

Why and How to Design a Contingent Convertible Debt Requirement

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Abstract

We develop a proposal for a contingent capital (CoCo) requirement. A proper CoCo requirement, alongside common equity, would be more effective as a prudential tool and less costly than a pure common equity requirement. CoCos can create strong incentives for the prompt recapitalization of banks after significant losses of equity but before the bank has run out of options to access the equity market. That dynamic incentive feature of a properly designed CoCo requirement would encourage effective risk governance by banks, provide a more effective solution to the “too-big-to-fail” problem, reduce forbearance risk (supervisory reluctance to recognize losses), and address uncertainty about the appropriate amount of capital banks need to hold, and the changes in that amount over time. If a CoCo requirement had been in place in 2007, the disruptive failures of large financial institutions, and the systemic meltdown after September 2008, could have been avoided. To be maximally effective, (a) a large amount of CoCos (relative to common equity) should be required, (b) CoCo conversion should be based on a market value trigger, defined using a moving average of a “quasi market value of equity ratio” (QMVER), (c) all CoCos should convert if conversion is triggered, and (d) the conversion ratio should be dilutive of preexisting equity holders.

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I. Introduction

Although debates still rage over the causes of the financial crisis of 2007 - 2009, 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 asset risks relating to sub-prime mortgages and other risky investments, but they maintained equity capital that was too small to absorb the losses that resulted from those risky investments. In other words, relative to risk, equity capital¹ proved inadequate to insulate these firms, and many others, from insolvency when their risks were realized.

Internal bank risk management and external prudential regulation and supervision failed precisely because they did not envision 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, Citigroup's ratio of the market value of equity relative to the market value of assets was nearly twice that of Goldman Sachs; and yet, Citigroup, not Goldman Sachs, was the institution whose losses produced insolvency. The difference occurred because Citigroup's risk exposures, including off-balance sheet risks associated with implicit liability to clean up problems in special purpose entities and special investment vehicles, were disproportionately larger than those of Goldman Sachs.

Examples of failures to constrain risk within a firm's capacity to bear loss abound. Chief executive officers and boards appeared to have lacked an effective framework or lacked the willingness to apply the appropriate tools to measure risk correctly or to constrain aggregate risk

¹ By "equity capital" we refer here and elsewhere in this paper 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.

within prudent limits.² Ellul and Yerramilli (2010) find that banks that rewarded risk managers more prior to the crisis not only saw smaller crisis-related losses, but also had lower ex ante volatility, which provides strong evidence that management decisions not to prioritize and empower risk management were a central contributor to the crisis.

This defect can take many forms within a bank's risk management system: an over reliance 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 macro-economic conditions; a tendency to follow the herd in an attempt to grow revenues and market share rather than question the adequacy of capital to absorb risks inherent in particular strategies; a reluctance to question fundamental assumptions about basis risks and hedges; a disregard for the risk inherent in the centuries-old challenge of funding long-term assets with short-term liabilities, and for liquidity risk more generally; a tendency to override limits when they conflicted with revenue goals; an inability to track aggregate exposures over complex legal structures and product silos in any reasonable amount of time; and a failure to risk-adjust the price of internal transfers of funds and compensation more generally.

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

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.

Examples of these problems may be found in the bankruptcy of Lehman Brothers (Valukas 2010), the losses sustained by UBS (UBS 2008) and AIG (Special Inspector General for TARP 2009), the collapse of Northern Rock (Kirkpatrick 2009), the forced merger of Bear Stearns (Kirkpatrick 2009, SEC 2008), the collapse of Indy-Mac, WAMU (Office of the Inspector General 2010, Kelly 2008) and Wachovia (Corston 2010), as well as the string of losses reported by Citibank (Special Inspector General for TARP 2011), Merrill Lynch, and Bank of America (SEC 2010). The studies of these individual experiences have questioned whether anyone, including corporate board members, senior management, or supervisors, even comprehended these institutions' exposures to sub-prime mortgage risks.

These 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 that the Basel Committee says that it has been targeting all along when setting its minimum standards for capital. Obviously, despite widespread 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 failed to require sufficient capital commensurate with that risk.

Why did the regulatory system perform so badly? The failure was not the result of the inadequate richness of the conceptualization of risk. The Basel Accord on Minimum Capital Requirements (1987) has undergone numerous refinements, including a major amendment in 1996 to take account of market risks, and a complete renovation of risk measurement with the announcement of Basel II (2004). Principles for enhancing the corporate governance of risk have been addressed in a series of supervisory studies (BCBS 1997, BCBS 1999a, BCBS 1999b,

BCBS 2005, BCBS 2006, BCBS 2008, BCBS 2010a, BCBS 2010b, Joint Forum 1998, Davies 2003). Indeed, “The Core Principles of Banking Supervision” (BCBS 1997) incorporate sound corporate governance of risk as a key principle.

There were two central reasons that prudential regulation failed to require financial institutions to maintain adequate capital. Incentive problems that: (1) Distorted the measurement of risk, and (2) 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 used by regulators. Bankers and rating agencies, however, suffer from conflicts of interest that offer benefits to them when they understate risk. Banks that understate their risk enjoy lower capital requirements. Rating agencies that do so receive larger fee income, allocated through a competitive process known as “ratings shopping.” Given their reliance on banks’ internal models of risk and on rating agency opinions, prudential authorities 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 being measured correctly, it cannot be managed properly. If banks have a strong incentive to understate their risks, then even they may fail to understand the magnitude of risk mismeasurement, which will prevent them from taking 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. As we will show below, 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 the systemic collapse, roughly \$450 billion of 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 their market value of equity relative to assets, chose not to raise sufficient capital.

A top executive at one of those banks confessed to one of us over breakfast during the summer of 2008 that, despite the need to replace lost equity, the price of stock was too low. Issuing significant equity in the summer of 2008 would have implied 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 risky asset prices that would accompany that market improvement. After the bailout of Bear Stearns, they also believed that if their situation deteriorated severely, the government likely would step in. That further undermined any incentive to replace equity capital promptly or even 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 the ex post failure to replace lost equity – are related. If banks realized that they would be forced to replace lost capital in a timely fashion, then they would have greater incentive to manage risk properly and maintain adequate equity capital commensurate with that risk in the first place,

since 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 to postpone 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 so that they will improve the accuracy of their risk assessments, manage risk better, and replace lost equity capital faster?

In this paper, we show how a properly designed requirement for Convertible Contingent Capital (CoCos) can provide unique incentives that will both (a) motivate Systemically Important Financial Institutions (SIFIs) to implement strong systems of risk governance to measure and manage risk and (b) 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 (see Calomiris 2011), but we show that they are not substitutes for CoCos, which play a unique role in improving incentives for risk management and the maintenance of adequate capital, especially for large, "too-big-to-fail" institutions.

II. Why Equity Capital Requirements Are Not Enough

Basel III (2010) has placed emphasis on requirements for more and better quality capital and more intensive supervision. Do the increases in capital contemplated by the Basel

Committee offer a solution to the two crucial problems of risk mismeasurement and the failure to replace lost capital in a timely fashion? Will the contemplated enhancements to supervision solve these two problems? History does not provide much reason to be optimistic about either of the proposed solutions.

Although the emphasis on increasing shareholders' equity is a move in the right direction, these reforms will not solve the fundamental problems of risk measurement and maintenance of adequate capital. The measure of shareholders' equity employed by Basel tends to lag its true 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 risk exposures. 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 accounting principles which, while they vary from country to country,³ combine book values, fair values and market values when measuring capital compliance. This approach inevitably delays the recognition of losses. This permits banks and supervisors – both of whom may stand to benefit from postponing the recognition of loss – to conceal losses in a number of ways. Bankers can be very creative in their use of complex transactions to disguise losses. Supervisors face substantial challenges in detecting and preventing manipulation of book values through gains trading (the recognition of

³ 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 U.S. GAAP so that the leverage for the five major U.S. dealers in derivatives is substantially understated relative to their European peers.

capital gains on positions that are held at book value, while deferring the recognition of losses), which is a common practice. The bankruptcy of Lehman Brothers (Valukas 2010) revealed another device to exaggerate capital adequacy measures – the so-called 104 or 108 transactions that disguised repos (a collateralized borrowing) as a removal of assets and thus a reduction in the size of the balance sheet.

