordable housing' goals)
2. Require NRSROs to use numerical forecasts of default, with 'sit out' penalties for egregious errors	Rating agencies will have strong incentives to make estimates accurate, and will resist buy-side pressures to inflate ratings	Avoids micromanaging NRSROs Transparency improves accountability of enforcement
3. Use loan interest rates to help set capital ratios	Loan pricing reflects risk and will continue to do so when loan spreads are used to budget risk-based capital	Standards are transparent and rule-based, and therefore credible
4. Require CoCos with market triggers	Banks pre-emptively raise equity	Enforcement of conversion is automatic, so credible: CoCos automatically convert before resolution, so will not be bailed out even if other debts are
5. 10% minimum haircuts when government limits losses to creditors	Enhances market discipline	Less excuse for avoiding haircuts because they are not too large
6. Ring fencing of jurisdictions over resolution	Less able to game resolution	Clear responsibility implies better enforcement, implying fewer bailouts of creditors *ex post*
7. Remunerative reserve requirement = 20% of assets	Improves incentives to manage risk	Clearly observable and therefore credibly enforced
8. Macro-prudential changes in capital, liquidity and provisioning requirements based on dual threshold of credit growth and asset price growth	Improves incentives to manage risk (anticipating changes in requirements)	Limits discretion and concentrates regulatory responsibility, which enhances credibility of enforcement
9. Regulatory capital and liquidity requirement surcharges on non-exchange cleared transactions	Encourages counterparties to employ centralized clearing while avoiding prohibitive costs for innovative contracts	Easy to enforce and therefore credibly enforced
10. Establish principles and guidelines (e.g. matching requirements) to constrain assistance of banks	Enhances market discipline	Makes resolution rules credible

2 The Key Persistent Policy Failures that Reforms must Address

2.1 The Subsidization of Mortgage Default Risk

The US government's support for mortgage lending dates from 1913. Prior to the establishment of the Federal Reserve System national banks were prohibited from mortgage lending, which was perceived as too risky an activity to permit banks to engage in. As a political quid pro quo for passing the Federal Reserve Act in 1913, agricultural interests demanded a relaxation of that regulatory prohibition, which opened the door to mortgage lending by US commercial banks on a large scale. Mortgage lending was further promoted by the establishment of a variety of special institutions and requirements beginning in the 1930s and continuing into subsequent decades. These included Fannie Mae, the Federal Home Loan Banks, federal thrift institutions chartering, Freddie Mac, FHA and the Community Reinvestment Act (CRA), all of which encouraged growth in mortgage finance on an increasingly levered and government-subsidized basis, and ultimately, with deteriorating underwriting standards.[1]

The thrift crisis of the 1980s made visible the high potential costs of mortgage risk subsidization, which at that time mainly consisted of the subsidization of market risks related to 30-year fixed-rate prime mortgages. Despite the costly crisis of the 1980s and the new discipline applied to the thrift industry in 1989 and afterwards, regulatory reformers of the 1990s did *not* roll back government subsidization of the mortgage market after the thrift crisis of the 1980s. In contrast, the retreat of the S&L industry was more than offset by the expansion of Fannie Mae, Freddie Mac and the Federal Home Loan Banks in the 1990s and 2000s, with the clear understanding in the market that their creditors enjoyed the implicit (now explicit) protection of the US taxpayers. Initially, until the late 1990s, the main risks related to Fannie and Freddie remained market risks (especially mortgage prepayment risks). The reason for that was simple: Fannie and Freddie did not absorb much default risk during that period. In the 1980s and 1990s, their portfolios of high-default risk mortgages were small, and they generally required private mortgage insurance on risky mortgages (Calomiris, 2001).

That began to change in the mid-1990s. The purposeful subsidization of mortgage default risk in the 1990s and 2000s by Fannie and Freddie was driven by the political agenda of promoting 'affordable housing' through a combination of off-budget government initiatives: increasingly generous

[1]Government subsidies can be created, and were created, through a variety of mechanisms, including underpriced deposit insurance for thrifts, underpriced mortgage insurance by FHA, unfunded CRA and department of Housing and Urban Development (HUD) mandates that effectively taxed financial institutions to finance the government-imposed subsidy, and the implicit government guarantee of the debts of Fannie Mae and Freddie Mac.

FHA loan guarantees provided explicitly by the government, mandates for increased 'affordable housing' lending Fannie Mae and Freddie Mac, and CRA mandates on commercial banks. HUD established mandates for Fannie Mae and Freddie Mac during the 1990s, which required increasing amounts of their mortgage portfolios to be dedicated to 'low and moderate income' and 'underserved' and 'special affordable' borrowers over time (Pinto, 2010a, 2010b; Wallison, 2011). In 1996, the HUD goal for Fannie Mae for underserved borrowers was 21 per cent of its portfolio; by 2006 it had risen to 38 per cent.

The growth in government mandates meant that the amount of government-directed mortgage money chasing low-income borrowers was rising dramatically, while the number of creditworthy low-income borrowers did not rise commensurately. Filling that gap required the deterioration of underwriting standards so that the government-mandated increase of supply could be accommodated. The need to absorb the supply of government-directed mortgage lending was the key driver behind the dramatic reduction in downpayments during the 2000s, the changes in Fannie's and Freddie's mortgage default protocols in the late 1990s (which required originators to be much more forgiving of defaults), the decision by Fannie and Freddie to enter no-docs lending aggressively in 2004 despite the concerns of risk managers about its risks (Calomiris, 2008), their decision to turn a blind eye to the inaccurate representations and warranties that became common in subprime mortgage securitizations during the boom, and the federal legislation in 2006 that sought to encourage more lenient ratings of mortgage-backed securities (MBS).[2] All of this was associated with a near tripling of subprime originations that year, and a further doubling of them by 2006. According to Pinto (2010a, 2010b), Fannie and Freddie ended up holding a $1.8 trillion exposure to subprime losses. Total outstanding government programme-related subprime exposure (Fannie, Freddie, FHA and CRA and other HUD-related lending) totals $2.7 trillion, while other private exposure totals $1.9 trillion.

2.2 *Prudential Regulation and Supervision's Failures to Measure* Ex Ante *Risk and* Ex Post *Loss*

Putting aside the decisions of Fannie and Freddie—which clearly reflected political pressures that were unique to their charters (Calomiris, 2008)—what explains why some financial institutions (e.g. Bear Stearns, Citibank, UBS, American International Group (AIG) and Lehman) took the plunge into subprime while other financial institutions (Deutsche Bank, JPMorgan Chase, Credit Suisse, Goldman Sachs and many others) avoided large exposure to subprime? To what extent can regulatory explanations of bank risk

[2]The federal government's actions in trying to prevent 'notching' is a little-known attempt to encourage the rating agencies to relax their standards. See Calomiris (2009a, 2009c) for further discussion.

taking be said to be relevant, given that the same regulatory and supervisory policies were associated with such different consequences across banks?

The interaction of agency problems with prudential supervision and regulation can explain the differences across banks in their subprime risk exposures. The first line of defence against unwise investing on the part of bank management should be its fiduciary obligation to pursue the interest of stockholders. A manager that was properly incentivized to identify investments with a desirable risk-return profile should have avoided a large exposure to subprime investments during the crucial boom period of 2004–6. Subprime securities on an *ex ante* basis offered little expected returns relative to the outsized risks coming from potential slowing or decline of house prices and the adverse-selection problems related to no-docs lending. As Rajan *et al*. (2011) show, more than half of the difference between the actual subprime loss experience and the losses forecast at the time of origination of subprime securitizations is attributable to adverse-selection problems related to no-docs lending, and the remainder of the difference reflects the effects of house price declines (which forecasts of default risk assumed were virtually impossible). Based on both logic and experience, adverse-selection problems should have been anticipated. If a lender makes it known in the market that it will cease to verify employment and income information, then that lender will predictably attract a biased and less-creditworthy group of borrowers. Freddie Mac's risk managers were aware of that principle, and had experienced these adverse-selection related losses in the late 1980s, which was the basis for their vocal opposition to entering no-docs lending in 2004 (Calomiris, 2008).

