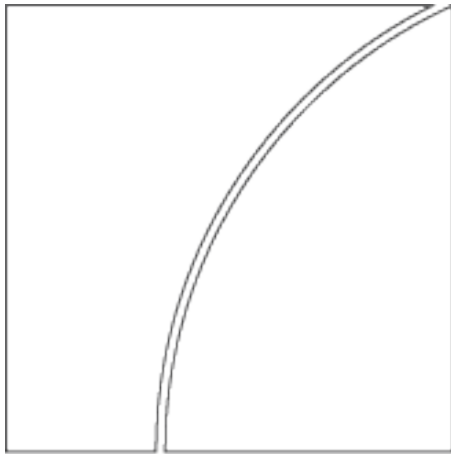# Basel Committee on Banking Supervision

MAR

Calculation of RWA for market risk

This standard describes how to calculate capital requirements for market risk and credit valuation adjustment risk.

BANK FOR INTERNATIONAL SETTLEMENTS

Contents

MAR10

Definition and application for market risk

This chapter defines market risk, the scope and coverage of market risk capital requirements and the methods available for calculating market risk capital requirements.

Version effective as of 15 Dec 2019

First version in the format of the consolidated framework.

Definition of market risk

10.1 Market risk is defined as the risk of losses in on and off-balance-sheet positions arising from movements in market prices. The risks subject to this requirement are:

(1) The risks pertaining to interest rate related instruments and equities in the trading book;

(2) Foreign exchange risk and commodities risk throughout the bank.

Scope and coverage of the capital requirements

10.2 The capital requirements for interest rate related instruments and equities will apply to the current trading book items prudently valued by banks, alongside CAP50. The definition of trading book is set out in RBC25.

10.3 All transactions, including forward sales and purchases, shall be included in the calculation of capital requirements as from the date on which they were entered into. Although regular reporting will in principle take place only at intervals (in most countries quarterly), banks are expected to manage the market risk in their trading book in such a way that the capital requirements are being met on a continuous basis, ie at the close of each business day. Supervisory authorities have at their disposal a number of effective measures to ensure that banks do not "window-dress" by showing significantly lower market risk positions on reporting dates. Banks will also, of course, be expected to maintain strict risk management systems to ensure that intra-day exposures are not excessive. If a bank fails to meet the capital requirements, the national authority shall ensure that the bank takes immediate measures to rectify the situation.

10.4 The capital requirements for foreign exchange risk and for commodities risk will apply to banks' total currency and commodity positions, subject to some discretion to exclude structural foreign exchange positions. It is understood that some of these positions will be reported and hence evaluated at market value, but some may be reported and evaluated at book value.

10.5 A matched currency position will protect a bank against loss from movements in exchange rates, but will not necessarily protect its capital adequacy ratio. If a bank has its capital denominated in its domestic currency and has a portfolio of foreign currency assets and liabilities that is completely matched, its capital/asset ratio will fall if the domestic currency depreciates. By running a short position in the domestic currency the bank can protect its capital adequacy ratio, although the position would lead to a loss if the domestic currency were to appreciate.

10.6 Supervisory authorities are free to allow banks to protect their capital adequacy ratio in this way. Thus, any positions which a bank has deliberately taken in order to hedge partially or totally against the adverse effect of the exchange rate on its capital ratio may be excluded from the calculation of net open currency positions, subject to each of the following conditions being met:

(1) such positions need to be of a "structural", ie of a non-dealing, nature (the precise definition to be set by national authorities according to national accounting standards and practices);

(2) the national authority needs to be satisfied that the "structural" position excluded does no more than protect the bank's capital adequacy ratio;

(3) any exclusion of the position needs to be applied consistently, with the treatment of the hedge remaining the same for the life of the assets or other items.

10.7 No capital requirements need apply to positions related to items that are deducted from a bank's capital when calculating its capital base, such as investments in non-consolidated subsidiaries, nor to other long-term participations denominated in foreign currencies which are reported in the published accounts at historic cost. These may also be treated as structural positions.

10.8 Positions in the bank's own eligible regulatory capital instruments are deducted from capital. Positions in other banks', securities firms', and other financial entities' eligible regulatory capital instruments, as well as intangible assets, will receive the same treatment as that set down by the national supervisor for such assets held in the banking book, which in many cases is deduction from capital. Where a bank demonstrates that it is an active market maker then a national supervisor may establish a dealer exception for holdings of other banks', securities firms', and other financial entities' capital instruments in the trading book. In order to qualify for the dealer exception, the bank must have adequate systems and controls surrounding the trading of financial institutions' eligible regulatory capital instruments.

10.9 In the same way as for credit risk, the capital requirements for market risk are to apply on a worldwide consolidated basis. Where appropriate, national authorities may permit banking and financial entities in a group which is running a global consolidated book and whose capital is being assessed on a global basis to report short and long positions in exactly the same instrument (eg currencies, commodities, equities or bonds), on a net basis, no matter where they are booked. [1] Moreover, the offsetting rules as set out in this section may also be applied on a consolidated basis. Nonetheless, there will be circumstances in which supervisory authorities demand that the individual positions be taken into the measurement

system without any offsetting or netting against positions in the remainder of the group. This may be needed, for example, where there are obstacles to the quick repatriation of profits from a foreign subsidiary or where there are legal and procedural difficulties in carrying out the timely management of risks on a consolidated basis. Moreover, all national authorities will retain the right to continue to monitor the market risks of individual entities on a non-consolidated basis to ensure that significant imbalances within a group do not escape supervision. Supervisory authorities will be especially vigilant in ensuring that banks do not pass positions on reporting dates in such a way as to escape measurement.

Footnotes

[1]   *The positions of less than wholly-owned subsidiaries would be subject to the generally accepted accounting principles in the country where the parent company is supervised.*

Correlation trading portfolio

10.10 For the purposes of this framework, the correlation trading portfolio incorporates securitisation exposures and n-th-to-default credit derivatives that meet the following criteria:

(1)   The positions are neither resecuritisation positions, nor derivatives of securitisation exposures that do not provide a pro-rata share in the proceeds of a securitisation tranche (this therefore excludes options on a securitisation tranche, or a synthetically leveraged super-senior tranche); and

(2) All reference obligations are single-name products, including single-name credit derivatives, for which a liquid two-way market exists. This will include commonly traded indices based on these reference obligations. A two-way market is deemed to exist where there are independent bona fide offers to buy and sell so that a price reasonably related to the last sales price or current bona fide competitive bid and offer quotations can be determined within one day and settled at such price within a relatively short time conforming to trade custom.

(3) Positions which reference an underlying that would be treated as a retail exposure, a residential mortgage exposure or a commercial mortgage exposure under the standardised approach to credit risk are not included in the correlation trading portfolio.

(4) Positions which reference a claim on a special purpose entity are not included either.

(5) A bank may also include in the correlation trading portfolio positions that hedge the positions described above and which are neither securitisation exposures nor n-th-to-default credit derivatives and where a liquid two-way market as described above exists for the instrument or its underlyings.

FAQ

FAQ1   *Leveraged super-senior tranches have to be treated according to standardised rules. We hedge leveraged super-senior tranches with non-leveraged super-senior tranches. This has the bad effect of increasing the credit risk capital requirement because of unhedged positions and increasing the floor for the comprehensive risk measure at the same time for the same reason. Can we treat the super-senior tranches which serve as hedges to leveraged super-senior tranches in the same way as leveraged super-senior tranches?*

From an economical point it makes sense to treat positions and their hedges together for capital calculations. This may be acceptable as long as this is done in a consistent way and the supervisor can be reassured that no capital arbitrage is done by changing the scope of comprehensive risk measure modelling on an ongoing basis.

From a regulatory perspective this exclusion may also be acceptable. MAR10.10 states that: "For the purposes of this framework, the correlation trading portfolio incorporates securitisation exposures and n-th-to-default credit derivatives that meet the following criteria: ..." Accordingly, credit risk capital requirement models do not have to incorporate all the securitisation exposures and n-th-to-default credit derivatives which meet the criteria to be "modelled".

FAQ2   *What exactly is meant by "[...] that do not provide a pro-rata share in the proceeds of a securitisation tranche [...]" in MAR10.10(1)?*

This provision is intended to capture any complex "double leverage" position, but which might not be captured by the definition of re-securitisation and therefore automatically excluded.

FAQ3   *What is the rationale for the exclusion of synthetically leveraged super-senior tranches from the incremental risk capital (IRC) requirement and the correlation trading portfolio?*

"Synthetically leveraged super-senior tranche" in this context refers specifically to a type of position that has a non-linear pay-off profile referencing a super-senior collateralised debt obligation (CDO) position. In any case, the non-linearity is driven by the fact that the super-senior tranche is leveraged. Beyond this, the non-linearity may also result from the presence of certain trigger events that can cause the pay-off from a leveraged super-senior position to be dislocated from that of the super-senior tranche to which it is referenced under certain scenarios. In this context, a synthetically leveraged super-senior position does not provide a pro-rata share in the proceeds of a securitisation tranche.

The following example highlights the inconsistency between the leveraged super-senior tranche and the super-senior tranche that leads to its exclusion. This example is stylised and is based on a description of leveraged super-senior tranches provided in A DeServigny and N Jost (ed), Handbook of Structured Finance, Standard and Poor's.

