

THE ESSENTIALS OF RISK MANAGEMENT

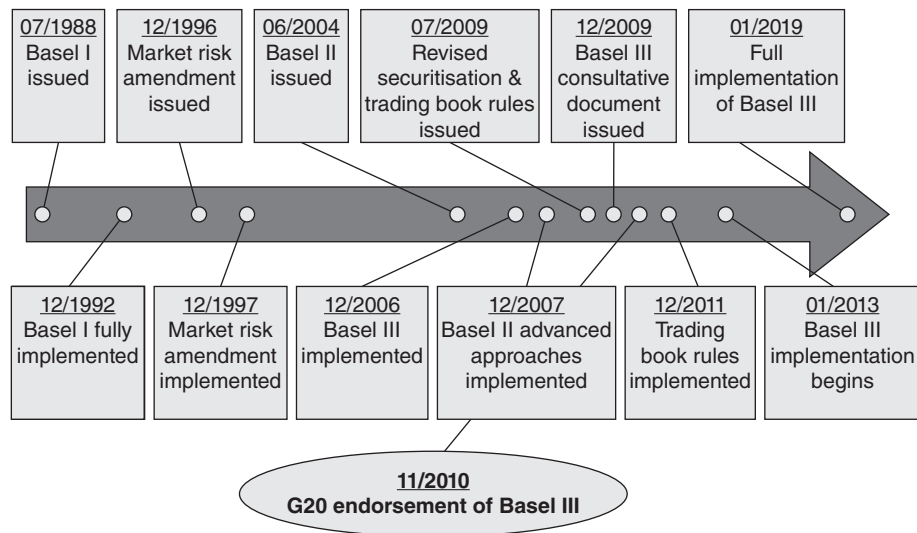
Third Edition (EoRM3)

ONLINE CONTENT FOR CHAPTER 3

Figure 3-1, Appendix 3.1, 3.2, 3.3, 3.4, and 3.5 from EoRM2

From p. 71 of *The Essentials of Risk Management, Second Edition (EoRM2)*

FIGURE 3-1 Twenty-Five Years of Capital Regulation



Source: Bank for International Settlements

From pp. 117–124 of *The Essentials of Risk Management, Second Edition (EoRM2)*

APPENDIX 3.1

Basel I

The 1988 Basel Accord

The 1988 Basel Accord, also referred to as the Accord or Basel I, established international minimum capital guidelines for the world's banking systems. Its principal reform was to use a simple scheme to link each bank's capital requirements to the bank's specific credit exposures. To do so, the regulators divided bank exposures into broad classes that grouped together similar types of borrowers such as OECD banks, non-OECD banks, and corporate borrowers. Each borrower type was then linked to specific capital requirements.

What exactly did the 1988 Accord require of banks?

The 1988 Accord is laid out in a document called "International Convergence of Capital Measurement and Capital Standards," published in July 1988. It defines two minimum standards for meeting acceptable capital adequacy requirements: an assets-to-capital multiple and a risk-based capital ratio.

The assets-to-capital multiple is an overall measure of the bank's capital adequacy. The second and more critical measure focuses on the credit risk associated with specific on- and off-balance-sheet asset categories. It takes the form of a solvency ratio, known as the Cooke ratio, defined as the ratio of capital to risk-weighted on-balance sheet assets plus off-balance-sheet exposures (the risk weights being assigned on the basis of the broad classes of counterparty credit risk that we mentioned above).

Below, we review the main features of the 1988 Basel Accord as it stands today after several modifications.

The assets-to-capital multiple

The assets-to-capital multiple is calculated by dividing the bank's total assets, including specified off-balance-sheet items, by its total capital. The off-balance-sheet items included in this test are direct credit substitutes (including letters of credit and guarantees), transaction-related contingencies, trade-related contingencies, and sale and repurchase agreements. All of these items are included at their notional principal amount.

The maximum multiple allowed under Basel I is 20. It is conceivable that a bank with large off-balance-sheet activities might trigger this multiple as the minimum capital requirement, but in general the assets-to-capital multiple is not the binding constraint on a bank's activities.

The risk-weighted amount used to compute the Cooke ratio

The second and more critical measure takes the form of a solvency ratio, known as the Cooke ratio.¹ This is defined as the ratio of capital to risk-weighted on-balance-sheet assets plus off-balance-sheet exposures, where the weights are assigned on the basis of credit risk.

In effect, the Cooke ratio requires banks to calculate the sum of their risk-weighted assets of various kinds (e.g., 100 percent for corporate loans, 50 percent for uninsured residential mortgages), and then set aside a flat fixed percentage (i.e., 8 percent or more under Basel I) of the total as regulatory capital against default.

To work out the sum of their risk weighted assets, banks have to consider both the on-balance sheet as well as specific off-balance-sheet items. On-balance-sheet items have risk weightings from 0 percent for cash, revolving credit agreements with a term of less than one year, and OECD government securities, to 100 percent for corporate bonds and others. Off-balance-sheet items are first expressed as a credit equivalent, and then are appropriately risk-weighted by counterparty. The risk-weighted amount is then the sum of the two components: the risk-weighted assets for on-balance sheet instruments and the risk-weighted credit equivalent for off-balance-sheet items.

Table 3A-1 gives the full list of risk capital weights (WA) by asset categories, and Table 3A-2 shows the weights that apply to credit equivalents by type of counterparty (WCE).

TABLE 3A.1 Risk Capital Weights by Broad On-Balance-Sheet Asset Category (WA)

Risk Weights (%)	Asset Category
0	Cash and gold bullion, claims on OECD governments such as Treasury bonds, or insured residential mortgages.
20	Claims on OECD banks and OECD public-sector entities such as securities issued by U.S. government agencies or claims on municipalities.
50	Uninsured residential mortgages.
100	All other claims, such as corporate bonds and less-developed country debt, claims on non-OECD banks, equity, real estate, premises, plant and equipment.

TABLE 3A.2 Risk Capital Weights for Off-Balance-Sheet Credit Equivalents by Type of Counterparty (WCE)

Risk Weights (%)	Type of Counterparty
0	OECD governments
20	OECD banks and public-sector entities
50	Corporations and other counterparties

1. Named after W. P. Cooke, Bank of England, who chaired the Cooke Committee, a forerunner of the present Basel Committee.

There is an apparent inconsistency between Table 3A-1 and Table 3A-2, since the risk weight for corporate assets as they relate to off-balance instruments is half that required for on-balance-sheet assets. The original rationale for this asymmetry was the superior quality of the corporations that participated in the market for off-balance-sheet products. However, this quickly became an outdated assumption.