Of course, not all employees or all organizations will choose to avoid 'value-destroying', over-priced investments like subprime MBS, if incentives within the organization encourage portfolio managers to take excessive risks in the interest of growing the portfolios that they manage. Poorly designed compensation systems for rewarding portfolio managers can contribute greatly to that problem. For example, to the extent that portfolio managers' compensation depends, either explicitly or implicitly, on the size of assets under management (e.g. when managers receive a bonus in proportion to the assets they manage), a portfolio manager may see substantial private gains from expanding investment, even in an undesirable security, if that security offers the easiest path to growing the portfolio. That is especially the case if he or she believes that competing portfolio managers within or outside his or her firm are riding the same wave, based on the same exaggerated debt ratings; when the bubble collapses, they all can expect to point to the supposed collective error of judgment and the opinions of rating agencies to insulate themselves from the reputational consequences of having made such bad investments. Call that a 'plausible deniability' equilibrium.

The key to avoiding these sorts of problems is to establish a healthy risk management culture. Such a culture rewards long-term performance of

portfolios, not just short-term growth. It does so through the structure of compensation, and by limiting the concentration of investments in any one set of risks.

Not all organizations have equally effective risk management cultures, and there is substantial evidence that variation in the quality of risk management matters greatly for limiting the potential exposure of an institution to risks like the subprime bubble. Ellul and Yerramilli (2010) find that commercial banks with a strong commitment to risk management (which they measure by the ratio of the compensation of the Chief Risk Officer relative to the compensation received by the Chief Executive Officer) fared much better during the subprime crisis than those with weaker commitments to risk management. Those *ex post* differences were also visible in *ex ante* implied volatility differences of stock returns. Banks that paid their risk managers more experienced less *ex ante* risk and less *ex post* loss.

While risk managers, acting in the interest of their stockholders, are the first line of defence against imprudent investing, prudential supervision and regulation is the second line of defence. If prudential regulation measures risk accurately, and requires the budgeting of sufficient capital to absorb risk, then agency problems should be substantially mitigated. The undesirable investments and the concentration of risk that poorly managed institutions would fail to observe and prevent should run afoul of the risk-based capital budgeting process required by effective prudential regulation, enforced by attentive prudential supervisors. Only if regulations and supervisors fail to establish a framework capable of accurately measuring risk and requiring an adequate amount of capital (i.e. an amount sufficient to absorb losses commensurate with that risk) can the failures of risk managers lead to the disastrous level of excessive risk taking observed in firms like Citibank, UBS, Merrill Lynch and AIG.

That is the sense in which ineffective prudential supervision and regulation bears a significant share of the blame for the disasters that befell those institutions. The failure of supervisors and regulators to measure risk has been the rule rather than the exception in banking for the past three decades, in the USA and abroad. Under the Basel system—unbelievably—the risks of the largest banks are measured in two ways: by employing rating agency opinions about the debts the institutions hold to gauge the risk of those debts, and by asking the banks themselves what they believe their risk is.

Obviously, relying on banks to gauge their own risks will prevent prudential regulation and supervision from identifying and correcting errors in risk measurement and management that are occurring within the banks. The opinions of rating agencies are also unreliable (as discussed further below), and this has been known since at least the early 1990s (Cantor and Packer, 1994; Calomiris, 2009a, 2009c). The regulatory use of ratings to control risk means that regulated buy-side investors (at banks, pensions,

mutuals and insurance companies) prefer that ratings be inflated. Ratings inflation relaxes suitability rules and capital requirements based on ratings that otherwise would bind more tightly on the regulated buy side. In particular, rating inflation allows buy-side banks and insurance companies to budget less equity capital when making their investments. Given the desire to avoid regulatory mandates (even in the absence of agency conflicts), and all the more so if agency problems are present, rating agencies have every incentive to cater to the preferences of their regulated buy-side clients, who prefer ratings inflation.

Not only has the regulatory framework failed to provide adequate *ex ante* protection, supervision has also failed to identify losses on a timely basis once they have occurred. The pattern of delayed recognition of loss has been visible in many countries for decades, and is generally understood to reflect a combination of low supervisory effort (it is not their money, after all), low supervisory skills (the smartest people get paid more to hide losses from the less smart and less highly paid supervisory folk), and the pressuring of supervisors by government officials to 'forebear' (that is a polite word for purposefully delaying the recognition of losses) in the interest of helping banks to survive and continuing the flow of bank credit.

Japanese banks in the 1990s pretended for a decade that their losses were much smaller than they actually were, which allowed them to delay the economic and political costs of recapitalizing, effectively permitting banks to continue to gamble with the house's money (the implied backing of the taxpayers) in a 'heads I win, tails you lose' game of 'resurrection risk taking'. The Mexican bank supervisory authorities allowed Mexican banks to pretend that their capital was much larger than it was for several years after the Mexican crisis of 1995, and only strengthened their accounting rules for loss recognition as banks' profits and portfolio values rose sufficiently to allow the banks to meet the more stringent and realistic criteria. US recognition of bank and thrift losses in the 1980s was postponed for many years (until after the 1988 election) to avoid the political consequences of recognizing the magnitude of those losses, and avoiding the disruption that regulators feared might accompany an honest accounting of the money centre banks. These are examples of a pervasive tendency worldwide.

Notwithstanding the attempt to address this problem in the USA through the 1991 Federal Deposit Insurance Improvement Act's (FDICIA) prompt corrective action reforms, the same pattern was visible in the post-FDICIA period (before and during the recent crisis); failing banks have not been identified as weak and forced to recapitalize before they become insolvent. Contrary to the promise of FDICIA, banks can lose capital over a long period of time with impunity, as supervisors and regulators stand by doing nothing to force banks to recapitalize before it is too late.

Calomiris and Herring (2011) calculate the ratio of the market value of equity relative to the market value of assets of the largest US financial

institutions from 2006 to 2008. That ratio declined persistently over many months prior to the September 2008 collapse. The market for equity capital was wide open, and in the year prior to September 2008 large global banks raised about $450 billion in new capital (Calomiris, 2009a). But Merrill Lynch, Lehman and AIG (among others) chose not to raise substantial amounts of capital prior to September 2008, in the hope that equity prices would rise, allowing them to recapitalize with less dilution of existing stockholders. The bailout of Bear Stearns (and the expectation of too-big-to-fail protection that resulted from that bailout) further encouraged these delays in raising capital, since banks felt protected on the extreme downside if matters got much worse.

Is it really true that the measurement of risk and the measurement of loss are such crucial problems in prudential regulation and supervision? If so, why have not those problems commanded more attention? After all, Secretary Geithner has not focused attention on these failures. He argued before Congress that the key to effective reform was 'capital, capital, capital'.

More capital is essential, both to discourage banks from wilfully taking on excessive risk (because they are playing with the house's money), and because capital is the absorber of shock that keeps banks from failing when adverse shocks occur. But the emphasis should be on maintaining a sufficient amount of capital *commensurate with risk*. If equity capital is raised by a few percentage points (as envisioned under the new Basel rules) but banks are free to raise risk as much as they like, then banks may offset the stabilizing effect of higher capital with higher risk.

The importance of budgeting capital commensurate with risk is illustrated nicely by the experience of the recent crisis. Bank capital ratios prior to the crisis did not predict which banks would suffer the worst declines during the crisis. Some of the banks with relatively high amounts of equity did very poorly (Citibank being an obvious example), while other banks with lower capital ratios (e.g. Goldman Sachs) fared much better. In April 2006, Citibank's market equity ratio (defined as the ratio of Citibank's market value of equity relative to the sum of the market value of equity and the face value of debt) was above 13 per cent, while Goldman Sachs market equity ratio was half that (Calomiris and Herring, 2011). The obvious source of the difference between the experiences of the two institutions was their levels of risk, not their capital ratios.