Consider a CDO with 100 obligors. Suppose that the super-senior tranche is defined with an attachment point of 20% of pool losses and a detachment point of 100% of pool losses. Accordingly, a protection seller of a super-senior tranche receives a pre-specified payment over the life of the tranche, say five years, in return for protecting the protection buyer against all losses in excess of 20% of the pool's notional value, say $100m. Now consider a leveraged super-senior tranche that is structured as follows. The leveraged super-senior tranche is identified with an attachment point of 20% and a detachment point of 28%. Further the leveraged super-senior tranche is subject to a "trigger". The trigger is a pre-specified event. The occurrence of the trigger events results in an "unwind". In the event of an "unwind" the protection seller makes a cash payment to the protection buyer sufficient to purchase protection on losses from 29% to 100% of the pool. Consider the case of a weighted average spread (WAS) trigger in which case an "unwind" occurs if the WAS of all names in the CDO portfolio exceeds 200 basis points.

Now consider the following event. On the first day of the transaction, all credit default swap spreads on all obligors increase from 100 to 250 basis points and remain at that level until the end of year five. At the end of year five, no defaults have occurred in the portfolio.

In this case the protection seller of the super-senior tranche has received all premium payments and made no payments. Accordingly, the protection seller books a net profit. In the case of the leveraged super-senior tranche, the protection seller receives no premium payments and makes a payment on day one to purchase protection on the 28% to 100% portion of the super-senior tranche. Accordingly, the protection seller has booked a net loss.

This example illustrates that the proceeds from an investment in a super-senior and a leveraged super-senior tranche are not always proportional. Two specific points are worth noting here. First, the proceeds of two investment structures are considered to be proportional (pro rata) if this is the case in all possible scenarios. Proportionality makes no reference to the likelihood of any set of events. Second, in the case of leveraged super-senior tranches the non-proportionality is driven by the presence of trigger events that result in a divergence between the payoff of the super-senior tranche and the leveraged super-senior tranche. The example above has considered one particular sort of trigger. In general there are a variety of complex trigger events that are built into leveraged super-senior structures. Whenever these triggers result in a divergence of the payoffs of the leveraged super-senior tranche from the corresponding super-senior tranche the leveraged super-senior tranche would be excluded from the correlation trading portfolio.

FAQ4   [MAR10.10](4) specifies that *"positions which reference a claim on a special purpose entity are not included either". However, in the context of a securitisations operation, notes issued by a special purpose entity (SPE) are claims on this SPE (collateralised by asset portfolios). This may probably need further clarification. What was the exact purpose of the sentence? Certainly not to exclude all kind of structures using SPEs.*

The intent is to ensure that the SPE structure is not used to evade the criteria limiting the types of positions that may be included in the correlation trading portfolio. Specifically, a bank must exclude from the correlation trading portfolio any SPE-issued instrument backed, directly or indirectly, by a position that would itself be excluded if held by the bank directly. Thus, notes issued by an SPE holding residential or commercial mortgages would not be eligible for inclusion in the correlation trading portfolio. However, a cash CDO position could be included in the correlation trading portfolio if the assets underlying the CDO met all of the relevant criteria (eg the underlyings are single-name corporate bonds having liquid two-way markets).

Methods of measuring market risks

10.11 Each bank subject to capital requirements for market risk will be expected to monitor and report the level of risk against which a capital requirement is to be applied. In measuring their market risks, a choice between two broad methodologies (described in MAR20 and MAR30, respectively) will be permitted, subject to the approval of the national authorities.

(1) One alternative will be to measure the risks in a standardised manner, using the measurement frameworks described in MAR20.

(2) The alternative methodology, which is subject to the fulfilment of certain conditions and the use of which is therefore conditional upon the explicit approval of the bank's supervisory authority, is set out in MAR30. This method allows banks to use risk measures derived from their own internal risk management models, subject to seven sets of general conditions, namely:

(a) certain general criteria concerning the adequacy of the risk management system;

(b) qualitative standards for internal oversight of the use of models, notably by management;

(c) guidelines for specifying an appropriate set of market risk factors (ie the market rates and prices that affect the value of banks' positions);

(d) quantitative standards setting out the use of common minimum statistical parameters for measuring risk;

(e) guidelines for stress testing;

(f) validation procedures for external oversight of the use of models;

(g) rules for banks which use a mixture of models and the standardised approach.

10.12 Unless a bank's exposure to a particular risk factor, such as commodity prices, is insignificant, the internal models approach will in principle require banks to have an integrated risk measurement system that captures the broad risk factor categories (ie interest rates, exchange rates (which may include gold), equity prices and commodity prices, with related options volatilities being included in each risk factor category). Thus, banks which start to use models for one or more risk factor categories will, over time, be expected to extend the models to all their market risks. A bank which has developed one or more models will no longer be able to revert to measuring the risk measured by those models according to the

standardised methodology (unless the supervisory authority withdraws approval for that model). However, pending further experience regarding the process of changing to an internal models approach, no specific time limit will be set for banks which use a combination of internal models and the standardised approach to move to a comprehensive model. The following conditions will apply to banks using such combinations:

(1)   Each broad risk factor category must be assessed using a single approach (either internal models or the standardised approach), ie no combination of the two methods will in principle be permitted within a risk category or across banks' different entities for the same type of risk (but see MAR10.12 above);[2]

(2)   All the criteria laid down in MAR30 will apply to the models being used;

(3)   Banks may not modify the combination of the two approaches they use without justifying to their supervisory authority that they have a good reason for doing so;

(4)   No element of market risk may escape measurement, ie the exposure for all the various risk factors, whether calculated according to the standardised approach or internal models, would have to be captured;

(5)   The capital requirements assessed under the standardised approach and under the models approach are to be aggregated according to the simple sum method.

Footnotes

[2]   *However, banks may incur risks in positions which are not captured by their models, for example, in remote locations, in minor currencies or in negligible business areas. Such risks should be measured according to the standardised methodology.*

FAQ

FAQ1 *Will partial model approvals be allowed under the framework (eg, internal models for some credit positions, with standardised specific risk charges for positions not having approved incremental risk capital (IRC) or comprehensive risk models)?*

Partial approval will be permitted on a case-by-case basis in line with local regulations. In particular, as new products and businesses arise supervisors may want to have the authority to restrict certain products from the IRC or comprehensive risk model. A simple model for partial approval would be:

- *One set of products are approved for IRC. For these products there is a single comprehensive, fully integrated model, not a set of IRC models taken one at a time. Likewise, a similar approach would be used for comprehensive risk models.*

- *The remaining products attract the fallback capital requirement according to the standardised measurement method.*

To clarify, this does not mean that a bank would be able to have "partial use" for any particular element of specific interest rate risk (eg include corporate positions in VaR for specific risk without including corporates in the IRC). Supervisors should consider the risks of cherry-picking if they allow partial use.

Types of market risk capital requirement

10.13 The minimum capital requirement for market risk is expressed in terms of:

(1)   general market risk; and

(2)   specific risk (ie risk associated with exposures to specific issuers of debt securities or equities).[3]

Specific risk includes the risk that an individual debt or equity security moves by more or less than the general market in day-to-day trading (including periods when the whole market is volatile) and event risk (where the price of an individual debt or equity security moves precipitously relative to the general market, eg on a take-over bid or some other shock event; such events would also include the risk of "default").

Treatment of specific risk using the internal models approach

10.14 The standardised approach uses a "building-block" approach in which specific risk and the general market risk arising from debt and equity positions are calculated separately. The focus of most internal models is a bank's general market risk exposure, typically leaving specific risk to be measured largely through separate credit risk measurement systems. Banks using models should be subject to capital requirements for the specific risk not captured by their models. Accordingly, a separate capital requirement for specific risk will apply to each bank using a model to the extent that the model does not capture specific risk. The capital requirement for banks which are modelling specific risk is set out in MAR10.15 to MAR10.18 and MAR30.28 to MAR30.43.

10.15 For equity positions, where a bank has a value-at-risk (VaR) measure that incorporates specific risk from equity risk positions and where a supervisor has determined that the bank meets all the qualitative and quantitative requirements for general market risk models, as well as the additional criteria and requirements set out in paragraphs MAR30.28 to MAR30.32, the bank is not required to subject its equity positions to the capital requirement according to the standardised measurement method as specified in MAR20.

10.16 For interest rate risk positions other than securitisation exposures and n-th-to-default credit derivatives, the bank will not be required to subject these positions to the standardised capital requirement for specific risk, as specified in MAR20.4 to MAR20.21, when all of the following conditions hold:

(1) The bank has a VaR measure that incorporates specific risk and the supervisor has determined that the bank meets all the qualitative and quantitative requirements for general market risk models, as well as the additional criteria and requirements set out in MAR30.28 to MAR30.32; and

(2) The supervisor is satisfied that the bank's internally developed approach adequately captures incremental default and migration risks for positions subject to specific interest rate risk according to the standards laid out in MAR30.33 and MAR30.34.

FAQ

FAQ1   *Will partial model approvals be allowed under the framework (eg internal models for some credit positions, with standardised specific risk charges for positions not having approved incremental risk capital (IRC) or comprehensive risk models)?*

Partial approval will be permitted on a case-by-case basis in line with local regulations. In particular, as new products and businesses arise supervisors may want to have the authority to restrict certain products from the IRC or comprehensive risk model. A simple model for partial approval would be:

- *One set of products are approved for IRC. For these products there is a single comprehensive, fully integrated model, not a set of IRC models taken one at a time. Likewise, a similar approach would be used for comprehensive risk models.*

- *The remaining products attract the fallback capital requirement according to the standardised measurement method.*

To clarify, this does not mean that a bank would be able to have "partial use" for any particular element of specific interest rate risk (eg include corporate positions in VaR for specific risk without including corporates in the IRC). Supervisors should consider the risks of cherry-picking if they allow partial use.

