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That Helps Solve Our Too-Big-to-Fail Problem**

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Although debates still rage over the causes of the financial crisis of 2007-09, one thing is clear: several of the world's largest financial institutions—including Fannie Mae, Freddie Mac, Citigroup, UBS, AIG, Bear Stearns, Lehman Brothers, and Merrill Lynch—had amassed huge and concentrated credit and liquidity risks stemming from subprime mortgages and other risky investments, but they maintained equity capital that was too small to absorb the losses that resulted from those investments. In other words, relative to their risks, their equity capital proved inadequate to insulate these firms—and many others—from insolvency when the risks materialized.¹ Internal bank risk management and external prudential regulation and supervision failed precisely because they did not compute risk correctly and require the appropriate amount of equity *relative to risk*. The regulatory failure was not that equity capital requirements were too low *per se*. After all, as of mid-2006, the ratio of the market value of Citigroup's equity to the market value of its assets was nearly twice that of Goldman Sachs; but it was Citigroup, not Goldman Sachs, whose losses produced insolvency. The difference occurred because Citigroup's risk exposures, including the off-balance sheet risks associated with its implicit obligation to clean up problems in its special purpose entities and special investment vehicles, were disproportionately larger than Goldman's.

Examples of failures to constrain risk within a firm's capacity to bear loss are not hard to find. Chief executive officers and boards appeared to lack either an effective framework or the willingness to apply the appropriate tools to measure risk correctly or to constrain aggregate risk-taking within prudent limits.² One recent study reported that banks that provided risk managers with greater compensation and standing within their organizations not only experienced smaller crisis-related losses, but had lower stock price volatility prior to the crisis. This finding suggests that top management decisions not to prioritize and empower risk management

were an important contributor to the crisis.³

This defect can take many forms within a bank's risk management system. It can show up as overreliance on risk decisions taken at a low level in many product lines and trading desks, without consideration of how such exposures might interact under various macroeconomic conditions. Or it can take the form of a tendency to follow the herd in an attempt to grow revenues and market share rather than questioning the adequacy of capital to absorb risks inherent in particular strategies. Other sources of vulnerability include reluctance to question fundamental assumptions about basis risks and hedges, general disregard for the risk inherent in the centuries-old challenge of funding long-term assets with short-term liabilities, and neglect of liquidity risk more generally. And coming on top of all these common risk management failings are a handful of others: the well-known tendency of people inside large organizations to override limits when they conflict with revenue goals; the difficulty of tracking aggregate exposures over complex legal structures and product silos in any reasonable amount of time; and the failure to "risk-adjust" the price of internal transfers of funds and compensation more generally.

As a fairly direct consequence of these kinds of errors of risk management, the bonuses and compensation that many financial firms granted were real, but the profits used to justify those payments were not. Not only did stockholders suffer as a result of these errors, but taxpayers were ultimately obliged to bail out insolvent large institutions or face the possibility of significant spillover costs to the rest of the financial system.

Examples of these problems can be found in the bankruptcy of Lehman Brothers, the losses sustained by UBS and AIG, the collapse of Northern Rock, the forced merger of Bear Stearns, and the collapses of Indy-Mac, Washington Mutual, and Wachovia as well as the string of losses reported by Citibank, Merrill Lynch, and Bank of America. Studies of all of these experiences have questioned whether anyone,

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1. By "equity capital" we refer here and elsewhere in this article to the economic value of equity (which we later proxy with a moving average of the market value of equity) rather than the book value of equity.

2. See Coffee (2010) for the view that these apparent failures in corporate governance may in fact be the consequence of pressure from institutional shareholders for managers to take greater exposures to risk. To the extent that this view has merit, our proposal addresses it by creating substantial dilution risk for shareholders, including the CEO, who is also at risk of losing both his equity interest and his institution-specific human capital.

3. See Ellul and Yerramilli (2010).

including corporate board members, senior management, or supervisors, even comprehended their institutions' exposure to subprime mortgage risk.⁴

These widespread failures to maintain adequate capital and to exercise effective governance of risk are all the more remarkable because regulators and supervisors have been focusing on the problems of risk measurement and capital budgeting for more than two decades. Risk-based capital is precisely the measure the Basel Committee says it has been targeting all along when setting its minimum standards for capital. Obviously, despite broad agreement that risk-based capital was the key concept on which to focus prudential regulation of capital, both bank risk managers and supervisors failed to measure risk correctly and to require capital commensurate with that risk.

Why did the regulatory system perform so badly? The failure was not the result of a lack of attention to the challenge of defining risk. The Basel Accord on Minimum Capital Requirements has undergone numerous refinements since its initial publication in 1987, including a major amendment in 1996 to account for market risks and a complete renovation of risk measurement with the announcement of Basel II in 2004. Principles for enhancing governance of risk have been addressed in a series of supervisory studies.⁵ Indeed, the Basel Committee report on "The Core Principles of Banking Supervision," published as far back as 1997, incorporates sound corporate governance of risk as a key principle.⁶

Prudential regulation failed to require financial institutions to maintain adequate capital for two main reasons. First, incentive problems distorted the measurement of risk; second, incentive problems discouraged the timely replacement of lost equity capital.

With respect to the first of these problems, the process for measuring risk—on which capital requirements are based—encourages the understatement of risk. Under existing rules, banks and rating agencies control the measurement of risk that is used by regulators. Bankers and rating agencies, however, suffer from conflicts of interest that provide incentives to understate risk. Banks that understate their risk enjoy lower capital requirements; and rating agencies that do so receive larger fees, which are allocated through a competitive process known as "ratings shopping." And this means that prudential regulatory authorities, given their reliance on banks' internal models of risk and on rating agency opinions, have no credible, independent information to serve as a basis for forcing banks to raise their internal assessments of risk.

When bank risk is not measured correctly, it cannot be managed properly. And since banks have a strong incen-

tive to understate their risks, they may often fail to identify the magnitude of their exposures to risk. If they have not measured risks properly, they cannot take appropriate measures to penalize excessive risk-taking within their firms.

With respect to the second problem—the failure to replace lost capital in a timely fashion—it is instructive to consider how long it took Citigroup and other financial institutions to deplete their capital during the recent financial crisis. Many months passed between the initial financial shocks of the crisis—the first revelations of the spring of 2007, the August 2007 run on asset-backed commercial paper, the Bear Stearns bailout of March 2008—and the systemic collapse of mid-September 2008. During the year and a half leading up to this collapse, roughly \$450 billion in capital was raised by global financial institutions. Clearly, global capital markets were open, and there were many willing investors, especially hedge funds and private equity funds, as well as wealthy individuals. But many of the financial institutions most deeply affected by the crisis prior to September 2008, despite persistent and significant declines in the market value of their equity relative to assets, chose not to raise sufficient capital.

A top executive at one of those banks confessed to one of us during the summer of 2008 that, despite the need to replace lost equity, the price of his bank's stock was "too low." He was concerned that issuing significant equity in the summer of 2008 would have resulted in substantial dilution of stockholders—including existing management. Institutions that had suffered large losses preferred to wait, hoping for an end to the crisis in the summer of 2008 and the elevation of the prices of risky assets that would accompany that market improvement. After the bailout of Bear Stearns, they also believed that if their situation deteriorated severely, the government would be likely to step in. That expectation further undermined any incentive to replace equity capital promptly, much less preemptively. On balance, the best strategy was to wait and hope for the best.

Of course, these two problems—*ex ante* risk mismeasurement and mismanagement and *ex post* failure to replace equity once it is lost—are related. If banks believed that they would be forced to replace lost capital in a timely fashion, they would have greater incentive to manage risk properly and to maintain adequate equity capital commensurate with that risk in the first place. Why? Because they would face the prospect of a significant cost (in the form of stockholder dilution) from having to replace lost equity capital in a troubled market.

If regulation failed because of distorted or inadequate incentives to measure and manage risk and gains from

4. For a study of the collapse of Lehman Brothers, see Valukas (2010). For an account of the losses sustained by UBS, see UBS (2008). For AIG, see Eisenbeis (2009) and Special Inspector General for TARP (2009). For Northern Rock, see Kirkpatrick (2009). For Bear Stearns, see Kirkpatrick (2009) and SEC (2008). For Indy-Mac and Washington Mutual (WaMu), see Office of the Inspector General (2010) and Kelly (2008). For Wachovia, see Corston (2010). For Citibank, see Special Inspector General

for TARP (2011). For Merrill Lynch and Bank of America, see SEC (2010).

5. See BCBS (1997); BCBS (1999a); BCBS (1999b); BCBS (2005); BCBS (2006); BCBS (2008); BCBS (2010a); BCBS (2010b); Joint Forum on Financial Conglomerates (1998); and Davies (2003).

6. BCBS (1997).

postponing the replacement of lost capital, then it follows that a central focus of reform should be to address those two incentive problems. How can we change bankers' incentives to improve the accuracy of their risk assessment, manage risk better, and replace lost equity capital faster?

In this article, we show how a properly designed *requirement* for convertible contingent capital (or "CoCos") can provide strong incentives for systemically important financial institutions (SIFIs) to make two critical changes: (1) implement strong systems of risk governance to measure and manage risk; and (2) raise additional capital or sell assets in a timely fashion, when necessary, to minimize the chance of violating minimum capital adequacy standards. In addition, our proposed requirement would supplement an institution's capacity to bear loss. Finally, a suitably designed CoCo requirement would supplement supervisory oversight with market discipline. Of course, other complementary reforms of prudential regulatory standards would also be desirable,⁷ but we show that they are not substitutes for CoCos, which would play a unique and critically important role in improving incentives for risk management and the maintenance of adequate capital, especially for large, "too-big-to-fail" institutions.

Why Equity Capital Requirements Are Not Enough

Basel III has placed its main emphasis on requirements for more and better-quality capital and more intensive supervision. But do the increases in capital contemplated by the Basel Committee offer a solution to the two crucial problems of risk mismeasurement and failure to replace lost capital in a timely fashion? History does not provide much reason to be optimistic about the solutions proposed to either of these problems.

Although the emphasis on increasing shareholders' equity is a move in the right direction, these reforms will not solve the fundamental problems of accurate risk measurement and maintenance of adequate capital. The measure of shareholders' equity employed by Basel is an accounting measure that inevitably lags its true economic value, thus avoiding timely recognition of loss. The ability to avoid timely recognition of loss encourages banks to understate risk, since they will not be forced to raise dilutive equity in the wake of losses. And after unrecognized losses occur, banks' incentives for risk management can become even more distorted, since the temptation to "gamble for resurrection" can lead thinly capitalized banks to increase their risk exposure.

Why does the Basel approach to capital requirements produce errors and lags in the recognition of loss? The measure of shareholders' equity continues to rely on account-

ing principles that, while they vary from country to country, combine book values and "fair values" when measuring capital compliance.⁸ This approach inevitably delays the recognition of losses and permits banks and supervisors—both of whom may perceive benefits from postponing the recognition of loss—to conceal losses in a number of ways.⁹ Bankers can be very creative in their use of complex transactions to disguise losses. Supervisors face major challenges in detecting and preventing manipulation of book values through gains trading—for example, the common practice of recognizing capital gains on positions that are held at book value while deferring the recognition of losses. The bankruptcy of Lehman Brothers revealed another device to exaggerate capital adequacy measures—the so-called Repo 105 or 108 transactions, which disguised repos (a collateralized borrowing) as a removal of assets and thus a reduction in the size of the balance sheet.¹⁰

The agility of firms in devising strategies for regulatory and accounting arbitrage makes it unlikely that supervisors will ever be able to keep up. Effective regulation is a continual contest between those who are being regulated and their generally less well-paid and less well-informed supervisors. Even when regulators attempt to close a loophole, regulatees usually find another in only a matter of weeks.