Furthermore, choosing an initial capital level during good times does not guarantee that capital will be maintained. When banks suffer loan losses, those losses destroy capital. If supervisors fail to recognize those losses, capital will become overstated, and will cease to be an adequate buffer for future losses. Even worse, given the strong incentives that supervisors face to forebear, capital is likely to be purposely overstated by supervisors during financial crises. Given that such forbearance creates strong incentives for insolvent or severely undercapitalized banks to expand their risk (the moral-

hazard problem of 'asset substitution' or 'resurrection risk taking' documented, for example, by Brewer, 1995), this implies that the weakest banking systems are those most likely to increase their levels of risk at the worst possible time (when their capital is lowest).

In summary, the focus of prudential capital regulations must be on the credible measurement of risk and the budgeting of capital commensurate with that risk, and the amount of capital must be monitored continuously to ensure that it has not disappeared as the result of losses. These challenges have a technical component, but they are not merely or even mainly technical. For the measurement of risk to be credible, the incentives of the party doing the measurement are the key factor. Banks cannot be trusted to measure their own risks, and (under existing incentives) rating agencies cannot be trusted to measure banks' risks either.

In the USA historically, and in some countries still, when deposits are not protected by government insurance, depositors (especially informed depositors, many of which are bankers) play the role of supervising banks, imposing discipline on banks that are seen as too risky by withdrawing their deposits, which forces banks to de-lever, and encourages transparent and credible risk management. In the absence of that discipline, weakly incentivized government-employed supervisors, many of whom are less skilled than their more highly paid counterparts at the banks, and who rely on the opinions of conflicted parties to measure risk and capital, are unlikely to provide a substitute for that sort of discipline. The key to resolving the incentive problems of adequate prudential capital regulation, therefore, comes down to finding ways to produce and use information about *ex ante* risk and *ex post* loss that are informed and 'incentive-robust', by which I mean that the measures are immune to the incentives of banks, rating agencies, supervisors, regulators and politicians to understate both *ex ante* risk and *ex post* loss.

2.3 Too Big to Fail

After the March 2008 bailout of Bear Stearns, large and complex financial institutions with global reach had a reasonable expectation that, if they faced mounting losses, the government would step in to provide some assistance in support of an orderly acquisition by another firm, as it did for JP Morgan's acquisition of Bear Stearns. During the crisis, that expectation of protection likely led Merrill Lynch, Lehman and others to delay the issuance of substantial amounts of stock, especially in the summer of 2008. Firms reasoned that prices would likely improve, and sought to avoid the dilutive consequences of issuing stock into an illiquid and worried market.

Whatever the economic pros and cons of bailouts, the path of least political resistance will generally be to bailout large, complex firms. It is

hard to manage an orderly transfer of control over operations, assets and liabilities of large firms with complex subsidiary structures, operating in many countries with overlapping and unclear regulatory jurisdiction over their assets, liabilities and operations, which are engaged in a large number of counterparty transactions with other large, complex financial institutions. Without a credible plan (a so-called 'living will') in place that would require a sufficient degree of clarity and simplicity in organizational structure, guide the orderly transfer of operations, assets and liabilities, and allocate losses in a way that would be transparent, legally enforceable and perceived as unlikely to create further knock-on failures related to losses imposed on counterparties, the pressure for the government to avoid potential problems with a bailout will be too tempting. Furthermore, to the extent that there had been willingness to allow large banks to fail prior to 2008, the coincidence of the failure of Lehman and the post-September 2008 financial collapse has decreased the prospect for 'tough love' decisions in the future.

Reform proposals to address too-big-to-fail usually focus on the creation of credible procedures for taking control of troubled financial behemoths in a way that would limit adverse systemic consequences of their failure while avoiding blanket bailouts of creditors and stockholders. The too-big-to-fail problem also adds urgency to the need to design reforms that would address the key challenges of credible risk measurement and loss measurement; too-big-to-fail protection aggravates the incentives of large institutions to minimize equity capital and raise risks, in order to profit from risk taking at public expense.

3 Solutions

In this section, I propose 10 reforms (summarized in Table 1) that would address the fundamental problems of risk subsidization outlined above (mortgage risk subsidization, the failure to measure bank risk and require commensurate capital, the failure to recognize bank losses and too-big-to-fail bailouts), and other important challenges of prudential policy reform (the proper design of liquidity requirements, macro-prudential guidelines, the regulation of OTC clearing and the mechanisms for assisting banks during crises). A central principle that guides all these proposed reforms is 'incentive robustness'. An incentive-robust reform is one that satisfies two key criteria: (i) market participants will not find it easy to circumvent it via regulatory arbitrage, and (ii) supervisors, regulators and politicians will have incentives to enforce it. Indeed, I suggest that all future proponents of regulatory reforms should have to fill out an 'incentive scorecard' like Table 1 in which they explain why they believe that their proposed reforms would meet these two incentive robustness criteria.

3.1 Replace Mortgage Risk Subsidies with Explicit, Means-tested Housing Subsidies

The central problem in mortgage risk subsidization in the USA has become the tolerance for extremely high leverage by government-subsidized lenders. Without high leverage the subprime boom and bust could not have happened. In particular, risky no-docs lending (a major driver in the subprime loss experience) was made possible by high leverage; non-creditworthy borrowers would have been unwilling to deceive lenders if they had to pledge a large amount of their own savings as a downpayment. House price declines would not have produced huge loan losses if homeowners had retained a minimum 20 per cent stake in their homes.

During the 1990s and 2000s leverage tolerances on US government-guaranteed mortgages rose steadily and dramatically at FHA, Fannie Mae and Freddie Mac. The average loan-to-value (LTV) ratio of FHA mortgages rose to 96 per cent, and a third of Fannie and Freddie's purchases leading up to their insolvencies had LTVs of greater than 95 per cent. Not only are high LTVs destabilizing, they undermine the objectives of housing policy. Its central goal is promoting stronger communities by encouraging residents to have a stake in them. But a 97 per cent LTV creates a trivial stake; homeowners become renters in disguise, able to abandon homes at little cost.

I propose a three-part plan for redesigning US government housing finance policy: first, replacing leverage subsidies with means-tested downpayment assistance alongside reduced LTVs; second, means-tested interest rate risk assistance; and finally means-tested, tax-favoured savings accounts for would-be homeowners.

An obvious alternative to subsidizing mortgage risk is subsidizing downpayments. This is the approach of Australia's (non-means tested) housing policy, which gives A$7000 to all first-time home buyers. An improved variant would offer means-tested subsidies for first-time home buyers, while also phasing in increases in minimum downpayments. For example, first-time home buyers with houses worth less than a (regionally adjusted) maximum, who earn less than a maximum family income, would be eligible for a lump sum housing grant equal to the smaller of, say, $10,000 or 30 per cent of the downpayment on their home.

Minimum downpayments on all mortgages would rise by, say, 1 per cent a year over 17 years to the new minimum of 20 per cent. Phasing in the rising downpayment requirement would avoid disruptive declines in housing prices that might result from a sudden change in mortgage finance. Given the potential for government bailouts of mortgages even when they were not explicitly part of any government programme, this rising minimum should apply to all mortgages, not just those of buyers receiving explicit government assistance. Recipients of downpayment assistance would pay no interest on

their grants. The assistance would take the form of a junior equity lien on their homes (senior to their own equity investments, but junior to mortgages). Principal would be repaid in full upon sale or refinancing of the house.

Reducing the cost of locking in a long-term fixed rate—of particular importance to low-income households—should be the second part of supporting affordable housing. Rather than provide invisible interest rate subsidies through FHA, Fannie and Freddie, the government should subsidize low-income buyers of privately supplied mortgage interest rate swaps (limiting the subsidy to, say, to the lower of $5000 or 30 per cent of the cost of the swap).