Calculation of the credit equivalent for off-balance-sheet exposures

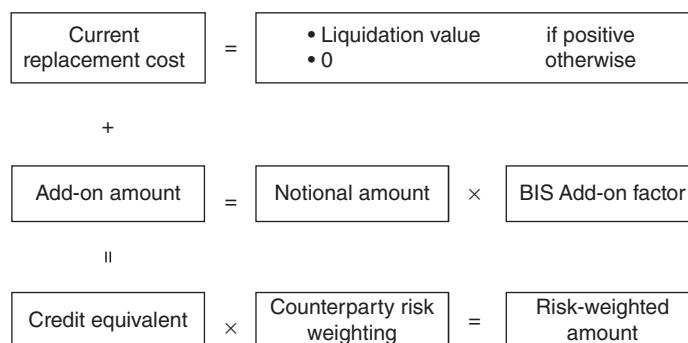
For nonderivative off-balance-sheet exposures, a conversion factor applies. This is because the notional or “face value” amount of these instruments is not always representative of the true credit risk that is being assumed; the value of the conversion factor is set by the regulators at somewhere between 0 and 1, depending on the nature of the instrument (Table 3A-3). The resulting credit equivalents are then treated exactly as if they were on-balance-sheet instruments.

TABLE 3A.3 Credit Conversion Factors for Nonderivative Off-Balance-Sheet Exposures

Conversion Factor (%)	Off-Balance-Sheet Exposure Factor
100	Direct credit substitutes, bankers' acceptances, standby letters of credit, sale and repurchase agreements, forward purchase of assets.
50	Transaction-related contingencies such as performance bonds, revolving underwriting facilities (RUFs), and note issuance facilities (NIFs).
20	Short-term self-liquidating trade-related contingencies such as letters of credit.
0	Commitments with an original maturity of one year or less.

The Accord also recognizes that the credit risk exposure of long-dated financial derivatives fluctuates in value. The Accord methodology estimates this exposure by supplementing the current marked-to-market value with a simple measure of the projected future risk exposure.

Calculation of the Accord risk-weighted amount for derivatives proceeds in two steps, as shown in Figure 3A.1. The first step involves computing a credit equivalent amount, which is the sum of the current replacement cost when it is positive (and zero otherwise), and an add-on amount that approximates future projected replacement costs. The current replacement value of a derivative is its marked-to-market or liquidation value. (When the value is negative, the institution is not exposed to default risk as the replacement cost of the contract is zero.)

FIGURE 3A-1 Calculation of the Risk-Weighted Amount for Derivatives

The add-on amount is computed by multiplying the notional amount of the transaction by the Accord required add-on factor.

Capital and the Cooke ratio

Banks are required to maintain a capital amount equal to at least 8 percent of their total risk-weighted assets (as calculated in the previous section). Capital, as defined by the Cooke ratio, is much broader than equity capital. It has three components:

Tier 1, or core capital, which includes common stockholder's equity, noncumulative perpetual preferred stock, and minority equity interests in consolidated subsidiaries, less goodwill and other deductions.

Tier 2, or supplementary capital, which includes hybrid capital instruments, such as cumulative perpetual preferred shares and qualifying 99-year debentures. These instruments are essentially permanent in nature and have some of the characteristics of both equity and debt. Tier 2 capital also includes instruments with more limited lives, such as subordinated debt with an original average maturity of at least five years.

According to the original Accord, Tier 1 and Tier 2 capital should represent at least 8 percent of the risk-weighted assets, to protect the bank against credit risk. At least 50 percent of this amount must take the form of Tier 1 capital.

In practice, the capital levels of regulated banks tend to exceed minimum requirements. There are various reasons why banks might want to retain capital in excess of the minimum required by regulators, but research suggests the most important is to create a buffer that prevents them from accidentally transgressing the regulatory rules. Other powerful reasons are peer pressure, and the need for banks to maintain credit ratings and credit standings that allow them to access wholesale markets cheaply. The rating agencies take their own view of how well capitalized a bank is, and this may not be directly related to the bank's minimum capital requirement. This does not mean that minimum capital requirements are unimportant; they are very important drivers of overall capital levels, even if they don't determine those levels exactly.

Under the 1996 Amendment to the original Basel Accord, now itself superseded by Basel III and IV, banks were allowed to use a third tier of capital to cover market risk in the trading book (but not credit risk in the banking book). Tier 3, or sub-supplementary capital, consisted of short-term subordinated debt with an original maturity of at least two years. It had to be unsecured and fully paid up. It

was also subject to lock-in clauses that prevented the issuer from repaying the debt before maturity, or even at maturity if the issuer's capital ratio threatened to fall below 8 percent after repayment.

What Are the Key Weaknesses of Basel I?

The rules of the original 1988 Accord are generally acknowledged to be flawed for five main reasons.

First, the risk-weighted ratios in the rules don't differentiate adequately between the riskiness of bank assets—and are in some ways nonsensical. For example, they assume that a loan to a corporate counterparty generates five times the amount of credit risk as does a loan to an OECD bank, regardless of their respective creditworthiness. That means a loan to a highly creditworthy corporate counterparty (e.g., rated AA+) has to be supported by five times as much regulatory capital as a similar loan to a Mexican (BBB) or Turkish bank (BBB-), and that the loan is also considered to be considerably more risky than the sovereign debt of Turkey or Mexico. Clearly, this is the opposite of what one might think appropriate.

Second, regulatory rules assume that all corporate borrowers pose an equal credit risk. For example, a loan to an AA-rated corporation requires the same amount of capital as a loan to a B-rated credit. This is also clearly inappropriate.

Third, the 1988 Accord does not appropriately take maturity factors into effect. For example, revolving credit agreements with a term of less than one year do not require any regulatory capital, while a short-term facility with 366 days to maturity bears the same capital charge as any long-term facility. (A revolver is a facility that allows a corporation to borrow and repay the loan at will within a certain period of time.) The bank is clearly at risk from offering short-term revolver facilities, yet so long as the term is less than one year no regulatory capital is required. This led to the creation by many banks of a 364-day facility, in which banks commit to lend for 364 days only but then continuously roll over the facility into the next year—a clear example of how banks alter their behavior to circumvent regulatory rules. (Such a facility attracts no capital under Basel I, even if the terms of the facility are such that if the commitment is canceled, the obligor then has the right to payback the drawn amount over a number of years.)

Fourth, the Accord does not provide any incentive for credit risk mitigation techniques such as the use of credit derivatives.

Fifth, the Accord does not address complex issues such as portfolio effects, even though credit risk in any large portfolio is bound to be partially offset by diversification across issuers, industries, and geographical locations. For example, a bank is required to set aside the same amount of regulatory capital for a single \$100 million corporate loan as for a portfolio of 100 different and unrelated (independent) \$1 million corporate loans. While a single \$100 million loan might go sour, it's extremely unlikely that 100 loans of a similar standing in a fully diversified portfolio will all go wrong at once.