Supervisors not only can be caught unaware of losses, they may also prefer not to recognize them for regulatory purposes. "Forbearance"—especially the ever-greening of loans to borrowers who would otherwise be delinquent, just enough to keep them current on their debt service payments—remains a constant challenge for supervisors, who often find themselves under substantial political pressure to delay bank loss recognition.

We emphasize that delayed recognition is not only a technical challenge. Supervisors are subject to substantial political pressure, and that pressure often leads them to prefer to forbear and "play for time" rather than enforce capital adequacy requirements. The purposeful delays by the U.S. authorities in the 1980s, and by the Japanese and Mexican authorities in the 1990s, are just the most visible examples of a widespread phenomenon that has been documented time and time again. Supervisors also may lack incentives to enforce the spirit of prudential rules because they are likely to be challenged in judicial or administrative proceedings or legislative hearings for any action that forces an institution to recognize losses, especially when there is some hope that losses will be reversed in time. Moreover, in some countries, supervisors have been held personally liable and subject to criminal penalty for such supervisory errors. That legal liability is often

7. See Calomiris (2011).

8. This, of course, creates problems in comparing capital adequacy across countries. For example, countries that follow international financial reporting standards take a much stricter view of netting off-balance sheet positions than does the U.S., which follows generally accepted accounting principles (GAAP), so that the leverage for the five

major U.S. dealers in derivatives is substantially understated relative to that of their European peers.

9. For evidence of such understatements of loss during the recent crisis, see Huizinga and Laeven (2012).

10. Valukas (2010).

used to threaten supervisors against taking aggressive actions. The result of these measurement and incentive problems is that supervisory action is often delayed until losses become indisputable instead of when they actually occur.

Given these information and incentive problems that face supervisors, there is little reason to have confidence in new supervisory powers to bring about timely recognition of loss. For example, Britain's Financial Services Authority, which was widely regarded as one of the most effective, forward-looking supervisory authorities in the world, provided an especially egregious example with regard to its oversight of Northern Rock. Just weeks before the bank collapsed, supervisors authorized it to adopt the advanced internal measurements approach to risk weighting its mortgages, which reduced its required capital by 30% and permitted that amount to be paid out to shareholders.

Accounting loss recognition lags were substantial during the recent crisis. For example, Darrell Duffie notes that "Citibank, a SIFI that did receive a significant government bailout...had a Tier 1 capital ratio that never fell below 7% during the course of the financial crisis and was 11.8% at roughly its weakest moment in December 2008, when the stock-market capitalization of Citibank's holding company fell to around \$20 billion, or about 1% of its total accounting assets."¹¹ Moreover, as we have seen, the thin layer of equity capital maintained by most financial institutions can be overwhelmed by sudden losses that occur in a crisis, especially if they respond by selling illiquid assets into thin markets.

The IMF has shown that all of the banks that required bailouts in the crisis reported higher-than-average levels of capital in the last period before the intervention.¹² Moreover, the recent crisis made clear that all three components of the regulatory capital adequacy ratio are fundamentally flawed: one, the measure of capital in the numerator did not reflect an institution's ability to absorb loss without going through some kind of resolution process; two, the risk adjustment of assets in the denominator did not reflect some of the most important risks that banks faced; and three, the minimum acceptable level of capital so reported was much too low.

The ease with which banks, especially SIFIs, can evade capital regulation and engage in regulatory arbitrage suggests a need for creating some form of reliable, incentive-based regulation that makes maximum use of available information (including market-based information) to force them to recognize and replace lost capital and to measure and control their risks more effectively. The current approach of understating risk *ex ante*, disguising loss *ex post*, and seeking to avoid dilutive equity issues when they are needed most leaves SIFIs with few options if that risky gamble does not

pay off—apart from an appeal for a bailout accompanied by the implicit threat that their demise will cause chaos if they do not receive a bailout.

Of course, one could argue that making initial book equity capital requirements much higher would solve some of the incentive problems that distort risk measurement and risk management, even without providing effective incentives for the timely replacement of capital. Recently, several academic proposals for reform have called for significant increases in bank equity requirements. Clearly, if banks maintained, say, 50% of their financing in the form of book equity, then bank stockholders, rather than taxpayers, would almost certainly pay the full cost of any understated risks gone wrong. But would that approach encourage proper risk management by banks? Would it produce banking system outcomes consistent with the public interest?

We do not think so. First, a draconian increase in equity requirements would raise the costs of finance for banks. That increase in cost would translate into a contraction of banking activity—most importantly, bank lending. A recent paper argues that more equity finance might not substantially increase the funding cost of banks.¹³ We do not agree. Equity is costlier to raise than debt for fundamental reasons associated with both information and managerial agency problems.

With respect to information problems, a seminal paper by Stewart Myers and Nicholas Majluf (1984) showed that there can be large "adverse selection" costs associated with raising external equity that result from information "asymmetries"—that is, the possibility of significant differences between management's and other insiders' views of a company's future earnings prospects, and what outside investors, and hence the market, are able to know.¹⁴ Such adverse selection costs are reflected, first and foremost, in the significant negative average market reactions to the announcement of equity offerings.

Such costs are also reflected in the much higher underwriting costs paid by companies to issue equity rather than debt. These underwriting costs reflect the attempts by issuers to overcome asymmetric information problems during "road shows" in which their investment bankers meet with institutional investors to explain the issuers' motives for raising capital and attempt to allay any concerns they may have about the prospects of the issuer.¹⁵ And consistent with this argument about the high information costs of equity, studies of bank "capital crunches" provide clear evidence that shocks to bank equity capital have large contractionary effects on the supply of lending—presumably because it is more costly to replace lost equity than to reduce loans.¹⁶

To be sure, the negative signaling effects associated with equity offerings will tend to be mitigated if equity offerings

11. Duffie (2009)

12. IMF (2008)

13. Admati and others (2011)

14. Myers and Majluf (1984).

15. See Calomiris and Tsoutsoura (2011).

16. As assumed by Myers and Majluf (1984) Bernanke (1983), Bernanke and Lown (1991), Kashyap and Stein (1995 and 2000), Houston, James, and Marcus (1997), Peek and Rosengren (1997 and 2000), Campello (2002), Calomiris and Mason (2003), Calomiris and Wilson (2004), and Cetorelli and Goldberg (2009).

More on the Information and Agency Costs of New Equity

Companies with unused debt capacity and profitable uses for more capital but whose managers believe their shares are undervalued will generally issue debt rather than equity to avoid diluting the value of existing stockholders' claims. Conversely, companies whose managers think their companies are overvalued may be tempted to issue equity, even if they have no current profitable uses for the capital. But sophisticated investors understand these motives, as well as the tendency of managers (especially in mature industries) to waste excess

capital on low-return investments. And such investors are accordingly skeptical about announcements of plans to raise outside equity, especially when companies have no clearly profitable uses for the capital. Recognizing their own informational disadvantage and managers' incentives to issue overpriced securities (or at least to avoid issuing undervalued ones), investors usually respond to announcements of new equity offerings by significantly reducing the value of the shares.²⁰

are mandated by regulatory actions rather than chosen voluntarily. But the costs associated with such signaling effects will not be eliminated by a regulatory mandate. First, even if all banks went to the equity market at the same time to raise equity, banks whose managers know they are in better condition will have an incentive to spend more on underwriting to ensure that investors receive credible information of their superior condition. Those expenditures contribute to the costs of equity capital requirements. Second, there will still be differences among banks in the extent to which they choose to raise equity, which suggests that there will still be material signaling costs associated with announcing equity offerings. For example, some banks—particularly those with high-quality risky assets whose value might be very hard to reveal to outsiders—may well decide to avoid equity offerings and meet their higher equity ratios by selling some of their less opaque assets instead. For both of those reasons, higher equity capital requirements will not eliminate the information costs and attendant adverse selection risks that make equity offerings costly.

In addition to the information costs associated with raising equity, very high equity ratios are likely to have undesirable effects on managerial efficiency—effects that are well understood by investors, and almost certainly part of the explanation for their negative reaction to such offerings under many circumstances. Although a moderate increase in equity requirements can encourage better risk management by bankers, a dramatic increase could have the opposite effect. As Anil Kashyap, Raghuram Rajan, and Jeremy Stein argued in a 2008 paper, requiring banks to hold too much equity is likely to create significant agency problems by insulating bank managers from market pressures and blunting the urgency of their push for efficiencies.¹⁷

Whether the tax benefits of debt—stemming from the deductibility of interest in corporate taxation—should be included when measuring the relative *long-run* costs of equity finance has been hotly debated.¹⁸ But even if tax savings matter only from a transitional perspective, banks that were permitted to raise capital in part through CoCos¹⁹ would almost certainly choose to issue capital faster—and thus restrict loan growth less—during the transition to higher capital. And given the desirability of improving access to credit as one of the means of promoting economic recovery, transitional issues are far from trivial.

All of this is not to say that we oppose a significant increase in capital requirements. We believe that a significant increase is necessary. At the same time, however, we are convinced that there are negative—not just diminishing—social returns to achieving a higher amount of capital solely by raising equity capital requirements beyond a certain point. In our view, raising equity requirements on SIFIs to 9.5% of risk-weighted assets under the new Basel III requirements makes sense, and we could also see legitimate arguments for raising capital requirements even higher. But a draconian increase in equity capital requirements would not be desirable because the risk of default at SIFIs can be reduced in less costly ways. Moreover, we emphasize that the moderate increase in the required capital ratio under Basel III would not alone be sufficient to allay all concerns about the adequacy of capital to cover potential losses on assets, much less enough to ensure the adequacy of capital after a significant loss. That becomes especially clear when one recognizes the ability of financial institutions to target a higher level of risk that would more than compensate for any moderate rise in capital requirements.

17. Kashyap, Rajan, and Stein (2008).

18. See, for example, Admati and others (2011).

19. The CoCo that we propose is designed to be converted from debt to equity only in rare circumstances. Thus we would argue the tax authorities should permit the deduction of interest on CoCos, like interest on straight debt, for tax purposes.

20. By contrast, the average market reaction to new debt offerings, though also negative, is not significantly different from zero.

Furthermore, it is hard for regulators to determine the appropriate amount of capital for a bank, a task that is complicated by the reality that that amount changes over time with changes in risks. A given amount of equity, even if appropriate today, may not be the right amount tomorrow. Because a properly designed CoCo requirement creates incentives for banks to issue equity to maintain the right amount of capital—that is, equity plus CoCos—relative to risk, CoCos encourage not only timely replacement of lost capital and better management of risk, but also decisions to respond to increased risk with higher equity.

The limitations of equity capital requirements as a prudential device that we have just identified—problems of measuring and enforcing book capital requirements, the asymmetric information costs and managerial efficiency problems of excessive reliance on equity requirements, the manifestation of those costs in inadequate credit supply, the social costs of potentially inadequate capital, and the need to respond to losses and increases in risk through timely increases in capital—all of these considerations motivate our proposal for a contingent capital requirement. Our proposed contingent capital requirement retains debt finance as the dominant form of bank finance. Most importantly, it ensures that management would face strong incentives to manage risk, set capital appropriately, and replace any significant loss of equity capital with new equity capital offerings on a timely basis.

The case for CoCos over equity requirements alone can also be justified in terms of political economy and fair treatment of bank shareholders. Banks that currently benefit from the safety net will undoubtedly resist any increase in capital requirements because, thanks to implicit and explicit government protection of their liabilities, they already benefit from the lower borrowing costs they would otherwise expect to gain by raising more equity. When faced with a choice between issuing CoCos or equity, however, bankers should prefer CoCos. CoCos permit banks to continue to make use of the tax shield provided by the different treatment of interest and dividends in the tax codes of most countries.²¹ But most important, the issuance of CoCos need not result in the significant loss of value to bank shareholders that a mandate to issue new equity almost certainly would inflict on them.

