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# Contingent Capital: An In-Depth Discussion*

STAN MAES[†,‡] – WIM SCHOUTENS[§,¶]

*Regulators have embraced the idea of pre-arranging bank recapitalizations through (funded or unfunded) contingent capital issuance. Contingent capital is intended to be triggered when a bank is headed toward failure to provide an automatic equity injection that keeps the bank out of distress. This note discusses counterparty risk, effectiveness, moral hazard, contagion and systemic risk, as well as death-spiral issues arising from the hedging strategies of the investors. We pay attention to important design issues with respect to the trigger and conversion ratio and comment on their pricing from an equity and credit derivative perspective.*

*(J.E.L.: G12, G13, G21, G28, G32)*

## 1. Introduction

The modern banking sector is characterized by too-big-to-fail (TBTF), moral hazard, the absence of market discipline, and contagious bank failures. But these characteristics have become increasingly important over time as banks increased their importance and interconnectedness whilst – paradoxically – reducing their self-insurance through lower capital and liquidity ratios (see Haldane and Alessandri, 2009). These long term balance sheet trends and corresponding characteristics incentivise banks to take excessive risks, resulting in financial inefficiency and instability. Banks will be reluctant to voluntarily give up their TBTF status, as it would result in higher funding costs, lower profitability, and more market discipline. The unprecedented state aid granted to banks in the wake of the Lehman

[†]European Commission (EC), DG Competition, Chief Economist Team, 59 Rue Joseph II, 1000 Brussels, Belgium. E-mail stan.maes@ec.europa.eu

[‡]Catholic University of Leuven, Faculty of Business and Economics, Naamsestraat 69, B-3000 Leuven, Belgium

[§]Catholic University of Leuven, Celestijnenlaan 200B, B-3001 Leuven, Belgium. E-mail: wim@schoutens.be

[¶]Corresponding author: Wim Schoutens, Catholic University of Leuven, Celestijnenlaan 200B, B-3001 Leuven, Belgium. E-mail: wim@schoutens.be

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Brothers bankruptcy – be it in the form of capital injections, government guarantees on bank debt, or asset relief – has further increased the root problems of TBTF and the corresponding absence of market discipline.

With the recent experience in mind, there is an urgent need to reduce bank incentives to take socially excessive risks (while relying on a government safety net) and to reduce the likelihood of a disorderly bank failure (with the corresponding massive negative externalities). On the global level, a host of solutions are currently being proposed, discussed, and implemented. All proposals can be slotted into two distinct groups. A first group of proposals bluntly *rejects* the possibility of banks being TBTF any longer by trying to construct a middle ground between a disorderly and hence costly bankruptcy and a costly bailout. Proposals here include the setting up of special bank resolution and/or living will regimes and the bank break-up proposals.[1] A second group of proposals allows banks to *remain* TBTF, but aims to avoid at all cost that TBTF banks will fail, i.e. become insolvent and illiquid, ever again. The Basel III proposals (capital surcharges, raw leverage caps, etc.) all belong to this second group of solutions. Contingent capital also belongs to that second group of solutions that allows for the existence of TBTF institutions but wants to avoid their failure taking place. In fact, we will argue below that the obligatory issuance of government-purchased contingent capital instruments would in a way *institutionalize* the TBTF label of certain banks.

The remainder of this section introduces the reader to regulatory bank capital, defines contingent capital, discusses its merits, and lists some examples of recent issuances.

### *1.1 A Primer on Regulatory Bank Capital*

Because even solvent banks are vulnerable to destabilising bank runs (Diamond and Dybvig, 1983), explicit deposit guarantee schemes have been put in place already decades ago. Besides these explicit insurance schemes, banks over time also have increasingly enjoyed implicit guarantees given their increasing importance and interconnectedness and reduced self-insurance. To avoid that banks would take excessive risks following these implicit and explicit guarantee schemes and the corresponding absence of market discipline (moral hazard), banks are subject to regulation imposing (risk-based) minimum capital requirements and supervision.

[1] Special resolution regimes aim to reduce the burden on the state (and taxpayers) by imposing some losses on selected unsecured senior debt holders, whilst avoiding the financial instability of an ordinary bankruptcy procedure (similar to what the Federal Deposit Insurance Corporation is doing for small and medium-sized banks in the United States). The idea is to give Prompt Corrective Action

Primary responsibility for enforcing minimum bank capital requirements lies with national central banks and supervisors where the banks are domiciled. International harmonisation is driven through guidance from the Basel-based Bank for International Settlements (BIS) and the London-based European Banking Authority (EBA).

A bank's capital is meant to absorb losses arising from the issuer's business and financial risks. Regulatory capital can be decomposed conceptually into Tier 1 capital and Tier 2 capital. Tier 1 capital should reflect high-quality capital that is able to absorb bank losses in a *going* concern context, whereas Tier 2 capital is supposed to absorb losses only in a *gone* concern context.