Under Basel I, these shortcomings produced a distorted assessment of actual risks and led to a misallocation of capital. The problem is a general one: as the definition of regulatory capital drifts further away from the bank's understanding of the true amount of risk capital necessary to support a position (i.e., economic capital), the bank faces a strong incentive to play a game of "regulatory arbitrage."

From pp. 125–129 of *The Essentials of Risk Management, Second Edition (EoRM2)*

APPENDIX 3.2

The 1996 Market Risk Amendment

Background: The Explosion of Bank Market Risk

When devising the 1988 Accord, regulators focused primarily on the credit risks that banks were exposed to, and ignored market risk and other risks. But this hardly reflected the reality of many banks' risk exposures, even during the 1980s.

Modern banks are engaged in a range of activities that extend well beyond lending and the credit risk this generates. They trade all types of cash instruments, as well as derivatives such as swaps, forward contracts, and options—either for their own account or to facilitate customer transactions.

This kind of bank trading activity grew exponentially in the 1980s and 1990s, so that by the time the Basel Committee published its important 1996 Market Risk Amendment the Federal Reserve Bank estimated that U.S. banks possessed over \$37 trillion of off-balance-sheet assets and liabilities, compared to approximately \$1 trillion only 10 years earlier. According to a more recent BIS publication, as of November 2011, banks worldwide had a total exposure to derivatives of approximately \$708 trillion.

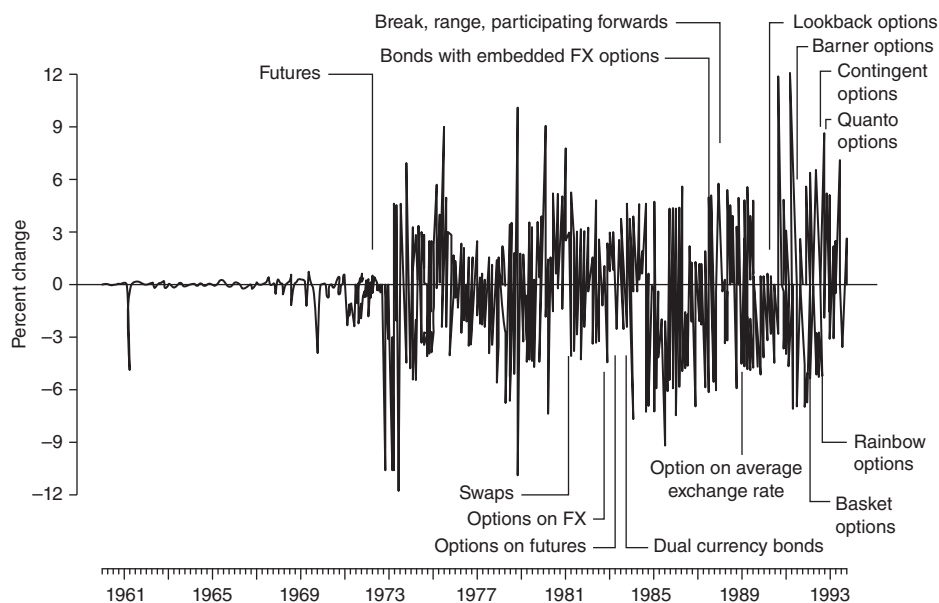
The rise in importance of risk management instruments over the last few decades has been driven by a rise in volatility in many of the principal financial markets, which has led banks to become both users and providers of risk management instruments.

The prime example of this change is the foreign currency market. From 1944, with the signing of the Bretton Woods Agreement, international foreign exchange rates were artificially fixed. Central banks intervened in their foreign currency markets whenever necessary to maintain stability. Exchange rates were changed only infrequently, with the permission of the World Bank and the International Monetary Fund (IMF). These bodies usually required a country that devalued its currency to adopt tough economic measures in order to ensure the stability of the currency in the future.

The regime of fixed exchange rates broke down during the late 1960s due to global economic forces. These included a vast expansion of international trading and inflationary pressure in the major economies. The shift to flexible foreign exchange rates introduced daily (and intra-day) volatility to exchange rates. As the, hitherto obscured, volatility surfaced in traded foreign currencies, the financial market began to offer currency traders special tools for insuring against these “new” risks.

Figure 3A-2 depicts the percentage change in the value of the German Deutsche mark relative to the U.S. dollar up to the early 1990s.¹ The shift in the levels of volatility is very noticeable in the early 1970s, as the currency market moved to floating exchange rates. As indicated in the figure, the shift precipitated a string of novel financial contracts based on the exchange rates of leading currencies.

1. On January 1, 1999, the euro was launched and became the official currency of the eurozone, which consists of 17 of the 27 member states of the European Union. The euro replaced former national currencies such as the German Deutsch mark and the French franc.

FIGURE 3A-2 Month-End German Deutsche Mark/U.S. Dollar Exchange Rates

The first contracts tended to be various kinds of futures and forwards, though these were soon followed by foreign currency options. In 1972 the Mercantile Exchange in Chicago (CME) created the International Monetary Market (IMM), which specialized in foreign currency futures, and options on futures on the major currencies. In 1982, the Chicago Board Option Exchange (CBOE) and the Philadelphia Stock Exchange introduced options on spot exchange rates. Banks joined the trend by offering over-the-counter (OTC) forward contracts and options on exchange rates to their customers.

The development of interest rate volatility and derivative instruments followed a similar story from the early 1970s, as we describe in Chapter 6 of EoRM3. The equity and commodity markets also came to support significant derivatives markets, often actively developed by banking institutions. The end result of bank activity in these new derivative markets was that banks naturally became ever more exposed to volatile derivative instruments—and these exposures had to be carefully risk managed.

Group of Thirty (G-30) Policy Recommendations

The 1996 Amendment to the Basel Accord had a notable precursor. In 1993, the Group of Thirty (G-30) published a report that described best-practice price risk management recommendations for dealers and end-users of derivatives (as well as for legislators, regulators, and supervisors). The report was based in part on a detailed survey of industry practice among dealers and end-users around the world.

The G-30 focussed on providing practical guidance in terms of managing derivatives businesses, offering an important benchmark against which participants could measure their own price risk management practices. Its recommendations covered sound market risk policies (e.g., the establishment of a market risk function independent from trading decisions); credit risk policies; enforceability policies; infrastructure policies and accounting and disclosure policies; and so on. They continue to act as the cornerstones of any modern bank risk management framework.

The 1996 Market Risk Amendment (“1996 Amendment”)

The recommendations in the G-30 report helped establish qualitative standards for bank risk management of derivative market risk. But the explosion in bank trading of derivatives and more mundane securities clearly had implications for how regulators calculated the amount of regulatory capital a bank should set aside to cover risk.