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 regulatees and less-well-paid and less-well-informed supervisors. Even when regulators attempt to close a loophole, it is usually only a matter of weeks before regulatees find another. The innovation known as a Re-Remic provides a good example of the process (IMF, October 2009). Because resecuritized securitizations (CDOs) were a major source of loss during the crisis, the regulatory authorities attempted to patch the regulatory framework by increasing the risk weights for resecuritized debt in July 2008.⁴ The Basel Committee raised the capital charge on BB-rated tranches of rescuritizations from 350% to 650% and on the AAA-rated tranches of resecuritizations from 20% to 40%.

Within weeks financial engineers had found a loophole. By resecuritizing a Remic that had been downgraded from AAA to BB to create a Re-Remic it could exchange the old securities for newly-tranched securities of which, say, 30% would be rated BB because they would take the first loss, but that would enable the remaining 70% of the new securities to be rated AAA. The BB-rated tranche could be sold to a hedge fund or other investor interested in distressed debt or held by the banks. In the latter case, the result would be a reduction in Tier 1 capital required

⁴ The Basel Committee (BCBS, 2009) has defined a resecuritization as a securitization where “at least one of the underlying exposures is a securitization exposure.”

against the position from 14% ($= 350\% * 4\%$) to 8.92% ($= 40\% * 70\% * 4\% + 650\% * 30\% * 4\%$). The Re-Remic could even include a trigger clause so that if the newly minted AAA securities were subsequently downgraded, these securities could be re-subdivided into two “exchange classes.” Through this means 65% of the original portfolio of securities could retain a AAA rating and another 5% could be allocated to a BB-rated first loss tranche. But still the amount of required capital to be held against the position would be 9.37% ($= 65\% * 40\% * 4\% * 35\% * 650\% * 4\%$) rather than the original 14%.

Not only can supervisors be caught unaware, they may prefer to pretend that they are unaware of losses. “Forbearance” – especially the ever-greening of loans to borrowers who would otherwise be delinquent, just enough to keep 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 those pressures often lead 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 some of 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 for any action that forces an institution to recognize losses, especially when there is some hope that losses will be reversed in time. In some countries, supervisors are personally liable, and subject to criminal penalty, for such supervisory errors, and that legal liability is often 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 can be proven beyond any reasonable doubt rather than when they actually occur.

Given the 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 supervisors in the world, provided a particularly egregious example with regard to its oversight of Northern Rock. Just weeks before the bank collapsed the supervisors authorized it to adopt the Advanced Internal Measurements Approach to risk weighting its mortgages, which reduced its required capital by 30% and was to be paid out to shareholders.

Accounting loss recognition lags were substantial during the recent crisis. For example, Duffie (2009) 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 dollars, or about 1% of its total accounting assets." Moreover, 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 are forced to sell illiquid assets into thin markets.

The IMF (2008, April) 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. Indeed, the recent crisis showed that all three components of the regulatory capital adequacy ratio are fundamentally flawed: (1) the measure of capital in the numerator did not reflect an institution's

ability to absorb loss without going through some sort of resolution process; (2) the risk-adjustment of assets in the denominator did not reflect some of the most important risks that banks faced; and (3) the minimum acceptable level of capital 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 SIFIs to recognize and replace lost capital, and 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 appealing for a bailout accompanied by the implicit threat that its demise will cause chaos if it does not receive a subsidy.

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 properly incentivizing 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, it would be almost certain that bank stockholders, rather than taxpayers, would pay the full cost of any understated risks gone wrong. Would that approach encourage proper risk management by banks, and 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 by Admati et al. (2011) has argued that more equity finance might not substantially increase the funding cost of banks. We do not agree. Equity is costlier to raise than debt for fundamental reasons associated with asymmetric information, and with managerial agency costs.

With respect to the first of these, Myers and Majluf (1984) showed that adverse-selection costs of raising external equity result from asymmetric information, and that these information problems add to the cost of equity relative to debt. Those costs are reflected both in negative returns upon the announcement of an equity offering, and in the much higher underwriting costs firms pay to issue equity rather than debt, which reflect the attempts by issuers to overcome asymmetric information problems during the road show (Calomiris and Tsoutsoura 2011). The literature on bank “capital crunches” documents that shocks to bank equity capital have large contractionary effects on the supply of lending precisely because lost equity is costly to replace, as assumed by Myers and Majluf (Bernanke 1983, Bernanke and Lown 1991, Kashyap and Stein 1995, 2000, Houston, James, and Marcus 1997, Peek and Rosengren 1997, 2000, Campello 2002, Calomiris and Mason 2003, Calomiris and Wilson 2004, Cetorelli and Goldberg 2009).

The negative signaling effects of equity offerings (as modeled by Myers and Majluf 1984) will tend to be mitigated if equity offerings are mandated by regulation, rather than chosen voluntarily, but that does not imply that higher regulatory capital requirements would eliminate the negative signaling effects of an issuance in equity to meet those higher regulatory requirements. First, even if all banks went to the equity market at the same time to raise equity, banks whose managers know that they are in better condition will have an incentive to expend 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 means that signaling costs from announcing equity offerings will still be present. For example, some banks (those with high-quality risky assets whose values might be very hard to reveal to outsiders) may decide to avoid equity offerings and meet their higher equity ratios by selling some of their less-opaque assets instead. For both of these reasons, higher equity capital requirements do not eliminate the information costs, and attendant adverse selection risks, that make equity offerings costly.

In addition to asymmetric information costs of raising equity, very high equity ratios can have undesirable consequences for managerial efficiency. Although a moderate increase in equity requirements can encourage better risk management by bankers, a dramatic increase could have the opposite effect. As Kashyap, Rajan and Stein (2008) argue, too much equity can exacerbate agency problems within a bank, as reduced leverage and new stock offerings could produce a more entrenched status for bank managers by insulating them from market discipline if leverage is low and ownership is more fragmented.

Whether tax benefits of debt (the deductibility of interest in corporate taxation) should be included when measuring the relative *long-run* costs of equity finance has been hotly debated (see, for example, Admati et al. 2011). But even if tax savings only matter from a transitional perspective, it is beyond doubt that if banks were permitted to raise capital in part through CoCos, they would likely choose to issue capital faster, and thus to restrict loan growth less, during the transition to higher capital. 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 a significant increase is necessary (see Admati et al. 2011 and Miles et al. 2011), but we recognize that there are negative, not just diminishing, social returns to achieving that higher amount of capital solely by raising equity capital requirements beyond some point. In our view, raising equity requirements on SIFIs to 9.5 percent of risk-weighted assets, as under Basel III, makes sense, and we could also see legitimate arguments for raising capital even higher, but a draconian increase in equity capital requirements would not be desirable, given that there are less-costly ways of lowering the risk of default at SIFIs. But we also emphasize that the moderate increase in the required capital ratio under Basel III would not be sufficient, per se, to allay all ex ante concerns regarding the adequacy of capital to cover all potential losses on assets, much less enough to ensure the adequacy of capital after a significant loss. That is especially so when one recognizes the ability of financial institutions that wish to target a high probability of default on their debts to raise their levels of risk to more than compensate for any moderate rise in capital requirements.

Furthermore, it is hard for regulators to determine the appropriate amount of capital for a bank, and that amount changes over time as its risks change. A given 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 (equity plus CoCos) relative to risk, CoCos not only encourage timely replacement of lost capital and better management of risk, they also encourage banks to respond to increased risk with higher capital.

The limitations of equity capital requirements as a prudential device that we have identified – problems of measuring and enforcing book capital requirements, the asymmetric-information and managerial-efficiency costs 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 motivate our proposal for a contingent capital requirement. Our proposed contingent capital requirement retains deductible 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.

From the standpoints of political economy and the fair treatment of bank shareholders, CoCos also have merit in comparison with equity requirements alone. Banks that currently benefit from the safety-net will undoubtedly resist any increase in capital requirements because, due to implicit and explicit government protection of their liabilities, they already benefit from the lower borrowing costs that otherwise they would gain by raising more equity. When faced with a choice between issuing CoCos or equity, however, they should prefer CoCos. CoCos permit banks to continue to exploit the tax shield provided by the asymmetry of treatment between interest and dividends in the tax codes of most countries,⁵ but mainly because issuance of CoCos need not result in value loss to shareholders, while the forced issuance of equity (given the bank's assets) automatically does (through the reduced tax shield, as well as any funding cost effects related to adverse-selection costs of raising equity and agency costs of reduced leverage).

⁵ Albul, Jaffee, and Tchisty (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."