Tax-favoured treatment of savings accounts that could be used by low- and moderate-income families to accumulate adequate downpayments would further encourage 'skin in the game'. Given that low-income Americans pay little or no income tax, it may be desirable to allow some reduction in payroll taxes on funds placed into 'Home Savings Accounts'.

The small costs (relative to current programmes) of these proposals include: the time value of money and losses from default on downpayment assistance, the cost of swap subsidies and foregone payroll taxes. All these costs should be recognized explicitly on the government's budget. These programmes would replace existing implicit mortgage risk subsidies provided through FHA, Fannie and Freddie. FHA mortgage guarantees would end, Fannie's and Freddie's assets would be sold into the market, and Federal Home Loan Banks would also be phased out.

3.2 Improve the Accuracy of Credit Ratings through Incentive Reforms

Credit rating agencies, which constitute a key component of regulatory risk measurement, performed badly in measuring credit risk on the subprime-related debts that they rated. Were rating agencies suborned, and if so, by whom and to what purpose? The evidence of rating agency failure shows up in *inflated* ratings and *low-quality* ratings. The inflation of ratings is the purposeful underestimation of default risk on rated debts. Low-quality ratings are ratings based on flawed measures of underlying risk. The recent collapse of subprime-related securitizations revealed both problems in the extreme.

What harm do these deficiencies do? Inflation subverts the intent of regulations that use ratings to control risk taking, resulting in ineffectual prudential regulation. If rating inflation is accompanied by low-quality ratings, this causes deeper problems. Investors can 'reverse engineer' a debt rating that is merely inflated and recover the true measure of risk; the revelation of severe flaws in risk modelling that usually occur in response to a financial shock leaves investors unsure how to price the debts they are holding, and unwilling to buy additional debts of similar securitizations, resulting in severe market disruption.

Evidence abounds that severe errors in subprime ratings were predictable. The two most important modelling errors relating to subprime risk were both assumptions that contradicted logic and experience, namely that US house prices could not decline, and that the underwriting of no-docs mortgages would not lead to a severe deterioration in borrower quality (Rajan *et al*., 2011).

Who was behind these biased models? Many policy makers incorrectly believe that securitization sponsors are the constituency that controls ratings. That is false. Ratings that exaggerated the quality of securitized debts were demanded by the *buy* side of the market (the institutional investors whose portfolio purchases are regulated according to the ratings that are attached to those purchases) because inflated ratings benefited them.

Ratings that understate risk are helpful to institutional investors because they: (i) increase institutional investors' flexibility in investing, (ii) reduce the amount of capital that institutions have to maintain against their investments (e.g. the objective of the new 're-remics' alchemy), and (iii) increase their perceived risk-adjusted profitability in the eyes of less sophisticated ultimate investors (mutual fund, bank and insurance company shareholders, pensioners or policyholders) by making it appear that an AAA-rated investment is earning an AA-rated return. If buyers wish rating agencies to inflate ratings to overcome regulatory hurdles and make them appear more favourably in the eyes of their ultimate investors, rating agencies can reap substantial profits from catering to buyers' demands for inflated ratings. This has an important implication: rating inflation on securitized debts is done at the behest of the *buy side*.

Consider the case of the collateralized debt obligation (CDO) market. CDOs were constructed using unsold debts from other securitizations (often subprime MBS). CDO issuance volume increased dramatically in the early 2000s, rising from $100–150 billion a year in 1998–2004 to $250 billion in 2005 and $500 billion in 2006.

Were institutional investors aware of the high risk of CDOs prior to the 2006 boom? Yes. Moody's published data on the five-year probability of default, as of December 2005, for Baa tranches of CDOs which showed that these Baa debts had a 20 per cent five-year probability of default, in contrast to the Baa corporate debts, which showed only a 2 per cent five-year probability of default. Despite the rhetoric rating agencies publish claiming to maintain uniformity in rating scales, institutional investors knew better: in 2005 CDOs debts of a given rating were 10 times as risky as similarly rated corporate debts.

Why did institutional investors play this game? Asset managers were placing someone else's money at risk, and earning huge salaries, bonuses and management fees for being willing to pretend that these were reasonable investments. On one occasion, when one agency was uninvited by a sponsor from providing a rating (because the rating agency did not offer to approve

as high a percentage limit for AAA debt as the other rating agencies), that agency warned a prominent institutional investor not to participate as a buyer, but was rebuffed with the statement: 'we have to put our money to work'.

Strong evidence that buy-side investors encouraged the debasement of the ratings process comes from the phenomenon of 'ratings shopping'. Before actually requesting that a rating agency rate something, sponsors ask rating agencies to tell them, hypothetically, how much AAA debt they would allow to be issued against a given pool of securities being put into the CDO portfolio. If a rating agency gives too conservative an answer relative to its competitors, the sponsor just uses another rating agency.

It is crucial to recognize, however, that, for ratings shopping to result in a race to the bottom in ratings, the race to the bottom must be welcomed by the buyers; if institutional investors punish the absence of a relatively good agency's rating of an offering (by refusing to buy or paying a sufficiently lower price), then would-be ratings shoppers would have no incentive to exclude reputable rating agencies. Thus, the evidence that ratings shopping tends to produce a race to the bottom implies that the buy side favours the low-quality, inflated ratings that result from the race to the bottom.

Under pressure from Fitch, Congress and the SEC also played a role in encouraging the debasement of ratings of subprime MBS and related securities. Congress passed legislation in 2006 that prodded the SEC to propose 'anti-notching' regulations that would have facilitated ratings shopping in the subprime MBS market. 'Notching' arose when CDO sponsors brought a pool of securities to a rating agency to be rated which included debts (often subprime MBS) not previously rated by that rating agency. When asked to rate the CDO that contained those subprime MBS, Moody's, say, would offer either to rate the underlying MBS from scratch or to notch (adjust by ratings downgrades) the ratings that had been given by, say, Fitch.

The new anti-notching rules would have forced each rating agency to accept ratings of other agencies without adjustment when rating CDO pools. This policy constituted an attack on any remaining conservatism within the ratings industry: trying to swim against the tide of ratings inflation would put a rating agency at risk of running afoul of its regulator!

Once one recognizes that the core constituency for low-quality and inflated ratings is the buy side in the securitized debt market, that carries important implications for reform. Proposals that would require buy-side investors to pay for ratings, rather than the current practice of having securitization sponsors pay for ratings, would have no effect in improving ratings.

Any solution to the problem *must make it profitable for rating agencies to issue high-quality, non-inflated ratings*, notwithstanding the demand for low-quality, inflated ratings by institutional investors (and politicians). This can be accomplished by objectifying the meaning of ratings, and linking fees earned by rating agencies to their performance. If fees are linked to the

quality of objectified ratings, then rating agencies would find it unprofitable to cater to buy-side preferences for inflated, low-quality ratings. How could this be done?

Require all agencies wishing to qualify as Nationally Recognized Statistical Ratings Organizations (NRSROs)—the rating agencies whose ratings are used in regulation—to submit ratings for regulatory purposes that link letter grades to specific estimates of the probability of default. For example, for NRSRO purposes BBB could be defined as a forecast of a 2 per cent five-year probability of default from the date of origination, and A could be defined as a forecast of a 1 per cent five-year probability of default.

Once the ratings are equated to numbers, rating agencies could be held accountable for their ratings. For example, if an NRSRO's ratings at origination for a particular product were found to be persistently inflated to an egregious degree, then it would face a penalty. That penalty could 'claw back' fees the agency had earned on that product (enforced by requiring that agencies post some of their fees as a 'bond' to draw upon). Alternatively, a rating agency found to have exaggerated its ratings could simply lose its NRSRO status (and, therefore, its fee income from ratings) for a brief time (say, several months), which would also provide powerful incentives not to inflate.