The “1996 Amendment” to the 1988 Accord, implemented in 1998, extended the initial Accord to include risk-based capital requirements for the market risks that banks incur in their trading accounts. The fundamental innovation of the 1996 Amendment was to allow sophisticated banks to use their own internal VaR model (see Chapter 7 of EoRM3) to calculate regulatory capital for market risk in their trading book.

Market risk is not the only risk arising from instruments such as derivatives: they give rise to credit risk as well. Under the 1996 Amendment, off-balance-sheet derivatives, such as swaps and options, are subject to both the market risk charge and to the credit risk capital charges stipulated in the original 1988 Accord.

By contrast, on-balance-sheet assets in the trading portfolio are subject to the market risk capital charge only—a feature that helped offset the aggregate effect of the new rules on the amount of capital banks had to set aside.

Also, banks adopting the internal models approach tended to realize substantial capital savings, in the order of 20 to 50 percent, depending on the size of their trading operations and the type of instruments they traded. This is because internal models can be designed to capture diversification effects by modeling the correlations between positions.

In addition to the market risk capital adequacy requirements, the Basel Committee set limits on concentration risks. Under the Amendment, risks that exceed 10 percent of the bank’s capital must be reported, and banks are forbidden to take positions that are greater than 25 percent of the bank’s capital. As a historical footnote, had these rules been in effect in 1994, Barings Bank would have been prohibited from building up such huge exchange-traded futures positions, and the world’s most famous example of rogue trading might have been avoided. (At the time the bank collapsed in February 1995, Barings’ exposures on the SIMEX and OSE were 40 percent and 73 percent of its capital, respectively.)

1996 Amendment qualitative requirements

Before an institution became eligible to use its own internal VaR model to assess the regulatory capital related to market risk, the regulators insisted it must put sound risk management practices in place—largely in accord with the G-30 recommendations we described earlier.

In particular, the institution needed to demonstrate that it had a strong risk management group, independent from the business units that the group monitored and reporting directly to the senior executive management of the institution.

Implementing a VaR model is a significant endeavor, as we describe in more detail in Chapter 7 of EoRM3. An important part of setting up any VaR model for regulatory purposes is ensuring that the risk factor model inputs are reliable and accurate:

- A formal vetting system is needed to approve the models, any modifications to them, their assumptions, and their calibration.
- Model parameters should be estimated independently of the trading desks to avoid the temptation by the traders to “fudge” volatility numbers and other key parameters.

From pp. 131–136 of *The Essentials of Risk Management, Second Edition (EoRM2)*

APPENDIX 3.3

Basel II and Minimum Capital Requirements for Credit Risk

The Basel II framework maintained both the wide definition of capital employed by Basel I and the minimum capital requirement of 8 percent of risk-weighted assets (though these decisions were undermined by the 2007–2009 financial crisis and have been altered in Basel III). However, Basel II made two key changes with regard to minimum capital requirements.

First, the regulators extended the risk calculation to include both market risk (i.e., incorporation of the 1996 Amendment on market risk) and operational risk:

$$\frac{\text{Total Capital}}{\text{Credit Risk} + \text{Market Risk} + \text{Operational Risk}} = \text{Capital Ratio (Minimum 8\%)} \quad (1)$$

where risk weighted assets are the sum of the assets subject to market, credit, and operational risk. Tier 2 capital cannot exceed more than 50 percent of total regulatory capital, which is the sum of Tier 1 and Tier 2 capital.

The second key change concerns the way that credit risk is to be calculated. Basel II set out an improved standard approach for calculating credit risk (known as the Standardized Approach), as well as two more advanced approaches based on a bank's own internal ratings: the Internal Ratings Based (IRB) Foundation and Advanced approaches to calculating minimum required capital for credit risk.

There is a significant wrinkle in how the three approaches treat expected and unexpected losses. Under the Standardized Approach, Basel II incorporates both expected and unexpected losses (see Chapter 1 of EoRM3 for their definition) into the calculation of credit risk capital requirements (in contrast to the 1996 Market Risk Amendment, which is only concerned with *unexpected loss* for market risk in the trading book).¹ Under both the IRB approaches, the above treatment of the 1988 Accord to include general loan-loss reserves in Tier 2 capital is withdrawn. Instead, banks need to compare the expected loss to the total eligible provisions. When expected loss is greater than the eligible provisions, banks have to deduct the difference from capital, with the deduction being on the basis of 50 percent from Tier 1 and 50 percent from Tier 2 capital. In the other instance, when expected loss is less than the eligible provisions, banks may recognize the difference in Tier 2 capital up to a maximum of 0.6 percent of credit risk-weighted assets.

Now let's look in more detail at the Standardized, IRB Foundation, and IRB Advanced approaches to calculating minimum required capital for credit risk.

1. The justification for including expected losses in the capital requirement is that loan loss reserves are already counted as Tier 2 capital and are constituted to protect the bank against credit losses. However, loan loss reserves are only eligible for Tier 2 capital up to a maximum of 1.25 percent of risk weighted assets.

The Standardized Approach

The Standardized Approach is conceptually the same as the 1988 Accord, but was designed to be more risk sensitive. The bank allocates a risk weight to each of its assets and off-balance-sheet positions and produces a sum of risk-weighted asset values.

For example, a risk weight of 50 percent means that an exposure is included in the calculation of risk-weighted assets at 50 percent of its full value, which then translates into a capital charge equal to 8 percent of that value or, equivalently, to 4% ($= 8\% \times 50\%$) of the exposure.

Individual risk weights depend both on the broad category of borrower, that is, whether the borrower is a sovereign, a bank, or a corporation, and on the rating provided by an external rating agency (Table 3A.4). For banks' exposures to sovereigns, the Basel Committee applies the published credit scores of export credit agencies.

For claims on corporations, Basel II retains a risk weight of 100 percent except for highly rated companies, that is, those rated AAA to A⁺ and non-investment-grade borrowers rated below BB⁻. Highly rated companies benefit from a lower risk weight of 20 to 50 percent. Non-investment-grade companies rated below BB⁻ are attributed a risk weight of 150 percent. Short-term revolvers, with a term less than a year, are subject to a capital charge of 20 percent, instead of zero under Basel I. Therefore, Basel II puts highly rated corporate claims on the same footing as the obligations of banks and government-sponsored enterprises.