Design Choices of the Various CoCo Proposals

The essential idea of a CoCo has been widely discussed for a number of years by a number of banking and finance scholars. Despite numerous differences in design and specific intent, virtually all versions of CoCos have the common

goal of establishing a contractual structure that increases bank capital in adverse states of the world. That can occur either directly through contractual convertibility or indirectly through incentives to raise new equity capital voluntarily. Recapitalization restores the bank to a viable position of capital adequacy and thereby avoids regulatory resolution.

The existing proposals can be characterized according to how they differ with regard to three critical features: (1) the amount of CoCos required to be issued as a percentage of the total book value of assets; (2) the trigger for conversion from bonds to equity; and (3) the conversion rate, or the amount of equity to be issued in exchange for CoCos when converted. The differences among proposals with respect to these three key design features (which are laid out in detail in the Appendix) reflect differences in the weights that the various CoCo proposals attach to the following three objectives:

1. providing a contingent cushion of common equity that results from the conversion of debt when the CoCo is triggered, which we label the “bail-in” objective;
2. providing a credible signal of default risk in the form of the observed yield spread on convertible debt prior to any conversion, which we call the “signaling” objective; and
3. providing strong incentives for the voluntary, preemptive, and timely issuance of equity (or rights offerings) as a means of avoiding highly dilutive CoCo conversion, which we call the “timely equity-issuance” objective.

The particulars of the design characteristics of our proposal reflect our view that the primary objective of a CoCo should be the timely issuance of equity objective. Our recommendations regarding the amount, the trigger, and conversion terms of CoCos all reflect our view that the central objective served by requiring CoCos should be to encourage the prompt voluntary issuance of equity in response to significant losses of equity by a SIFI. Rather than focusing on facilitating a more orderly liquidation of assets, as advocates of the bail-in objective propose, or on creating a convertible debt instrument that would credibly suffer substantial default risk via conversion and so provide useful, forward-looking prices embedding the perceived possibility of default, our proposal aims primarily to provide institutions with a strong incentive to strengthen risk management and take remedial measures to raise equity *well before* they face a substantial risk of insolvency.

As pointed out in a study by D’Souza and others (2009), the incentive to issue equity preemptively will be strong given the following three conditions: (1) the amount of CoCos to be converted is large relative to the book value of equity; (2) the trigger is credibly and observably based on market prices and

21. Albul, Jaffee, and Tchistyi (2010) suggest that a plausible way to limit the tax shield benefit from issuance of CoCos might be to permit a full deduction for “interest payments that correspond to the coupon on similar, straight bank debt, but to exclude any part of the [CoCo] coupon that represents compensation for the conversion risk. As McDonald (2010) notes, tax deductibility may have “political value” by virtue of eliminating a reason for banks to oppose contingent convertibles. Although CoCos are of value

even without the tax shield, if banks are deprived of a tax benefit that is available to other institutions, some business is likely to migrate from the banking sector to the shadow banking sector, where it is more difficult to monitor and regulate. Of course, the first best solution to this problem would be to eliminate the asymmetry in the tax treatment of dividends and interest payments.

pegged to a high ratio of equity to assets (and thus conversion would take place well before serious concerns about insolvency arise); and (3) the conversion ratio is dilutive of existing common shareholders, creating a “sword of Damocles” that makes the prospective dilution from issuing preemptive equity appear desirable by comparison.²² Under these conditions, a SIFI experiencing significant loss and approaching the point at which dilutive conversion would be triggered would choose to issue significant equity, possibly combined with asset sales, which would raise the market value of its outstanding equity relative to assets, thereby avoiding the conversion trigger.

To be effective for this purpose, the required amount of CoCos must be a significant percentage of total bank assets to make the threat of dilution from conversion a serious concern for bank managers and shareholders. And the dilutive conversion rate, in combination with the size of the CoCos being converted, must result in more dilution of common stockholders than the alternative preemptive stock offering. By a “dilutive” CoCo conversion, we mean a conversion that will leave the holders of CoCos with at least as much value in new equity as the principal of the bonds they surrender.

The study by D’Souza and others emphasizes that CoCos designed to result in substantial dilution upon conversion not only encourage banks to voluntarily raise preemptive equity capital to avoid CoCo conversion but also have another practical advantage as debt instruments. The strong incentives they provide management to avoid conversion are likely to make CoCos trade more like fixed-income instruments than ordinary convertibles. As a result, CoCos are likely to have greater appeal to institutional investors,²³ who tend to prefer low-risk debt instruments.²⁴ In the colorful words of Thomas Huertas, “To the common shareholder, contingent capital holds out the prospect of death by dilution, and it can be anticipated that shareholders would task management to undertake the necessary measures to avoid such dilution.”²⁵

Given the strong incentives embedded in our version of CoCos to promote timely equity offerings, we believe that our CoCos would almost never convert into equity. And as a consequence, they are likely to play little if any role in either “bail-ins” or in signaling CoCo holders’ losses, which should be expected to be nearly zero. Of course, if a bank experienced a sudden and complete loss of market confidence (say, as the

result of accounting fraud à la Enron or WorldCom), then the SIFI would probably be unable to avoid conversion through a preemptive equity offering. Although we value the ability of CoCos to absorb losses under such circumstances, our main interest is in creating very strong incentives for managers to take corrective action while they still have multiple options for doing so.

Not only would the corrective action of a preemptive stock issue or asset sale preserve high ratios of equity to assets in the wake of significant shocks, but the knowledge of the existence of CoCos and the anticipation of the possibility of facing dilutive CoCo conversion would create strong incentives for management to maintain high ratios of capital, accurate measures of risk, and effective controls on risk at SIFIs. CoCo conversion would be a CEO’s nightmare: not only would existing stockholders diluted by the conversion be calling for his head, but he would also face an onslaught of sophisticated new block holders of stock—the institutional investors who formerly were CoCo holders—who would also likely be eager to sack senior management for its demonstrated incompetence.

The literature on CoCos has become vast in a short period of time, with numerous studies highlighting the potential value of requiring some form of contingent equity capital infusion for banks through conversion of existing debt, insurance contracts, or rights offering as buffers against loss.²⁶ The Dodd-Frank Act has mandated that the Federal Reserve study the scope for use of some minimum amount of contingent capital as part of regulatory capital requirements.²⁷ And a statement released by the Basel Committee (2011) sets out standards that CoCos must meet to qualify as tier 1 or tier 2 capital. The Swiss have specified a requirement for CoCos. In addition, the European Commission in 2011²⁸ proposed standards for debt “bail-ins” that are designed to avoid the use of taxpayer funds by requiring mandatory conversions of debt to equity. And several banks have begun issuing one or another version of them. Thus requiring a minimum amount of subordinated debt instruments that convert automatically into equity in adverse states of the world prior to reaching the regulatory insolvency intervention point has been endorsed by numerous regulators as a credible means of promoting market discipline.

In the past, financial economists and regulators have

22. This can be viewed as a reversal of the debt overhang problem, in which shareholders are reluctant to issue equity because most of the gains will go to creditors. Our approach provides incentives for shareholders to issue equity preemptively in order to avoid massive dilution.

23. Some insurance companies and bond mutual funds, which have been substantial holders of subordinated debt in the past, have protested that their regulators will not permit them to hold CoCos because they may convert to equity. But if the conversion occurs, the equity could be quickly sold and reinvested in bonds; therefore that does not seem to be an insuperable constraint.

24. D’Souza and others (2009) runs simulations to show that the strong incentives for CoCo issuers to avoid conversion would make conversions extremely rare; thus they would have yields quite close to those of traditional subordinated debt. During the Brookings-Nomura-Wharton Conference on Capital and Financial Markets, at which an earlier draft of this chapter was presented, Shigesuke Kashiwagi reported on the results of a survey of more than 150 institutional investors around the world, which was con-

ducted by Nomura. The survey was designed to gauge the appetite of institutional investors for contingent capital instruments. The survey showed that 74 percent of respondents were either “relatively comfortable” or “very comfortable” with their ability to value Crédit Suisse Buffer Capital Notes (an early example of a CoCo). Of the 150 respondents, 46 percent had purchased Crédit Suisse Buffer Capital Notes and 50 percent had purchased varieties of CoCos issued by Lloyds Bank and Rabobank.

25. Huertas (2009), p. 5.

26. See, for example, Doherty and Harrington (1995), Flannery (2005), Kashyap and others (2008), D’Souza and others (2009), Huertas (2009), Duffie (2009), Pennacchi (2010), Pennacchi and others (2009), Bolton and Samama (2010), and Hart and Zingales (2010). For a review of this literature, see Murphy and Willison (2011).

27. See section 112 (a).2.1 of the Dodd-Frank Act.

28. European Commission (2011).

assumed that at least some measure of market discipline would be achieved by having banks issue traditional subordinated (or sub) debt that does not convert into equity.²⁹ But CoCos are superior to straight sub debt as a form of required capital from several perspectives. First, by making subordinated debt convert into equity *prior to* bank insolvency, CoCos eliminate the necessity of a politically charged decision about whether to impose losses on debt holders after intervention—something most regulators were reluctant to do in the recent crisis. Since CoCos will have already converted into equity, they will share in any losses suffered by equity holders, and so the issue of imposing loss is removed from consideration. CoCos, unlike straight subordinated debt, will offer greater credible protection for deposits against loss in adverse times.

Second, because CoCos would credibly remain in the bank and suffer losses in insolvency states, the prices of CoCos will accurately reflect their true risks. Given the widespread practice of bailing out subordinated debt during the crisis, sub debt can no longer serve this function.

Third, in the event that conversion is triggered, CoCos provide a better buffer against losses to depositors, counterparties, and senior debtors than subordinated debt because CoCos cease to accrue interest once they convert and therefore reduce liquidity pressures on the bank to some extent.

Fourth, and most importantly, if properly structured (as discussed above), CoCos will give incentives to boards and senior managers to replenish any significant losses of equity on a timely basis and also to strengthen controls over risk and corporate governance.

Of course, if an institution waits too long, or experiences a sudden, dramatic loss of market confidence (as in the

Enron collapse), it may find that equity markets are closed to it or that it can sell assets only at distressed prices. That is why SIFIs are likely to launch new issues or sell assets long before they approach the CoCo conversion point, particularly if the CoCo trigger is set high enough so that this point is reached long before insolvency (when it may be too late to issue new shares).³⁰

Setting an Appropriate Trigger and Related Issues

An appropriate trigger must be accurate, timely, and comprehensive in its valuation of the issuing firm.³¹ What's more, it should be defined so that it can be implemented in a predictable way so that CoCo holders can price the risks inherent in the instrument at the time of its offering. The latter point has been emphasized by one rating agency that refused to rate a CoCo in which the conversion is contingent upon the decision of a regulator or of bank management.³²

Some proposals for contingent capital assume that the book values of the institution's equity relative to its assets would be the appropriate conversion trigger for CoCos.³³ But as an accounting concept, book value is subject to manipulation and is inevitably a lagging indicator of deterioration of a bank's balance sheet.³⁴ And the problem with using book value as the trigger is not just one of managerial dishonesty.³⁵ As we saw earlier, regulators and supervisors have consistently shown a marked reluctance to opine negatively about SIFIs in a way that will become public. Such forbearance leads to protracted delays in recognizing problems. Thus, a principal rationale for requiring the issuance of CoCos is to reinforce official supervision with market discipline.