I would argue that the second approach would be the easier one to implement. It would be desirable to use a several-year moving average of actual experience when gauging performance. That approach would preserve the 'through the [business] cycle' quality of ratings and also ensure a sufficient sample size. The universe of rated products would be divided into several categories (MBS, credit cards etc.). Each category would use an identical definition of BBB and A (2 per cent and 1 per cent probabilities of default). If either the five-year backward looking moving averages of the proportion of rated BBB tranches or the proportion of rated A tranches substantially exceeded their 2 per cent and 1 per cent respective benchmarks, then the rating agency would be barred from providing ratings for regulatory purposes for that class of debt instruments for several months. The threshold for substantially exceeding the 2 per cent target could be 4 per cent, and the threshold for substantially exceeding the 1 per cent target could be 2 per cent. The reason to focus on BBB and A is that these are sufficiently risky that their default experience will be observable over short periods of time. If A and BBB ratings are reasonably accurate, that will go a long way in constraining the over-rating of the related AA and AAA tranches.

Why is this approach to ratings reform incentive-robust? First, it incentivizes rating agencies to provide high-quality, non-inflated ratings. If a rating agency is suspended from being able to provide NRSRO ratings for a significant period of time on a class of debt, that would have a major impact on their fees. Second, there is no discretionary role for supervisors, regulators or politicians in this proposal, and thus no concern that they will shirk or

forbear from enforcement. And the record of ratings is observable to the public, ensuring that no hidden forbearance could occur.

3.3 Use Loan Spreads to Measure Loan Default Risk

For debts held by banks, reformed ratings could provide reasonably accurate measures of default risk, but how can regulators credibly measure the default risk of bank loans? Ashcraft and Morgan (2003) show that, not surprisingly, interest rate spreads (all in interest cost on the loan minus the comparable maturity riskless interest rate) are accurate forecasters of the probability that a loan will become non-performing. In Argentina in the 1990s, interest rate spreads were used as a measure of loan risk for purposes of budgeting capital buffers for loans; higher loan spreads required higher capital budgeted in support of the loan. As Calomiris and Powell (2001) show, the Argentine approach to prudential regulation worked quite well in the 1990s.

This means of measuring risk is incentive-robust because banks cannot easily circumvent it. Clearly, banks would not have an incentive to lower interest rates just to reduce their capital budgeting against a loan, since doing so would reduce their income. To avoid any attempt to manipulate the formula using teaser rates, regulation should use the highest possible all-in spread during the life of the loan as the measure of the all-in spread. If this rule had been applied to subprime loans in 2003, the capital budgeted against those loans would have been substantially higher, and the subprime boom and boost might never have occurred.

3.4 Require Contingent Capital to Better Measure and Replace Lost Capital

Calomiris and Herring (2011) develop a contingent capital certificate (CoCo) requirement proposal whose primary intent is to identify equity losses and incentivize banks to replace lost equity with new offerings on a timely basis. Calomiris and Herring (2011) show that the declines in the market equity ratios of large US banks occurred gradually over many months. Markets for raising new equity were open, and there was plenty of time to raise capital, but some banks (most notably, Lehman and Merrill) avoided significant equity issues, which they viewed as dilutive, hoping the crisis would pass and they would be able to avoid issuing equity or issue it at a higher price. And even most of the banks that issued significant amounts prior to September 2008 allowed their market equity ratios to decline significantly over the period from March 2007 to March 2008.

Calomiris and Herring (2011) show that CoCos, if properly designed, would be an incentive-robust means of encouraging the timely replacement of lost capital. The three key features of that proper design are: (i) a sufficiently large quantity of CoCos (e.g. roughly equal as a proportion of assets to the

tier 1 capital ratio, which they also propose raising significantly above its current required ratio), (ii) a conversion trigger based on the moving average of the market equity ratio, and (iii) a sufficiently dilutive conversion ratio.

The market equity ratio is a desirable trigger because it is an observable and forward-looking market indicator of the value of bank equity capital. Using a market trigger means that the implementation of CoCo conversion is automatic, rather than subject to regulatory discretion (as is the case when the trigger is defined using a book value of equity ratio). Using the market equity ratio as the trigger avoids forbearance problems, and also implies that the prospective variation over time in the ratio can be modelled quantitatively, which also permits the embedded conversion option to be priced by the market (a highly desirable feature for any financial instrument).

By making conversion predictable, by making the amount of converted CoCos sufficiently large, and by making the conversion ratio sufficiently dilutive, the prospect of a triggered conversion would be so dilutive of existing stock that management would be keen to avoid conversion, if possible. Since the conversion trigger is based on the market equity ratio, banks could avoid conversion by issuing equity into the market to replace lost equity. Thus, the key advantage of a properly designed CoCo requirement is the incentive that it provides for the voluntary timely replacement of capital via pre-emptive issues of equity that are intended to avoid conversion. In cases where equity offerings are not feasible (e.g. if the decline in equity is caused by reports of accounting fraud), then a sufficient decline in the market equity ratio would trigger conversion of the CoCos, which would reduce the amount of debt and debt service payments made by the bank, and thus improve its prospects for surviving.

3.5 Require Minimum Creditor Haircuts as Part of Too-big-to-fail Resolution Policy

The above reforms to risk measurement, loss measurement and the encouragement of timely replacement of lost capital would go a long way towards reducing the moral hazard problems and taxpayer loss exposures associated with the too-big-to-fail problem. There is also potential for improving resolution procedures (under, for example, Dodd-Frank) in a way that would make the imposition of losses on creditors of large failed banks more credible, which would also ameliorate the moral hazard and fiscal costs of too big to fail.

The Dodd–Frank Act of 2010 institutionalizes the bailouts of creditors of large, complex banks that fail. Federal Deposit Insurance Corporation officials and politicians, of course, deny this, and argue that they can be trusted to use their discretion to impose losses on creditors. Maybe, but why not be sure? Why not require that any deviations from strict priority enforcement of creditors' rights during a resolution (i.e. bailouts) must impose a

minimum haircut on unsecured creditors of, say, 10 per cent of principal and all accrued interest? Adding this simple amendment to Dodd–Frank would place a hard limit on discretionary bailouts, and thus put a roadblock on the political path of least resistance.

Why not make the minimum haircut 20 per cent or 30 per cent of principal plus all accrued interest? There certainly may be good economic arguments in favour of a larger minimum haircut than 10 per cent of principal, but there is an incentive-robustness argument against raising the minimum haircut to too high a proportion: if politicians and regulators can make a reasonable sounding argument about potential 'systemic risks' from 'daisy chains' of failing banks, brought down by the losses imposed on concentrated exposures to a failed counterparty, then that could encourage *ad hoc* bailouts that sidestep the rules-based resolution system established under the law. If that seems farfetched, please note that this is precisely what happened during the recent crisis: the FDICIA safeguards against bailing out uninsured bank creditors simply were put aside in the heat of the moment. If a rule has too much tough love, it will be less credible. That is a reason to limit minimum haircuts to 10 per cent, a number too small to permit a reasonable fear of systemic risks from counterparty losses of failing banks. In other words, no counterparty should be able to argue reasonably that losing 10 per cent of the principal of the debts it holds from another large bank would sink it.

3.6 Clearly Allocate Legal and Regulatory Authority over Resolution

It is much harder to impose losses on creditors of failed global banks if the regulatory and legal authorities governing the disposition of the assets and liabilities of the bank are not clearly established in advance. During the Lehman bankruptcy, for some of the assets of the company it was not clear which country's subsidiary had legal ownership of those assets. Banks, of course, have little incentive to clarify such matters in advance, since the lack of clarity improves their chance of receiving a bailout.

It is not realistic to expect legal systems or regulatory systems to be able to coordinate actions effectively in real time on an *ad hoc* basis in the middle of a crisis, especially since the regulators will often have conflicting incentives (each will want to maximize his or her claim on assets and minimize his or her claim on liabilities). It is necessary, therefore, to establish a 'ring-fencing' approach, whereby every asset and liability of the bank is assigned in advance, as part of a 'living will', to a particular location. Those assignments should be approved in advance and in writing by the regulatory authorities of each of the countries in which the bank operates, to ensure accountability and to avoid potential disagreements during the crisis. This arrangement would make speedy and orderly resolution, and the potential to impose haircuts on failed banks' creditors, much more credible, and thereby mitigate too-big-to-fail problems. And, of course, this is just one of the many aspects of resolu-

tion that should be dealt with in advance by the living will, to ensure a speedy, orderly and predictable means of resolving failed global banks.