III. 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 authors. Despite numerous differences in design and specific intent, virtually all versions of CoCos have the common goal of establishing a contractual structure that results in an increase in bank capital in adverse states of the world. This can occur, either directly through contractual convertibility, or indirectly through incentives to voluntarily raise new equity capital. Recapitalization restores the bank to a viable position of capital adequacy and thereby avoids regulatory resolution. Table 1 shows how a number of these proposals vary with regard to three critical features: (1) the amount of CoCos required to be issued; (2) the trigger for conversion from bonds to equity; and (3) the conversion rate – or the amount of equity to be issued when the CoCos are converted.

The differences across proposals with respect to these three key design aspects reflect differences in the weights that the various CoCo proposals attach to the following 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 label the “signaling” objective; and (3) incentivizing the voluntary, pre-emptive, and timely issuance of equity into the market as a means of avoiding highly dilutive CoCo conversion – which we label the “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 “equity-issuance” objective. Our recommendations regarding the amount, trigger, and conversion terms of CoCos all reflect our view that the central

objective of CoCos should be to incentivize the prompt voluntary issuance of equity into the market 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 advocate, or on creating a convertible debt instrument that would credibly suffer substantial default risk via conversion, and therefore, provide useful market signals about forward-looking perceptions of default, we focus on providing institutions with a strong incentive to take remedial measures to raise equity long before they face the risk of insolvency.

As recognized by D’Souza et al. (2009), the incentive to issue equity pre-emptively is strengthened when the size of CoCos is large, when the trigger is credibly and observably based on market prices at a high ratio of equity-to-assets (long before concerns about insolvency arise), and when the conversion ratio is dilutive of existing common shareholders (creating a conversion dilution “sword of Damocles” that makes the prospective dilution from issuing pre-emptive equity into the market appear desirable by comparison). Under those conditions, a SIFI experiencing significant loss and approaching the neighborhood in which dilutive conversion would be triggered, would choose to issue significant equity into the market, possibly combined with asset sales that would raise the market value of its outstanding equity relative to assets, thereby avoiding the conversion trigger.

To be effective for this purpose, a large amount of CoCos must be required (otherwise the threat of dilution from conversion will not be as great), 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 pre-emptive 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.

D'Souza et al (2009) emphasize that CoCos designed to result in substantial dilution upon conversion not only encourage banks to voluntarily raise pre-emptive equity capital to avoid CoCo conversion; they have another practical advantage as debt instruments: the strong incentives for management to avoid conversion mean that CoCos are likely to trade more like fixed income instruments than ordinary convertibles. Thus CoCos are likely to hold greater appeal to institutional investors⁶, who tend to prefer low-risk debt instruments.⁷ In Huertas' colorful phrase: “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 dilution” (2009, p. 5).

Given the strong incentives embedded in our version of CoCos to promote timely equity offerings, we believe our CoCos would almost never actually convert into equity. They would play little role in “bail-ins” or in signaling CoCo holders’ losses (which, in equilibrium, 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 a la Enron), then the SIFI likely would be unable to avoid conversion through a pre-emptive 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 to do so.

⁶ Some insurance companies and bond mutual funds, who have been substantial holders of sub 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, and so this does not seem like an insuperable constraint.

⁷ D'Souza et al (2009) run simulations to show that the strong incentives for CoCo issuers to avoid conversion would make conversions extremely rare and thus they would have yields quite close to traditional subordinated debt.

Not only would the corrective action of a pre-emptive stock issue or asset sale preserve high ratios of equity to assets in the wake of significant shocks ex post, 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 who are diluted by the conversion be calling for his head, but he would also face an onslaught of sophisticated new block holders of stock (institutional investors who formerly were CoCo holders) who are likely to be eager to sack senior management for their demonstrated incompetence.

The literature on CoCos has become vast in a short period of time (see Murphy and Willison 2011 for a review). For example, research by Doherty and Harrington (1995), Flannery (2005), Kashyap et al. (2008), D'Souza et al. (2009), Huertas (2009), Duffie (2009), Pennacchi (2010), Pennacchi et al. (2010), Bolton and Samama (2010), and Hart and Zingales (2010) has highlighted the potential value of requiring some form of contingent equity capital infusion for banks via either conversion of existing debt, insurance contracts, or a rights offering as a buffer against loss. The Dodd-Frank Act mandates the Fed to study the scope for use of some minimum amount of contingent capital as part of regulatory capital requirements. The Basel Committee on Banking Supervision (2011) has set out standards that CoCos must meet to qualify as Tier 1 or Tier 2 capital. The Swiss have specified a requirement for CoCos. Several banks have begun issuing one or another version of them. The European Commission (2011) has proposed standards for debt bail-ins to avoid the use of taxpayer funds. Requiring a minimum amount of subordinated debt instruments that convert automatically into equity in adverse states of the world, and prior to reaching the regulatory insolvency intervention point, has been embraced by

numerous regulators as a credible means to promoting market discipline, which would have several advantages relative to traditional subordinated debt (sub debt).⁸

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 potential, politically-charged issue of deciding whether to impose losses on debt holders after intervention -- something most regulators were reluctant to do in the recent crisis. Since the CoCos will have already converted to equity, they will share in any losses suffered by equity holders, and so the issue of imposing loss is removed from consideration.

⁸ 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, publicizes market perceptions of default risk. This 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 particularly useful as indicators to policy-makers 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: (1) banks will have to react to supervisors' concerns by limiting their risks and raising their equity capital once they suffer losses that increase their default risk on debt; (2) banks that are unable to prevent continuing deterioration in their condition will be subject to credible Prompt Corrective Action to prevent them from becoming deeply insolvent. Indeed, the advocates of sub debt requirements, therefore, traditionally have 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 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 Fed 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 this 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 important 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 2005-2007, 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 that sense, the failure of sub debt to signal problems could simply reflect correct expectations by market participants that the debts they were holding were not effectively at risk.

CoCos, unlike straight subordinated debt, credibly will protect deposits against loss in adverse times.

Second, because CoCos would credibly remain in the bank and suffer losses in insolvency states, *ex ante*, 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 conversion is triggered, CoCos will provide a better buffer against losses to depositors, counterparties and senior debtors, than subordinated debt, since they will cease to accrue interest once they convert and therefore alleviate liquidity pressures on the bank to some extent.

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

Of course, if an institution waits too long, or if it experiences a sudden, dramatic loss of market confidence (as in the Enron collapse) it may find that equity markets are closed to it or 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 neighborhood is reached long before insolvency (a time when it may be too late to issue new shares).⁹

⁹ 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, they will not be keen to buy them when the prospect of a

IV. Setting an Appropriate Trigger, and Related Questions

An appropriate trigger must be accurate, timely, and comprehensive in its valuation of the issuing firm (D'Souza et al 2009). And the trigger 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. This latter point has been emphasized by the ratings agencies that refuse to rate CoCos in which the conversion is contingent upon the decision of a regulator or bank management.

Some proposals for contingent capital (e.g., D'Souza et al 2009; Hart and Zingales 2010) assume that book values of the institution's equity relative to its assets would be the appropriate conversion trigger for CoCos. But book value is an accounting concept, subject to manipulation and, inevitably a lagging indicator of deterioration in a bank's balance sheet.¹⁰ The problem of using book value as the trigger is not just one of managerial dishonesty.¹¹ As we have argued above, regulators and supervisors have shown time and again that they are hesitant to opine negatively about SIFIs in a way that will become public. Such forbearance leads to protracted delays in recognizing problems. Thus, a central purpose of employing non-equity capital is to reinforce official supervision with market discipline.

What market-based measures could be employed as the trigger? The two obvious candidates are CDS spreads and stock price movements. CDS markets seem less desirable for the

haircut is near. In that neighbourhood, equity issues may also 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, and which dilute stockholders in favour of debt holders, do not suffer from this problem.

¹⁰ 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.

¹¹ And the complicity of accounting firms in window-dressing transactions as shown in the Lehman Brothers case.

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 that same spread observed at another time under a different set of business conditions (see, for example, Bekaert, Hoerova, and Lo Duca 2010).

Equity values, if used properly, would provide the best source of information to design a trigger. Indeed, some of the best-known cases of the failures of large firms that surprised rating agencies and regulators were signaled long in advance by *severe and persistent decline in the aggregate market value of their equity*. KMV's rating of Enron's debt was the only rating that correctly predicted a severe probability of default. The reason for its success was that the KMV model was based on the Black-Scholes approach to measuring default risk as a function of leverage (measured using market values) and asset risk (also derived from observed stock returns volatility). Similarly, market value information about Lehman provided an early warning of its problems. Valukas (2010) shows that the market value of Lehman's equity as a percentage of the derived market value of assets¹² was slipping over time during the spring and summer of 2008 so that it was actually negative on several occasions in July and August of 2008. If Lehman had been required to issue CoCos with a trigger based on its market value of equity, this substantial and protracted market decline in the equity value of Lehman would have produced conversion of debt into equity long before insolvency. (See Figure 1.)