The concept of regulatory capital has disappointed during the crisis, as its quality, consistency and transparency showed fundamental flaws (see BIS, 2009; HMT, 2009). The large bank losses that materialized in the crisis[2] highlighted the economic distinctions between Tier 1 and Tier 2 regulatory capital. Because Tier 2 capital (such as subordinated debt) is only loss-absorbing after a bank is declared bankrupt, banks needed to raise new equity to remain solvent notwithstanding their non-negligible stock of Tier 2 capital. Banks disposed of surprisingly little capital that was effectively loss absorbing, despite very high reported Tier 1 capital ratios (only so-called core Tier 1 capital, composed of mostly retained earnings and common shares turned out to be loss- absorbing). Going-concern capital instruments failed to bear losses and banks were in fact reluctant to cancel coupon payments or not to call the instruments at their first call dates (even though it was more expensive for the bank to subsequently refinance), in part for fear of a negative investor reaction as well as due to the legal complexity of the instruments. Moreover, there was little consistency and harmonization in definitions of capital instruments across countries (for example in some countries the negative available-for-sale reserve is included in the Tier 1 ratio, but in others the reserve is excluded). Regulators and supervisors added to the confusion by sometimes slotting exactly the same instrument differently within the capital structure. Transparency was weak and disclosure too often deficient. Ultimately, many market participants and even institutions such as the IMF lost confidence

(PCA) powers to bank supervisors before technical insolvency is reached, so that liquidation can take place in an orderly fashion, i.e. before the capital is completely depleted. Resolution procedures may also include creating incentives for takeovers, for example, via a bridge bank as proposed in the UK Special Resolution Regime or, as temporarily implemented by the US FED in the September 2008 turmoil, through relaxation of the rules governing minority investments in banks. The bank break-up proposals include Paul Volker's proprietary trading proposal, Simon Johnson's 4% of GDP per bank proposal, etc.

[2]IMF (2010) estimates a total of USD 2.3 trillion of write-downs for the global banking sector in the period 2007–2010. Euro area and UK banks are estimated to account for USD 1.1 trillion. Out of the latter USD 1.1 trillion, USD 0.77 trillion have already been written down.

in regulatory capital ratios and started to report alternative measures such as tangible common equity.[3] The latter nets out preferred shares and intangible assets such as goodwill and tax shields from net-operating-loss carry forwards, as these are not realisable in insolvency proceedings.[4]

Part of the reform proposals put forward by the BIS in a consultation document (BIS, 2009) try to rebuild the credibility (i.e. quality, consistency, and transparency) of the regulatory capital requirements by making sure that Tier 1 and Tier 2 ratios play the role they were originally intended to play. It is being proposed for example that Tier 1 instruments without exception should be subordinated, have fully discretionary non-cumulative dividends or coupons, and do not have a maturity date or an incentive to redeem. Moreover, the idea is being put forward to impose supplementary and simple maximum leverage ratios that assess the relative size of a bank's total and non-risk-weighted (on- and off-balance) exposures to a high-quality measure of capital.

The flaws in the regulatory capital design in the EU complicated the active role played by the European Commission in the treatment of incumbent hybrid capital holders. Short term financial stability might arguably have been reinforced by a generous stance towards historical hybrid capital note holders, as this would entail a lower financing cost for banks and possibly more secure access to new private capital. However, such a stance also would encourage moral hazard (and hence the need for future state aid), would weaken market discipline, would weaken the capital buffer, and would shift the burden disproportionally on taxpayers. To minimise moral hazard looking forward and to strengthen capital buffers, the Commission adopted the policy stance early on in the crisis that hybrid capital holders of banks that are under formal restructuring obligations should support part of the restructuring burden (through coupon deferral, loss absorption, preventing banks to make use of their option to call these instruments at 100 per cent of nominal value, etc.), according to the level of seniority of the hybrid financial instrument, and to the extent that financial stability is not endangered and legal certainty not breached (i.e. where banks legally have a discretion to impose these burdens on the hybrid capital holders). Although this issue was deemed contentious when announced and implemented, several observers and academics now concur that this approach was appropriate in the current unprecedented financial crisis (Scharfstein and Stein, 2008; Acharya *et al*., 2011).

It is not clear yet to what extent the future regulatory framework will allow or in fact require contingent capital instruments. But the NY

[3] Wood (2009) described government usage of hybrids during the crisis as follows: "Regulators are changing the rules as they go along, governments are arbitraging them, and markets are ignoring them."

[4] As we document below, Tier 1 ratios of numerous large banks have been recorded to be at comfortably high levels just before the states had to intervene with emergency capitalizations.

FRB President and the Chairman of the Federal Reserve System have given their support for contingent capital instruments (Bernanke, 2009; Dudley, 2009). The Bank of England governor is more skeptical, but stated that the instruments are 'worth a try' (King, 2009). The BIS (2010) is in the process of studying the merits and risks of different instruments in terms of their design (type of trigger, trigger levels, maturity of the instruments, conversion price, etc.). This paper will discuss the contingent capital proposal and will raise and discuss policy issues with respect to its effectiveness and possible unintended consequences.