3.7 Impose a Remunerative Minimum Reserve Requirement on Banks

It is interesting to note that liquidity requirements are much older than capital requirements. In fact, liquidity requirements—which were employed one and a half centuries ago by the New York City Bank Clearing House as a self-regulatory device—predate the government enactment of liquidity or capital requirements. With the exception of a few cases (e.g. briefly lived state-chartered banks in the USA that offered deposit insurance during the early 20th century, and banking regulations in early 20th century Norway) minimum capital ratio requirements are a fairly recent prudential tool (established around the world, for the most part, in the 1980s).

In what respect are liquidity requirements substitutes for capital requirements? Are there objectives that liquidity requirements can accomplish better than capital requirements? Should both be required or only one? If both, then in what combination?

These are challenging questions. I can identify four objectives in pursuit of which liquidity requirements can play a unique role. First, as is well understood in the corporate finance literature, liquid asset holdings and debt capacity are not perfect substitutes. Because debt capacity is a stochastic variable, cash in hand has real option value for the firm (Almeida *et al*., 2004). Stated simply, debt capacity can disappear when a firm's fortunes change, or when market conditions change (as during a financial crisis); cash does not.

The option value of cash is perhaps best understand by beginning with a model in which there is no option value from cash. Figure 1 displays isorisk curves for bank deposits, using the Black–Scholes model, for which the key parameters that determine default risk are the equity-to-assets ratio and the sigma of assets (the standard deviation of asset returns). Each isorisk curve is defined for a particular actuarily fair default risk premium (p value) of deposits. Assuming that a bank's asset portfolio consists of only riskless cash assets (Treasury bills) and loans, then the sigma of assets can be re-defined as the product of the loan-to-assets ratio and the sigma of the loan portfolio. In this simple model, raising the proportion of cash assets reduces the sigma of assets in proportion. To achieve a given p value of deposits (say, one basis point), a bank can choose from a continuum of combinations of its equity ratio and its cash ratio (which implies a sigma of assets for any given sigma of loans).

In the Black–Scholes model, the question of whether and to what extent cash and equity are substitutes has a clear answer. Their substitutability is defined by the isorisk curves in Fig. 1, which can be used to define how much cash must be increased if equity is reduced in order to preserve the same level of default risk. In this model, however, there is no need for a liquidity

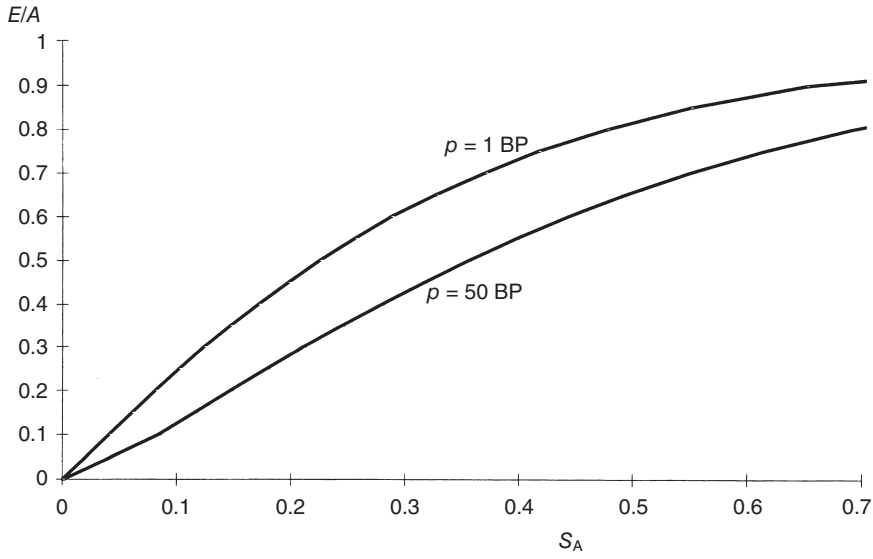

FIG. 1. Deposit Isorisk Curves under Black–Scholes
Note: BP is 'basis points of actuarily fair compensation for default risk'.

requirement; banks could be left free to determine their asset mix (including the possibility of holding zero treasury bills) and then would have to set their risk-based capital ratio accordingly. Any role for a liquidity requirement, therefore, must be based on the relaxation of one or more of the assumptions of the Black–Scholes model.

In the Black–Scholes model, all information that is knowable is known costlessly to all parties. In reality, information is costly, imperfect and asymmetrically so. During a crisis, risk rises and adverse-selection costs of accessing equity and long-term debt markets also rise because it becomes quite difficult for informationally disadvantaged outsiders to value assets. Debt capacity consequently falls, and equity issuance (to restore debt capacity) may be prohibitively costly. Firms that prior to the crisis thought that they had substantial debt capacity may find that it has disappeared. If they do not possess a buffer of cash to finance their investment needs, they may have to contract their investments in fixed or working capital, or cut employment. Calomiris *et al.* (1997) present evidence of just such state-contingent effects of leverage on investment and employment. Calomiris *et al.* (1995) show that liquidity buffers are differentially acquired by firms depending on the reliability with which they access debt markets.

How does one quantify the trade-off between liquidity and capital requirements in a realistic model in which cash assets create option value for the firm? It is possible to create an illustrative model and solve for an optimal cash cushion in such a model (e.g. Calomiris and Wilson (2004) offer a model

that could determine optimal combinations of capital and cash holdings, under specific assumptions about tradeoffs between adverse-selection costs and quasi-rents from lending), but such models are not general enough to provide a reliable answer to that question. A great irony about liquidity requirements is that when you need them (in environments more complicated than the Black–Scholes world) you really cannot reliably quantify *how much* you need them.

A second motivation for liquidity requirements arises from the effects of the unobservability of capital (due, once again, to asymmetric information) on the incentives of banks to increase their portfolio risk (the so-called 'asset substitution' problem). If banks experience a large decline in asset value that is not costlessly observable to outsiders, banks may choose to increase their portfolio risk (also not costlessly observable to outsiders) as a way to extract value from depositors (i.e. require depositors to bear more risk than they are being compensated to bear). In this environment, holding more cash assets can serve as a commitment device to depositors to convince them that asset substitution risk is low (Calomiris *et al.*, 2011). As in the case of the first motivation for a liquidity requirement, the qualitative prediction that some liquidity requirement is better than none is clear, but the amount of the liquidity requirement is not clear, since the parameterization of the model is not sufficiently general to inspire confidence.

Third, as Calomiris and Kahn (1991) show, holding cash can reduce the risk that noisy signals received by a subset of imperfectly informed depositors about bank asset quality could create an unwarranted run on a bank. This motivation for requiring bank liquidity holdings is relevant to the extent that banks issue a large quantity of uninsured short-term debt. As in the other two cases, the qualitative need for liquidity is clear, the amount is not.

Fourth, and finally, political considerations may motivate liquidity requirements. The best example of this during the recent crisis was Brazil. The Brazilian central bank did not act as a lender of last resort in the traditional sense during the crisis, in part, because it did not want to face the political consequences of having to explain any lending it would have done. Brazil imposes significant cash reserve requirements against deposits, and at the onset of the 2008 crisis Brazilian banks in the aggregate held cash reserves equal to roughly 20 per cent of deposits. The central bank substantially lowered reserve requirements to permit banks to lend to each other to keep the system liquid.

The large banks, however, did not want to lend to all banks that were in need of liquidity. The central bank intervened by twisting the arms of the larger banks to lend to smaller banks as needed. The central bank also 'encouraged' the private deposit insurer to expand coverage during the crisis for an additional premium. By taking these steps, the central bank was able to avoid the need to act as an explicit lender of last resort, although one could

argue that its pressuring of creditor banks and the deposit insurer may have created an implicit backing against the exposures that the central bank encouraged them to take.