TABLE 3A.4 Standardized Approach: New Risk Weights

Claim	Credit Assessment					
	AAA to AA ⁻	A ⁺ to A ⁻	BBB ⁺ to BBB ⁻	BB ⁺ to BB ⁻ (B ⁻) ^a	Below BB ⁻ (B ⁻) ^a	Unrated
Sovereigns	0%	20%	50%	100%	150%	100%
Option 1 ^b	20%	50%	100%	100%	150%	100%
Banks	20%	50%	50%	100%	150%	50%
Short-term claims ^d	20%	20%	20%	50%	150%	20%
Corporates	20%	50%	100%	100%	150%	100%
Securitization tranches ^e	20%	50%	100%	350%	Deduction from capital	

^a B⁻ is the cutoff rating for sovereigns and banks. It is BB⁻ for corporates and securitization exposures.

^b Risk weighting based on risk weighting of sovereign in which the bank is incorporated. Banks incorporated in a given country will be assigned a risk weight one category less favorable than that assigned to claims on the sovereign, with a cap of 100 percent for claims to banks in sovereigns rated BB⁺ to B⁻.

^c Risk weighting based on the assessment of the individual bank.

^d Short-term claims in option 2 are defined as having an original maturity of three months or less.

^e The risk weights for short-term ratings are 20 percent for A-1/P-1, 50 percent for A-2/P-2, and 100 percent for A-3/P-3; for all other ratings or unrated, there is capital deduction.

Source: Basel Committee on Banking Supervision, 2004.

Shortcomings of the Standardized Approach

How successful is the Standardized Approach at mending the gaps in the original 1988 Accord? Our view is that the Standardized Approach is an improvement, but presents flaws rather similar in kind to those of the 1988 Accord. Banks have the same incentive to play the regulatory arbitrage game for the following reasons:

- There is not enough differentiation among credit categories: six credit categories (including unrated) are not sufficient. For example, the same risk weight (100 percent) is attributed to a corporate investment-grade facility rated BBB and a non-investment-grade facility rated BB⁻.
- The unrated category receives a risk weight of 100 percent, which is less than that attributed to noninvestment grade facilities rated below BB⁻. This does not make much sense since it removes any incentive for high risk institutions to pay for a rating. So long as they remain unrated, they will be treated as if they were investment grade. Clearly, the highest risk weight should apply to any firms that elect to remain unrated.
- The Standardized Approach attributes too much capital—more than is required for economic protection—to investment grade facilities (e.g., 1.6 percent for AA facilities) and not enough to non-investment-grade debt (e.g., 12 percent to B facilities).

For example, if we look at the period 1981–1999 there was not a single default on bonds rated AAA to AA⁻ (corresponding to the first bucket of the Standardized Approach), within one year of an entity holding that rating (though a few exceptions did occur in subsequent years). Yet the Standardized Approach attributes 1.6 percent of capital to such assets held by a bank.

The IRB approach

Under the IRB (internal-ratings-based) approach to assess risk capital requirements, banks have to categorize banking book exposures into at least five broad classes of assets with different underlying credit risk characteristics; the classes include corporations, banks, sovereigns, retail, and equity. This classification is broadly consistent with established bank practices. Within the corporate and retail asset classes, sub-classes are separately identified. The IRB proposes a specific treatment for securitization exposures.

The IRB approach provides for distinct analytical frameworks for different types of loan exposures—for example, corporate and retail lending. Here, we'll focus on corporate loans and bonds.

Banks adopting the IRB approach are allowed to use their own internal risk ratings methodology to assess credit risk subject to the approval by the regulator of the bank's internal rating system, and validation of the way the bank produces the key risk parameters for calculating credit risk.

These key risk parameters include the probability of default (PD) for each rating category, the loss given default (LGD), and exposure at default (EAD) for loan commitments.

Under the IRB, the calculation of the potential future loss amount, which forms the basis of the minimum capital requirement, encompasses unexpected losses. It is derived from a formula whose key inputs are the PD, LGD, EAD, and maturity, M, of the facility.

In the Foundation approach, banks estimate the PD associated with each borrower, and the supervisors supply the other inputs, as follows:

- LGD = 45 percent for senior unsecured facilities and 75 percent for subordinated claims; the existence of collateral will lower the estimated LGD

- $EAD = 75$ percent for irrevocable undrawn commitments²
- $M = 2.5$ years except for repo-style transactions where the effective maturity will be six months

In the Advanced IRB approach, banks that meet rigorous standards in terms of their internal ratings system and capital allocation process are permitted to set the values of all the necessary inputs. That is, they won't be restricted to estimating the PD of their assets but can also estimate the LGD, EAD, and M risk parameters.

Still, the Basel Committee stopped short of permitting banks to calculate their capital requirements on the basis of their own internal credit risk portfolio models, which would have allowed each bank to capture unique portfolio effects that tend to reduce total bank risk exposure. Instead, the IRB approach allocates capital facility by facility (though some portfolio effects are indirectly captured in the formula through the average asset correlation embedded in the calculation of the risk weights). However, the Basel Committee does encourage banks to use more sophisticated approaches and models to assess credit risk under Pillar II of the new rules.

2. The credit conversion factor is zero percent only for unconditionally and immediately cancellable commitments.

From pp. 137–142 of *The Essentials of Risk Management, Second Edition (EoRM2)*

APPENDIX 3.4

Basel 2.5: Enhancements to the Basel II framework

During the 2007–2009 crisis a number of banks experienced large losses in their trading books, the risk of which had not been captured in the banks' VaR models. This pointed to a number of deficiencies in the VaR-based capital methodology, which is typically based on a 99 percent one-day VaR, scaled up to 10 days. The following additional capital charges were therefore imposed:¹

- *Stressed value-at-risk.* Banks using internal models in the trading book must calculate a stressed value-at-risk based on a 12-month period of significant financial stress. The calculation should be portfolio specific. This additional capital charge recognizes that traditional VaR calculations capture the risk of normal markets, and are not calibrated to period of stress.
- *Incremental Risk Charge (IRC).* Many of the losses during the credit crisis were not caused by defaults, but rather by a loss of liquidity and a decline in values due to credit migration and a widening of credit spreads. The IRC represents an estimate of the default and migration risks of unsecuritized credit products over a one-year horizon at the 99.9 percent confidence level, taking into account the liquidity horizons of individual positions, or sets of positions.²

The IRC encompasses all positions subject to a capital charge for specific interest rate risk according to the internal models approach, except securitization positions which have a different treatment as discussed below.

The IRC model should also capture the impact of rebalancing positions at the end of their liquidity horizons so as to achieve a constant level of risk over a one-year horizon; that is, existing exposures are rebalanced at the end of the liquidity horizon or rolled over when they mature so as to maintain the initial risk level as indicated by a risk metric such as VaR or the profile of exposures by credit rating and concentration.

The IRC charge includes the impact of clustering of default and migration events during stressed markets.

The impact of diversification between default or migration events and other market factors is not taken into account. Therefore, the IRC capital charge is simply added to the VaR-based capital charge for market risk.