### *1.2 Contingent Capital Instruments*

Conceptually, contingent capital instruments are debt instruments in 'good' states of the world, but convert into common equity at pre-specified trigger levels in 'bad' states of the world. In principle, the triggers can be tied to the deterioration in the condition of the specific banking institution and/or to the banking system as a whole. Contingent capital is a form of catastrophe insurance subscribed to by the bank. In general, contingent capital is a type of facility or instrument that automatically converts into equity when a certain stress-related trigger is breached, meaning that (typically) private investors provide an automatic boost to loss-absorbing capital at the time when it is most needed. This does not always imply actual cash being transferred to the bank, but sometimes simply a change in the existing liability structure.

As detailed design issues will turn out to be crucial to assess the success and effectiveness of contingent capital instruments, it is important to provide some more clarity about the different types of contingent capital instruments. Probably the most important distinction to be made across contingent capital instruments is the extent to which the instruments are able to provide *fresh* funding to the bank in distress.

#### *1.2.1 Funded*

So-called 'contingent reverse convertible' (CRC) debt[5] notes or 'conditional convertibles' (CoCos) are hybrid debt instruments which convert into ordinary equity if the trigger has been breached. Stricto sensu CoCos are not contingent capital, as CoCos typically are already perceived and assessed as capital at the time of their issuance. CoCos are (hybrid) capital

[5]Whereas convertible debt gives investors the option to convert debt into equity, reverse convertible debt gives issuers that right. Contingent reverse convertible debt is recently proposed as an instrument for banks to issue reverse convertibles that are exercisable into their own newly issued common stock following one or more trigger events.

instruments that can be contingently converted into common shares. They are considered to be funded notes and do not generate *new* cash for a bank at the time of conversion and thus are unlikely for example to stop a liquidity crisis once it has begun.

### *1.2.2 Unfunded*

Alternatively, more traditional contingent capital facilities[6] do put *new* cash in the hands of the issuer at the time the facility is drawn, and give the bank access to loss absorbing capital and liquidity during times of crisis. Contingent capital is a put option that allows the bank to issue new securities on pre-negotiated terms, typically following the occurrence of one or more risk-based triggering events. The bank that is entitled to issue new capital periodically pays a premium (a commitment fee) to the providers of the contingent capital. Unlike paid-in capital, the contingent capital issuer receives no cash and issues no new securities when the commitment is put in place (hence 'unfunded'). The commitment is typically of finite duration.

### *1.2.3 Literature overview*

Raviv (2004) proposes a debt-for-equity swap that is triggered when the bank's regulatory capital ratio drops below a pre-specified level. Flannery (2002, 2009) proposes a similar contingent capital instrument, but with a market-based trigger, i.e. the bank's equity falling below a pre-specified level whereby the conversion price would be the market price at conversion. Kashyap *et al*. (2008) propose capital insurance whereby the insurer receives a premium for agreeing to provide an amount of capital to the bank in case of a systemic crisis. The insurer would be required to hold the full insured amount. The trigger would be some measure of aggregate write-offs of major financial institutions over a year-long period. Caballero and Kurlat (2009) propose tradable insurance credits issued by the central bank, allowing the holders to attach a central bank guarantee to assets on their balance sheet during a systemic crisis. A trigger for systemic crisis would be determined by the central bank. Admati and Pfleiderer (2010) argue for increasing the liability of equity holders and find that such a structure will mitigate the conflicts of interest between equity and debt holders and may reduce the need for bail outs.

[6]Contingent capital is different from insurance and reinsurance instruments. When a policy holder gets paid out, it is typically in cash and the insurance purchaser has no ongoing obligation towards the insurance company. Similarly, the insurance company no longer has an ongoing contingent liability to the insurance purchaser.

### *1.3 Merits of Contingent Capital*

#### *1.3.1 Advantages*

Contingent capital instruments provide leverage in good times and a buffer to absorb losses and relief from debt servicing obligations in bad times. An advantage for the bank is that convertible capital provides a capital-efficient method to maintain sufficient reserves. Sometimes markets require banks to hold more capital than what is required by the regulators. In such instances, keeping paid-in capital on the balance sheet to absorb losses is less efficient than putting in place a credible contingent capital facility.

Another advantage of (funded or unfunded) contingent capital instruments from a supervisory perspective is that they create the incentives for banks to avoid ever needing to use the conversion facility. The cost of diluting the owners (incumbent shareholders and management through their holding of own company shares) provides a strong incentive for issuers to engage in conservative and prudent investment and risk management. Moral hazard is as such contained if the dilution threat is meaningful enough in size and if the bank is not close to insolvency.