What market-based measures could be employed as the

29. A long tradition in the theory of capital regulation suggests that some form of credibly unprotected subordinated debt would be useful to include as part of a bank's capital requirement because of its role as a disciplinary device. The primary motivation behind the subordinated debt idea (Horvitz (1983); Guttentag and Herring (1987); Calomiris (1999); Shadow Financial Regulatory Committee (2000); Herring (2004)) is that requiring a bank to issue a minimum amount of junior, unprotected debt, which would suffer first loss in the event of an insolvency, helps to publicize market perceptions of default risk. That could inform bank supervisors about the condition of a bank and make supervisors more likely to act rather than forbear from disciplining banks (since the signal is public). Junior debt yields are especially useful as indicators to policymakers since the FDIC is in a senior position relative to junior debt. Thus, observing the yields on junior, subordinated debt provides a helpful indicator of market perceptions of the risk borne by the FDIC. If supervisors can detect risk in a timely fashion, bank failures will be less likely because, first, banks will have to react to supervisors' concerns by limiting their risk and raising their equity capital once they suffer losses that increase their default risk on debt; second, banks that are unable to prevent continuing deterioration in their condition will be subject to credible prompt corrective action (PCA) to prevent them from becoming deeply insolvent. Indeed, the advocates of sub debt requirements therefore have traditionally seen a sub debt requirement as a complement to PCA. PCA envisions rule-based interventions by regulators (triggered by indicators of weakening bank condition) to require that banks increase capital and reduce risk prior to becoming insolvent. The problem in practice, however, is that intervention, which is triggered by book value ratios, typically has not been sufficiently prompt to permit any effective corrective action to be taken.

In response to the mandate within the Gramm-Leach-Bliley Act of 1999 that required the Federal Reserve and the Treasury to study the efficacy of a sub debt requirement, a Federal Reserve Board study reviewing and extending the empirical literature broadly concluded that sub debt could play a useful role as a signal of risk. Despite that conclusion, no action was taken to require a sub debt component in capital requirements; instead the Fed concluded that more research was needed. The development of the credit default swap (CDS) market and recent research showing that CDS yields contain impor-

tant information about bank risk not otherwise available to supervisors (Segoviano and Goodhart (2009)) has added further to interest in finding ways to harness the information content of sub debt for regulatory purposes. Other observers, however, have noted that actual sub debt yields and CDS spreads were quite low during the financial boom of 2005-07, indicating that they would not have provided a timely signal of increased bank risk in 2006 and early 2007. On the other hand, advocates of sub debt requirements have noted that outstanding bank sub debt in 2006 and 2007 was not credibly unprotected, and in fact was bailed out during the crisis in most cases. Indeed, all of the subordinated debt of Fannie Mae and Freddie Mac was bailed out. In that sense, the failure of sub debt to signal problems could simply reflect correct expectations by market participants that the debts that they were holding were not effectively at risk.

30. One problem frequently noted by Charles Goodhart—which does not apply to our proposal—arises with CoCos that aim to achieve the bail-in objective. Bailing in debts via conversion when banks are near the insolvency point may make it harder for banks to raise funds as they near that low CoCo trigger. In other words, since bail-in CoCos are intended to give haircuts to debt holders, investors will not be keen to buy them when the prospect of a haircut is near. Under those conditions, equity issues also may not be feasible. Goodhart worries that bail-in CoCos, therefore, could be destabilizing for banks nearing financial distress and thus would either be counterproductive or not enforced. Our emphasis on CoCos with high triggers, which dilute stockholders in favor of debt holders, does not suffer from this problem.

31. D'Souza and others (2009).

32. This point may be an important constraint on sales of CoCos because some institutions that would be natural holders of CoCos are not permitted to hold unrated securities.

33. See D'Souza and others (2009) and Hart and Zingales (2010).

34. For example, the Japanese banking system was insolvent for almost a decade while still satisfying its minimum book value capital requirements under the Basel standards.

35. It may also involve the complicity of accounting firms in window-dressing transactions as shown in the Lehman Brothers case.

trigger? The two obvious candidates are credit default swap (CDS) spreads and stock price movements. CDS markets seem less desirable for the purpose of deriving triggers for two reasons. First, the markets are relatively shallow and thus may be more susceptible to manipulation. Second, the pricing of risk is not constant over time; an observed spread at one point in the business cycle under one set of market conditions can be indicative of a higher level of risk than the same spread observed at another time under a different set of business conditions.³⁶

Equity values, if used properly, would provide the best source of information for designing a trigger. Indeed, some of the best-known cases of large-firm failures that surprised rating agencies and regulators were signaled well in advance by *severe and persistent declines in the aggregate market values of their equity*. For example, KMV's ratings of WorldCom's and Enron's debts were relatively successful in predicting their defaults. The reason for KMV's success was that their model is based on the Black-Scholes approach to measuring default risk as a function of two market-based variables: leverage (as measured using *market* values) and asset risk (which is also derived from the volatility of stock returns). Similarly, market value information about Lehman Brothers provided an early warning of its problems. One study, after evaluating the company's assets and liabilities on a market value basis, concluded that the substantial and protracted decline in Lehman's share price rendered it insolvent on several occasions during July and August 2008.³⁷ If Lehman had been required to issue CoCos with a trigger based on its market value of equity, this decline in Lehman's market value would have produced conversion of debt into equity long before insolvency.

As we have noted, the existence of a properly designed CoCo requirement would also provide all financial firms with strong incentives to voluntarily raise equity capital in large amounts before hitting the CoCo trigger. Lehman postponed a significant issuance of equity capital during the summer of 2008, in the hope that its share price would rise. If it had faced the prospect of CoCo conversion, it would almost certainly have issued new equity to avoid a much more dilutive conversion of CoCos. Provided the CoCos have face value that is a substantial proportion of the face value of

equity, and that the conversion is triggered well above the point of insolvency—and at a rate that is at least sufficient to maintain the face value of the CoCos in terms of the market value of new equity—the voluntary issuance of equity above the trigger point is likely to be more favorable to shareholders than the conversion of CoCos, even under extreme assumptions about the potential decline in share prices in reaction to the announcement of an equity offering.³⁸ Bank managers who seek to maximize the value of shareholders' claims in the firm always have a strong incentive to prevent the triggering of the conversion of CoCos by strengthening the governance of risk and, if necessary, preemptively issuing equity into the market or selling assets, *as long as the dilution effect of the CoCo conversion is sufficiently large*. Even managers not intent on maximizing shareholder value *per se* will want to avoid the potential corporate governance consequences of a massive CoCo conversion, which would almost certainly produce a shareholder revolt that is led by preexisting shareholders who have been diluted and joined by former holders of CoCos who have become inadvertent shareholders. That might improve the market for corporate control, which is virtually dormant for most highly regulated institutions.

Of course, there is cause for concern that stock market prices may be unreliable measures of true value. Declining equity values are reliable only as rough measures of a SIFI's health if the declines are sufficiently large and persistent—and even in such cases, stock price declines offer only a rough indication of the actual extent of the deterioration of the firm's financial health.

Fortunately, that indication is good enough to serve as an effective trigger for CoCos. And with the aim of smoothing fluctuations in share prices and reducing the noise in market value signals, we suggest using a 90-day moving average of the ratio of the market value of equity to the sum of the market value of equity and the face value of debt. We refer to this ratio as the quasi-market-value-of-equity ratio, or QMVER.³⁹ Besides limiting the effects of share price fluctuations and noise, the use of such a ratio would also make it more difficult for speculators to force a CoCo conversion through a coordinated bear run on a bank's stock.⁴⁰ (See Figure 1 for an illustration of the smoothing effect of the 90-day moving average on the QMVER of Citigroup and JPMorgan Chase

36. See, for example, Bekaert, Hoerova, and Lo Duca (2010).

37. See Valukas (2010), which derived the market value of assets by adding the equity market capitalization and the market value of liabilities. The study then used the balance sheet identity to infer the market value of assets, which could be compared with the face value of Lehman's liabilities.

38. As demonstrated by D'Souza and others (2009).

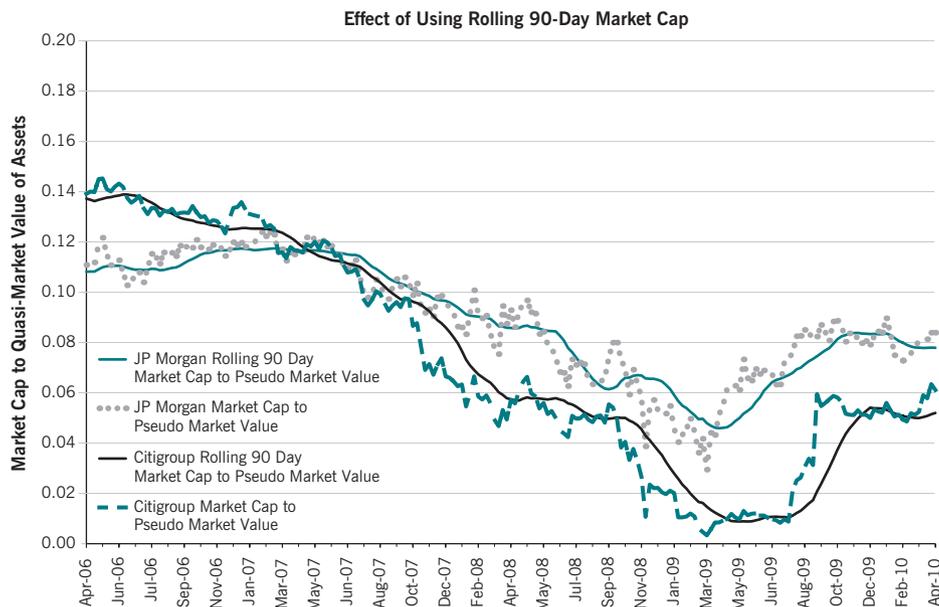
39. Given the practical difficulties of pricing bank debt on an ongoing basis and the fact that in equilibrium, the structure of CoCos that we propose would result in little risk of conversion, we believe that it is not worthwhile to attempt to price bank debt when determining the denominator of the QMVER, hence our reliance on a "quasi" market-value-of-equity ratio rather than a true one. Because the market value and face value of debt are likely to remain reasonably close to one another (except in the case of major interest rate shocks), we do not regard this as an important deficiency. Furthermore, one can argue that using the face value of debt when setting a QMVER trigger is conservative, since it does not allow the ratio to rise as the result of decreases in the value of debt

related to increased *default* risk.

In principle, liabilities could be adjusted for movements in the risk-free rate but not for movements in the risk premium. So long as monetary conditions are stable, however, that is a second-order refinement of a straightforward measure that would tend to undermine its transparency.

40. Albul, Jaffee, and Tchisti (2010) find that holders of CoCos will have an incentive to manipulate the equity price only if the ratio of the equity conversion value to CoCo value is high enough to make the conversion profitable for the holders of CoCos. In contrast, bank equity holders have an incentive to manipulate equity prices only if the ratio of equity conversion value to CoCo value is low enough to make the forced conversion profitable for them. Note that if the trigger is a long moving average, the resources required to manipulate the share price over a sufficiently long period would be very substantial. Moreover, a sustained departure from the equilibrium price is likely to attract speculators who can profit from resisting the attempt to manipulate share prices.

Figure 1 **The Smoothing Effect of a Ninety-Day Moving Average on the Quasi-Market-Value-of-Equity Ratio, April 2006–April 2010**



Source: CRSP Database

during the period April 2006–April 2010.)