[Insert Figure 1 about here.]

¹² The Valukas Report (2010) derived the market value of assets by adding together the equity market capitalization and the market value of liabilities, making use of the balance sheet identity to infer the market value of assets.

As we have noted, the existence of a properly designed CoCo requirement would also incentivize all financial firms to voluntarily raise equity capital in large amounts before hitting the CoCo trigger. Lehman postponed a significant raising of equity capital during the summer of 2008, apparently in the belief that the crisis would pass and its share price would rise. If it had faced the prospect of CoCo conversion, its behavior during the summer of 2008 likely would have been quite different. D'Souza et al (2009) show that even under extreme assumptions about the potential decline in share prices in reaction to the announcement of an equity offering, the dilution effects on stockholders could be much less from an equity offering than from a triggered conversion, provided that the CoCos subject to conversion are of sufficient size and provided that they convert on sufficiently favorable terms to the holders of the CoCos. Managers who are maximizing the value of shareholders' claims in the firm will 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, *so long as the dilution effect of the CoCo conversion is sufficiently large*. Even managers that are not maximizing shareholder value, per se, will want to avoid the potential corporate governance consequences of a massive CoCo conversion, which would almost assuredly lead to a shareholder revolt to oust them, which would be facilitated by the presence of newly converted and concentrated holdings of shares held by sophisticated institutional investors.

Of course, there is cause for concern that stock market prices may be unreliable measures of true value. Declining equity values are only reliable as rough measures of a SIFI's health if they are sufficiently persistent and severe, and even then, they offer only a rough indication of the firm's financial health. Fortunately, that indication is good enough to serve as an effective trigger for CoCos. We suggest employing a 90-day moving average of the ratio of the market

value of equity relative to the sum of the market value of equity plus the face value of debt to smooth fluctuations in share prices and reduce the noise in market value signals.¹³ We define this ratio as the quasi market value of equity ratio, or QMVER. This would also make it more difficult for speculators to force a CoCo conversion through a coordinated bear run on a bank's stock.¹⁴ Figure 2 provides an example of the smoothing effect of the 90-day moving average on the QMVER of Citigroup and JPMorgan Chase during the period April 2006 - April 2010.

[Insert Figure 2 about here.]

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 is the comprehensive measure of value, which includes, in principle, the value of tangible and intangible assets as well as off-balance sheet positions).

Because 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 tradeoff between the greater timeliness of a short

¹³ Given the practical difficulties of pricing bank debt on an on-going basis, and given the fact that, in equilibrium, the structure of CoCos we propose would result in little risk of conversion, we believe 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, 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.

¹⁴ Albul, Jaffee, and Tchistyi (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 sufficiently high 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 sufficiently low 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.

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 policy makers to respond to low-frequency disruptions (like 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 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 variance of those returns, and therefore, 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 the potential effects of dilution – both from CoCo conversion and from pre-emptive equity offerings to prevent CoCo conversion – would factor into both the pricing of CoCos and bank equity in the presence of a CoCo requirement. 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 particularly unreliable in detecting small valuation changes over short periods of time. They may also be subject to manipulation. For these 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 the ratio of the market capitalization of the bank to the quasi-market value of the bank falls to 4%. Assuming that 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? The long moving average, the liquidity of the equity market, and the ability of banks to issue equity in response to price declines (which we discuss further in Section VI below), we believe, 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 non-bank institutional investors, and requiring that any such investor be prohibited from simultaneously holding a bank's CoCo and shorting its equity

position. That prohibition would not limit short-selling in a bank's equity, but it would prevent CoCo holders from coordinating a short-selling strategy designed to force CoCo conversion.

Many policy-makers 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 paper, 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 incentivize firms to raise capital during booms, when they can do so most cheaply and when it will constrain growth. Similarly, it would allow firms to reduce outstanding CoCos somewhat in recessions, if they experience cyclical declines in the size of their balance sheets.

Because the trigger for CoCo conversion would occur while the SIFI is still demonstrably solvent, and because preemptive equity issues prior to hitting the trigger would result in further increases in equity, it is arguable that the CoCo requirement would make insolvency extremely unlikely. Nevertheless, unusually severe shocks do occasionally happen and, thus, 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.

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 4% ratio again after the recapitalization achieved by the CoCo conversion.

If CoCos convert, how quickly should the firm have to reissue a new batch of CoCos? Under our proposal, CoCo conversion would only happen for firms that experience a sudden and

lasting loss of the confidence of the equity market. These 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 (see also Flannery 2009a).

Should CoCo conversion be triggered by system-wide losses of capital or other macro-economic indicators? While indexation of bank debts to system-wide states of the world can be justified from a variety of perspectives (Diamond 1984, Hellwig 1998, Gersbach 2010), for CoCos to incentivize the appropriate management of risk and capital at each bank, there should 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 type we envision.

V. 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 quantity, especially relative to the amount of equity capital required (since relative dilution is key to ensuring pre-emptive offerings of equity). For that reason, we suggest – alongside a roughly 10% requirement for the ratio of the book equity relative to book assets – a similar magnitude for the required ratio of CoCos relative to book assets. For purposes of seeing 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.¹⁵ Under

¹⁵ The crisis showed that the definition of the numerator, the risk-weighted denominator and the minimum

these assumptions – employed only for illustrative purposes – 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. This 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 pre-emptive equity offerings, the conversion ratio should be set such that stockholders face significant dilution from conversion. Conversion should require a sufficient number of shares per face value of CoCos such that the market value of shares received is greater than the face amount of the CoCos.¹⁶

To be concrete, 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 (summarized in Table 2): Commensurate with the current Basel III book equity

acceptable ratio were completely inadequate. Nonetheless, for this retrospective examination of the crisis it is interesting to see whether the quasi-market value 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.

¹⁶ Two issues of Contingent Capital - one by Rabo Bank (a cooperative) and the other by Lloyds - have proven to be significantly more expensive than subordinated debt. But it is important to note that these issues present a very different incentive to the managers than what is contemplated in this proposal. In the case of Rabo Bank, 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. On the other hand, the Lloyds deal was part of an exchange in stressed circumstances. Moreover, the issuance of these bonds during the crisis probably increased their cost. A more interesting experiment is the February 2011 issue of CoCos by Credit Suisse. This issue is made by a bank that fared comparatively well during the crisis and is designed to buttress the new Basel III capital requirements. Although many institutional investors (especially regulated insurers and bond mutual funds), who 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, Credit 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 (Hughes, 2011) “ the...price anomalies inherent in a nascent market.” Clearly the traditional holders of hybrid capital 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 Credit 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 Credit Suisse should fall below 7%. Credit Suisse received orders exceeding 11 times the amount on offer.

requirement for SIFIs – which envisions as much as a 9.5% tier one equity requirement relative to risk-weighted assets – we propose that the amount of CoCos be set at 10% of book 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 (relative to face value). We suggest an 8% QMVER trigger for CoCo conversion based on a 90-day moving average.

VI. Does Our CoCos Proposal Suffer from a “Multiple-Equilibrium” Problem?

Some authors have challenged whether CoCos of the type we propose are feasible. In particular, Sundaresan and Wang (2010) – hereinafter SW – argue that CoCos with market value triggers can suffer from a multiple-equilibrium problem unless conversion is carefully designed to avoid any dilution of pre-existing common stock holders. 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 conclude that such multiple equilibria in share prices can make it impossible to price CoCos and 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 conclude, therefore, that CoCos should not both (1) be based on market equity triggers; and (2) convert into equity at ratios that favor CoCo holders (i.e., 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). That conclusion, as applied to our proposed CoCo requirement, is incorrect, but their analysis helps to motivate the specific design features of a proper CoCo requirement, which we develop here.¹⁷

¹⁷ 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 requiring conversion (as in Bolton and Samama

Following SW, assume a bank with the following (all values are defined in market value): assets=\$100, senior bond (or deposits)=\$80, CoCos=10, and one share of equity exists, and the total initial market value of equity is \$10. In the absence of a CoCo, the bank's equity share would be valued at \$10, but 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. Assume that the CoCo conversion trigger is set based on a market value of equity of 5% or less of assets, which in their example translates into a stock price at \$5 per share or less. The conversion ratio is assumed to be dilutive of pre-existing shareholders. Specifically, assume that the \$10 in CoCos converts into 3 shares of stock if the stock price is \$5 (the trigger price) – a non-dilutive conversion would require a conversion ratio of CoCos into 2 shares of equity when the equity price is \$5. SW show that there are two rational expectations equilibria: one where the stock price is \$10 per share and no conversion takes place, another where the stock price is \$5 and conversion takes place.