Following the bankruptcy of Lehman Brothers, banks were unable to raise new equity other than from the government. Hence regulators have embraced the idea of pre-arranging private recapitalizations through the issuance of contingent capital. Contingent capital is intended to be triggered when a bank is headed toward failure to provide an equity infusion that keeps the bank out of financial distress. Less taxpayer money will need to be injected into the banks, as their self-insurance increases and as the private sector automatically steps in when the bank runs into difficulty. Due to the debt overhang problem (Myers, 1977, 1984), incumbent shareholders will typically resist a bank recapitalization. A bank recapitalisation would increase the cushion for further loss absorption and hence would benefit the debt holders of the bank. Indeed, if a bank carries substantial impaired assets and has a lot of debt relative to equity, the market value of debt will reflect the higher probability of default and any equity injection will benefit the debt holders by pushing up the market value of their claims. However, private investors are only willing to invest new capital in a bank if their investment does not instantly leak away to prop up the value of the debt holders. They are not willing to subsidise the debt holders with their own money. Hence, the value that is gained by debt holders following the bank recapitalization necessarily reflects the value that is being transferred away from the incumbent shareholders to the debt holders, as the incumbent shareholders are being diluted through the injection of the new capital. As a result of these mechanics, the bank management and incumbent shareholders may resist a recap.

In fact, when the market value of existing equity would be negligible or negative, an additional complexity arises as even the new capital providers would see value flowing partially or fully to the debt holders. In those circumstances, the bank's attempt to issue equity in the private market to meet its capital requirement will simply fail and the state will need to step in. In case no special resolution regime for banks exists (such as the one that exists in the US for small and medium-sized banks, i.e. the Federal Deposit Insurance Corporation), this state capital injection will partially or wholly reflect a subsidy to the (unsecured) bank creditors. If the governments step in when the private market refuses to provide equity capital to a financial institution, a subsidy arises because a large part of the equity injection by the government does not end up as government (taxpayer) equity but rather goes to prop up the bank's debt holders.

To make matters worse, Akerlof's (1970) lemons problem also applies here, as new shares offered by distressed financial institutions may be perceived as lemons by potential investors. Hence, investors may only be willing to bid low prices for the new shares, up to the point that they may even back out completely as investors.

### *1.3.2 Disadvantages*

Somewhat paradoxically, funded contingent capital or CoCos may actually increase the systemic risks they are intended to reduce. For example, whereas some banking regulators recorded CoCos as capital, some insurance regulators treated them as debt. Hence, significant amounts of CoCos were held by insurers, creating a risk of contagion from the banking sector to the insurance sector. Also a problem of moral hazard arises. Taking excessive risks (by for example buying additional risky assets) could lead to a triggering of the note and hence the wiping out of a lot of outstanding debt. Banks with contingent debt could therefore be tempted to seek additional risk near the trigger point (taking risk on the back of the CoCo holders and maybe taxpayers as well).

Another disadvantage would be that any pay-out on the insurance will require a significant dilution of the existing shareholders, depending on the conversion ratio, with the negative market signals that may result from that.

The contingent capital instrument may disappoint, if not sufficiently important in size and if not properly designed. The contingent capital facilities that have been put in place in recent years are dwarfed by the amounts required to recapitalize the banking sector in the wake of the financial crisis.

Another problem may be that the contingent capital in a parent company may not help the subsidiaries in other jurisdictions. Alternatively,

the contingent capital at subsidiary level, may lead to problems through a dilution of the parent company's interest, and in some cases even a *de facto* spin off when the parent ownership would fall to minority status.

CoCos also may not improve the immediate cash position of the bank. Duffie (2009) advocates the use of traditional contingent capital instruments for this reason. Duffie (2010) proposes a mandatory rights offering of equity when financial institutions become distressed. Obviously, incumbent shareholders will not subscribe to the offering when the new shares are issued at the current market price due to debt overhang, dilution and adverse selection problems. However, when they can subscribe to new shares at prices that contain a sufficiently high discount, they may be willing to invest as they would see value flowing towards those shareholders that do subscribe if they do not invest.

Note as well that contingent capital would be more difficult to design for financial institutions that are not listed on a stock exchange, such as cooperative banks, savings banks, Cajas, etc.

When capital insurance is provided by the government, governments receive an up-front fee in return for an explicit arrangement to deliver capital to banks in times of systemic crisis. As with many insurance contracts, moral hazard issues may arise resulting from reduced loss-sharing across subordinated debt and hybrid capital, unless it could be ensured that all non-equity capital converts to equity ahead of any government capital injection. Governments lose some flexibility by pre-committing to a publicly provided facility. If the capital insurance is provided by the private sector, governments would need to be able to credibly commit not to provide any rescue aid (guarantees, capital injections) before conversion of all contingent capital has effectively taken place.

Finally, Hart and Zingales (2010) argue that contingent capital introduces inefficiency as conversion eliminates default, which forces inefficient businesses to restructure and incompetent managers to be replaced.

### *1.4 Examples of Contingent Capital Issuances*

Since the 1990s contingent capital has primarily been issued by insurance companies and non-financial corporations. Historically, commercial banks have not issued a lot of these instruments. To date, most contingent capital issuers have attempted to avoid dilution and violation of covenants in existing debt securities (including those relating to capital structure seniority). For this reason, most facilities have involved the funded contingent capital issuance of deeply subordinated long term debt, hybrids, or preferred stock.