The case of Brazil illustrates two key facts: first, higher liquidity holdings by banks do ensure banks against liquidity risk, but if asymmetric-information problems lead to a shutting down of the interbank market, banks will not help each other to bear liquidity risks voluntarily (see also Sprague, 1910; Goodhart 1995; Wicker, 2000). Second, central banks may see a significant advantage to performing their interventions by pressuring private parties to share liquidity, rather than by providing it themselves. For that reason, it may be efficacious to require banks to hold liquidity, so that a relaxation of those requirements during a crisis can provide a private source of extra liquidity during a crisis. As in the prior three motivations for requiring banks to hold liquidity, it is hard to move from this qualitative statement to any quantitative assessment of how large a reserve requirement would be adequate for this purpose.

The Basel Committee's proposed liquidity regulation does not seem to have struggled much with the questions posed here about liquidity requirements. There is no recognized trade-off between capital and liquidity in the Basel approach. Neither does Basel contemplate any trade-off between the two dimensions of liquidity regulation proposed by Basel (the 'net stable funding ratio' requirement and the 'liquidity coverage ratio'). And, buried in the Byzantine complexity of the Basel liquidity regulations there are many unsupported, and seemingly arbitrary assumptions about the stability of various sources of funding.

A simpler approach would be to require that banks maintain reserves at their central bank equal to, say, 20 per cent of assets. These reserves would be remunerated at the relevant Treasury bill rate. Because these reserves have a zero risk weight, the presence of a high proportion of reserves on the asset side of the balance sheet will reduce the amount of risk weighted assets used for calculating the banks' capital requirements accordingly.

It may also make sense (following the example of Argentina in the 1990s) to permit some percentage of these reserves to take the form of standby (irrevocable) letters of credit from AA-rated non-banks. For example, perhaps up to one fourth of the reserve requirement could be satisfied through standby letters of credit from AA-rated non-banks. The argument in favour of allowing banks to meet part of their reserve requirement through standbys is that doing so would reward banks whose relative riskiness is perceived as low in the market. Banks with low default risk could obtain standbys at very low cost, and would therefore be able to avoid the opportunity cost of high reserve holdings for a very small standby fee. This would provide a market-based reward to good risk management. Furthermore, permitting qualifying standbys to be provided only by non-banks would diversify the sources of liquidity available to the banking system.

3.8 How to Structure Macro-prudential Regulation

Macro-prudential regulation, broadly speaking, envisions changes in regulatory requirements that are time-varying in response to economic and financial conditions. Raising capital requirements, liquidity requirements, provisioning requirements and potentially other requirements during a credit-financed land or stock market bubble would both discourage the continuing growth in credit and create extra buffers to deal with a potential crash. Reducing those same requirements during a recession (so long as they always remain high enough to provide adequate protection) offsets the contractionary effects of bank capital losses on the supply of credit.[3]

What sorts of signals of high risk could be used to prompt increases in requirements during credit booms? Borio and Drehmann (2008) use a large sample of countries over many years to show that a dual threshold criterion for identifying financial overheating—i.e. the presence of a sufficiently high rate of bank credit growth coinciding with a sufficiently high rate of asset pricing growth, either in the stock market or in the real estate market—does an excellent job forecasting macroeconomic hard landings.

This criterion effectively was applied by the most successful macro-prudential regulator of the recent crisis, Colombia, which successfully reined in its financial boom in 2007–8, achieving a soft landing and making its central bank president, Jose Uribe, practically a national hero. What did Uribe do?

When Mr Uribe saw credit growth reach 27 per cent a year by December 2006, alongside a current account deficit of 3.6 per cent of GDP, a real GDP growth rate of 8 per cent, and accelerating asset prices and inflation, his first actions were to raise interest rates, which he did in several steps from April 2006 to July 2008, by a total of 400 basis points. It did not work. The central bank not only did not have a mandate to pursue macro-prudential regulation, it also lacked the necessary authority to change prudential capital and provisioning regulations (it had authority only over reserve requirements). So Mr Uribe coordinated with the other regulatory authorities in 2008 to substantially raise capital, provisioning and liquidity requirements on banks. He also imposed deposit requirements on short-term borrowings from abroad. Finally, he imposed limits on gross, as well as net, currency risk exposures of Colombian banks (the gross limits were intended to limit potential counterparty risks). Capital ratios of banks rose significantly (by several percentage points on a risk-weighted basis). Credit growth and GDP growth slowed, and Colombia avoided a crash or a recession (Uribe, 2008).

Few people seem to be aware of the Colombian experience with prudential regulation, but it illustrates some important points. First, neither a fancy empirical framework nor a regulator mandate is necessary to get a macro-

[3]For evidence on the severity of credit supply contraction as the result of bank capital losses during the Depression, see Calomiris and Mason (2003b) and Calomiris and Wilson (2004).

prudential regulator to act appropriately if he or she employs common sense and courage of purpose. Second, Mr Uribe effectively implemented the rule implied by the Borio Drehman dual threshold criterion: he responded in a discrete manner to the crossing of extreme value thresholds. Third, monetary policy was not as powerful as prudential regulatory changes in controlling credit growth.

I conclude from the Borio and Drehmann (2008) evidence and the Colombian experience that a simple dual threshold rule based on credit growth and either stock or real estate growth could work well. I would follow Charles Goodhart's suggestion of requiring the regulator charged with implementing the rule to either 'comply or explain'. That is, the presumption should be that, when the dual threshold is crossed, a substantial tightening of capital, liquidity and provisioning requirements would occur (to be concrete, say, a 20 per cent tightening of each of these requirements, phased in over three months). If the regulator charged with implementing that rule believes that it would be unwise to comply, then he should explain why. This places the burden of acting, and the accountability for deciding to deviate from the rule, squarely on the shoulders of one person. The regulator charged with acting would have to justify—based on extraordinary exigent circumstances—any decision to deviate from the rule, and would face personal career risk for deciding to deviate from the rule. During recessions, the same regulator would be bound to reduce capital requirements (but not provisioning requirements) to 20 per cent below their normal values; provisioning requirements would return to their normal level during the recession. Once the recovery from the recession has ended, capital and liquidity requirements would return to their normal levels, as well.

This is a simple approach to macro-prudential regulation. It does not rely on complicated judgments about the level of risk in the financial system (based on estimated correlations of risk, estimates of concentrations of counterparty risk or other complicated ideas subject to supervisory discretion). By avoiding complexity and supervisory discretion, and by placing a burden of action on regulators as a function of observables, the macro-prudential framework is more politically credible and more predictable to market participants, and therefore likely to be enforced in a timely way. Another advantage of a predictable framework based on observables is that it will have a chilling effect on credit booms even *before requirements are raised*, as market participants cool their demand for credit in anticipation of the tightening of standards. That behavioural response would serve as a further stabilizing influence on the financial system.

3.9 Encouraging Exchange-based OTC Clearing

When AIG was rescued by the government, one concern that was used to justify the bailout was the possibility that a failure by AIG of its contractual

commitments to counterparties on various OTC transactions might create undesirable knock-on effects that could further destabilize the financial system. Clearly, if AIG had been forced to properly collateralize its OTC positions (as it avoided doing because of its AAA credit rating), that counterparty risk would have been avoided. This and other revelations of the crisis have motivated proposals to encourage banks and other market participants to clear their transactions through central clearing houses, so that counterparty risk can be managed under clear and credible rules established by that clearing house. Doing so should limit the potential for any counterparty's failure to disrupt markets.

Of course, in some circumstances, it may be hard for highly customized instruments to clear through a centralized clearing house because the clearing house may have a hard time ascertaining appropriate margin standards for exotic instruments (indeed, this is a major challenge for getting credit default swaps to clear on an exchange). Thus, any rule encouraging the centralized clearing of contracts should be flexible enough to accommodate market decisions not to clear some transactions on an exchange. Failing to provide that flexibility could stifle worthwhile financial innovations by making today's customized products (which may become tomorrow's standard products) too costly for counterparties.