These are both rational expectations equilibria because expectations are fulfilled by equilibrium prices. If the market believes that the price should be \$5 per share, conversion will happen, the new number of shares will be 4, so the original owners of the bank, who owned 100% of the bank's equity prior to conversion now own only 25%. The new amount of equity will be \$20, since \$10 in CoCo debt has been cancelled upon conversion. The price per share of equity will be \$5. If the market believes that the price should be \$10, then conversion will not

2010). Those design choices are problematic. As we have already noted, a book value trigger depends on managerial and supervisory behaviour (which is not reliable) and thus makes the probability of CoCo conversion difficult to quantify. Given 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 from adding new capital to the bank. Furthermore, in a model where banks have the option to convert, the existence of CoCos will tend not to incentivize 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.

occur (since the market value of equity does not hit the 5% trigger). There are two rational expectations equilibria: if the market believes the price is \$5 per share, then that belief will turn out to be true, and if the market believes the price is \$10, then that belief will turn out to be true.

Note, however, that this example from SW makes another significant, implicit assumption: that the market knows that the bank would undertake no action to prevent the low-stock price equilibrium of a \$5 share price from occurring. In other words, SW implicitly require that the bank refrain from issuing new equity into the market 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. Make all the same assumptions employed by SW, but add two additional assumptions: (1) 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; and (2) the use of a moving average trigger, where the triggering of conversion only occurs 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, say, at any price between \$10 and \$5 a share. To be concrete, 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 a \$5 share price 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 will 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, and 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. Clearly, the bank will want to announce and follow this share-issuance policy, since it would avoid the dilutive conversion of CoCos that occurs in the lower price equilibrium.¹⁸

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, requiring, as in the above example, 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 be sufficiently long to allow management the time to arrange for a pre-emptive equity offering to prevent conversion. We believe that a 90-day moving average would allow plenty of time for a stock offering. In

¹⁸ It is surprising that SW omitted this possibility from their discussion, since 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 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.

empirical evidence below, we show that using a 90-day moving average during the crisis of 2007-2009 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 this 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 (requiring banks to maintain a significant proportion of their balance sheet financing in the form of CoCos), with a dilutive conversion ratio, 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.¹⁹

VII. How the CoCos Requirement Would Have Worked in 2007-2008

Figure 3 illustrates how the proposed CoCo trigger would work. As the QMVER falls, approaching the trigger, a firm like A (line A) would issue equity (or sell assets) to avoid hitting the trigger. 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). This will result in massive dilution of existing shareholders, who will undoubtedly be angry, and the new shareholders who formerly held CoCos may be unhappy as well. Shareholder dissatisfaction on this scale is likely to lead to an

¹⁹ Our solution to the multiple-equilibria problem is different from that of Pennacchi, Vermaelen and Wolff (2010) and Pennacchi (2010). In their 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.

ouster of the existing management and the installation of a new management team 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 further motivation to management to take corrective action before reaching the trigger.

[Insert Figure 3 about here.]

This doubling of capital and reduction in liquidity pressures (and perhaps a new management team) may buy the firm enough time to successfully restructure. Finally, a firm C may be unable to use the additional capital and time to accomplish a restructuring or recapitalization, and so its value would continue to decline until Prompt Corrective Action is triggered (line C).

Figure 4 shows the movement of the ratio of market cap to quasi-market value of assets from April 2006 to April 2010 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, not what would actually have happened if all institutions had been subject to a CoCo requirement.²⁰ Note that none of these institutions fell below the 4% ratio. If the CoCo requirement had been in place, only Goldman Sachs and Met Life might have triggered a conversion. The prospect of dilution, however, would have almost certainly caused the managers of both firms to issue more equity or sell assets to avoid hitting the trigger.

²⁰ 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, as that probability would increase, 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. These 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).

Contrast Figure 5, which shows the movement of the ratio of market cap to quasi-market value of assets ratio for 10 banks that required substantial government support, were forced to merge, or entered bankruptcy, with Figure 4, which shows the comparable ratio for banks that did not require substantial government support. Note that all of these firms breached the 4% ratio and in most cases did so many months before they were subject to intervention. It is particularly 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 these firms to higher standards of risk governance and 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.

[Insert Figures 4 and 5 about here.]

Note that Figure 6 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.

[Insert Figure 6 about here.]

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 2008-2009 crisis. Moreover, each of these institutions would have faced strong incentives preemptively to strengthen the corporate governance of risk and, 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 these firms.

Would the proposed CoCo requirement have reduced the damage from the two largest failures - AIG and Lehman Brothers? Although counterfactuals are speculative by definition, there are at least three reasons to believe that such a system would have been effective if AIG and Lehman Brothers would have 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 6-8 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. Even if they had hit the conversion trigger, however, 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 authorities of impending trouble so that there would have been no necessity 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 they faced in a resolution.

Since regulation of capital and supervision has proven so ineffectual, it is high time to try 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.

VIII. Conclusion

We develop a proposal for a contingent capital (CoCo) requirement. We show that CoCos can play a unique 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 CoCos 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. Consequently, it can also provide strong incentives for effective risk governance by regulated banks, and can reduce forbearance (supervisory reluctance to recognize losses).

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

The emphasis on the need to incentivize 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 maximally effective, (a) a large amount of CoCos (relative to common equity) should be required; (b) CoCo conversion should be based on a market value trigger, defined using a moving average of a “quasi market value of equity ratio” (QMVER); (c) all CoCos should convert if conversion is triggered; and (d) the conversion ratio should be dilutive of preexisting equity holders. We summarize the details of our proposal in Table 2.

Our proposed CoCo requirement does not suffer from a potential problem of multiple equilibria. 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. Arguably, if a CoCo requirement had been in place in 2007, the disruptive failures of large financial institutions, and the systemic meltdown after September 2008, could have been avoided.

Table 1. A Selective Survey of the Literature on Critical Features of CoCos

<u>Author(s)</u>	<u>Amount of CoCos Required to Be Issued</u>	<u>Trigger for Conversion</u>	<u>Terms for Conversion</u>
Doherty & Harrington (1995)	Uses 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 example, this appears to be the same proportion as that of Core Tier 1 Capital to risk weighted assets.	Finding by regulators that 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 et al (2009)	The amount issued should be large enough so that the firm can be recapitalized even in dire circumstances. (Back tests suggest that CoCos equal to 6% of RWA would have avoided government intervention in the 2007 - 2009 crisis.)	A “true” measure of capital above the solvency point. 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)	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 hit trigger.	Trigger could be tied to deterioration in the condition of the specific bank and/or to the banking system as a whole. Could be tied to regulatory measures of capital, but prefers market measures because tend to lead regulatory-based measures.	“The conversion terms could be generous to the holder of the contingent capital instrument. “ Conversion terms should be set so that debt holders could expect to get out at or close to whole –at par value.
Duffie (2009)	Assumes the full amount should be converted when the trigger is hit.	The trigger that converts debt to equity should be set to eliminate the debt claims before a liquidity crisis is likely to begin & with a strong enough impact on the balance sheet to forestall a self-	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.)

		fulfilling presumption of a liquidity crisis. Rejects 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.”	
Flannery (2009)	Uses term “Contingent Capital Certificates” (CCC). Firms would not be required to issue, but CCC could be used to offset the required amount of equity capital. Some of the CCC would be converted to equity to replace lost equity value. Supervisors determine minimum equity capital ratio and trigger point. SIFIs cannot hold any CCC for their own account. Since conversion may be partial must rely on an allocation mechanism: (1) Convert shortest remaining maturities first; (2) Sell with various seniorities so that some bonds must convert fully before others can begin to convert; (3) Select bonds randomly within a common-maturity or common seniority tranche; (4) Select CCC by lottery.	Would convert into equity if firm’s capital falls below some critical, pre-specified 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 crossed. If firm is insolvent (because of a sudden collapse in asset prices, covenants in CCC 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: (1) The system is in crisis based on objective indicators such as aggregate bank losses; and (2) 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.
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	2 triggers: (1) Declaration by regulators the financial system is suffering from a systemic crisis; and (2) the bank is in violation of bank covenants in CoCo contract, suggest ratio of Tier 1 capital to risk-	Fear that a conversion rate based on market values would trigger market manipulation. Prefer to convert each dollar of debt into a fixed quantity of equity shares rather than a fixed value of equity.