The first major CoCo issuance was performed in 2009 by Lloyds Banking Group (LBG). On 3 November 2009, Lloyds raised extra capital

in the markets to avoid entering into the UK Asset Protection Scheme which provides asset relief to banks in exchange for a fee to the UK Treasury. Part of the capital raising was contingent capital. More precisely, Lloyds Banking Group issued a Lower Tier 2 hybrid capital instrument, called 'Enhanced Capital Notes' (ECNs), which have a 10 year term and fixed, non-deferrable coupons. These subordinated debt notes include a contingent capital feature. They will convert into ordinary shares if Lloyds' published consolidated core Tier 1 ratio falls below 5 per cent of its regulatory risk-weighted assets. This instrument will not be included in the regulatory core Tier 1 ratio until a conversion occurs. The conversion price is the greater of (i) the volume-weighted average price of LBG's common stock between 11 November and 17 November 2009, and (ii) 90 per cent of the stock's closing price on 17 November multiplied by a factor. The instrument will give LBG a GBP 7.5 billion of private sector loss-absorbing equity in a stress scenario.

To issue the ECNs, the bank either has to issue new subordinated debt or hybrids or must replace existing securities with ECNs through an exchange offering. LBG successfully opted for the latter. Incumbent hybrid capital owners needed to trade off a higher coupon rate that is more likely to be paid out on a more subordinated instrument versus holding on to their old instruments. Note that LBG's successful exchange was helped by the Commission's prohibition to pay out discretionary coupon or dividend payments on existing hybrid securities.

Around the same time also RBS stepped into a contingent capital construction, because it did not have enough capital to pass the imposed stress tests. To remedy the problem, the UK government committed to RBS to provide them with an unfunded capital commitment such that they would provide RBS with core tier 1 capital at any time in the next 5 years if their core tier 1 ratio would fall below 5 per cent.

As a final example we mention the Rabobank Senior Contingent Note (SCN) issuance in early 2010. Rabobank issued EUR 1.25 billion of 10 year Senior Bonds with a fixed rate non-deferrable coupon (6.875 per cent yield). The issuer will redeem at 25 per cent of par upon the contingency. The trigger is related to the ratio of equity capital over Risk Weighted Assets. The trigger level was set at 7 per cent.

## 2. Key Features

### *2.1 Counterparty Risk, Systemic Risk and Death Spirals*

Unfunded contingent capital notes bear an enormous counterparty risk. The bank will have a guarantee of being provided new capital (up to some level) in return for a fee. Because such a conversion typically takes place in

an extreme market situation with severe systematic stress, one can wonder whether only the most solvent sovereign entities are *de facto* able to provide these unfunded contingent capital notes.[7]

If the counterparty is not a sovereign, serious counterparty risk may arise that could make even funded contingent capital deals completely useless. When funded notes are placed among the other financial players (what seems to have happened), the wiping out of the outstanding face-value in return for an equity position with low value can lead to serious loses on the books of the financial players, creating a potential domino effect of institutions in distress (and hence triggering other contingent capital facilities). Triggering one bank can furthermore lead to speculation about other banks. If one bank reveals it is triggered, this increases the triggering probability of other financial player dramatically in a systematic crisis (due to high correlation). Because short selling the underlying stock is a natural hedge for CoCo holders that are coming closer to the trigger point, this could lead to a 'death spiral' and a systemic crisis. Short sellers may be tempted to push down the stock price to profit from the resulting dilution of the bank's stock following the conversion triggered by the stock price drop. Volatility, which is anticipated to be high in these periods any way, could spike even higher.

Alternatively, collateral or margin calls can be required from the contingent capital investors. Sometimes a separate trust/SPV is being set up that is unaffiliated with the contingent capital provider and which writes a put option to the bank (giving the latter the right to sell capital to it under specified conditions). Securities are issued by the trust to investors. The trust invests in relatively low risk assets. As long as the put option is not exercised, the trust investors receive the return on the assets plus the put option premium. When the put option is being exercised, the assets will be sold to finance the purchase of the newly issued bank securities. Insurance and reinsurance companies typically are reluctant to provide fully collateralised insurance because it reduces their leverage and risk-adjusted return on capital. The difficulty is to invest the proceeds in collateral that is liquid and safe and yet still earns enough yield to attract investors. Trust-issued contingent capital has been an important source of capital for the monoline insurers. During the crisis, the facilities were drawn and the facilities resulted in capital injections into the monoliners. Although the

[7]The spotlights have been on Greece, Spain, Ireland and Portugal lately, but fiscal unsustainability is not just a problem of a handful of euro area member states. The fiscal-financial position of the euro area as a whole is stronger than that of the United Kingdom, the United States, and Japan. Ageing populations have been promised large health and retirement benefits, which no country has fully covered with taxes. Countries in reasonable fiscal shape seem to include Australia, New Zealand, Denmark, Norway, Sweden, Finland and Switzerland. Countries that are in reasonable shape, but only according to their neighbouring countries, seem to include Canada, Germany and the Netherlands.

amounts were largely insufficient to avert monoline defaults given the huge losses that arose, the facilities themselves performed as intended.