FAQ2   *Do the products currently approved for specific risk under the current regime need to go through an approval process for the IRC requirement? Do banks need separate IRC requirement model approval for each product or will a blanket approval be granted for the IRC model for non-securitisation positions?*

According to MAR30.2, the use of an internal model will be conditional upon the explicit approval of the bank's supervisors. Only when a bank holds the two supervisory approvals ((1) approval to use the market risk model which extends to specific interest rate risk; and (2) approval to use an IRC requirement model) can it avoid using the standardised approach for determining the minimum capital requirements for specific interest rate risk. The supervisor may grant both approvals in a single administrative act. As these approvals relate to different internal models, however, in practice the supervisor may perform the necessary assessments under distinct approval processes.

Whether banks need separate approval for each product for the IRC requirement model (and the market risk model for specific risk), or whether the supervisor grants a blanket approval, depends on the implementation of the market risk framework in the relevant jurisdiction.

10.17 For securitisation exposures and n-th-defualt credit derivatives, the bank is allowed to include its securitisation exposures and n-th-to-default credit derivatives in its VaR measure. Notwithstanding, it is still required to hold additional capital for these products according to the standardised approach, with the exceptions noted in MAR30.35 to MAR30.43.

FAQ

FAQ1   *According to MAR10.17, even a bank that includes securitisation exposures or n-th-to-default credit derivatives in its VaR measure must hold additional capital for these products according to the standardised measurement method, with the exceptions noted in MAR30.35 to MAR30.39. With respect to general market risk the bank may still be allowed to determine the capital requirement for those products using a VaR model according to MAR30.15. This leads to the question which risks are considered general market risk with respect to VaR modelling. The main issue in this context is whether credit spread risks form part of specific risk or general market risk.*

There is no unified approach across banks or across jurisdictions on how to make the distinction between general market risk and specific risks. Banks are invited to turn to their national supervisor for guidance.

10.18 For the correlation trading portfolio, the bank is allowed to include comprehensive risk of correlation trading portfolio in its internally developed approach as set out in MAR30.35 only when the bank is active in buying and selling correlation trading portfolio products.

MAR20

Standardised approach

This chapter sets out a standardised approach for calculating risk-weighted assets for market risk.

Version effective as of 15 Dec 2019

First version in the format of the consolidated framework.

Risk-weighted assets

20.1   The risk-weighted assets (RWA) for market risk under the standardised approach are determined by multiplying the capital requirements calculated as set out in this chapter by 12.5.

 (1)   MAR20.2 to MAR20.72 deal with interest rate, equity, foreign exchange and commodities risk.

 (2)   MAR20.73 to MAR20.85 set out a number of possible methods for measuring the price risk in options of all kinds.

 (3)   The capital requirement under the standardised measurement method will be the measures of risk obtained from MAR20.2 to MAR20.85, summed arithmetically.

Interest rate risk

20.2   This section sets out the standard approach for measuring the risk of holding or taking positions in debt securities and other interest-rate-related instruments in the trading book. The instruments covered include all fixed-rate and floating-rate debt securities and instruments that behave like them, including non-convertible preference shares.[1] Convertible bonds, ie debt issues or preference shares that are convertible, at a stated price, into common shares of the issuer, will be treated as debt securities if they trade like debt securities and as equities if they trade like equities. The basis for dealing with derivative products is considered in MAR20.30 to MAR20.39 below.

Footnotes

[1]   *Traded mortgage securities and mortgage derivative products possess unique characteristics because of the risk of prepayment. Accordingly, for the time being, no common treatment will apply to these securities, which will be dealt with at national discretion. A security which is the subject of a repurchase or securities lending agreement will be treated as if it were still owned by the lender of the security, ie it will be treated in the same manner as other securities positions.*

20.3 The minimum capital requirement is expressed in terms of two separately calculated amounts, one applying to the "specific risk" of each security, whether it is a short or a long position, and the other to the interest rate risk in the portfolio (termed "general market risk") where long and short positions in different securities or instruments can be offset.

Specific risk

20.4 The capital requirement for specific risk is designed to protect against an adverse movement in the price of an individual security owing to factors related to the individual issuer. In measuring the risk, offsetting will be restricted to matched positions in the identical issue (including positions in derivatives). Even if the issuer is the same, no offsetting will be permitted between different issues since differences in coupon rates, liquidity, call features, etc mean that prices may diverge in the short run.

FAQ1   *What could be the conditions under which trading book positions that are subject to interest rate specific risk could be netted in order to derive either the net long position or the net short position? Are the rules considering a perfect hedge only? Is it allowed to net cash and synthetic securitisations for the purpose of the capital calculation for structured products under the standardised approach for correlation trading?*

Netting is only allowed under limited circumstances for interest rate specific risk as explained in MAR20.4: "offsetting will be restricted to matched positions in the identical issue (including positions in derivatives). Even if the issuer is the same, no offsetting will be permitted between different issues since differences in coupon rates, liquidity, call features, etc means that prices may diverge in the short run."

In addition, partial offsetting is allowed in two other sets of circumstances. One set of circumstances is described in MAR20.20 and concerns n-th-to-default basked products. The other set of circumstances described in MAR20.15 to MAR20.17 pertains to offsetting between a credit derivative (whether total return swap or credit default swap) and the underlying exposure (ie cash position). Although this treatment applies generally in a one-for-one fashion, it is possible that multiple instruments could combine to create a hedge that would be eligible for consideration for partial offsetting. Supervisors should recognise that, in the case of multiple instruments comprising one side of the position, necessary conditions (ie value of two legs moving in opposite directions, key contractual features of the credit derivative, identical reference obligations and currency/maturity mismatches) will be extremely difficult to meet, in practice.

20.5   The specific risk capital requirements for "government" and "other" categories will be as follows.

Specific risk capital requirements for issuer risk

Government and "other" categories   Table 1

Categories	External credit assessment	Specific risk capital requirement
Government	AAA to AA-	0%
	A+ to BBB-	0.25% (residual term to final maturity 6 months or less) 1.00% (residual term to final maturity greater than 6 and up to and including 24 months) 1.60% (residual term to final maturity exceeding 24 months)
	BB+ to B-	8.00%
	Below B-	12.00%
	Unrated	8.00%
Qualifying		0.25% (residual term to final maturity 6 months or less) 1.00% (residual term to final maturity greater than 6 and up to and including 24 months) 1.60% (residual term to final maturity exceeding 24 months)
Other	Similar to credit risk charges under the standardised approach of this framework eg	
	BB+ to BB-	8.00%
	Below BB-	12.00%
	Unrated	8.00%

20.6 The category "government" will include all forms of government[2] paper including bonds, Treasury bills and other short-term instruments, but national authorities reserve the right to apply a specific risk capital requirement to securities issued by certain foreign governments, especially to securities denominated in a currency other than that of the issuing government.

20.7   When the government paper is denominated in the domestic currency and funded by the bank in the same currency, at national discretion a lower specific risk capital requirement may be applied.

20.8   The "qualifying" category includes securities issued by public sector entities and multilateral development banks, plus other securities that are:

    (1)   rated investment grade[3] by at least two credit rating agencies specified by the national authority; or

    (2)   rated investment grade by one rating agency and not less than investment grade by any other rating agency specified by the national authority (subject to supervisory oversight); or

    (3)   subject to supervisory approval, unrated, but deemed to be of comparable investment quality by the reporting bank, and the issuer has securities listed on a recognised stock exchange.

20.9   Each supervisory authority will be responsible for monitoring the application of these qualifying criteria, particularly in relation to the last criterion where the initial classification is essentially left to the reporting banks. National authorities will also have discretion to include within the qualifying category debt securities issued by banks in countries which have implemented this Framework, subject to the express understanding that supervisory authorities in such countries undertake prompt remedial action if a bank fails to meet the capital standards set forth in this Framework. Similarly, national authorities will have discretion to include within the qualifying category debt securities issued by securities firms that are subject to equivalent rules.

20.10   Furthermore, the "qualifying" category shall include securities issued by institutions that are deemed to be equivalent to investment grade quality and subject to supervisory and regulatory arrangements comparable to those under this Framework.

20.11 Unrated securities may be included in the "qualifying" category when they are subject to supervisory approval, unrated, but deemed to be of comparable investment quality by the reporting bank, and the issuer has securities listed on a recognised stock exchange. This will remain unchanged for banks using the standardised approach. For banks using the internal ratings-based (IRB) approach for a portfolio, unrated securities can be included in the "qualifying" category if both of the following conditions are met:

(1)   the securities are rated equivalent[4] to investment grade under the reporting bank's internal rating system, which the national supervisor has confirmed complies with the requirements for an IRB approach; and

(2)   the issuer has securities listed on a recognised stock exchange.

Footnotes

[4]   *Equivalent means the debt security has a one-year probability of default (PD) equal to or less than the one year PD implied by the long-run average one-year PD of a security rated investment grade or better by a qualifying rating agency.*

20.12 Instruments issued by a non-qualifying issuer will receive the same specific risk charge as a non-investment grade corporate borrower under the standardised approach for credit risk under this Framework.

20.13 However, since this may in certain cases considerably underestimate the specific risk for debt instruments which have a high yield to redemption relative to government debt securities, each national supervisor will have the discretion:

(1)   to apply a higher specific risk charge to such instruments; and/or

(2)   to disallow offsetting for the purposes of defining the extent of general market risk between such instruments and any other debt instruments.