For securitized products in the trading book, the capital charges of the banking book apply with the exception of so-called “correlation trading portfolios.” So-called “resecuritizations”—for example, collateralized debt obligations of asset-backed securities (CDOs of ABSs)—also receive a specific rating-based charge, reflecting their prominent role in the credit crisis.

1. Banks were originally expected to comply with the revised requirements by December 31, 2010; however, by 2012, only Australian, European, and several Asian banks had implemented Basel 2.5.

2. The liquidity horizon represents the time required to sell the position or hedge all material risks covered by the IRC model in a stressed market. The liquidity horizon has a minimum term of three months.

Correlation trading books³ are exempt from the full treatment for securitization positions and qualify for a revised standardized charge or a capital charge based on a “comprehensive risk measure” (CRM) that captures not only incremental default and migration risks, but all price risks including basis risk. But capital charges for these portfolios remain subject to a floor of 8 percent of the standardized charge.

In addition, banks using the internal models approach for market risk should have in place a rigorous and comprehensive stress-testing program. Banks’ stress scenarios should cover a range of factors that can create extraordinary losses or gains in trading portfolios. These factors include low-probability events in all major types of risks (market, credit, operational risks, and liquidity risk).

Scenarios should include past periods of significant disturbances, such as the 1987 equity market crash, the exchange-rate mechanism crises of 1992 and 1993, the fall in bond markets in the first quarter of 1994, the 1998 Russian financial crisis and subsequent LTCM failure, the bursting of the technology stock bubble at the turn of the millennium, and the 2007–2009 financial crisis. The scenarios should include both the large price movements, and the sharp reduction in liquidity, associated with these events. Furthermore, the bank should also develop a second type of scenario to evaluate the sensitivity of the bank’s market risk exposure to shocks in risk factors such as volatilities and correlations. Regulators say that banks must develop bank-specific scenarios, selecting the most challenging scenarios given the unique characteristics of each bank’s portfolios.

Taken as a whole, the result of the Basel 2.5 reforms is that each bank must meet, on a daily basis, a capital requirement expressed as the sum of:

$$\text{Capital} = \max \{ \text{VaR}, k \times (\text{average VaR over 60 days}) \} + \max \{ \text{Stress VaR}, k \times (\text{average Stress VaR over 60 days}) \} + \text{IRC}$$

where:

- $k \geq 3$.
- VaR is measured at the 99 percent confidence level over a 10-day period and combines both “general market risk” and “specific risk.”
- Stress VaR is computed using data from a stressful period, such as 2007–2009.
- IRC (incremental risk charge) is a credit VaR calculated over a one-year period at the 99.9 percent confidence level that should capture both default risk and migration risk and should be calibrated to the bank’s own “through the cycle” historical loss experience. All positions that generate a potential credit risk should be included in the IRC. Note that all sovereign bonds are subject to the IRC, which poses the thorny question of the probability of default of a country—for example, the United States.⁴

3. Correlation trading portfolios may include simple securitization exposures and n-to-default credit derivatives that meet the following criteria:

- The position is not a resecuritization, an option on a securitization tranche, or a synthetically leveraged supersenior tranche.
- All reference entities are single-name products, including single-name credit derivatives and CDS Index tranches, and bespoke tranches for which a two-way market exists.

Even so, these desks are exposed to “basis risk”—for example, between the bespoke and index tranches. At sophisticated firms, these risks are measured through VaR, which typically includes base correlation VaR and specific VaR.

4. Even if certain sovereign bonds are subject to a zero percent risk weight under the Standardized Approach, they will attract a capital charge under the IRC.

Discussion of Basel 2.5

Trading book capital used to be predominantly driven by one risk measure, VaR. Under Basel 2.5 it is driven by VaR, stressed VaR, the IRC, the CRM, and the standardized charges for securitization, plus a standardized floor for the CRM.

The main problem with this additional complexity is that it has many internal inconsistencies. Basel 2.5 is a patchwork of overconservative, overlapping rules that, added together, generate a punitive level of capital for the trading book. For some trades, the amount of capital may even exceed the face value of the position—that is, be more than the bank can possibly lose. According to the Basel Committee's own calculations, as a result of the Basel 2.5 revisions, market risk capital requirements will increase by an estimated average of three to four times for large internationally active banks. The banking industry is therefore hoping that a forthcoming fundamental review of trading book capital (see below) will propose a more consistent capital charge for market risk.

However, the rules themselves are not the only problem. Prompted by growing complaints from banks and analysts that the ratio of RWAs to assets can be inexplicably different from one institution to the next, the Basel Committee conducted a study in 2012 to review the calculation of the RWAs for the trading book. The Basel Committee handed the same hypothetical trading portfolio to 15 large banks in nine countries and asked them to calculate the total capital to support it. The results, published in January 2013, ranged from 13 to 35 million euros. This was worrying enough; however, the variation within individual asset classes, such as credit risk or interest rate portfolios, reached as much as eight times (from bank to bank).

The Basel Committee discovered that the variance in the results was driven as much by the decisions of different supervisors as by bank modeling decisions. In some countries, supervisors routinely instruct individual banks, or banks of a certain class, to hold extra capital against particular kinds of assets. Similarly, some supervisors restrict the kind of risk model that can be used by banks, while others allow banks more freedom. Whatever the cause, the results are clearly somewhat alarming and indicate the need for an overall revision of industry practices when computing trading book RWAs.

Fundamental Review of the Trading Book

Basel 2.5 was something of an emergency response to the undercapitalization of banks' trading books revealed during the subprime crisis. However, it suffers a number of recognized shortcomings. Regulators are preparing for a more fundamental review that is likely to address the following areas:

- *Lack of coherence:* The current framework is characterized by a layer of overlapping capital charges that can lead, as we discussed above, to a capital charge that is higher than the actual maximum loss.
- *Boundary between the trading book and the banking book:* Large differences in the capital requirements for similar types of risk in the trading book and the banking book (e.g., treatment of interest rate risk) may lead to regulatory arbitrage.
- *Market liquidity risk:* The industry needs to develop a comprehensive framework that captures the risk of market illiquidity during stressed periods.
- *Internal models-based approach and risk measure:* A number of weaknesses have been identified with regard to the use of value-at-risk (VaR) for determining regulatory requirements, including

its inability to capture “tail risk.” The Basel Committee is contemplating adopting an alternative: the expected shortfall (ES) approach. This measures the expected loss beyond a given confidence level, as we discuss in more detail in Chapter 7 of EoRM3. In addition, risk models would be calibrated to a period of significant financial stress.

- *Standardized approach*: The current standardized approach to market risk would be revamped to improve risk sensitivity, in order to reduce the risk sensitivity gap between the standardized and the models-based approaches. The revised standardized approach would also become a more credible fallback in case a bank’s internal risk model is deemed inadequate.
- *Credit value adjustments (CVA)*: The relationship between counterparty credit risk and the trading book regime needs to be clarified.