The best way to encourage exchange-based clearing, but allow desirable flexibility, is to impose a regulatory tax of some kind on transactions that do not clear on exchanges. This should take the form of either a higher minimum regulatory capital requirement or a higher minimum regulatory liquidity requirement on such transactions. Those higher requirements would serve to encourage behaviour that reduces systemic risk, and also increase the ability of counterparties to deal with problems that might arise from counterparty risks.

3.10 Mechanisms for Assisting Banks during Crises

Various governments and central banks responded to the financial crisis with a wide variety of assistance to banks, including capital injections of various kinds, nationalization, blanket guarantees, loans and selective guarantees for certain kinds of debts. The various forms of assistance were determined as emergency measures and their design was not always as wise as it could have been (Calomiris, 2009a, 2009d, 2009e). Because assistance was crafted in the heat of the moment, the debate over potential mechanisms and their relative efficacy was practically non-existent. Furthermore, central banks often participated in fiscal assistance to intermediaries that lay beyond their mandate. Central banks should be lenders of last resort, not end runs around the budgetary process in which taxpayers are represented by elected officials. The *ad hoc* approach to emergency policy not only is liable to make honest mistakes and involve central banks inappropriately in fiscal policy, it also

could encourage abuse—e.g. designing rescue packages that purposefully provide unnecessary subsidies at taxpayers' expense. For all these reasons, it makes sense to agree upon a set of principles, and some specific policy ideas for implementing those principles, that should guide future interventions.

Following are four central principles that should be articulated and embodied in specific policy mechanisms in a credible and predictable way. First, central banks should perform the function of the lender of last resort. To do so, they must make loans on good (but not riskless) collateral at a high rate (which Bagehot properly understood means at a rate above normal, but not as high as the rates observed in the market among private parties during the crisis). If central banks require riskless collateral, they will do no good, and may do harm by subordinating other claimants on the borrowing institution, which could amplify rather than dampen illiquidity problems (Calomiris and Mason, 2004). In other words, to be effective, central bank assistance has to absorb some risk.

Second, assistance provided by central banks and taxpayers should be structured to put them in a relatively senior position with respect to the underlying risks of the institutions they are assisting. That can be done through lending against good collateral, or investing in the preferred stock of banks that possess sufficient equity capital, or providing backstops guaranteeing relatively senior tranches of debt (as in the Fed's support for senior tranches of MBS during the subprime crisis, or the Bank of England's support for the London clearing banks during the Baring Crisis of 1890, or the support provided by the Banque de France for the Paris Bourse in 1882), or by having taxpayers provide out-of-the-money put options on bundles of assets that are trading at illiquidity-distressed prices far below their recovery values (as a means of short circuiting asset pricing collapses driven by illiquidity—Calomiris, 2009a, 2009d).

Third, government policy's primary objective is not to profit financially from its investments when assisting banks during a crisis. For example, it makes no sense for elected officials to demand that they get the 'upside' for helping distressed banks. The desire to imitate Warren Buffett's successful investment in Goldman Sachs prompted the US Congress to adopt the principle that taxpayers should earn a high return for providing risky assistance to banks. This logic fails to consider the macroeconomic goals of assistance: taxpayers wish to assist banks so that credit and payments will flow, and the economy will prosper, and they gain from assistance to banks primarily from these effects, not the profits on their investments. A narrow focus on profit can undermine the effectiveness of assistance. Requiring the 'upside' is dilutive of common equity, and can discourage participation in the preferred stock programme, or make it harder for the assisted bank to raise new equity. When the Reconstruction Finance Corporation invested in the preferred stocks of US banks after November 1933, it did not seek to earn a fair return. The coupons on the preferred stock were low enough to provide a subsidy to

banks. That subsidy improved banks' cash flows in order to boost the supply of credit. Rather than demand options for those preferred stock investments (which would have been highly dilutive of stock, and would have discouraged additional equity offerings), the Reconstruction Finance Corporation focused its efforts on making sure that assisted banks retained earnings and raised new capital where possible. That focus on encouraging capital rather than making a profit was consistent with the intent of the programme, to help restore bank credit, while limiting taxpayers' exposure to loss.

Fourth, assistance programmes should be structured to select worthwhile, solvent recipients, and should not be used as a means of avoiding the orderly resolution of failed institutions under the rules established for them. To ensure that objective, the government should offer assistance (e.g. in the form of preferred stock investments, or in the form of an out-of-the-money put option on a portfolio of securities) only to banks that can qualify for it by showing that they are not deeply insolvent. In pursuit of that objective, stock issuance matching requirements can be a very effective tool. Banks that, even after receiving a high subsidy in the form of a large preferred stock investment with a very low coupon, are unable to raise equity in the market are probably deeply insolvent. Using the market test of an equity offering matching requirement as a condition for receiving assistance could be a useful way to maximize the benefits of assistance and avoid wasteful investments in deeply insolvent firms.

4 Conclusion

It is possible to craft fairly simple rules that would be effective in meeting the main challenges that have destabilized the global financial system in the past several decades. Indeed, simpler rules (which tend to be more transparent and predictable, and therefore more credibly enforced) are likely to be more effective, particularly if they are crafted to be 'incentive-robust'. Incentive-robust rules (which take into account the incentives of market participants, supervisors, regulators and politicians) are designed to be difficult for market participants to circumvent, and easy for supervisors, regulators and politicians to enforce.

This paper argues that four critical goals of financial reform—(i) the elimination of destabilizing subsidization of mortgage risk by the government, (ii) the credible measurement of bank risk and the establishment of prudential capital requirements commensurate with that risk, (iii) the credible measurement of loss and the incentivizing of the timely replacement of lost capital, and (iv) the reduction of too-big-to-fail costs associated with moral hazard and taxpayer exposure to bank losses—are attainable through simple, incentive-robust rules.

Additional reforms to address other problems that have been highlighted by the recent crisis would also be desirable, namely the proper design

of liquidity requirements, macro-prudential rules for varying capital and liquidity requirements over time, rules that would encourage centralized clearing of OTC transactions, and rules that would guide government assistance programmes to banks during crises.

I develop 10 reform proposals, which include (i) the replacement of mortgage risk subsidization with a new means-tested downpayment assistance programme, (ii) the reform of the regulatory use of ratings that would quantify the meaning of debt ratings and hold NRSROs accountable financially for egregious inaccuracy in forecasting the probability of default of rated debts, (iii) the use of loan interest rate spreads to forecast nonperforming loans for purposes of budgeting capital to absorb loan default risk, (iv) the establishment of a contingent capital (CoCo) requirement that would measure loss and incentivize large banks to replace lost capital in a timely way, (v) a reform of resolution procedures for large financial institutions that would require a minimum haircut on unsecured creditors whenever the resolution authority employs taxpayer funds in the resolution (i.e. whenever there is a departure from the enforcement of strict priority in the resolution process), (vi) the establishment, as part of the 'living wills' of global financial institutions that govern their prospective resolution, of clearly demarcated lines of legal and regulatory jurisdiction ('ring fencing') over the disposition of all the assets and liabilities within the bank, (vii) the setting of simple liquidity requirements for banks alongside their capital requirements, (viii) the creation of a macro-prudential rule to govern the variation in capital and liquidity requirements over time, (ix) the implementation of regulations that would encourage, but not require, the greater clearing of OTC transactions in centralized clearing houses, and (x) the establishment of credible and predictable mechanisms, based on appropriate guiding principles, through which any assistance to banks from governments or central banks would be provided during crises.

This programme of reform would be effective in addressing the real challenges that have threatened our financial system for decades, and continue to threaten it. And this approach would avoid much of the collateral damage that comes from the many hundreds of pages of complex, costly and misguided mandates that typically substitute for credible reform.

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