20.14 The specific risk capital requirement of securitisation positions which are held in the trading book is to be calculated according to the revised method for such positions in the banking book as set out in the revised securitisation framework in CRE40 to CRE44. Alternatively, jurisdictions may allow banks to use the method they currently use for calculating their specific risk capital requirement of securitisation positions so long as any such method was applied by banks prior to 2019. A bank shall calculate the specific risk capital requirement applicable to each net securitisation position by dividing the risk weight calculated as if it were held in the banking book by 12.5.

20.15 Full allowance will be recognised for positions hedged by credit derivatives when the values of two legs (ie long and short) always move in the opposite direction and broadly to the same extent. This would be the case in the following situations, in which cases no specific risk capital requirement applies to both sides of the position.

(1) the two legs consist of completely identical instruments, or

(2) a long cash position (or credit derivative) is hedged by a total rate of return swap (or vice versa) and there is an exact match between the reference obligation and the underlying exposure (ie the cash position).[5]

Footnotes

[5]   *The maturity of the swap itself may be different from that of the underlying exposure.*

FAQ

FAQ1 *According to [MAR20.15](#) to [MAR20.17](#), the offsetting treatment is applied to a cash position that is hedged by a credit derivative or a credit derivative that is hedged by another credit derivative, assuming there is an exact match in terms of the reference obligations. Please illustrate the treatment.*

[MAR20.15](#) to [MAR20.17](#) are applicable not only when the underlying position being hedged is a cash position, but also when the position being hedged is a credit default swap (CDS) or other credit derivative. They also apply regardless of whether the cash positions or reference obligations of the credit derivative are single-name or securitisation exposures.

For example, when a long cash position is hedged using a CDS, the 80% offset treatment of [MAR20.16](#) (the partial allowance treatment of [MAR20.17](#)) generally applies when the reference obligation of the CDS is the cash instrument being hedged and the currencies and remaining maturities of the two positions are (are not) identical. Similarly, when a purchased CDS is hedged with a sold CDS, the 80% offset treatment (the partial allowance treatment) generally applies when both the long and short CDSs have the same reference obligations and the currencies and remaining maturities of the long and short CDSs are (are not) identical. The full allowance (100% offset) treatment generally applies only when there is zero basis risk between the instrument being hedged and the hedging instrument, such as when a cash position is hedged with a total rate of return swap referencing the same cash instrument and there is no currency mismatch, or when a purchased CDS position is hedged by selling a CDS with identical terms in all respects, including reference obligation, currency, maturity, documentation clauses (eg credit payout events, methods for determining payouts for credit events), and structure of fixed and variable payments over time.

As explained in [MAR20.4](#) and [MAR20.4](#) FAQ1, it is worth noting that the conditions under which partial or full offsetting of risk positions that are subject to interest rate specific risk are narrowly defined. In practice, offsets between securitisation positions and credit derivatives are unlikely to be recognised in most cases due to the explicit requirements in [MAR20.15](#) to [MAR20.17](#) on reference names etc.

20.16 An 80% offset will be recognised when the value of two legs (ie long and short) always moves in the opposite direction but not broadly to the same extent. This would be the case when a long cash position (or credit derivative) is hedged by a credit default swap (CDS) or a credit-linked note (or vice versa) and there is an exact match in terms of the reference obligation, the maturity of both the reference obligation and the credit derivative, and the currency of the underlying exposure. In addition, key features of the credit derivative contract (eg credit event definitions, settlement mechanisms) should not cause the price movement of the credit derivative to materially deviate from the price movements of the cash position. To the extent that the transaction transfers risk (ie taking account of restrictive payout provisions such as fixed payouts and materiality thresholds), an 80% specific risk offset will be applied to the side of the transaction with the higher capital requirement, while the specific risk requirement on the other side will be zero.

FAQ

FAQ1   The FAQ under MAR20.15 also applies to MAR20.16.

20.17 Partial allowance will be recognised when the value of the two legs (ie long and short) usually moves in the opposite direction. This would be the case in the following situations:

(1)   the position is captured in MAR20.15(2), but there is an asset mismatch between the reference obligation and the underlying exposure. Nonetheless, the position meets the requirements in CRE22.86.

(2)   The position is captured in MAR20.15(1) or MAR20.16 but there is a currency or maturity mismatch[6] between the credit protection and the underlying asset.

(3)   The position is captured in MAR20.16 but there is an asset mismatch between the cash position (or credit derivative) and the credit derivative hedge. However, the underlying asset is included in the (deliverable) obligations in the credit derivative documentation.

Footnotes

[6]   *Currency mismatches should feed into the normal reporting of foreign exchange risk.*

20.18 In each of these cases in MAR20.15 to MAR20.17, the following rule applies. Rather than adding the specific risk capital requirements for each side of the transaction (ie the credit protection and the underlying asset) only the higher of the two capital requirements will apply.

20.19 In cases not captured in MAR20.15 to MAR20.17, a specific risk capital requirement will be assessed against both sides of the position.

20.20 An n-th-to-default credit derivative is a contract where the payoff is based on the n-th asset to default in a basket of underlying reference instruments. Once the n-th default occurs the transaction terminates and is settled.

(1) The capital requirement for specific risk for a first-to-default credit derivative is the lesser of:

(a) the sum of the specific risk capital requirements for the individual reference credit instruments in the basket; and

(b) the maximum possible credit event payment under the contract.

(2) Where a bank has a risk position in one of the reference credit instruments underlying a first-to-default credit derivative and this credit derivative hedges the bank's risk position, the bank is allowed to reduce with respect to the hedged amount both the capital requirement for specific risk for the reference credit instrument and that part of the capital requirement for specific risk for the credit derivative that relates to this particular reference credit instrument. Where a bank has multiple risk positions in reference credit instruments underlying a first-to-default credit derivative this offset is allowed only for that underlying reference credit instrument having the lowest specific risk capital requirement.

(3) The capital requirement for specific risk for an n-th-to-default credit derivative with n greater than one is the lesser of:

(a) the sum of the specific risk capital requirements for the individual reference credit instruments in the basket but disregarding the (n-1) obligations with the lowest specific risk capital requirements; and

(b) the maximum possible credit event payment under the contract. For n-th-to-default credit derivatives with n greater than 1 no offset of the capital requirement for specific risk with any underlying reference credit instrument is allowed.

(4) If a first or other n-th-to-default credit derivative is externally rated, then the protection seller must calculate the specific risk capital requirement using the rating of the derivative and apply the respective securitisation risk weights as specified in the revised securitisation framework, as applicable. The alternative use of the current method specified in MAR20.14 is also applicable to this treatment.

(5) The capital requirement against each net n-th-to-default credit derivative position applies irrespective of whether the bank has a long or short position, ie obtains or provides protection.

FAQ

FAQ1 *MAR20.20(3) does not allow any offsetting with the use of second- or more-to-default credit derivatives. However, for the banking book, CRE22.104 allows offsetting by a second-to-default credit derivative if a bank has first-to-default-protection or one of the assets within the basket has already defaulted. This would be an inconsistency between trading book and banking book.*

This is factually correct, but the Committee has specifically removed this previous treatment of second- or more-to-default credit derivatives because it over-states the hedging benefits of these products.

If an n-th-to-default credit derivative is currently a first-to-default credit derivative as a result of n-1 reference names in the basket having defaulted, then the offsetting as described under MAR20.20(2) for first-to-default credit derivatives would be permitted.

FAQ2 *The framework mentions only tranches and n-th-to-default products explicitly, but not n-th to n+m-th-to-default products (eg the value depends on the default of the 5th, 6th, 7th and 8th default in a pool; only in specific cases such as the same nominal for all underlyings can this product be represented by, for example, a 5% to 8% tranche). Are n-th to n+m-th-to-default products covered in the framework?*

Yes. Such products are to be decomposed into individual n-th-to-default products and the rules for n-th-to-default products in MAR20.20 apply.

In the example cited above, the capital requirement for a basket default swap covering defaults 5 through 8 would be calculated as the sum of the capital requirements for a 5th-to-default swap, a 6th-to-default swap, a 7th-to-default swap and an 8th-to-default swap.

20.21 A bank must determine the specific risk capital requirement for the correlation trading portfolio as follows:

(1) The bank computes

    (a) the total specific risk capital requirements that would apply just to the net long positions from the net long correlation trading exposures combined; and

    (b) the total specific risk capital requirements that would apply just to the net short positions from the net short correlation trading exposures combined.

(2) The larger of these total amounts is then the specific risk capital requirement for the correlation trading portfolio.

FAQ

FAQ1   *Can the approach of taking the larger of the specific risk capital requirements for net long positions and the specific risk capital requirement for net short positions be applied to leveraged securitisation positions or option products on securitisation positions?*

    No. Leveraged securitisation positions and option products on securitisation positions are securitisation positions. They are not admissible for the correlation trading portfolio according to MAR10.10. The capital requirements for specific risk will be determined as the sum of the capital requirements for specific risk against net long and net short positions.

General market risk

20.22 The capital requirements for general market risk are designed to capture the risk of loss arising from changes in market interest rates. A choice between two principal methods of measuring the risk is permitted, a "maturity" method and a "duration" method. In each method, the capital requirement is the sum of four components:

(1) the net short or long position in the whole trading book;

(2) a small proportion of the matched positions in each time-band (the "vertical disallowance");

(3) a larger proportion of the matched positions across different time-bands (the "horizontal disallowance"); and

(4) a net charge for positions in options, where appropriate (see MAR20.83 to MAR20.84).