What would be the incentive for private investors such as pension funds and asset managers to buy and hold on to contingent capital notes, i.e. provide catastrophe insurance? One incentive would be to protect and support the value of their investment portfolios more generally. If sufficient insurance is given to a sufficient amount of banks, it may avert the banking distress and the resulting general loss of portfolio value we have observed. However, free rider problems and coordination failures are obvious in this setting and regulation will be required to resolve them.

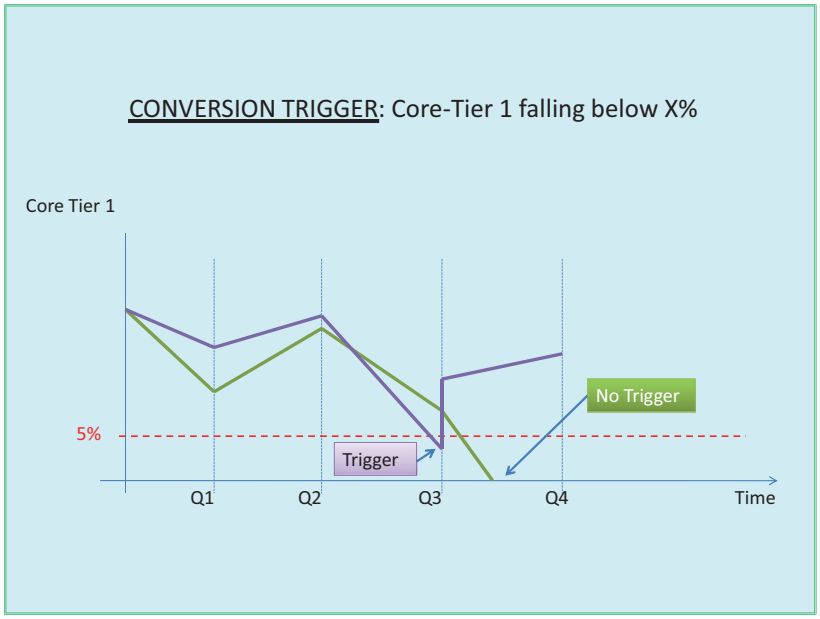
In case of a government counterparty, CoCos in a way institutionalize the 'too-big-to-fail' (TBTF) label of a company for which a CoCo deal is made. The state is guaranteeing upfront the rescue of the company in return for a fee. In a certain sense, one could say that the only thing that is changing is that the guarantee is made upfront and made explicit. If a company is perceived as TBTF by market players, the issuance of publicly provided contingent capital is in a way explicitly confirming this.

### *2.2 Conversion Trigger*

The first key feature for understanding contingent capital notes is the conversion trigger. As mentioned in the real-world examples above, this could be a bank-specific trigger, such as the CDS spread exceeding a specific level, the Core-Tier 1 ratio falling below x percent or some other related indicator.

An important question is whether contingent capital securities convert into capital early enough to help the company. To be effective in time of distress, the conversion needs to happen in a timely way. The frequency that the trigger ratio is monitored is therefore important. Although this may seem like a trivial issue, in reality it can be difficult since these ratios are not always publicly disclosed and often there is room for discussion (for example about the precise calculation of the Core-tier-1 ratio).

The conversion triggers need to be set at the appropriate level for contingent capital securities to prove effective as a buffer for senior bondholders. However, this appropriate level is difficult to determine before a crisis effectively hits. Published capital ratios can be lagging indicators of financial strength and can be calculated more conservatively by one bank than another. It may take some time for the contingent capital market to develop norms for trigger levels, and it may be complicated to compare these across banks. Open issues remain about how frequently the trigger will be monitored, who will do the monitoring, and whether the level of the ratio be disclosed at all times.




One problem with accounting-based triggers (such as the one used in LBG) is that accounting measures may fail to (timely) capture the true financial condition of a bank. Kuritzkes and Scott (2009) come to the conclusion that banks that failed in 2008 were beforehand supposedly better capitalized than those that did not fail. In particular they report that the five largest US financial institutions that either failed or were forced into government-assisted mergers in 2008 – Bear Stearns, Washington Mutual, Lehman Brothers, Wachovia and Merrill Lynch – had regulatory capital ratios ranging from 12.3 per cent to 16.1 per cent as of their last quarterly disclosures before they were effectively shut down. The capital levels of these five banks were between 50 per cent and 100 per cent above the regulatory minimums and 23 per cent to 61 per cent higher than the 'well-capitalised' level.

Citibank had a Tier 1 capital ratio that never fell below 7 per cent during the course of the financial crisis and stood at 11.8 per cent at its weakest moment in December 2008 when the stock market capitalisation of Citibank's holding company fell to around USD 20 billion or roughly 1 per cent of its accounting assets. Because of the limited liability property of equity and the prevailing uncertainty, it is reasonable to assume that Citibank's assets may even have been insufficient to pay off the Citibank debt (negative market value of equity). Despite this dire situation, a LBG-alike Tier 1 based capital trigger would probably not have led

to a conversion or capital injection. Similarly, with Northern Rock, in June 2007, i.e. three months before the bank run, regulatory capital was approximately GBP 1.5 billion. The British government ultimately had to inject around GBP 23 billion into the bank to keep it afloat.