From pp. 143–150 of *The Essentials of Risk Management, Second Edition (EoRM2)*

APPENDIX 3.5

Contingent Convertible Bonds

Contingent convertible bonds, known as “CoCos” or “CoCo bonds,” are bonds issued by a bank or an insurance company that convert into common equity, or are subject to a write-down, at prespecified trigger levels as soon as the bank enters a life-threatening situation. Conversion, or the write-down, happens via a predefined trigger mechanism—for example, when core Tier 1 capital (CT1) falls below 5 percent.

Contingent capital can be viewed as a form of catastrophe insurance. When the bank is in a stressed situation, with a high risk of default, investors provide automatic loss-absorbing capital with the debt being partially canceled or converted into common equity.

Conversion into common equity creates dilution for existing shareholders, but helps to protect taxpayers from a costly bailout if a conversion event occurs. From a bank perspective, these securities can help fulfill post-crisis capital requirements without diluting common equity holders, as long as conversion does not occur.

CoCos and Regulation

The primary function of capital is to absorb losses as they arise and help preserve the bank as a going concern. However, bank hybrid Tier 1 capital, such as trust preferreds, was found to be ineffective in practice during the 2007–2009 financial crisis. Banks continued to pay interest on their hybrid debt to avoid being shut out of the market in the future. Tier 2 capital instruments also failed to perform their loss absorbing function, beyond occasional coupon deferrals and voluntary exchanges, because institutions were often not permitted to fail.

Basel III specifically mentions the potential role for CoCos in meeting capital requirements.¹ According to Basel III, the new capital requirements are a minimum CT1 of 4.5 percent with a minimum Tier 1 capital ratio of 6 percent, and a minimum total capital ratio of 8 percent. Since September 2010, Basel III requires banks to constitute, in addition to these minima, a capital conservation buffer (CCB) of 2.5 percent over the period 2016–2019. It follows that banks are permitted under Basel III to hold 1.5 percent of their risk-weighted assets in noncore Tier 1 (6 percent Tier 1 – 4.5 percent CT1) and 2 percent in Tier 2 capital. This 3.5 percent bucket of noncore Tier 1 capital could be met by using CoCos.

In addition, banks may use CoCos to meet capital requirements imposed by national regulators that are above the minimum Tier 1 set by Basel III. In October 2010, the Swiss government asked Swiss banks to hold 19 percent of their risk-weighted assets as Tier 1 capital, of which 9 percent could be held in the form of CoCos; of the 9 percent, 3 percent must trigger if CT1 falls below 7 percent and the other

1. But the Basel Committee ruled against the use of CoCos to meet the capital surcharge for SIFIs. Only common equity will be eligible for that purpose.

6 percent must trigger if CT1 falls below 5 percent. Swedish and Danish regulators have said banks may be able to use CoCos to meet additional capital requirements.

The European Commission's new Basel III directive (CRD 4) explicitly refers to CoCos as a way of meeting additional Tier 1 capital, with a trigger event occurring when CT1 falls below 5.125 percent (or at a higher level set by the institution).²

Tax laws in Europe allow banks to deduct the coupon on CoCos from their taxable income, whether the CoCos are of the convertible or write-down variety. However, the U.S. Internal Revenue Service treats CoCos as equity so issuers' interest payments are not tax deductible—making CoCos much less attractive for U.S. banks. This wrinkle probably explains why the Basel Committee decided not to allow the use of CoCos to meet the additional capital surcharge for systemically important financial institutions.

Features of CoCos

There are various kinds of CoCo, differentiated by the timing of the cash infusion (funded versus unfunded), the type of trigger, and the conversion amount.

Funded vs. unfunded CoCos

So far, we've mainly discussed funded CoCos, which allow an institution to raise capital in the good times and, potentially, to meet regulatory capital requirements.

By contrast, unfunded CoCos provide cash only when the conversion is triggered, offering loss-absorbing capital and liquidity during times of crisis. The institution pays a premium for this option: a commitment fee. Typically, the commitment is of finite duration.³ Unfunded CoCos create counterparty risk because the bank only receives the cash when conversion is triggered, typically at a time of systemic stress that may also affect the counterparty.

Trigger events

Trigger events can be either accounting-based or market-based, although so far only accounting-based triggers have been proposed.

Accounting-based triggers

Accounting triggers are in the form of Tier 1 capital or equity capital thresholds—for example, when Tier 1 capital falls below 5 percent. One problem here is that Tier 1 ratios are not directly observable by market participants. They are reported on a quarterly basis by most banks, or at the discretion of the banks, though regulators and supervisors have access to this information and can require the bank to make it public.

A second problem is that, in the run-up to the 2007–2009 financial crisis, there was little difference between the Tier 1 ratios of “crisis banks”—that is, those that eventually failed or were bailed out by their

2. European Directive CRD, European Commission 2011, pp. 74–77. The European Directive CRD 4 translates the Basel III rules into law for European banks.

3. Unfunded CoCos are somewhat similar to a CDS except that when triggered new equity is exchanged for cash.

governments—and banks that survived.⁴ On a related note, regulators have become concerned about variations in the risk weights assigned to similar assets by different banks, which may reflect an intention by some banks to underplay risk.⁵ This kind of variation means that capital ratios may not be easy to compare.

The worry that capital triggers lack transparency, can be manipulated, and may be triggered far too late, explains why regulators often retain the option to force conversion if they judge that the bank is close to default.

Market-based triggers

Potentially, market-based triggers can be used to circumvent the limitations of accounting-based triggers. They could take various forms, for example:

- Pre-agreed minimum price level for bank shares
- Ratio of market capitalization to book value of assets
- Credit default swap spread on the debt issued by the bank

Market-based triggers are relatively objective and transparent and can be verified in real time by regulators and market participants. They could also help in enhancing supervisory discretion and market discipline.

There are some potential issues to overcome. For example, during the “Flash Crash” of May 6, 2010, almost all the stocks traded in the United States suffered a huge downward price correction, only to recover minutes later. A share price trigger might have forced a CoCo conversion for no good reason. However, most of these practical concerns, including manipulation by short sellers, can be overcome quite easily—for example, by basing the trigger on a rolling average of stock prices over the preceding 20 or 30 days.

Conversion amount

Most CoCo issues are converted into shares of common equity either according to a pre-determined number of shares (or equivalently at a predetermined share price), which affects the extent of the dilution to existing shareholders, or at a share price defined in reference to the share price prevailing when conversion is triggered.