20.23 Separate maturity ladders should be used for each currency and capital requirements should be calculated for each currency separately and then summed with no offsetting between positions of opposite sign. In the case of those currencies in which business is insignificant, separate maturity ladders for each currency are not required. Rather, the bank may construct a single maturity ladder and slot, within each appropriate time-band, the net long or short position

for each currency. However, these individual net positions are to be summed within each time-band, irrespective of whether they are long or short positions, to produce a gross position figure.

20.24 In the maturity method (see MAR20.28 for the duration method), long or short positions in debt securities and other sources of interest rate exposures including derivative instruments are slotted into a maturity ladder comprising thirteen time-bands (or fifteen time-bands in case of low coupon instruments). Fixed-rate instruments should be allocated according to the residual term to maturity and floating-rate instruments according to the residual term to the next repricing date. Opposite positions of the same amount in the same issues (but not different issues by the same issuer), whether actual or notional, can be omitted from the interest rate maturity framework, as well as closely matched swaps, forwards, futures and forward rate agreements (FRAs) which meet the conditions set out in MAR20.34 and MAR20.35 below.

20.25 The first step in the calculation is to weight the positions in each time-band by a factor designed to reflect the price sensitivity of those positions to assumed changes in interest rates. The weights for each time-band are set out in Table 2 below. Zero-coupon bonds and deep-discount bonds (defined as bonds with a coupon of less than 3%) should be slotted according to the time-bands set out in the second column of Table 2.

Coupon 3% or more	Coupon less than 3%	Risk weight	Assumed changes in yield
1 month or less	1 month or less	0.00%	1.00
1 to 3 months	1 to 3 months	0.20%	1.00
3 to 6 months	3 to 6 months	0.40%	1.00
6 to 12 months	6 to 12 months	0.70%	1.00
1 to 2 years	1.0 to 1.9 years	1.25%	0.90
2 to 3 years	1.9 to 2.8 years	1.75%	0.80
3 to 4 years	2.8 to 3.6 years	2.25%	0.75
4 to 5 years	3.6 to 4.3 years	2.75%	0.75
5 to 7 years	4.3 to 5.7 years	3.25%	0.70
7 to 10 years	5.7 to 7.3 years	3.75%	0.65
10 to 15 years	7.3 to 9.3 years	4.50%	0.60
15 to 20 years	9.3 to 10.6 years	5.25%	0.60
Over 20 years	10.6 to 12 years	6.00%	0.60
	12 to 20 years	8.00%	0.60
	Over 20 years	12.50%	0.60

20.26 The next step in the calculation is to offset the weighted longs and shorts in each time-band, resulting in a single short or long position for each band. Since, however, each band would include different instruments and different maturities, a 10% capital requirement to reflect basis risk and gap risk will be levied on the smaller of the offsetting positions, be it long or short. Thus, if the sum of the weighted longs in a time-band is $100 million and the sum of the weighted shorts $90 million, the so-called "vertical disallowance" for that time-band would be 10% of $90 million (ie $9.0 million).

20.27 The result of the above calculations is to produce two sets of weighted positions, the net long or short positions in each time-band ($10 million long in the example above) and the vertical disallowances, which have no sign.

(1) In addition, however, banks will be allowed to conduct two rounds of "horizontal offsetting":

(a) first between the net positions in each of three zones, where zone 1 is set as zero to one year, zone 2 is set as one year to four years, and zone 3 is set as four years and over (however, for coupons less than 3%, zone 2 is set as one year to 3.6 years and zone 3 is set as 3.6 years and over); and

(b) subsequently between the net positions in the three different zones.

(2) The offsetting will be subject to a scale of disallowances expressed as a fraction of the matched positions, as set out in Table 3 below. The weighted long and short positions in each of three zones may be offset, subject to the matched portion attracting a disallowance factor that is part of the capital requirement. The residual net position in each zone may be carried over and offset against opposite positions in other zones, subject to a second set of disallowance factors.

Horizontal disallowances   Table 3

Zones[7]	Time band[7]	Within the zone	Between adjacent zones	Between zones 1 and 3
Zone 1	0-1 month	40%		
	1-3 months			
	3-6 months			
	6-12 months		40%	
Zone 2	1-2 years	30%		100%
	2-3 years			
	3-4 years			
	4-5 years		40%	
Zone 3	5-7 years			
	7-10 years			
	10-15 years	30%		
	15-20 years			
	Over 20 years			

Footnotes

[7]   *The zones for coupons less than 3% are 0 to 1 year, 1 to 3.6 years, and 3.6 years and over.*

20.28 Under the alternative duration method, banks with the necessary capability may, with their supervisors' consent, use a more accurate method of measuring all of

their general market risk by calculating the price sensitivity of each position separately. Banks must elect and use the method on a continuous basis (unless a change in method is approved by the national authority) and will be subject to supervisory monitoring of the systems used. The mechanics of this method are as follows.

(1) First calculate the price sensitivity of each instrument in terms of a change in interest rates of between 0.6 and 1.0 percentage points depending on the maturity of the instrument (see Table 4 below).

(2) Slot the resulting sensitivity measures into a duration-based ladder with the fifteen time-bands set out in Table 4.

(3) Subject long and short positions in each time-band to a 5% vertical disallowance designed to capture basis risk.

(4) Carry forward the net positions in each time-band for horizontal offsetting subject to the disallowances set out in Table 3 of MAR20.27 above.

Duration method: time-bands and assumed changes in yield			Table 4
	Assumed change in yield		Assumed change in yield
Zone 1:		Zone 3:	
1 month or less	1.00	3.6 to 4.3 years	0.75
1 to 3 months	1.00	4.3 to 5.7 years	0.70
3 to 6 months	1.00	5.7 to 7.3 years	0.65
6 to 12 months	1.00	7.3 to 9.3 years	0.60
Zone 2:		9.3 to 10.6 years	0.60
1.0 to 1.9 years	0.90	10.6 to 12 years	0.60
1.9 to 2.8 years	0.80	12 to 20 years	0.60
2.8 to 3.6 years	0.75	Over 20 years	0.60

20.29 In the case of residual currencies (see MAR20.23 above) the gross positions in each time-band will be subject to either the risk weightings set out in MAR20.25,

if positions are reported using the maturity method, or the assumed change in yield set out in MAR20.28, if positions are reported using the duration method, with no further offsets.

Interest rate derivatives

20.30 The measurement system should include all interest rate derivatives and off-balance-sheet instruments in the trading book which react to changes in interest rates, (eg FRAs, other forward contracts, bond futures, interest rate and cross-currency swaps and forward foreign exchange positions). Options can be treated in a variety of ways as described in MAR20.73 to MAR20.85 below. A summary of the rules for dealing with interest rate derivatives is set out in MAR20.39 below.

20.31 The derivatives should be converted into positions in the relevant underlying and become subject to specific and general market risk charges as described above. In order to calculate the standard formula described above, the amounts reported should be the market value of the principal amount of the underlying or of the notional underlying resulting from the prudent valuation guidance set out in CAP50.[8]

Footnotes

[8]   *For instruments where the apparent notional amount differs from the effective notional amount, banks must use the effective notional amount.*

20.32 Futures and forward contracts (including FRAs) are treated as a combination of a long and a short position in a notional government security. The maturity of a future or a FRA will be the period until delivery or exercise of the contract, plus - where applicable - the life of the underlying instrument. For example, a long position in a June three-month interest-rate future (taken in April) is to be reported as a long position in a government security with a maturity of five months and a short position in a government security with a maturity of two months. Where a range of deliverable instruments may be delivered to fulfil the contract, the bank has flexibility to elect which deliverable security goes into the maturity or duration ladder but should take account of any conversion factor defined by the exchange. In the case of a future on a corporate bond index, positions will be included at the market value of the notional underlying portfolio of securities.

20.33

Swaps will be treated as two notional positions in government securities with relevant maturities. For example, an interest rate swap under which a bank is receiving floating-rate interest and paying fixed will be treated as a long position in a floating-rate instrument of maturity equivalent to the period until the next interest fixing and a short position in a fixed-rate instrument of maturity equivalent to the residual life of the swap. For swaps that pay or receive a fixed or floating interest rate against some other reference price, eg a stock index, the interest rate component should be slotted into the appropriate repricing maturity category, with the equity component being included in the equity framework. The separate legs of cross-currency swaps are to be reported in the relevant maturity ladders for the currencies concerned.

20.34   Banks may exclude from the interest rate maturity framework altogether (for both specific and general market risk) long and short positions (both actual and notional) in identical instruments with exactly the same issuer, coupon, currency and maturity. A matched position in a future or forward and its corresponding underlying may also be fully offset,[9] and thus excluded from the calculation. When the future or the forward comprises a range of deliverable instruments offsetting of positions in the future or forward contract and its underlying is only permissible in cases where there is a readily identifiable underlying security which is most profitable for the trader with a short position to deliver. The price of this security, sometimes called the "cheapest-to-deliver", and the price of the future or forward contract should in such cases move in close alignment. No offsetting will be allowed between positions in different currencies; the separate legs of cross-currency swaps or forward foreign exchange deals are to be treated as notional positions in the relevant instruments and included in the appropriate calculation for each currency.

Footnotes

[9]   *The leg representing the time to expiry of the future should, however, be reported.*

20.35   In addition, opposite positions in the same category of instruments[10] can in certain circumstances be regarded as matched and allowed to offset fully. To qualify for this treatment the positions must relate to the same underlying instruments, be of the same nominal value and be denominated in the same currency.[11] In addition:

(1)   for futures: offsetting positions in the notional or underlying instruments to which the futures contract relates must be for identical products and mature within seven days of each other;

(2)   for swaps and FRAs: the reference rate (for floating rate positions) must be identical and the coupon closely matched (ie within 15 basis points); and

(3)   for swaps, FRAs and forwards: the next interest fixing date or, for fixed-coupon positions or forwards, the residual maturity must correspond within the following limits:

   (a)   less than one month hence: same day;

   (b)   between one month and one year hence: within seven days;

   (c)   over one year hence: within thirty days.