	CoCos are converted.	weighted assets.	
Hart and Zingales (2010)	Reject CoCos because argue that by limiting defaults, they 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. Instead argue 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% on average over the previous month. Express concern about finding an appropriate CoCo trigger. If based on accounting numbers will lag actual deterioration in bank assets. If triggered when market prices are low, manager 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%.
Albul, Jaffee & Tchisty (2010)	Full amount will be converted. Also stipulate that CoCos be substituted for straight debt. Amount converted not specified.	When capital reaches a "distressed level", but regulatory benefits are greater, the higher the trigger at which conversion occurs	No exact ratio, but 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 initial value equal to the initial value of equity. All will be converted when dual triggers are hit. 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: (1) the bank's shareholders' equity price must fall below a threshold; <u>and</u> (2) an index of financial firms' stocks must also breach a pre-specified threshold. Rationale: 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. Expresses concern that unprofitable stock price manipulation might create a profit if trader also holds a position in market-triggered CoCos. 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 was at par. To correct for this, a higher threshold should be used if conversion is at less than par than when conversion

		<p>is at par.</p> <p>If a bank's asset returns follow a pure diffusion process without jumps and fixed coupon CoCos convert to equity at the par value of the CoCos, then the yield to maturity equals the comparable Treasury yield. But the possibility of conversion before maturity will lead to a smaller yield if the Treasury yield curve is upward sloping. But if assets follow a jump process, default risk is positive and CoCos will have a positive credit spread. This will be higher, the lower the value of shareholders' equity at which conversion is to occur and the larger the conversion discount from the bond's par price trigger. The bank's risk shifting incentives increase when CoCos are designed to convert at a discount from par value or convert at a lower shareholders' equity threshold. Note that the proposal of Canada's superintendent of financial institutions that the conversion trigger for contingent capital should be when the regulator is ready to seize control of the institution because its problems are so deep that no private buyer would be willing to acquire shares in the bank implies that new issues yield on contingent capital will be very high. 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</p>
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			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 so 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% of CoCos might be converted with a 25% decline in share prices since the time the CoCos were issued. Another 25% would convert if the share price decline reached 50% and the balance would convert if the share price fell by 75%.	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 risk pressures for excessive risk taking.
Sundaresan & 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 transfers between equity and CoCo holders. They conclude only one conversion ratio is an equilibrium and it depends on the design of the CoCo. The CoCo must be designed such 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 stock price at which mandatory conversion will occur.
Swiss State Secretariat for International Financial Matters (2011), Swiss Commission of Experts (2010)	Envisions two kinds of CoCos with two different triggers. Up to 3% of Buffer capital (=8% of risk-weighted assets) may be comprised of CoCos. The Progressive component of capital requirements is to be comprised of 6% CoCos. This leads to a total capital requirement of 19% of RWA comprising at least 10% common equity and up to 9% CoCos.	CoCos with a trigger of 7% of risk weighted assets serve as a capital buffer. CoCos with a trigger of 5% of RW 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 not specified explicitly. Appears to be 1 for 1.

Table 2. Summary of Key Features of Proposed CoCo Requirement

<u>Requirement or Feature</u>	<u>Recommendation</u>
Primary Goal	Prompt Recapitalization
Minimum Amount of CoCos	10 percent of book value of assets
Trigger	QMVER of 8 percent, using a 90-day moving average of market value
Conversion ratio	5 percent dilutive of stockholders relative to face value
Conversion amount	All CoCos are converted on hitting the trigger
Holders	Qualified institutional investors holding; no short equity positions in the common equity permitted
PCA trigger	if 8 percent trigger is breached twice
Time to replace converted CoCos	One year

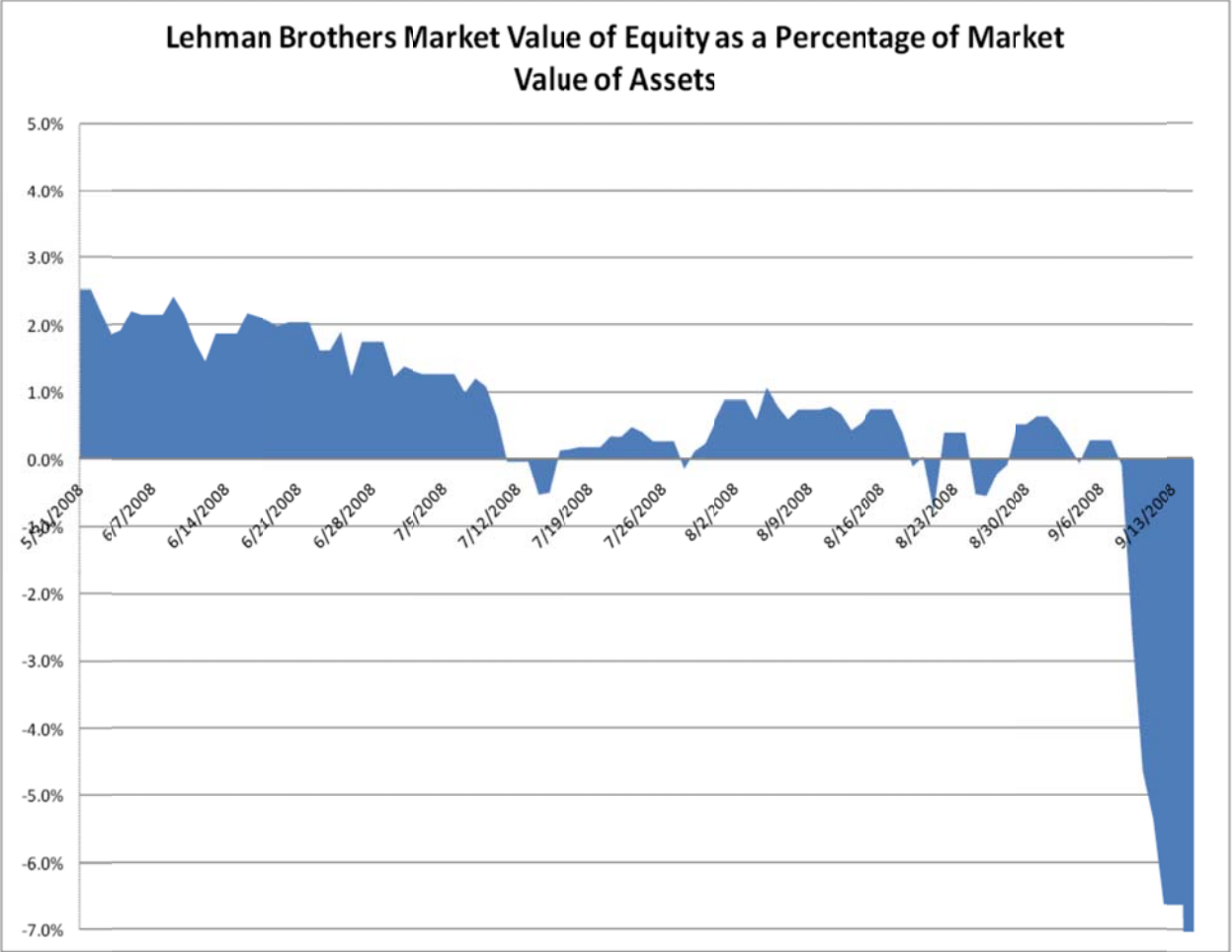


Figure 1. Lehman Brothers Market Value of Equity Relative to Assets

Source: Valukas Report (2010, volume 5, p. 1581.) The Market Value of Assets was measured indirectly by adding together the market value of equity and the market value of liabilities.