CoCos that have the conversion strike set at the spot level prevailing at issuance imply a significant risk for the CoCo holders, potentially increasing the risk premium to potentially uneconomical levels for the issuer. By contrast, if the new shares are issued at the share price prevailing when conversion is triggered, then there is no dilution and no loss of value for the CoCo holders. It is expected that the regulator will oblige the holders of CoCos to participate in losses, so the trigger will be probably set at around 50 percent of the stock price at issuance.

An alternative to conversion into shares of common equity is a partial, or total, write-down of the nominal of the CoCos. This is more natural than conversion into new shares for a nonpublic institution.

4. Indeed, many banks that failed in 2008 were better capitalized before the crisis than those that did not fail. Five U.S. financial institutions that either failed or were forced into government-assisted mergers in 2008—that is, Bear Stearns, Washington Mutual, Lehman Brothers, Wachovia, and Merrill Lynch—had regulatory capital ratios 50 to 100 percent above the regulatory minimum of 8 percent. Citibank had a Tier 1 capital ratio that never fell below 7 percent during the course of the financial crisis and stood at 11.8 percent in December 2008 when the bank’s stock market capitalization reached its lowest level. (Kuritzkes, A. and H. Scott, “Markets are the Best Judge of Bank Capital,” *Financial Times*, September 23, 2009).

5. “A Weight on Their Minds,” *Risk Magazine*, July 2011, pp. 36–39.

Pros and Cons of CoCos

CoCos provide leverage in good times and a buffer to absorb losses and relief from debt servicing obligations in bad times. They can help to reduce the risk to the taxpayer from implicit “too-big-to-fail” government guarantees. Both the funded and unfunded versions incentivize financial institutions to engage in conservative and prudent risk management because the cost of diluting incumbent shareholders and management (through their holding of company shares) is substantial.

However, the triggering of a CoCo might itself trigger a wider stress scenario if it signals to investors that other banks might also be in a stressed situation. There is also the risk of contagion if the bank’s CoCos have been mainly invested in by other financial institutions, who are forced to absorb large losses. Also, as the trigger point comes closer, some investors may protect their investment by short selling shares against their long position in the CoCos—potentially setting off a “death spiral” for the bank. Furthermore, as the trigger comes closer, banks might be tempted to take additional excessive risks to force conversion—wiping out their outstanding CoCo debt. Finally, it is possible that contingent capital will introduce market inefficiencies because conversion will eliminate or postpone a default event, which is often the moment that inefficient businesses are restructured and poor managers replaced.⁶

CoCo Issuers

Principal examples

As of early 2013, five banks (Lloyds in November 2009, Rabobank in March 2010, Credit Suisse in February 2011, Bank of Cyprus in April 2011, and KBC in January 2013), one insurance company (Allianz, the German insurer, in July 2011), and one reinsurance company (Swiss Re in March 2013) have issued CoCos.⁷

While CoCo issuance is off to a relatively slow start, other international institutions are now contemplating CoCos—for example, the Spanish and Portuguese governments plan to use CoCos to help support their banks.

Other CoCos and CoCo-related issues

An example of an unfunded CoCo is the contingent capital solution provided in 2009 by the U.K. government to the Royal Bank of Scotland (RBS). The U.K. government is committed to providing RBS with £8 billion of capital if its CT1 falls below 5 percent.

Another example of an unfunded guarantee akin to a CoCo is the deal brokered by Royal Bank of Canada (RBC) in 2001 with Swiss Re. Swiss Re will inject C\$200 million into RBC in exchange for preferred shares if a high loss-low probability event happens to lower a large portion of RBC’s reserves.

In the same insurance context, in 2010, SCOR, a Paris-based insurance and reinsurance company entered into a three-year contingent capital deal with UBS. If the amount of net catastrophe losses

6. O. Hart, and L. Zingales, “A New Capital Regulation for Large Financial Institutions,” working paper, April 2009.

7. For a detailed analysis of these CoCo bonds, consult J. De Spiegeleer and W. Schoutens, *Contingent Convertible (CoCo) Notes: Structure and Pricing*, Euromoney Books, 2011.

experienced by SCOR reaches a certain trigger, UBS is committed to inject €150 million into SCOR in exchange for shares of common equity at a preset price.

CoCo Bonuses

The bonus culture in investment banks has been blamed for encouraging disproportionately risky behavior, which in turn helped to lead to the financial crisis. New compensation schemes are needed that better align compensation with long-term shareholder interests,⁸ and perhaps also with the interests of other bank stakeholders.

So far, the schemes that have been suggested are largely based on equity. However, the trouble with equity incentives is that equity is the equivalent of a call option on the assets of the bank—the holder enjoys all of the upside of a share price rise, but only a limited amount of the downside. Given this limited liability, executives paid in equity have a powerful incentive to take excessive risks. And when the bank is in trouble they may be tempted to bet the bank, in the knowledge that they can only lose their residual near-valueless equity; bondholders and creditors have much more at stake if the bank fails.

The G20 meeting of September 2009 recommended that bankers should be exposed to downside risk by deferring compensation and through mechanisms that could claw back bonuses.

CoCos offer an interesting way to achieve this. Bonuses paid in the form of a CoCo bond have a value that is closely tied to the health and actual performance of banks. They increase exposure to downside risk, and they do not incentivize strategies that would ramp-up the share price in the shortterm (as equity can).⁹ With CoCo bonuses, there should be no risk of a “death spiral,” as banks and regulators can enforce rules against employee short selling and hedging CoCo exposures.¹⁰

In 2010, the European Parliament gave banks the green light to use CoCos as part of their compensation packages, as follows:

- Upfront cash bonuses will be capped at 30 percent of the total bonus and at 20 percent for particularly high bonuses.
- Between 40 and 60 percent of any bonus must be deferred for at least three years.
- Moreover, at least 50 percent of the total bonus will be paid as contingent capital and shares.

Barclays Capital was the first bank to say publicly, in January 2011, that it will issue CoCos and use them as bonus payments to employees (as part of their deferred compensation). These CoCo bonds would become worthless should Barclays' CT1 fall below 7 percent. Barclays' preferred version of CoCos takes the form of a loss-absorbing bond—for example, possibly one that loses its coupons or has a haircut in value, rather than a bond that converts into equity.

8. However, a substantial portion of the equity at both Lehman Brothers and Bear Stearns was in the hands of the CEOs and the top executives, who probably believed that their interests were aligned with those of outside shareholders. This suggests that shareholder alignment may offer only a partial solution to the problem.

9. There is “unlimited” upside only after conversion, when the bank becomes closely monitored by the regulator.

10. There may still be a “perception” problem here. CoCos usually pay a high coupon to compensate for the conversion risk. Public opinion may regard this as a “double bonus”—that is, a high coupon plus a cash payment at maturity. Therefore, CoCo bonuses should be structured so that they don't pay any coupon or pay very low interest.