Footnotes

[10]   *This includes the delta-equivalent value of options. The delta equivalent of the legs arising out of the treatment of caps and floors as set out in MAR20.77 can also be offset against each other under the rules laid down in this paragraph.*

[11]   *The separate legs of different swaps may also be "matched" subject to the same conditions.*

20.36   Banks with large swap books may use alternative formulae for these swaps to calculate the positions to be included in the maturity or duration ladder. One method would be to first convert the payments required by the swap into their present values. For that purpose, each payment should be discounted using zero coupon yields, and a single net figure for the present value of the cash flows entered into the appropriate time-band using procedures that apply to zero- (or low-) coupon bonds; these figures should be slotted into the general market risk framework as set out above. An alternative method would be to calculate the sensitivity of the net present value implied by the change in yield used in the maturity or duration method and allocate these sensitivities into the time-bands set out in MAR20.25 or MAR20.28. Other methods which produce similar results could also be used. Such alternative treatments will, however, only be allowed if:

(1)   the supervisory authority is fully satisfied with the accuracy of the systems being used;

(2)   the positions calculated fully reflect the sensitivity of the cash flows to interest rate changes and are entered into the appropriate time-bands; and

(3)   the positions are denominated in the same currency.

20.37

Interest rate and currency swaps, FRAs, forward foreign exchange contracts and interest rate futures will not be subject to a specific risk charge. This exemption also applies to futures on an interest rate index (eg the London Interbank Offered Rate, or LIBOR). However, in the case of futures contracts where the underlying is a debt security, or an index representing a basket of debt securities, a specific risk charge will apply according to the credit risk of the issuer as set out in MAR20.4 to MAR20.21 above.

20.38 General market risk applies to positions in all derivative products in the same manner as for cash positions, subject only to an exemption for fully or very closely matched positions in identical instruments as defined in MAR20.34 and MAR20.35. The various categories of instruments should be slotted into the maturity ladder and treated according to the rules identified earlier.

20.39 Table 5 below presents a summary of the regulatory treatment for interest rate derivatives, for market risk purposes.

Instrument	Specific risk charge[12]	General market risk charge
Exchanged-traded future		
Government debt security	Yes[13]	Yes, as two positions
Corporate debt security	Yes	Yes, as two positions
Index on interest rates (eg LIBOR)	No	Yes, as two positions
Over-the-counter (OTC) forward		
Government debt security	Yes[13]	Yes, as two positions
Corporate debt security	Yes	Yes, as two positions
Index on interest rates	No	Yes, as two positions
FRAs, swaps	No	Yes, as two positions
Forward foreign exchange	No	Yes, as one position in each currency
Options		Either
Government debt security	Yes[13]	
		(a) carve out together with the associated hedging positions: simplified approach; scenario analysis; internal models
Corporate debt security	Yes	(b) general market risk charge according to the delta-plus method (gamma and vega should receive separate capital requirements)
Index on interest rates	No	
FRAs, swaps	No	

Equity risk

20.40 This section sets out a minimum capital standard to cover the risk of holding or taking positions in equities in the trading book. It applies to long and short positions in all instruments that exhibit market behaviour similar to equities, but not to non-convertible preference shares (which are covered by the interest rate risk requirements described in MAR20.2 to MAR20.39). Long and short positions in the same issue may be reported on a net basis. The instruments covered include common stocks (whether voting or non-voting), convertible securities that behave like equities, and commitments to buy or sell equity securities. The treatment of derivative products, stock indices and index arbitrage is described in MAR20.43 to MAR20.51 below.

Specific and general market risks

20.41 As with debt securities, the minimum capital standard for equities is expressed in terms of two separately calculated capital requirements for the "specific risk" of holding a long or short position in an individual equity and for the "general market risk" of holding a long or short position in the market as a whole. Specific risk is defined as the bank's gross equity positions (ie the sum of all long equity positions and of all short equity positions) and general market risk as the difference between the sum of the longs and the sum of the shorts (ie the overall net position in an equity market).The long or short position in the market must be calculated on a market-by-market basis, ie a separate calculation has to be carried out for each national market in which the bank holds equities.

20.42 The capital requirement for specific risk and for general market risk will each be 8%.

Equity derivatives

20.43 Except for options, which are dealt with in MAR20.73 to MAR20.85, equity derivatives and off-balance-sheet positions which are affected by changes in equity prices should be included in the measurement system.[14] This includes futures and swaps on both individual equities and on stock indices. The derivatives are to be converted into positions in the relevant underlying. The treatment of equity derivatives is summarised in MAR20.51 below.

Footnotes

[14]   *Where equities are part of a forward contract, a future or an option (quantity of equities to be received or to be delivered), any interest rate or foreign currency exposure from the other leg of the contract should be reported as set out in MAR20.2 to MAR20.39 and MAR20.52 to MAR20.61.*

20.44 In order to calculate the standard formula for specific and general market risk, positions in derivatives should be converted into notional equity positions:

(1)   Futures and forward contracts relating to individual equities should in principle be reported at current market prices;

(2)   Futures relating to stock indices should be reported as the marked-to-market value of the notional underlying equity portfolio;

(3)   Equity swaps are to be treated as two notional positions;[15]

(4)   Equity options and stock index options should be either "carved out" together with the associated underlyings or be incorporated in the measure of general market risk described in this section according to the delta-plus method.

Footnotes

[15]   *For example, an equity swap in which a bank is receiving an amount based on the change in value of one particular equity or stock index and paying a different index will be treated as a long position in the former and a short position in the latter. Where one of the legs involves receiving/paying a fixed or floating interest rate, that exposure should be slotted into the appropriate repricing time-band for interest rate related instruments as set out in MAR20.2 to MAR20.39. The stock index should be covered by the equity treatment.*

20.45

Matched positions in each identical equity or stock index in each market may be fully offset, resulting in a single net short or long position to which the specific and general market risk charges will apply. For example, a future in a given equity may be offset against an opposite cash position in the same equity.[16]

Footnotes

[16]   *The interest rate risk arising out of the future, however, should be reported as set out in MAR20.2 to MAR20.39.*

20.46 Besides general market risk, a further capital requirement of 2% will apply to the net long or short position in an index contract comprising a diversified portfolio of equities. This capital requirement is intended to cover factors such as execution risk. National supervisory authorities will take care to ensure that this 2% risk weight applies only to well-diversified indices and not, for example, to sectoral indices.

20.47 In the case of the futures-related arbitrage strategies described below, the additional 2% capital requirement described above (set out in MAR20.46) may be applied to only one index with the opposite position exempt from a capital requirement. The strategies are:

(1)   when the bank takes an opposite position in exactly the same index at different dates or in different market centres; and

(2)   when the bank has an opposite position in contracts at the same date in different but similar indices, subject to supervisory oversight that the two indices contain sufficient common components to justify offsetting.

20.48 Where a bank engages in a deliberate arbitrage strategy, in which a futures contract on a broadly based index matches a basket of stocks, it will be allowed to carve out both positions from the standardised methodology on condition that:

(1)   the trade has been deliberately entered into and separately controlled; and

(2)   the composition of the basket of stocks represents at least 90% of the index when broken down into its notional components.

20.49 In such a case as set out in MAR20.48 the minimum capital requirement will be 4% (ie 2% of the gross value of the positions on each side) to reflect divergence and execution risks. This applies even if all of the stocks comprising the index are held in identical proportions. Any excess value of the stocks comprising the basket over the value of the futures contract or excess value of the futures

contract over the value of the basket is to be treated as an open long or short position.

20.50 If a bank takes a position in depository receipts against an opposite position in the underlying equity or identical equities in different markets, it may offset the position (i.e. bear no capital requirement) but only on condition that any costs on conversion are fully taken into account.[17]

Footnotes

[17]   *Any foreign exchange risk arising out of these positions has to be reported as set out in MAR20.52 to MAR20.66.*

20.51 Table 6 below summarises the regulatory treatment of equity derivatives for market risk purposes.

Summary of treatment of equity derivatives   Table 6

Instrument	Specific risk [18]	General market risk
Exchanged-traded or OTC future		
Individual equity	Yes	Yes, as underlying
Index	2%	Yes, as underlying
Options		Either
Individual equity	Yes	(a) carve out together with the associated hedging positions: simplified approach; scenario analysis; internal models
Index	2%	(b) general market risk charge according to the delta-plus method (gamma and vega should receive separate capital requirements)

Footnotes

18   *This is the specific risk charge relating to the issuer of the instrument. Under CRE55, a separate capital requirement for the counterparty credit risk applies.*

Foreign exchange risk

20.52 This section sets out the standardised approach for measuring the risk of holding or taking positions in foreign currencies, including gold.[19]

Footnotes

19   *Gold is to be dealt with as a foreign exchange position rather than a commodity because its volatility is more in line with foreign currencies and banks manage it in a similar manner to foreign currencies.*

20.53 Two processes are needed to calculate the capital requirement for foreign exchange risk.

(1)   The first is to measure the exposure in a single currency position as set out in MAR20.54 to MAR20.57.

(2)   The second is to measure the risks inherent in a bank's mix of long and short positions in different currencies as set out in MAR20.58 to MAR20.61.