Would a trigger based on the QMVER be desirable based on the criteria of predictability, timeliness, comprehensiveness, and accuracy? Clearly, it is a comprehensive measure of firm value. (In fact, the market capitalization of a bank would be viewed by most economists as *the only* reliable comprehensive measure of value—one that includes, in principle, the value of tangible and intangible assets as well as off-balance sheet positions.)

Because the market values of the shares of SIFIs are continuously observable in broad, deep, resilient secondary markets—markets that continued to trade actively even during the depth of the financial crisis (when many other markets ceased to function)—a trigger based on equity valuation will be timely. There is an obvious trade-off between the greater timeliness of a short moving average period and the greater reliability of the signal from a longer time period. We suggest 90 days for the moving average based on the experience from the recent crisis, which suggests to us that 90 days offers plenty of time for policymakers to respond to low-frequency disruptions—such as the August 2007 run on asset-backed commercial paper—and also plenty of time for banks to respond to declines in equity value by raising new equity in the market.

With respect to the latter point, we note that between September 2007 and September 2008, some \$450 billion in capital was raised by financial institutions. A typical road show for a fully marketed seasoned equity offering is

measured in weeks. Although many seasoned equity offerings nowadays are executed on an expedited basis, especially by large firms, it is probably reasonable to assume that the due diligence required to issue equity into the market during a time of severe loss would require the offering to be fully marketed, with a somewhat protracted road show. Hence, we think that a 30-day moving average window for the trigger may be a bit short if the intent is to motivate share offerings in the wake of equity value losses.

A trigger based on the QMVER would also make the valuation of CoCos more predictable. We do not mean to imply, of course, that stock market returns are predictable but rather that markets are able to forecast the time-varying volatility of those returns and therefore to make reasonable inferences about the probabilities of different potential states, including movements into the neighborhood of the trigger. That is useful for pricing CoCos and bank stock, since in the presence of a CoCo requirement the anticipated effects of dilution—both from CoCo conversion and from preemptive equity offerings to prevent CoCo conversion—would factor into the pricing of both CoCos and bank equity. The ability to model conversion when it is based on observable functions of market equity prices is a highly desirable feature of the QMVER trigger.

Will the QMVER be a sufficiently accurate measure of financial condition? Yes, so long as the demands placed on the measure are not excessive. Equity prices are not perfectly reliable, and they are especially unreliable in detecting small

valuation changes over short periods of time. They also may be subject to manipulation. For those reasons, it is useful to sacrifice some degree of timeliness by relying on a moving average. But for the purpose of constructing a credible, predictable, comprehensive, and reasonably accurate measure of large swings in the market value of a SIFI, the market value of the firm is the only real possibility. So long as the user does not seek to achieve false precision, equity is reliable.

For example, suppose a trigger were defined as follows: the CoCo will convert from debt to equity if and when the ratio of the market capitalization of the bank to the quasi-market value of the bank falls to 4%.⁴¹ Assuming the bank started with a prudent ratio of market cap to the quasi-market value of assets, a decline to this trigger point would provide a reasonably accurate measure of a sustained decline in the value of the firm. Since the share prices are 90-day moving averages, no SIFI could reasonably argue that the decline in the value of its equity was the product of market manipulation or irrational shareholder behavior.

Is there cause for concern that CoCo holders might try to force conversion through a coordinated bear run on a bank's stock? We believe that the length of the moving average, the liquidity of the equity market, and the ability of banks to issue equity in response to price declines (discussed further below) would prevent such a strategy from yielding a profit. Nevertheless, as an added precaution against any possibility of market manipulation, we suggest limiting investments in CoCos to qualified nonbank institutional investors and requiring that any such investor be prohibited from simultaneously holding a bank's CoCo and shorting its equity position.⁴² That prohibition would not limit short selling in a bank's equity, but would prevent CoCo holders from coordinating a short-selling strategy designed to force CoCo conversion.

Many policymakers and academics have argued in favor of cyclical variation in capital standards, which has also been embodied in the buffer component of the Basel III approach to capital requirements. That topic is beyond the scope of this chapter, but suffice it to say that by fixing the minimum proportion of CoCos relative to the quasi-market value of the firm's assets, our approach would provide strong incentives for firms to raise capital during good times, when they can do so most cheaply. It would also encourage banks to be more cautious about funding unsustainable lending booms with small capital buffers. In that sense, CoCo requirements could automatically help to achieve a key objective of cyclical variation in capital standards even without varying actual capital requirements over the cycle. At the same time, we recognize that time-varying capital requirements for equity and CoCos

may be desirable because they would allow firms to reduce outstanding CoCos somewhat in recessions, and to mitigate the contractionary effects of capital requirements on lending. But such reductions should be allowed only if CoCo requirements are raised to above-average levels during expansion periods, otherwise the relaxation of capital requirements will provide inadequate protection against the risk of insolvency.

Because the trigger for CoCo conversion would occur while the SIFI is still demonstrably solvent and because preemptive equity issues (before the trigger point) would result in further increases in equity, the CoCo requirement would arguably make insolvency extremely unlikely. Nevertheless, because unusually severe shocks will occasionally happen, it is still important to have available a prompt corrective action (PCA) regime as well as an effective system of resolution to go with it. And for the same reasons that a ratio of market value to the quasi-asset value of the firm would serve as the best trigger for CoCo conversion, it would also serve as the best trigger for PCA. If the CoCo conversion trigger occurred at 4%, then the PCA trigger should start if the firm breaches the 2% ratio again after the recapitalization achieved by the CoCo conversion.

But this raises another important policy question: If CoCos convert, how quickly should the firm have to reissue a new batch of CoCos? Under our proposal, CoCo conversion would happen only for firms that experience a sudden and lasting loss of the confidence of the equity market. Such firms are likely to become distressed and enter into resolution. But if they do not, they should be required to place new CoCos into the market within a reasonable period of time—say, within a year.⁴³

Should CoCo conversion be triggered by *system-wide losses* of capital or other macroeconomic indicators instead of an individual bank's losses? While indexation of bank debts to system-wide states of the world can be justified from a variety of perspectives,⁴⁴ in order for CoCos to provide incentives for the appropriate management of risk and capital at each bank, there must be a link between the individual bank's circumstances and the triggering of CoCo conversion. For that reason, system-wide triggers—which are potentially useful for some purposes—are not useful for CoCo requirements of the kind that we envision.

The Right Amount and Conversion Ratio for the CoCos

Because the comparative efficacy of CoCos as an incentive device depends crucially on their dilutive effects on equity holders, it is important that CoCos be issued in sufficient

41. We have chosen a 4% trigger for illustrative purposes because it is roughly equivalent to the 4% Tier One Ratio that prevailed at that time. Since then, the Basel Committee has concluded that standard was not nearly high enough and we concur.

42. Our proposal also prohibits banks from purchasing CoCos—both their own and those issued by other banks.

43. See also Flannery (2009).

44. Diamond (1984); Hellwig (1998); Gersbach (2010).

Poorly Designed and Well-Designed CoCos.

Two issues of contingent capital—one by Rabobank (a cooperative) and the other by Lloyds—have proven to be significantly more expensive than subordinated debt. But it is important to note that those two issues present very different incentives to the managers than those that would be provided by the CoCos contemplated in our proposal. In the case of Rabobank, which is a mutual, there are no shareholders to be diluted and the conversion terms are extremely unfavorable to the holders of CoCos—an 85% reduction in the value of their claims upon conversion. The Lloyds issue of CoCos was part of an exchange in stressed circumstances. Moreover, the issuance of the bonds during the crisis probably increased their cost.

A more interesting—and to us more instructive—experiment is the February 2011 issue of CoCos by Crédit Suisse. This issue, which was made by a bank that fared comparatively well during the crisis, was designed to buttress the new Basel III capital requirements. Although many institutional investors (especially regulated insurers and bond mutual funds) that have

been the main buyers of hybrid capital instruments have warned that they cannot hold the bonds without changing their investment mandates to allow them to hold equity-linked debt, Crédit Suisse reported a large number of inquiries from wealthy individuals seeking higher yields as well as hedge funds and other asset managers hoping to exploit the “price anomalies inherent in a nascent market.”⁴⁷ Clearly the traditional holders of hybrid capital—instruments that the tax authorities are willing to treat as tax deductible but the regulatory authorities have been willing to count as capital for regulatory purposes—are reluctant to exchange them for CoCos because the regulators have shown by their actions during the recent crisis that they will protect holders of hybrid capital from loss, preferring instead to shift the losses to taxpayers. When the \$2 billion Crédit Suisse issue was made, it proved to be an overwhelming success. The CoCos featured a coupon of 7.875% and would be converted if the common equity tier 1 ratio of Crédit Suisse fell below 7%. Crédit Suisse received orders exceeding 11 times the amount on offer.

quantity, especially relative to the amount of equity capital required (since relative dilution is key to ensuring preemptive offerings of equity). For that reason, we suggest that, alongside a roughly 10% requirement for the ratio of book equity⁴⁵ relative to book assets, regulators require a similar ratio of CoCos relative to book assets.

To see how such a requirement might have worked during the recent crisis, in which banks were required to hold a minimum of 2% common equity relative to risk-weighted assets (both measured in book value terms), it seems plausible to propose that the minimum required amount of CoCos consistent with our proposal would have been set at roughly 2% of the quasi-market value of the firm’s assets.⁴⁶ Under those assumptions—employed for illustration only—we note that a 4% trigger would set off a conversion of CoCos equal to 2% of the quasi-market value of the bank’s assets. That would imply a huge potential dilution of equity holders. To

maximize the incentive effects from the threat of dilution upon conversion, all of the required CoCos should be converted when the ratio hits the trigger.

Similarly, to ensure incentives for preemptive equity offerings, the conversion ratio should be set so that stockholders face significant dilution from conversion. Conversion should thus require the issuance of enough new shares per face value of CoCos that the post-dilution market value of the shares received is greater than the face amount of the CoCos.

To be more specific, and to ensure adequate incentives for timely equity offerings while the bank still has access to the equity market, we propose the following combination of CoCo design features (which are summarized in Table 1): Commensurate with the current Basel III book equity requirement for SIFIs—which envisions as much as a 9.5% tier 1 equity requirement relative to risk-weighted assets—we propose that the amount of CoCos be set at 10% of the book

45. Our CoCos proposal does not link the amount of CoCos to off-balance sheet asset positions, such as derivatives. That could be done, in several possible ways. For example one could use accounting concepts such as the loan equivalent value of the derivatives portfolio, to compute an additional amount of assets or risk-weighted assets, over and above on-balance sheet assets and risk-weighted assets, for purposes of the equity and CoCos requirements. Alternatively, one could argue that improvements in disclosure of derivatives positions might be adequate in the presence of our on-balance sheet CoCos requirement, even in the absence of such additional adjustments. If detailed public disclosures were made about (1) the net long or short positions of the total off-balance sheet positions with respect to the major asset pricing factors (various benchmarks, such as credit risk measures, exchange rate risk, interest rate risk, etc.), (2) the “deltas” of each of those positions (that is, the sensitivity of the value of the net position to changes in the various factors), and (3) the concentration of counterparty risk and the quality of coun-

terparty risk in the gross positions, then the market value and volatility of the bank share price would reflect off-balance sheet exposures reasonably accurately. In the presence of our CoCos trigger, this would incentivize management to manage off-balance sheet risks conservatively, since the failure to do so would create a risk of adverse market reactions, which might require preemptive and dilutive equity offerings, or in extreme cases, even trigger a CoCo conversion.

46. The crisis showed that the regulatory definition of the numerator, the risk-weighted denominator, and the minimum acceptable ratio were completely inadequate. Nonetheless, for this retrospective examination of the crisis it is interesting to see whether employing the quasi-market-value-of-equity ratio would have been informative in separating SIFIs that would require intervention from SIFIs that did not. Basel III will require a much higher level of equity and the issuance of CoCos should be larger as well.