Given the above, it may make a lot of sense to define triggers in terms of market based terms. Note however that a simple market based trigger may not be desirable as short sellers may be tempted to push down the stock price to profit from the resulting dilution of the bank's stock following the conversion triggered by the stock price drop. Such a self-generated decline in shares prices is referred to as a 'death spiral'. The above problem can be mitigated by making the trigger dependent on a rolling average stock price [say the average closing price of the stock over the preceding 20 business days, as Duffie (2010) and Goodhart (2010) propose]. In fact, Flannery (2009) demonstrates that the incentive for speculative attack is lessened or even eliminated altogether by setting a sufficiently high contractual conversion price, such that the conversion becomes anti-dilutive (raising the price of the share rather than lowering it). A market based trigger has the additional advantage that it limits the ability of management to engage in balance sheet manipulation. Also, it prevents forbearance on behalf of the regulators, as it eliminates regulatory discretion in deciding when the trigger should be invoked. Some analysts refer to the double trigger as the double disaster (regulatory discretion as well as politics).

Finally, *in addition* to a bank-specific trigger, sometimes a trigger is proposed that is not bank-specific. The European Commission or the ECB could for example declare the start of a 'systemic crisis'. Obviously such a systemic crisis trigger is always an additional one, as otherwise even sound banks would be forced to convert their contingent capital into equity, which would go against their incentives to remain sound. A disadvantage of such an additional trigger is that the first bank to experience problems may not be in a position to recapitalise until it is too late. This would mean that these banks are being penalised relative to the other banks or alternatively that the declaring institutions are provided with incentives to declare systemic crises too often.

### *2.3 Conversion Ratio (strike price)*

In case of a conversion to equity, new stock will be issued in return for the CoCo when the trigger is hit. Exactly how many new shares will be issued will depend on whether the stock price at the issuance of the CoCo, the stock price at the time the trigger is breached, or some other level is being used for conversion.

The stock price just before triggering could be expected to be very low (near zero), because a CoCo is triggered when the company is close

to, but not yet, in default. Hence, the corresponding dilution of incumbent shareholders is likely to be significant.

If the conversion is based on the conversion at issuance of the note or facility (like with LBG), we will not see that much dilution in case of conversion. However, the value of the CoCo after conversion (equity) is very low. This of course is the trade-off made at issuance to receive an attractive coupon (the high coupon reflects the risk of losing part of the principal).

If the conversion ratio is based on the stock price at the time of the triggering point, the amount of capital to be brought in can be very substantial and will make the counterparty a major, if not the largest, shareholder. Original shareholders will be diluted. On the one hand, there is a clear potential dilution effect which could affect the bank's equity price itself. On the other hand, CoCos may as well introduce a floor on the equity price in these situations.

When the conversion ratio is determined at the time of conversion and not at the time of issuance, the conversion is likely to be relatively generous to the holder of the contingent capital instrument. When the debt holders can expect to get out at close to par value, it would reduce the cost of the contingent capital instrument, making it a significantly cheaper form of capital than equity (of course its low coupon would reduce investors' appetite).

## 3. Pricing Issues

In this section we elaborate the CoCo pricing intuition from an equity as well as from a credit perspective. For a more fundamental pricing model based on the firm's balance sheet dynamics and using conic finance theory, we refer to Madan and Schoutens (2010a,b). Key point of this section is to point to similarities with equity like barrier products as well as to compare with credit default swaps (CDS) and to highlight the pricing and hedging problems that come along with these products.

CDSs are fat-tail-event driven and barrier options are known to have their pricing difficulties in other markets. Furthermore, there is very high dependency between the hitting of the trigger and the level of the stock price level at conversion. Since also the barrier is typically at levels very far away from current spot, the trigger event is clearly an extreme event and fat-tail-behaviour should intrinsically be part of any pricing model. Ordinary Black–Scholes theory would dramatically underprice the risk present in such notes (implied volatility levels used should most likely be multiples of at-the-money levels). Volatilities of deep out-of-the-money puts could give us a clue, but are hard to estimate. Other issues complicate matters further. It is not impossible to see a significant drying up of liquidity

near the trigger, which will have an influence on the price. In addition, the behaviour and psychology of all stakeholders (CEO, minority shareholders, major shareholders, bondholders, CDS holders, governments, etc.) near the trigger point is not clear and hard to model.

Hence, the pricing of CoCos is not an easy task. And the pricing of the CoCo is key to have an investor base for these instruments. Investors have been surprised that their hybrid instrument payments were deferred or suspended altogether, hence they may not have a lot of appetite for instruments that are even more equity like under stress scenarios.

### *3.1 Pricing from an Equity Derivatives Perspective*

From an equity derivatives perspective the CoCo holder is short a kind of down-and-in barrier put option, with payoff $(K - S_T)^+ 1(\min S_T < H)$, where $S_T$ is the bank's stock price at time $t$, $H$ the trigger at which the CoCo is being converted into common stock, $K$ the conversion price, and $T$ the time of conversion.