Measuring the exposure in a single currency

20.54 The bank's net open position in each currency should be calculated by summing:

(1)   the net spot position (ie all asset items less all liability items, including accrued interest, denominated in the currency in question);

(2)   the net forward position (ie all amounts to be received less all amounts to be paid under forward foreign exchange transactions, including currency futures and the principal on currency swaps not included in the spot position);

(3)   guarantees (and similar instruments) that are certain to be called and are likely to be irrecoverable;

(4)   net future income/expenses not yet accrued but already fully hedged (at the discretion of the reporting bank);

(5) depending on particular accounting conventions in different countries, any other item representing a profit or loss in foreign currencies; and

(6) the net delta-based equivalent of the total book of foreign currency options.[20]

Footnotes

[20] *Subject to a separately calculated capital requirement for gamma and vega as described in MAR20.76 to MAR20.79; alternatively, options and their associated underlyings are subject to one of the other methods described in MAR20.73 to MAR20.85.*

20.55 Positions in composite currencies need to be separately reported but, for measuring banks' open positions, may be either treated as a currency in their own right or split into their component parts on a consistent basis. Positions in gold should be measured in the same manner as described in MAR20.67.[21]

Footnotes

[21] *Where gold is part of a forward contract (quantity of gold to be received or to be delivered), any interest rate or foreign currency exposure from the other leg of the contract should be reported as set out in MAR20.2 to MAR20.39 and MAR20.54 above.*

20.56 Interest, other income and expenses should be treated as follows. Interest accrued (ie earned but not yet received) should be included as a position. Accrued expenses should also be included. Unearned but expected future interest and anticipated expenses may be excluded unless the amounts are certain and banks have taken the opportunity to hedge them. If banks include future income /expenses they should do so on a consistent basis, and not be permitted to select only those expected future flows which reduce their position.

20.57 Forward currency and gold positions should be measured as follows. Forward currency and gold positions will normally be valued at current spot market exchange rates. Using forward exchange rates would be inappropriate since it would result in the measured positions reflecting current interest rate differentials to some extent. However, banks which base their normal management accounting on net present values are expected to use the net present values of each position, discounted using current interest rates and valued at current spot rates, for measuring their forward currency and gold positions.

Measuring the foreign exchange risk in a portfolio of foreign currency positions and gold

20.58 For measuring the foreign exchange risk in a portfolio of foreign currency positions and gold as set out in MAR20.53(2), a bank that is not approved to use internal models by its supervisory authority must use a "shorthand" method which treats all currencies equally.

20.59 Under the shorthand method, the nominal amount (or net present value) of the net position in each foreign currency and in gold is converted at spot rates into the reporting currency.[22] The overall net open position is measured by aggregating:

(1)   the sum of the net short positions or the sum of the net long positions, whichever is the greater;[23] plus

(2)   the net position (short or long) in gold, regardless of sign.

Footnotes

[22]   *Where the bank is assessing its foreign exchange risk on a consolidated basis, it may be technically impractical in the case of some marginal operations to include the currency positions of a foreign branch or subsidiary of the bank. In such cases the internal limit in each currency may be used as a proxy for the positions. Provided there is adequate ex post monitoring of actual positions against such limits, the limits should be added, without regard to sign, to the net open position in each currency.*

[23]   *An alternative calculation, which produces an identical result, is to include the reporting currency as a residual and to take the sum of all the short (or long) positions.*

20.60 The capital requirement will be 8% of the overall net open position (see example in Table 7 below). In particular, the capital requirement would be 8% of the higher of either the net long currency positions or the net short currency positions (ie 300) and of the net position in gold (35) = 335 x 8% = 26.8.

	JPY	EUR	GBP	CAD	USD	Gold
Net position per currency	+50	+100	+150	-20	-180	-35
Net open position	+300			-200		35

Example of the shorthand measure of foreign exchange risk — Table 7

20.61 A bank of which business in foreign currency is insignificant and which does not take foreign exchange positions for its own account may, at the discretion of its national authority, be exempted from capital requirements on these positions provided that:

(1) its foreign currency business, defined as the greater of the sum of its gross long positions and the sum of its gross short positions in all foreign currencies, does not exceed 100% of eligible capital as defined in CAP10.1; and

(2) its overall net open position as defined MAR20.59 above does not exceed 2% of its eligible capital as defined in CAP10.1.

Commodities risk

20.62 This section sets out the standardised approach for measuring risk of holding or taking positions in commodities, including precious metals, but excluding gold (which is treated as a foreign currency according to the methodology set out in MAR20.52 to MAR20.61 above). A commodity is defined as a physical product which is or can be traded on a secondary market, eg agricultural products, minerals (including oil) and precious metals.

20.63 The price risk in commodities is often more complex and volatile than that associated with currencies and interest rates. Commodity markets may also be less liquid than those for interest rates and currencies and, as a result, changes in supply and demand can have a more dramatic effect on price and volatility.[24] These market characteristics can make price transparency and the effective hedging of commodities risk more difficult.

Footnotes

Banks need also to guard against the risk that arises when the short position falls due before the long position. Owing to a shortage of liquidity in some markets it might be difficult to close the short position and the bank might be squeezed by the market.

20.64 The risks associated with commodities include the following risks:

(1) For spot or physical trading, the directional risk arising from a change in the spot price is the most important risk.

(2) However, banks using portfolio strategies involving forward and derivative contracts are exposed to a variety of additional risks, which may well be larger than the risk of a change in spot prices. These include:

  (a) basis risk (the risk that the relationship between the prices of similar commodities alters through time);

  (b) interest rate risk (the risk of a change in the cost of carry for forward positions and options); and

  (c) forward gap risk (the risk that the forward price may change for reasons other than a change in interest rates).

(3) In addition banks may face counterparty credit risk on over-the-counter derivatives, but this is captured by one of the methods set out in CRE52 and MAR50.

(4) The funding of commodities positions may well open a bank to interest rate or foreign exchange exposure and if that is so the relevant positions should be included in the measures of interest rate and foreign exchange risk described in MAR20.2 to MAR20.39 and MAR20.52 to MAR20.61, respectively.
[25]

Where a commodity is part of a forward contract (quantity of commodities to be received or to be delivered), any interest rate or foreign currency exposure from the other leg of the contract should be reported as set out in MAR20.2 to MAR20.39 and MAR20.52 to MAR20.61. Positions which are purely stock financing (i.e. a physical stock has been sold forward and the cost of funding has been locked in until the date of the forward sale) may be omitted from the commodities risk calculation although they will be subject to interest rate and counterparty risk requirements.

20.65 There are two alternatives for measuring commodities position risk under the standardised approach which are described in MAR20.67 to MAR20.72 below. Commodities risk can be measured using either the maturity ladder approach, which is a measurement system which captures forward gap and interest rate risk separately by basing the methodology on seven time-bands as set out in MAR20.67 to MAR20.70 below. or the simplified approach, which is a very simple framework as set out in MAR20.71 and MAR20.72 below. Both the maturity ladder approach and the simplified approach are appropriate only for banks which, in relative terms, conduct only a limited amount of commodities business. Major traders would be expected to adopt a models approach subject to the safeguards set out in MAR30.

20.66 For the maturity ladder approach and the simplified approach, long and short positions in each commodity may be reported on a net basis for the purposes of calculating open positions. However, positions in different commodities will as a general rule not be offsettable in this fashion. Nevertheless, national authorities will have discretion to permit netting between different sub-categories[26] of the same commodity in cases where the sub-categories are deliverable against each other. They can also be considered as offsettable if they are close substitutes against each other and a minimum correlation of 0.9 between the price movements can be clearly established over a minimum period of one year. However, a bank wishing to base its calculation of capital requirements for commodities on correlations would have to satisfy the relevant supervisory authority of the accuracy of the method which has been chosen and obtain its prior approval. Where banks use the models approach they can offset long and short positions in different commodities to a degree which is determined by empirical correlations, in the same way as a limited degree of offsetting is allowed, for instance, between interest rates in different currencies.

Maturity ladder approach

20.67   In calculating the capital requirements under the maturity ladder approach banks will first have to express each commodity position (spot plus forward) in terms of the standard unit of measurement (barrels, kilos, grams etc). The net position in each commodity will then be converted at current spot rates into the national currency.

20.68   Secondly, in order to capture forward gap and interest rate risk within a time-band (which, together, are sometimes referred to as curvature/spread risk), matched long and short positions in each time-band will carry a capital requirement. The methodology is similar to that used for interest-rate-related instruments as set out in MAR20.2 to MAR20.39. Positions in the separate commodities (expressed in terms of the standard unit of measurement) will first be entered into a maturity ladder while physical stocks should be allocated to the first time-band. A separate maturity ladder will be used for each commodity as defined in MAR20.66 above.[27] For each time-band as set out in the table 10, the sum of short and long positions which are matched will be multiplied first by the spot price for the commodity, and then by the spread rate of 1.5%.

Time band	Spread rate
0-1 month	1.5%
1-3 months	1.5%
3-6 months	1.5%
6-12 months	1.5%
1-2 years	1.5%
2-3 years	1.5%
over 3 years	1.5%

Footnotes

[27]   *For markets which have daily delivery dates, any contracts maturing within ten days of one another may be offset.*

20.69 The residual net positions from nearer time-bands may then be carried forward to offset exposures in time-bands that are further out. However, recognising that such hedging of positions among different time-bands is imprecise, a surcharge equal to 0.6% of the net position carried forward will be added in respect of each time-band that the net position is carried forward. The capital requirement for each matched amount created by carrying net positions forward will be calculated as in MAR20.68 above. At the end of this process a bank will have either only long or only short positions, to which a capital requirement of 15% will apply.