47. Hughes (2011).

Table 1 **Summary of Key Features of Proposed CoCo Requirement**

Feature	Recommendation
Primary goal	Prompt recapitalization
Minimum amount of CoCos	10 percent of book value of assets
Trigger	QMVER of 8 percent, using a ninety-day moving average of market value
Conversion ratio	5 percent dilutive of the market value of stockholders' shares relative to the face value of their shares
Conversion amount	All CoCos are converted on reaching the trigger
Holdings	Qualified nonbank institutional investors holding no short equity positions in the common equity
PCA trigger	If 8 percent trigger is reached twice
Time to replace converted CoCos	One year

value of assets. To ensure adequate dilution risk to shareholders, we propose that all CoCos convert upon hitting the trigger with a conversion ratio that is 5% dilutive of equity holders, meaning that the value of the shares upon conversion is 1.05 times the face value of the bonds. And we suggest an 8% QMVER trigger for CoCo conversion based on a 90-day moving average.

Does Our CoCo Proposal Suffer from a “Multiple-Equilibria” Problem?

Some finance scholars have challenged whether CoCos of the type that we propose are feasible. In particular, Suresh Sundaresan and Zhenyu Wang—hereinafter *SW*—argue in a 2010 paper that CoCos with market value triggers can suffer from a “multiple-equilibria problem” unless conversion is carefully designed to avoid any dilution of preexisting holders of common stock.⁴⁸ In their model, dilutive CoCo conversion leads to the possibility of more than one potential time path of stock prices for any given time path of asset values. *SW* suggest that such multiple equilibria in share prices could make it impossible to price CoCos and could also lead to potentially destabilizing bear runs on bank stocks, as small perturbations in market prices might lead market participants to switch from a belief in one equilibrium to another. *SW* therefore conclude that CoCos should not both be based on market equity triggers and convert into equity at ratios that favor CoCo holders—that is, conversion ratios in which the face value of CoCos is converted into more shares than the equivalent amount of equity, using the equity price at the date of conversion.

But, as we demonstrate below, that conclusion, when applied to our proposed CoCo requirement, is incorrect. Nevertheless, as we also show, *SW*'s analysis (and example) can be used to motivate the specific design features of a proper CoCo requirement, which we now provide.⁴⁹

Following *SW*, we assume a bank with the following asset and liability structure (in which all values are defined in market value): assets of \$100; senior bonds (or deposits) of \$80; and CoCos of \$10. There is also one share of equity whose initial value is \$10, and thus the total market value of the bank's equity also starts out at \$10. In the absence of a CoCo, the bank's equity share would be valued at \$10. But as *SW* show, in the presence of a CoCo with a market value trigger and a dilutive conversion feature, \$10 is only one of the possible values of the equity share.

The following example illustrates the problem identified by *SW*. We assume that the CoCo conversion trigger is set based on a market value of equity of 5% or less of assets, which in the *SW* example translates into a stock price of \$5 per share or less. The conversion ratio is assumed to be dilutive of preexisting shareholders. Specifically, we assume that the \$10 in CoCos converts into three shares of stock if the stock price is \$5 (the trigger price). Such a conversion ratio is “dilutive” because the value of the CoCos after conversion—at roughly \$15—would be greater than their face value of \$10. (A non-dilutive conversion—one in which the value of the CoCo's claim would be roughly the same after conversion as before it—would require a conversion ratio of CoCos into two shares of equity when the equity price is \$5.)

Under these circumstances, *SW* show that there are two equally plausible expected outcomes (or “rational expectations equilibria”): one in which the stock price is \$10 per share and no conversion takes place and another in which the stock price is \$5 and conversion takes place. Both outcomes are “rational” in the sense that they are consistent with expectations and are fulfilled by equilibrium prices. That is, if the market believes that the price should be \$5 per share, conversion will happen, the new number of shares will be four, and the original owners of the bank, who owned 100% of the

48. Sundaresan and Wang (2010).

49. Concerns about multiple equilibria have encouraged some CoCo proponents to design triggers based on book value ratios or to give banks an option to convert rather than require conversion (see Bolton and Samama (2010)). Those design choices are problematic. As we have already noted, a book value trigger depends on the behavior of management and supervisors (which is not easily predictable) and thus makes the probability of CoCo conversion difficult to quantify. Giving banks the option to convert creates

a different problem: during a crisis, if banks believe that asset prices are temporarily depressed, they may prefer not to convert, thus reducing the benefit of adding new capital to the bank. Furthermore, in a model in which banks have the option to convert, the existence of CoCos will not encourage pre-emptive offerings of equity. Here we show that neither a book value trigger nor a bank option for conversion is necessary to deal with the potential problem of multiple equilibria.

bank's equity prior to conversion, now own only 25%. The new amount of equity will be \$20, since \$10 in CoCo debt was cancelled upon conversion causing net worth to rise by the same amount. And the price per share of equity will be \$5.

But what if instead the market believes that the price should be \$10? In that case, conversion will not occur (since the market value of equity does not hit the 5% trigger). And so we have an example in which two different share values can be described as rational expectations equilibria. That is to say, if the market believes the price is \$5 per share, then that belief would turn out to be true—but if the market believes the price is \$10 instead, then that belief would turn out to be true.

There is, however, a problem with this argument. Without stating it, SW make a critical assumption that effectively determines their conclusion: namely, that the market *knows* that the bank will take no action to prevent the low-stock price equilibrium of a \$5 share price from occurring. In other words, SW's argument implicitly requires that the bank refrain from issuing new equity if the price of equity begins to fall toward the lower equilibrium value of \$5.

To see why this implicit assumption is important, consider the following amendment to the SW example. We make all the same assumptions employed in SW but make two additional assumptions: one, it is possible for the bank to issue new shares prior to conversion if the price of shares in the market starts to move toward the lower equilibrium price; two, a moving average trigger is used whereby the triggering of conversion occurs only if the stock price falls to the trigger value or below for a finite length of time.

Under these assumptions, if the share price begins to fall below \$10, the bank could issue one share of common stock into the market at, say, any price between \$10 and \$5 a share. To be more specific, suppose that the stock price falls to \$5 and that the bank issues one share of stock into the market at \$5 a share. Doing so raises both the value of assets and the value of equity by \$5. Because the trigger for CoCos is defined in terms of the ratio of market value of equity relative to assets (the QMVER), at a \$5 share price, *conversion will not take place*, since the offering of a new share has raised the new QMVER above 5%.

Note that without conversion the lower equilibrium price of \$5 a share is no longer a rational expectations equilibrium, since the expectation of conversion that underlay the \$5 price will not be realized. Indeed, the price of equity would rebound to \$7.50 a share (which contradicts the \$5 equilibrium assumption) if the share price had actually fallen to \$5, prompting the bank to issue the single share into the market.

But this “out-of-equilibrium” offering and price volatility should not occur, since the \$5 share price is no longer a rational expectations equilibrium; therefore, there is no reason to expect that the price would ever have fallen to \$5 in the first place. The bank will never have to issue into the market at \$5 a share, since \$10 is now the unique equilibrium price (and arbitrage in the market will ensure that the market price will never fall below \$10). Moreover, as our example makes clear, the bank will want to announce and follow this share-issuance policy, since this would enable it to avoid the dilutive conversion of CoCos that occurs in the lower price equilibrium.⁵⁰

Several clear lessons emerge from this analysis. First, in light of the possibility of multiple equilibria, it is especially desirable to put a moving-average process into the definition of the trigger, which would require, as in the example above, that the QMVER trigger be hit over a period of time, not just at a moment. Second, when considering the necessary length of time for that moving average, it is important to make sure that the period is long enough to give management time to arrange for a preemptive equity offering to prevent conversion. As stated earlier, we believe that a 90-day moving average would allow plenty of time for a stock offering. In the next section of the paper, we show that using a 90-day moving average during the crisis of 2007-09 would have provided ample opportunity for banks that were losing equity value to have issued equity to restore their QMVERs.

Third, CoCo triggers should be set relative to the QMVER, *not* the share price. Stock offerings could change the price per share (as could a stock split); obviously, it is the total equity buffer that should matter from the perspective of the CoCo trigger, and that should be set as a proportion of assets.

In summary, we have shown that our CoCo proposal does not suffer from the SW multiple-equilibria problem. A substantial CoCo requirement—one that requires banks to maintain a significant proportion of their balance sheet financing in the form of CoCos—with a dilutive conversion ratio that is triggered by a smoothed QMVER trigger (which we define as the 90-day moving average) would not produce multiple equilibria in the pricing of bank stock.⁵¹

How the CoCos Requirement Would Have Worked in 2007–08

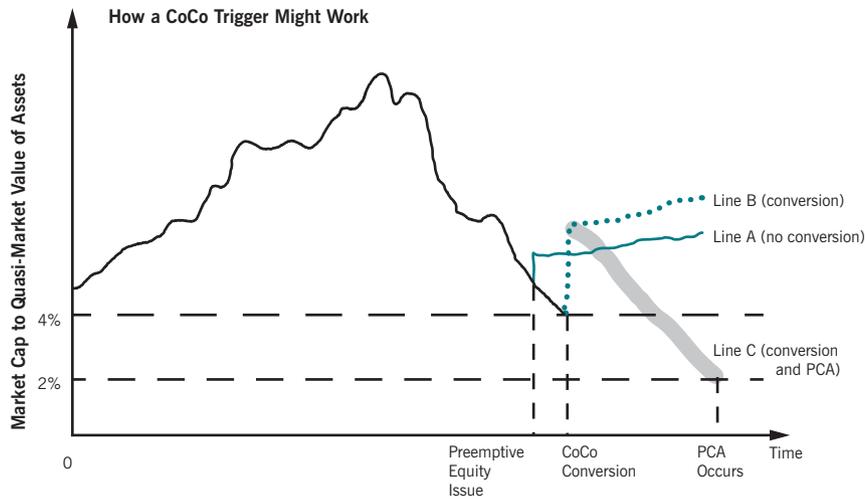
Figure 2 illustrates how the proposed CoCo trigger would work for three different firms in somewhat different circumstances.

As the QMVER falls, approaching the trigger, a firm like A (whose path of values is shown in line A) would issue equity (or sell assets) to avoid hitting the trigger.

50. As early as 2009, many advocates of CoCos with dilutive conversion were pointing precisely to the incentives CoCos can create for timely issuance of common stock to prevent dilutive CoCo conversion (D'Souza and others (2009)). Indeed, as we emphasize, this feature of CoCos has been central to the discussion of why they would be helpful in preventing “too-big-to-fail” bailouts.