Effect of Using Rolling 90 Day Market Cap

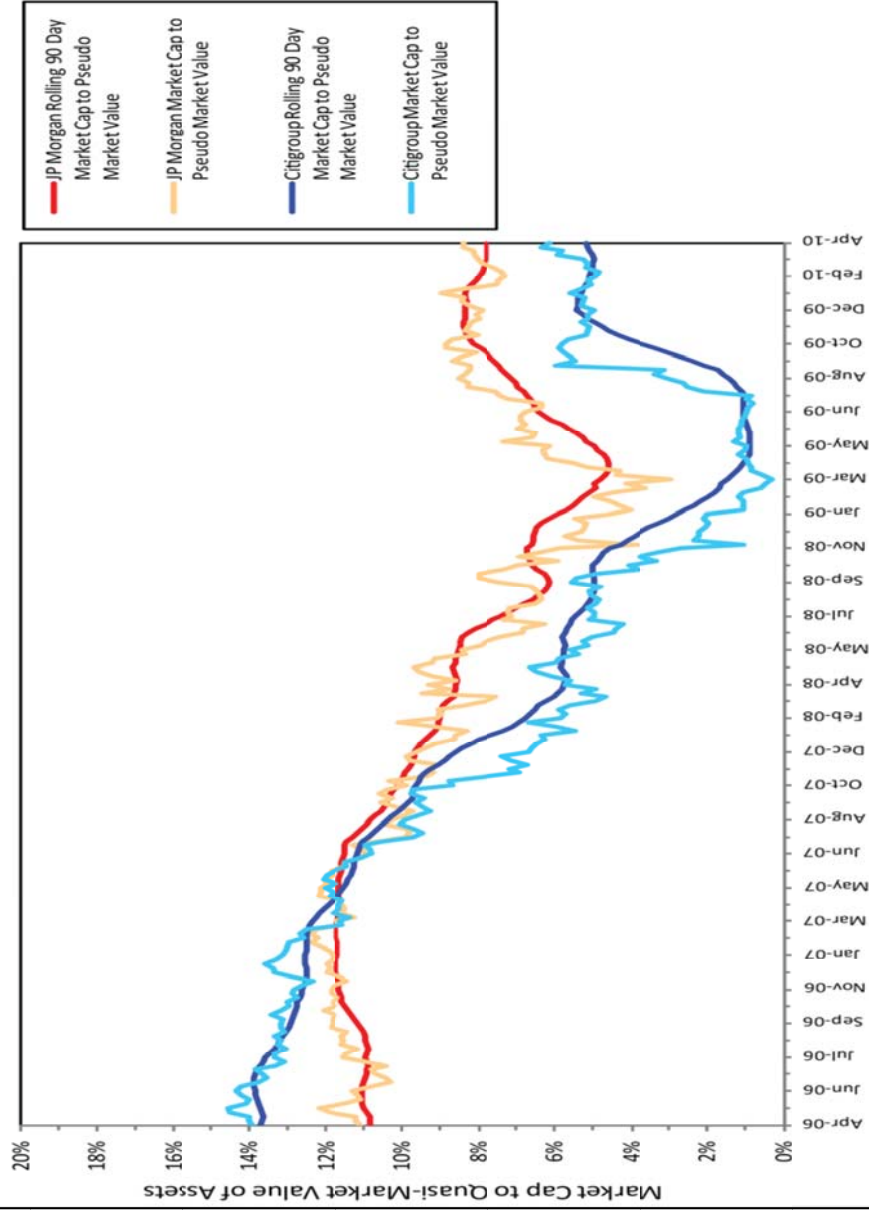


Figure 2. The Impact of a 90-day Rolling Average on Smoothing Volatility in Market Prices