The strike is related to the conversion price. Where exactly the trigger barrier level lies, is not exactly clear. The similarity lies in the fact that when the barrier is hit (trigger), the investor receives stock (short put option) and is paying a potentially high price (strike $K$) for it. At hitting, the stock has typically a very low value, the barrier level ($H$).

Down-and-in barrier put options are very hard to price. They are known to be very skew-sensitive and heavily depend on an appropriate model of (stochastic) volatility. Recall that the stock price $S$ is likely to be very volatile near the trigger level $H$. The pricing of such barrier products typically is done after calibration of the model to an available vanilla option surface. However, the crucial implied volatility parameters reflecting the situation near the barrier are most of the time not really based on market traded prices, but are more extrapolation values of volatilities levels in the center. Finally, it is well documented that, next to a serious calibration risk (see Guillaume and Schoutens, 2010), also a significant model risk exists (see Schoutens *et al*., 2004). Pricing of exotics heavily depend on the chosen model, even if calibrated in an almost perfect sense to a broad and reliable implied volatility surface. Table 1 furthermore illustrates the strong dependence of the down-and-in barrier put price on the estimated volatility (under the Black–Scholes model; $K = S_0 = 100$; $T = 5$ years; $r = 2$ per cent).

### *3.2 Pricing from a credit Derivatives Perspective*

Another way of pricing CoCos is by treating it as a proxy for a CDS. Actually, the note is designed to convert in roughly comparable

Table 1: Black–Scholes Down-and-In Barrier put Price as a Function of the Estimated Stock Price Volatility and Trigger Point ($K = S_0 = 100$; $T = 5$ years; $r = 2$ per cent)

| Volatility | $H = 30$ | $H = 20$ | $H = 10$ |
|---|---|---|---|
| 70% | 45.74 | 40.59 | 27.97 |
| 65% | 41.75 | 35.82 | 22.53 |
| 60% | 37.46 | 30.71 | 17.19 |
| 55% | 32.82 | 25.32 | 12.17 |
| 50% | 27.83 | 19.76 | 7.75 |
| 45% | 22.50 | 14.23 | 4.25 |
| 40% | 16.93 | 9.08 | 1.85 |
| 35% | 11.36 | 4.79 | 0.56 |
| 30% | 6.28 | 1.82 | 0.09 |
| 25% | 2.42 | 0.38 | 0.00 |
| 20% | 0.44 | 0.02 | 0.00 |
| 15% | 0.01 | 0.00 | 0.00 |
| 10% | 0.00 | 0.00 | 0.00 |

circumstances as when a CDS is triggered. A good pricing model should incorporate equity as well as credit dynamics (E2C). The CDS implied default probability could serve as a lower bound for the trigger probability. However a CDS spread or its related default probability is calculated on the basis of a recovery rate. All this reminds us of the Equity Default Swap (EDS) market that was introduced in the early 2000s, but has disappeared by now. Quants often use the following rule of thumb for determining the CDS spread: CDS spread = (1 – CDS Recovery) * $\lambda_{CDS}$ where E(default time) = $1/\lambda$ and Prob(default before $T$) $\approx \lambda$T holds. An analogous formula for the CoCo could use the value of the stock position after conversion as recovery rate, which is most likely to be smaller than the assumed CDS recovery rate and actually could be very close to zero. Because at all times the trigger probability by construction will be greater than the default probability ($\lambda_{coco} > \lambda_{\mathrm{CDS}}$) one obtains: CoCo spread = (1 – Coco Recovery) $\lambda_{coco}$> CDS spread.

The yield offered to CoCo investors is therefore greater than the CDS spread. In reality one has observed that this yield can be several multiples of the CDS rate.

## 4. Conclusions

Contingent capital is being put forward by regulators as an important new tool to avoid that banks become insolvent and illiquid ever again. It is intended to automatically provide a pre-arranged equity infusion that keeps the bank out of financial distress. We discuss the key features of contingent capital notes, namely their counterparty risk, their advantages and disadvantages, and the conversion trigger and conversion

ratio complexities. Furthermore, we elaborate on moral hazard, potential risk-seeking, contagion, and systematic risk as well as death-spiral issues arising from underlying hedging strategies of investors. We close by raising concerns about the pricing of the instruments by highlighting the similarities between CoCos and equity barrier options and CDSs. These barrier-like features and the fact that CoCos are fat-tail event claims, in combination with calibration and model risks, imply that these contingent instruments are very hard to value under a particular model. Since CoCos are expected not to be highly liquid instruments (and until real market prices are widely available), the extreme complexity of mark to modelling CoCos will be a big disadvantage that may hamper their success.

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**Non-technical Summary**

Regulators have embraced the idea of pre-arranging bank recapitalizations through (funded or unfunded) contingent capital issuance. Contingent capital is intended to be triggered when a bank is headed toward failure to provide an automatic equity injection that keeps the bank out of distress. This note discusses counterparty risk, effectiveness, moral hazard,

contagion and systemic risk, as well as death-spiral issues arising from the hedging strategies of the investors. We pay attention to important design issues with respect to the trigger and conversion ratio and comment on their pricing from an equity and credit derivative perspective.