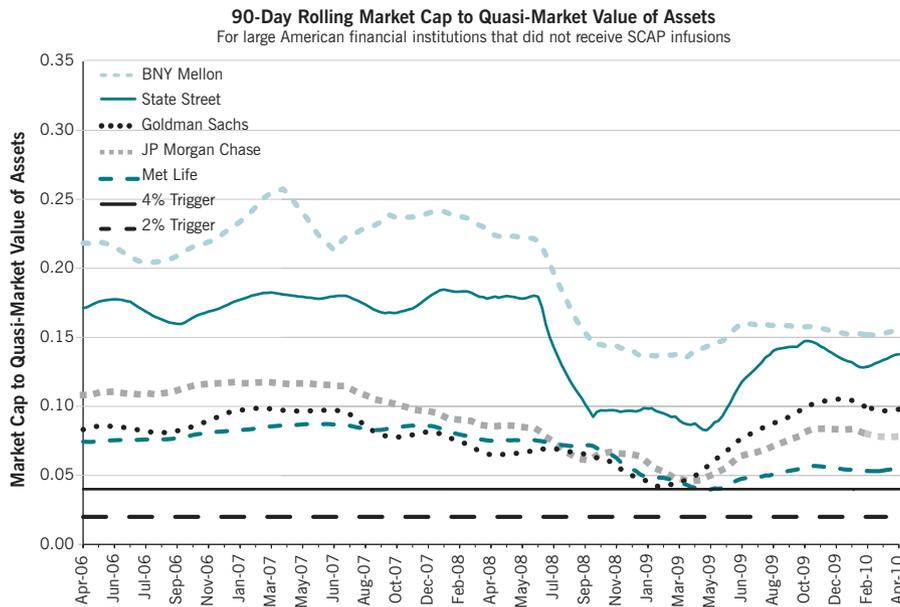
51. Our solution to the multiple-equilibria problem is different from that in Pennacchi, Vermaelen and Wolff (2010) and Pennacchi (2010). In that proposal, incumbent stockholders have the right to purchase converted equity at a non-dilutive price from new (post-conversion) stockholders. That option avoids multiple equilibria, but because it eliminates the cost of dilution on incumbent stockholders, it also dampens the incentive to raise new capital to replace lost capital or to manage risk better *ex ante*, which we see as central advantages of our proposal.

Figure 2 How a CoCo Trigger Might Work



Source: Author's illustration.

Figure 3 Ratio of the Market Cap to the Quasi-Market Value of Assets for the Five SIFIs That Did Not Require Substantial Government Intervention, April 2006–April 2010

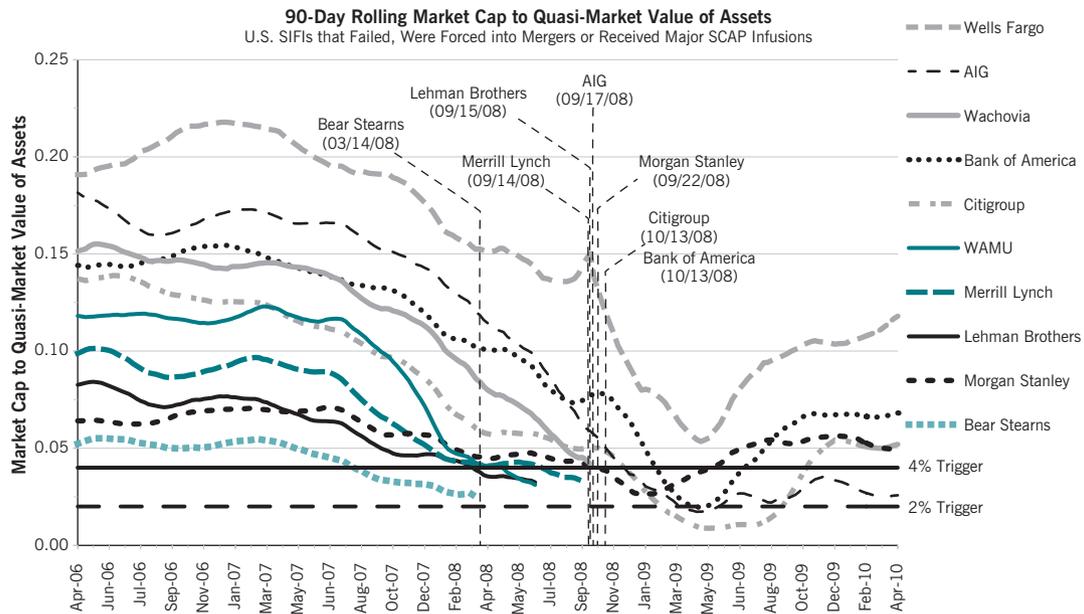


Source: Author's illustration.

If for some reason a firm like B is unable or unwilling to issue equity or sell assets, the conversion of CoCos is triggered (line B). That will result in massive dilution of existing shareholders, who will undoubtedly be angry, and the new shareholders who formerly held CoCos are likely to be unhappy as well. Shareholder dissatisfaction on this scale is likely to lead to the ouster of the existing management and the installation

of new management that will strengthen the governance of risk. And so CoCo conversion might enhance the virtually moribund market for corporate control of regulated financial institutions—an important element of market discipline that is largely ineffectual among regulated banks. It will certainly add management's motivation to take corrective action before reaching the trigger. The doubling of capital and reduction in

Figure 4 **The Ratio of the Market Cap to the Quasi-Market Value of Assets for Ten Banks That Required Substantial Government Intervention, April 2006–April 2010**



Source: Author's illustration.

liquidity pressures (and perhaps a new management team) may buy the firm enough time to successfully restructure.

Finally, we come to the case of firm C, which may be unable to use the additional capital and time to accomplish restructuring or recapitalization. Its value continues to decline until prompt corrective action is triggered at, say, 4% (line C).

Figure 3 shows the movement from April 2006 to April 2010 of the ratio of the 90-day moving average of the market cap to the quasi-market value of assets for five SIFIs that did not require government support. It is important to emphasize that this simply illustrates the ability of the QMVER ratio measure to distinguish between soundly managed institutions and weaker institutions; it does not show what would actually have happened if all institutions had been subject to a CoCo requirement.⁵² Note that none of these institutions fell below the 4% ratio. If the CoCo requirement had been in place, only Goldman Sachs and MetLife might have triggered a conversion. The prospect of dilution, however, would almost certainly have caused the managers of both firms to issue more equity or sell assets to avoid hitting the trigger.

Now consider the contrast of Figure 3 with Figure 4, which shows the movement of the ratio of the market cap to the quasi-market value of assets for ten banks that required substantial government support, were forced to merge, or

entered bankruptcy. Note that all of these firms breached the 4% ratio and, in most cases, they did so many months before they were subject to intervention. It is especially noteworthy that Bear Stearns, Lehman Brothers, and AIG—all of which appeared to catch the supervisory authorities by surprise and were subject to different interventions, hastily improvised over sleepless weekends—had in fact fallen below the 4% trigger several months earlier. It is possible that a CoCo requirement might have induced those firms to adopt higher standards of risk governance and make more aggressive attempts to raise capital or sell assets. At a minimum, it would have bought them additional time to prepare for an orderly resolution and would have been a clear warning to regulators to refine their rapid resolution plans.

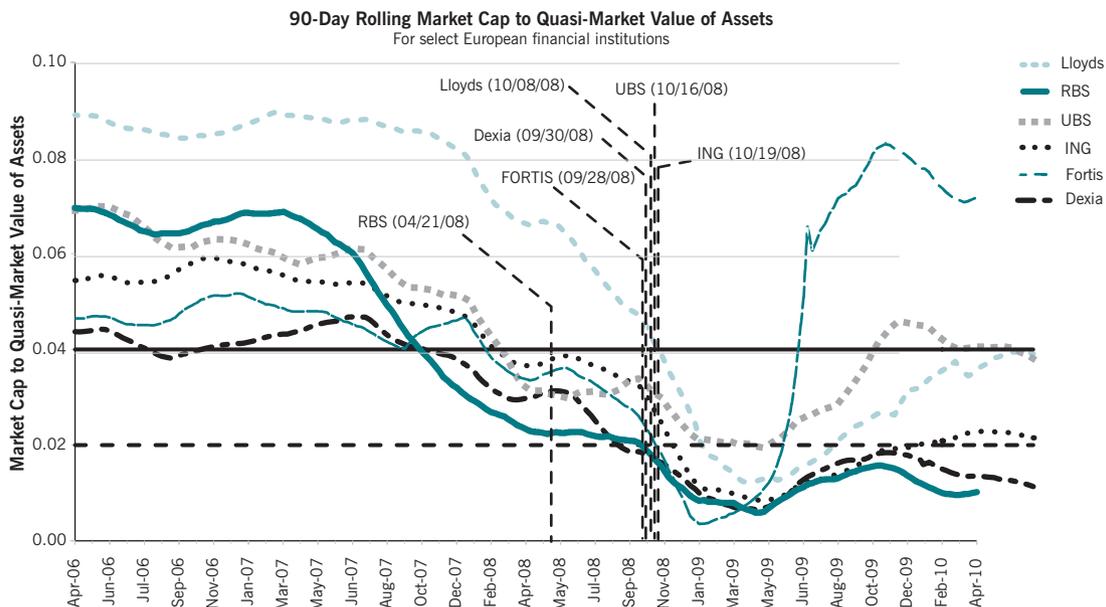
Figure 5 shows a similar pattern for the European banks that required large-scale intervention. In almost every case, the 4% ratio was breached long before intervention was hastily arranged.

In summary, a 4% trigger based on the ratio of the market cap to the quasi-market value of assets might have been an effective device for preventing the collapse of all of these troubled SIFIs during the 2008-09 crisis. Moreover, each of these institutions would have faced strong incentives to strengthen preemptively the corporate governance of risk and,

52. In the presence of our proposed CoCo requirement, the rate of decline in the QMVER would be higher than in the absence of the requirement. Stock prices would take into account the small probability of conversion, and as the QMVER approached the trigger and that probability increased, two effects would reduce stock prices: the dilution

that existing shareholders would suffer from conversion, and the loss of tax savings from the deductibility of interest. Those effects, however, would be small, since the probability of conversion would remain small (banks would endogenously prevent the QMVER from getting too close to the trigger value by issuing equity).

Figure 5 **Ratio of the Market Cap to the Quasi-Market Value of Assets for European Banks That Required Substantial Government Intervention, April 2006–April 2010**



Source: Author's computation based on data from Datastream.

if necessary, issue equity or sell assets to avoid triggering their CoCos months earlier. And the supervisors could not have claimed to be taken by surprise at the sudden collapse of the firms. Although we illustrate our counterfactual with a 4% trigger, we suggest an 8% trigger for our CoCo conversion requirement because it would have worked even more effectively to prevent the post-September 2008 collapse by creating stronger incentives for voluntary equity issuance by banks long before September 2008.

In particular, our proposed CoCo requirement would have reduced the damage from the two largest failures—those of AIG and Lehman Brothers. Although counterfactuals are speculative by definition, at least three reasons suggest that such a system would have been effective if AIG and Lehman Brothers had been identified as SIFIs.

First, the issuance of CoCos would have enhanced market discipline and limited their risk taking.

Second, both firms crossed the CoCo trigger six to eight months before their demise. Since Lehman was heavily owned by its managers and employees, the prospect of dilution would have surely concentrated their minds on raising new equity, while they still had access to equity markets, or on selling lines of business or assets. And even if they had hit the conversion trigger, the automatic recapitalization would have given them more time to find a private solution to their problems, which might have involved a merger, a restructuring, an additional recapitalization, or a change in management. At a minimum, it would have warned the supervisors and resolution authori-

ties of impending trouble so that there would have been no need to engage in desperate measures over a sleepless weekend. Breaching the PCA trigger would have conserved liquidity by restricting dividends, share buybacks, and bonuses.

Third, the primary supervisor and the college of supervisors would have had warning to prepare for the challenges that they would face in a resolution.

Fourth, even if the proposed CoCo requirement had not prevented the disorderly failures of Lehman Brothers and AIG, the consequences for other financial institutions of those failures, and for the financial system as a whole, would have been far milder under our proposed requirement. If other large financial institutions had been encouraged by CoCo requirements to maintain higher capital ratios in 2007 and 2008, the severe consequences of the collapse of money markets might have been averted. The collapse of interbank deposit, repo, and asset-backed commercial paper markets reflected ballooning counterparty risks among these global intermediaries. If large banks had issued sufficient capital in response to their losses in 2007 and early 2008, such counterparty risk would have been contained.