How a CoCo Trigger Might Work

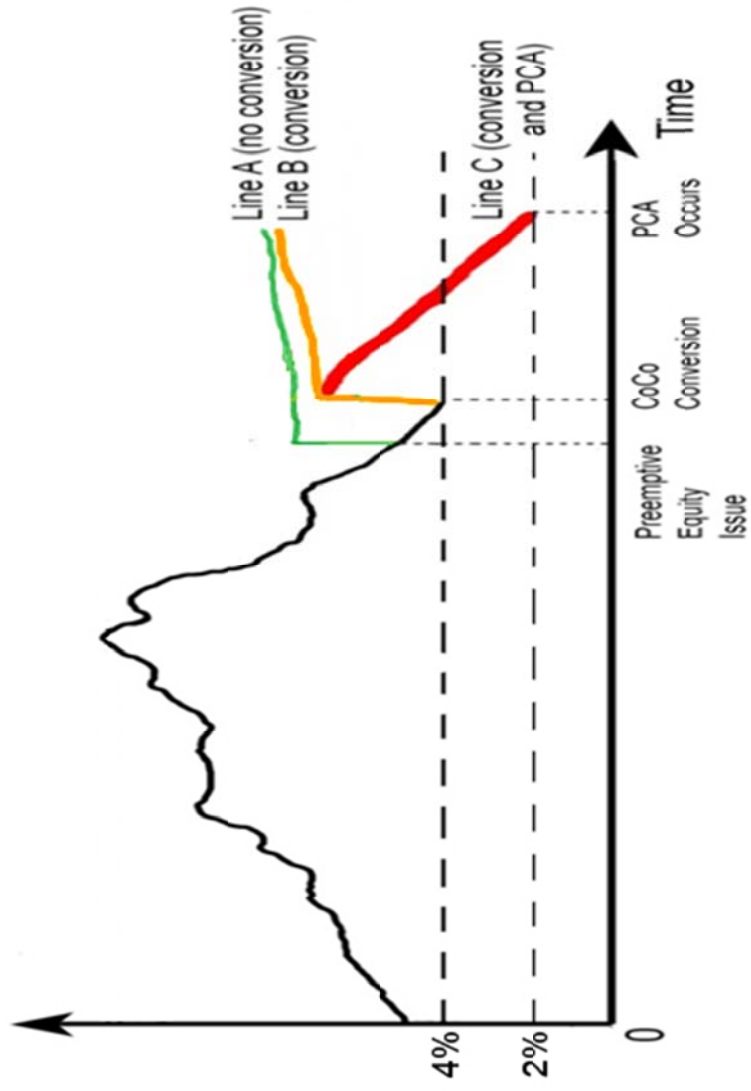


Figure 3. How a CoCo Trigger Might Work

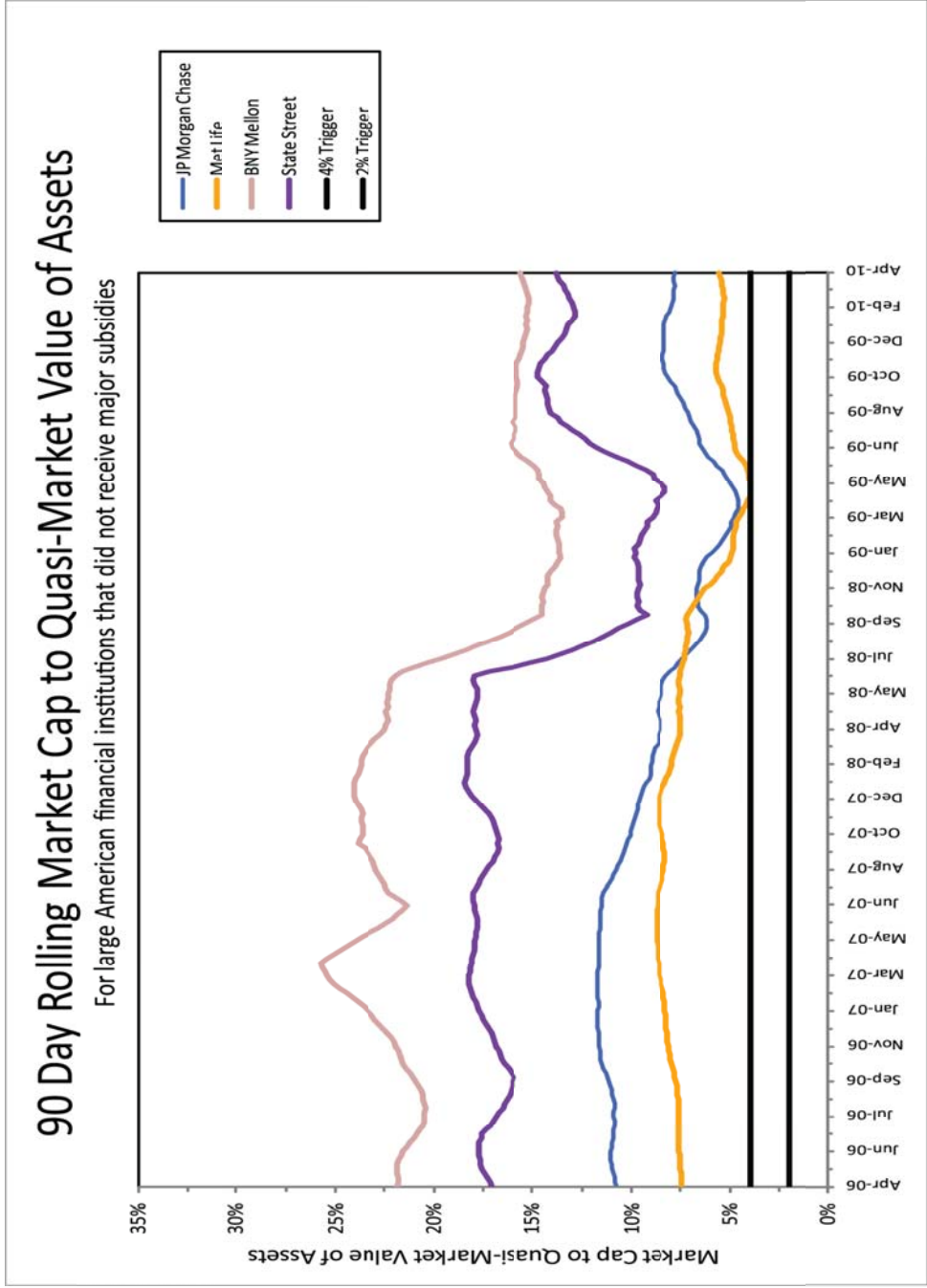


Figure 4. How a 2% CoCo Requirement Might Have Worked for U.S. SIFIs that Did Not Require Intervention

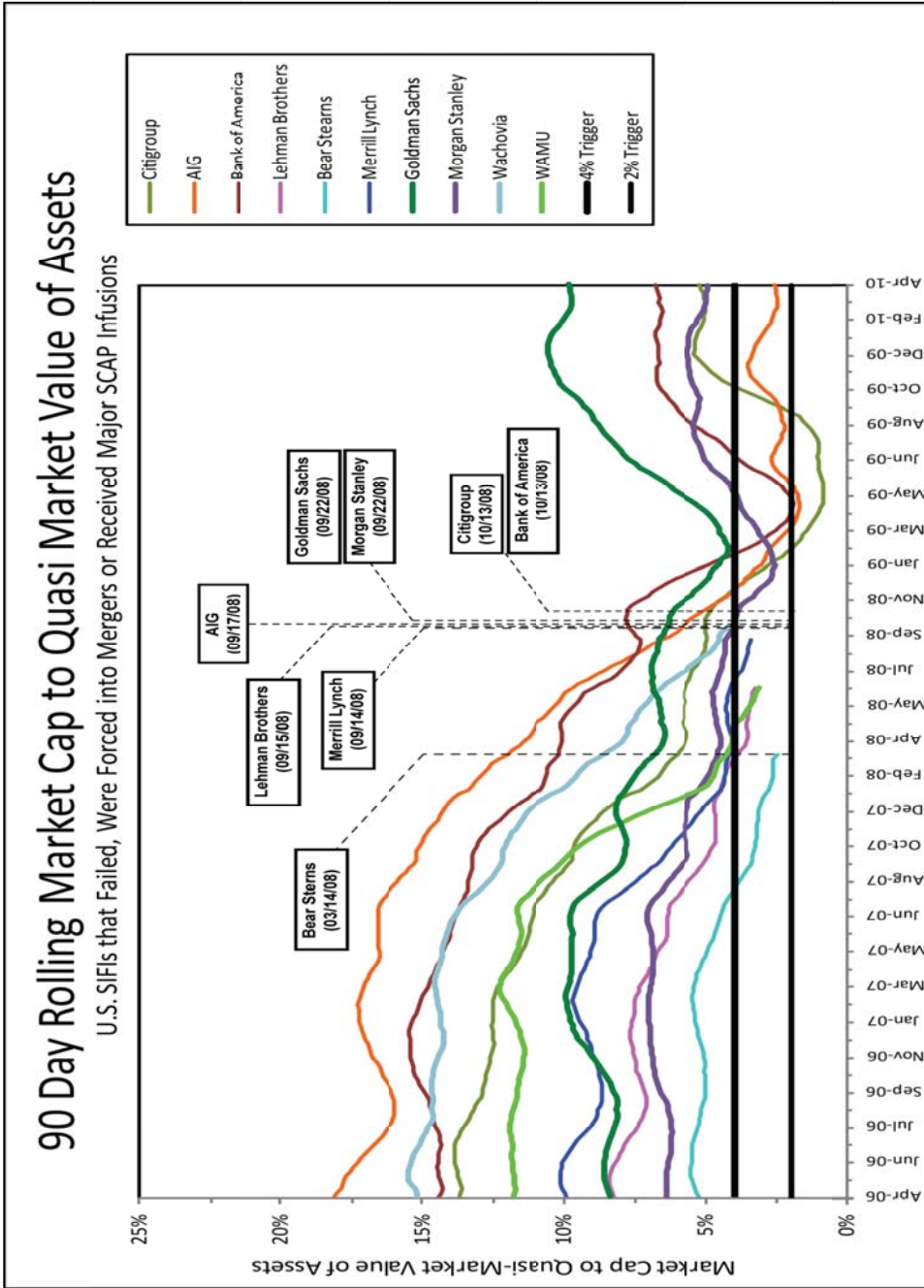


Figure 5. How a 2% CoCo Requirement Might Have Worked for US SIFIs that Did Require Intervention

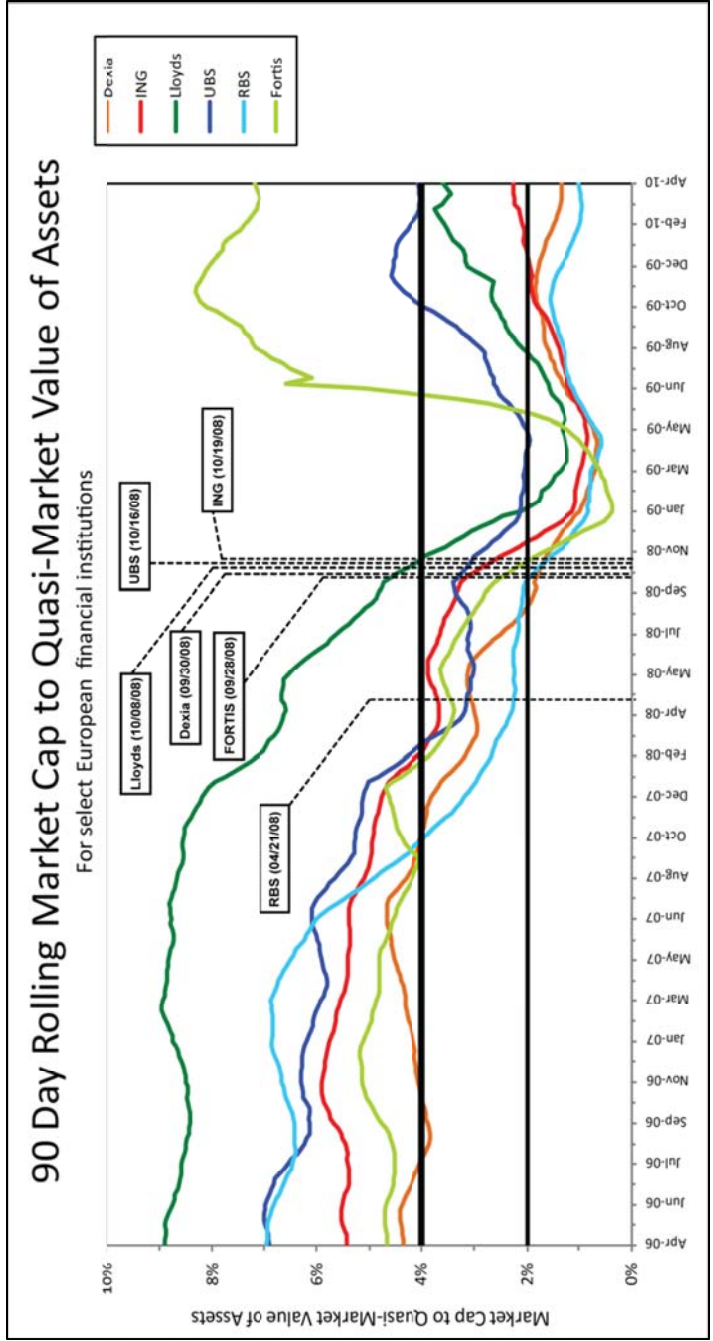


Figure 8. How a 2% CoCo Requirement Might Have Worked for Foreign SIFIs that Did Require Intervention

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