Since regulation of book capital ratios and supervision has proven so ineffectual, it is high time to place a greater emphasis on market signals that discipline SIFIs. CoCos, suitably designed, can be an ideal instrument for channeling such discipline in a way that strengthens the stability of the financial system.

Conclusion

We have developed a proposal for a contingent capital (CoCo) requirement and shown that CoCos can play a unique and critically important role alongside a standard minimum book-value-of-equity-ratio requirement. If properly designed, a CoCo requirement can provide a more effective solution to the too-big-to-fail problem by ensuring adequate capital relative to risk, and it can do so at a lower cost than a simple equity requirement. A proper CoCo requirement can provide strong incentives for the prompt recapitalization of banks after significant losses of equity or for the proactive raising of equity capital when risk increases. Correspondingly, it can provide strong incentives for effective risk governance by regulated banks, and help limit regulatory “forbearance,” supervisors’ well-known reluctance to recognize losses.

Different proposals for CoCo requirements reflect different regulatory objectives, including facilitation of bail-ins, signaling of bank risk, and encouragement of timely voluntary offerings of equity into the market by banks that have suffered significant losses. We argue that the third of these objectives is the most important, especially for dealing with the too-big-to-fail problem.

Thus, the emphasis on the need to provide effective incentives for the timely issuance of equity informs our discussion of the proper design of CoCo contracts that would be implemented by the CoCo requirement. We show that, to be as

effective as possible, a large amount of CoCos (relative to common equity) should be required; CoCo conversion should be based on a market value trigger that is defined by a moving average of a quasi-market-value-of-equity ratio; all CoCos should convert if conversion is triggered; and the conversion ratio should be dilutive of preexisting equity holders. (The details of our proposal are summarized in Table 1.)

Finally, our proposed CoCo requirement does not suffer from a potential problem of multiple equilibria, as some banking and finance scholars have claimed. Judging as best we can from the experience of the recent crisis, our proposed requirement would have been very effective in encouraging the timely replacement of lost capital early in the crisis. If a CoCo requirement had been in place in 2007, the disruptive failures of large financial institutions and the systemic meltdown after September 2008 may well have been avoided.

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Appendix **The Smoothing Effect of a Ninety-Day Moving Average on the Quasi-Market-Value-of-Equity Ratio, April 2006–April 2010**

Source	Amount of CoCos to be issued	Trigger for conversion	Terms for conversion
Doherty and Harrington (1995)	Authors use the term “reverse convertible debt.” Issue will be the optimal amount of leverage for the firm. All debt will be converted when trigger is reached.	At the discretion of shareholders.	The value of new shares given to bondholders is less than the face value of the debt.
Huertas (2009)	An amount equal to some specified proportion of risk-weighted assets. From the diagram on p. 4, that appears to be the same proportion as that of core tier 1 capital to risk-weighted assets.	Finding by regulators that the core tier 1 capital ratio has fallen below a specified level.	Implicitly all contingent capital will be converted. Although Huertas stresses the importance of the threat of dilution, he does not specify the terms for conversion.
D'Souza and others (2009)	The amount issued should be large enough that the firm can be recapitalized even in dire circumstances. (Back tests suggest that CoCos equal to 6 percent of RWA would have avoided government intervention in the 2007–09 crisis.)	A “true” measure of capital above the solvency point. Authors reject market values as too volatile and accounting measures as too slow to reflect deterioration. Prefer SCAP-like stress test that would calculate a two-year forward capital ratio for the firm.	Conversion terms must be sufficiently dilutive to original shareholders to motivate them to raise equity before hitting the trigger. The more dilutive the terms of conversion and the higher the trigger point, the lower the cost of issuing CoCos because they are less likely to be converted.
Dudley (2009)	Amount should be large because cost should not differ much from cost of straight debt and shareholders must face the potential for automatic and substantial dilution. Full amount issued will be converted when trigger is reached.	Trigger could be tied to deterioration in the condition of a specific bank and/or to the banking system as a whole. It also could be tied to regulatory measures of capital, but Dudley prefers market measures because they tend to lead regulatory-based measures.	“The conversion terms could be generous to the holder of the contingent capital instrument” (p.7). Conversion terms should be set so that debt holders could expect to get out at or close to par value.
Duffie (2009)	Duffie assumes the full amount would be converted when the trigger is reached.	The trigger that converts debt to equity should be set to eliminate the debt claims before a liquidity crisis is likely to begin and with a strong enough impact on the balance sheet to forestall a self-fulfilling presumption of a liquidity crisis. Duffie rejects a regulatory capital trigger. Favors tangible common equity trigger if restricted to accounting measures. Advocates a market value trigger but warns that unless a moving average is used, it can precipitate a “death spiral.”	Debt conversion should be accompanied by another sort of contingent capital that will immediately improve the cash position of the bank. Duffie favors a rights offering.
Flannery (2009)	Flannery uses the term “contingent capital certificates” (CCCs). Firms would not be required to issue CoCos, but CCCs could be used to offset the required amount of equity capital. Some of the CCCs would be converted to equity to replace lost equity value. Supervisors determine the minimum equity capital ratio and trigger point. SIFIs cannot hold any CCC for their own account. Since conversion may be partial, it must rely on an allocation mechanism: convert shortest remaining maturities first; sell with various seniorities so that some bonds must convert fully before others can begin to convert; select bonds randomly within a common maturity or common seniority tranche; select CCCs by lottery.	Would convert into equity if firm's capital falls below some critical, prespecified level. Conversion trigger must be expressed in terms of contemporary value of equity and scaled by the book value of assets.	The contemporary market price determines how many shares the holders of CCCs obtain. The terms for conversion should ensure that they suffer no capital loss. Conversion must happen the day after the trigger is reached. If firm is insolvent because of a sudden collapse in asset prices, covenants in CCCs must specify a conversion price that wipes out original shareholders.
Rajan (2009)	Banks should issue sufficient CoCos so that, when converted, they will dilute the value of old equity substantially.	Two triggers: the system is in crisis based on objective indicators such as aggregate bank losses; and the bank's capital ratio falls below a certain value.	The number of shares the debts convert into should ensure substantial dilution of old equity.

Source	Amount of CoCos to be issued	Trigger for conversion	Terms for conversion
Squam Lake Working Group (2009)	Banks must be required to issue CoCos because they will otherwise issue other debt securities more likely to shift costs of risky activities to government. When conversion is triggered, presumably all CoCos are converted.	Two triggers: declaration by regulators that the financial system is suffering from a systemic crisis; and the bank is found in violation of covenants in its CoCo contract expressed as a ratio of Tier 1 capital to risk-weighted assets.	Authors fear that a conversion rate based on market values would trigger market manipulation. They prefer to convert each dollar of debt into a fixed quantity of equity shares rather than a fixed value of equity.
Hart and Zingales (2010)	Authors reject CoCos, arguing that by limiting defaults, CoCos will provide more resources for inefficient managers to waste, while a default would force an inefficient business to restructure and incompetent managers to be replaced. They argue instead for direct issues of equity triggered by CDS price of a bank's debt exceeding a specified threshold.	An example suggests trigger might be that a bank's CDS price exceeds 1 percent on average over the previous month. Authors express concern about finding an appropriate CoCo trigger. If based on accounting numbers, it is likely to trigger remedial action that will lag actual deterioration in bank assets. If conversion is triggered when market prices are low, managers could deliberately talk down bank's value to activate trigger and obtain equity on the cheap.	Direct issuance of equity would substitute for conversion of debt. Presumably sufficient equity must be issued to reduce the CDS price below 1 percent.
Albul, Jaffee, and Tchisty (2010)	Full amount will be converted. Authors also stipulate that CoCos should be substituted for straight debt. They do not specify the amount to be converted.	Conversion is triggered when capital reaches a "distressed level," but regulatory benefits are greater the higher the trigger at which conversion occurs.	No exact ratio is given, but authors emphasize that the conversion ratio of CoCos into shares should not motivate either holders of CoCos or shareholders to manipulate share prices.
McDonald (2010)	Amount of CoCos issued has an initial value equal to the initial value of equity. All will be converted when dual triggers are reached. If CoCos are not converted, bonds would be retired gradually and randomly as maturity approaches to avoid large gains that could occur from manipulation at maturity.	Conversion with a dual price trigger: the bank's shareholders' equity price must fall below a threshold <i>and</i> an index of financial firms' stocks must breach a pre-specified threshold. The rationale is to ensure that conversion is permitted only during a financial crisis. Market price triggers should reduce pressure on regulators and accountants at critical times.	Conversion occurs into a fixed number of shares at a premium price (so that the value of the shares upon conversion is lower than the par value of the bonds) in order to minimize concerns about share price manipulation and equity death spirals. Author expresses concern that unprofitable stock price manipulation might create a profit if trader also holds a position in market-triggered CoCos. Author believes fixed-share conversion is most likely to deter such behavior.
Pennacchi (2010)	Assumes that all contingent capital converts to equity when a threshold is breached. (Partial conversion introduces additional complications because the value of shareholders' equity at conversion will depend on the value of unconverted CoCos.)	Trigger is stated as ratio of market value of equity to face value of deposits.	If threshold is stated in terms of market value of original shareholders' equity and contingent capital converts at a discount to face value, the resulting total capital will be less than if the conversion were at par. To correct for this, a higher threshold should be used when conversion is at less than par than when conversion is at par. Concludes that CoCos would be a low-cost means of mitigating financial distress and would reduce a bank's moral hazard incentives so long as the conversion threshold is set at a relatively high level of original shareholders' equity.
Coffee (2010)	Amount of CoCos issued should be set relative to a firm's short-term debt in an amount large enough that short-term creditors will not fear insolvency. May be negotiated case by case.	Multiple triggers for partial conversion set relative to substantial declines in share price. For example, 25 percent of CoCos might be converted with a 25 percent decline in share prices since the time that the CoCos were issued. Another 25 percent would convert if the share price decline reached 50 percent, and the balance would convert if the share price fell by 75 percent.	Conversion would be for an equal face value of cumulative, senior, nonconvertible, preferred stock with voting rights. The intent is to dilute equity to deter excessive risk taking and to create a class of voting preferred shareholders who would be rationally risk averse and would curb pressures for excessive risk taking.

Source	Amount of CoCos to be issued	Trigger for conversion	Terms for conversion
Sundaresan and Wang (2010)	Full amount will be converted. Amount issued not specified. Upon conversion, dividends are automatically suspended.	Trigger price and conversion ratio cannot be chosen independently.	Mandatory conversion must not result in any value transfer between equity and CoCo holders. The authors conclude that only one conversion ratio is an equilibrium, and it depends on the design of the CoCo. The CoCo must be designed so that the coupon payments are indexed so that the CoCo always sells at par. In this case, the conversion ratio is simply par value divided by the trigger level of the stock price at which mandatory conversion will occur.
Swiss State Secretariat for International Financial Matters (2011); Swiss Commission of Experts (2010)	The authors envision two kinds of CoCos with two different triggers. Up to 3 percent of buffer capital (= 8 percent of risk-weighted assets) may be composed of CoCos. The progressive component of capital requirements is to be composed of 6 percent CoCos. That leads to a total capital requirement of 19 percent of RWA, comprising at least 10 percent common equity and up to 9 percent CoCos.	CoCos with a trigger of 7 percent of risk-weighted assets serve as a capital buffer. CoCos with a trigger of 5 percent of RWA should ensure the necessary capital reserve to finance the maintenance of systemically important functions and to see to the orderly resolution of the remainder of the bank in the event of threatened insolvency.	Conversion rate is not specified explicitly; appears to be 1 unit of equity for 1 unit of convertible debt.

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