20.70 All commodity derivatives and off-balance-sheet positions which are affected by changes in commodity prices should be included in this measurement framework. This includes commodity futures, commodity swaps and options where the "delta-plus" method[28] is used (see MAR20.76 to MAR20.79 below). In order to calculate the risk, commodity derivatives should be converted into notional commodities positions and assigned to maturities as follows.

(1) Futures and forward contracts relating to individual commodities should be incorporated as notional amounts of the standard unit of measurement (barrels, kilos, grams etc) and should be assigned a maturity with reference to expiry date.

(2) Commodity swaps where one leg is a fixed price and the other the current market price should be incorporated as a series of positions equal to the notional amount of the contract, with one position corresponding with each payment on the swap and slotted into the maturity ladder accordingly. The positions would be long positions if the bank is paying fixed and receiving floating, and short positions if the bank is receiving fixed and paying floating. [29]

(3) Commodity swaps where the legs are in different commodities are to be incorporated in the relevant maturity ladder. No offsetting will be allowed in this regard except where the commodities belong to the same sub-category as defined in MAR20.66 above.

Footnotes

[28]   *For banks using other approaches to measure options risk, all options and the associated underlyings should be excluded from both the maturity ladder approach and the simplified approach.*

[29]   *If one of the legs involves receiving/paying a fixed or floating interest rate, that exposure should be slotted into the appropriate repricing maturity band in the maturity ladder covering interest rate related instruments.*

Simplified approach

20.71 In calculating the capital requirement for directional risk under the simplified approach, the same procedure will be adopted as in the maturity ladder approach above (see MAR20.67 and MAR20.70). Once again, all commodity derivatives and off-balance sheet positions which are affected by changes in commodity prices should be included. The capital requirement will equal 15% of the net position, long or short, in each commodity.

20.72 In order to protect the bank against basis risk, interest rate risk and forward gap risk under the simplified approach, the capital requirement for each commodity as described in MAR20.67 and MAR20.70 above will be subject to an additional capital requirement equivalent to 3% of the bank's gross positions, long plus short, in that particular commodity. In valuing the gross positions in commodity derivatives for this purpose, banks should use the current spot price.

Treatment of options

20.73 In recognition of the wide diversity of banks' activities in options and the difficulties of measuring price risk for options, two alternative approaches will be permissible at the discretion of the national authority under the standardised approach.

    (1)   Those banks which solely use purchased options[30] can use the simplified approach described in MAR20.75 below.

    (2)   Those banks which also write options are expected to use the delta-plus method or scenario approach which are the intermediate approaches as set out in MAR20.76 to MAR20.85. The more significant its trading activity is, the more the bank will be expected to use a sophisticated approach, and a bank with highly significant trading activity is expected to use the internal models approach using a comprehensive risk management model as set out in MAR30.

Footnotes

[30]   *Unless all their written option positions are hedged by perfectly matched long positions in exactly the same options, in which case no capital requirement for market risk is required.*

20.74 In the simplified approach for options, the positions for the options and the associated underlying, cash or forward, are not subject to the standardised methodology but rather are "carved-out" and subject to separately calculated capital requirements that incorporate both general market risk and specific risk. The risk numbers thus generated are then added to the capital requirements for the relevant category, ie interest-rate-related instruments, equities, foreign exchange and commodities as described in MAR20.2 to MAR20.72. The delta-plus method uses the sensitivity parameters or "Greek letters" associated with options to measure their market risk and capital requirements. Under this method, the delta-equivalent position of each option becomes part of the standardised methodology set out in MAR20.2 to MAR20.72 with the delta-equivalent amount subject to the applicable general market risk charges. Separate capital requirements are then applied to the gamma and vega risks of the option positions. The scenario approach uses simulation techniques to calculate changes in the value of an options portfolio for changes in the level and volatility of its associated underlyings. Under this approach, the general market risk charge is determined by the scenario "grid" (ie the specified combination of underlying and volatility changes) that produces the largest loss. For the delta-plus method and the scenario approach the specific risk capital requirements are determined separately by multiplying the delta-equivalent of each option by the specific risk weights set out in MAR20.2 to MAR20.51.

Simplified approach

20.75 Banks which handle a limited range of purchased options can use the simplified approach set out in Table 9 below for particular trades. As an example of how the calculation would work, if a holder of 100 shares currently valued at $10 each holds an equivalent put option with a strike price of $11, the capital requirement would be: $1,000 x 16% (ie 8% specific plus 8% general market risk) = $160, less the amount the option is in the money ($11 - $10) x 100 = $100, ie the capital requirement would be $60. A similar methodology applies for options whose underlying is a foreign currency, an interest rate related instrument or a commodity.

Position	Treatment
Long cash and long put or short cash and long call	The capital requirement will be the market value of the underlying security[31] multiplied by the sum of specific and general market risk charges[32] for the underlying less the amount the option is in the money (if any) bounded at zero[33]
Long call or long put	The capital requirement will be the lesser of: (1) the market value of the underlying security multiplied by the sum of specific and general market risk charges[32] for the underlying and (2) the market value of the option[34]

Footnotes

[31] *In some cases such as foreign exchange, it may be unclear which side is the "underlying security"; this should be taken to be the asset which would be received if the option were exercised. In addition the nominal value should be used for items where the market value of the underlying instrument could be zero, eg caps and floors, swaptions.*

[32] *Some options (eg where the underlying is an interest rate, a currency or a commodity) bear no specific risk but specific risk will be present in the case of options on certain interest-rate-related instruments (eg options on a corporate debt security or corporate bond index; see MAR20.2 to MAR20.39 for the relevant capital requirements) and for options on equities and stock indices (see MAR20.40 to MAR20.51). The charge under this measure for currency options will be 8% and for options on commodities 15%.*

[33] *For options with a residual maturity of more than six months the strike price should be compared with the forward, not current, price. A bank unable to do this must take the in the money amount to be zero.*

[34] *Where the position does not fall within the trading book (ie options on certain foreign exchange or commodities positions not belonging to the trading book), it may be acceptable to use the book value instead.*

Delta-plus method

20.76 Banks which write options will be allowed to include delta-weighted options positions within the standardised methodology set out in MAR20.2 to MAR20.72. Such options should be reported as a position equal to the market value of the underlying multiplied by the delta. However, since delta does not sufficiently cover the risks associated with options positions, banks will also be required to measure gamma (which measures the rate of change of delta) and vega (which measures the sensitivity of the value of an option with respect to a change in volatility) sensitivities in order to calculate the total capital requirement. These sensitivities will be calculated according to an approved exchange model or to the bank's proprietary options pricing model subject to oversight by the national authority.[35]

Footnotes

[35]   *National authorities may wish to require banks doing business in certain classes of exotic options (eg barriers, digitals) or in options at the money that are close to expiry to use either the scenario approach or the internal models alternative, both of which can accommodate more detailed revaluation approaches.*

20.77 Delta-weighted positions with debt securities or interest rates as the underlying will be slotted into the interest rate time-bands, as set out in MAR20.2 to MAR20.39, under the following procedure. A two-legged approach should be used as for other derivatives, requiring one entry at the time the underlying contract takes effect and a second at the time the underlying contract matures. For instance, a bought call option on a June three-month interest-rate future will in April be considered, on the basis of its delta-equivalent value, to be a long position with a maturity of five months and a short position with a maturity of two months.[36] The written option will be similarly slotted as a long position with a maturity of two months and a short position with a maturity of five months. Floating-rate instruments with caps or floors will be treated as a combination of floating rate securities and a series of European-style options. For example, the holder of a three-year floating rate bond indexed to six month LIBOR with a cap of 15% will treat it as:

(1)   a debt security that reprices in six months; and

(2)   a series of five written call options on a FRA with a reference rate of 15%, each with a negative sign at the time the underlying FRA takes effect and a positive sign at the time the underlying FRA matures.[37]

20.78 The capital requirement for options with equities as the underlying will also be based on the delta-weighted positions which will be incorporated in the measure of equity risk described in MAR20.40 to MAR20.51. For purposes of this calculation each national market is to be treated as a separate underlying. The capital requirement for options on foreign exchange and gold positions will be based on the method for foreign exchange rate risk as set out in MAR20.52 to MAR20.61. For delta risk, the net delta-based equivalent of the foreign currency and gold options will be incorporated into the measurement of the exposure for the respective currency (or gold) position. The capital requirement for options on commodities will be based on the simplified or the maturity ladder approach for commodities risk as set out in MAR20.62 to MAR20.72. The delta-weighted positions will be incorporated in one of the measures described in that section.

20.79 In addition to the above capital requirements arising from delta risk, there are further capital requirements for gamma and for vega risk. Banks using the delta-plus method will be required to calculate the gamma and vega for each option position (including hedge positions) separately. The capital requirements should be calculated in the following way.

(1)   For each individual option a "gamma impact" should be calculated according to a Taylor series expansion as follows, where VU is the variation of the underlying of the option.

$$Gamma\ impact = \frac{1}{2} \times Gamma \times VU^2$$

(2) VU is calculated as follows:

    (a) for interest rate options if the underlying is a bond, the market value of the underlying should be multiplied by the risk weights set out in MAR20.25. An equivalent calculation should be carried out where the underlying is an interest rate, again based on the assumed changes in the corresponding yield in MAR20.25;

    (b) for options on equities and equity indices: the market value of the underlying should be multiplied by 8%;[38]

    (c) for foreign exchange and gold options: the market value of the underlying should be multiplied by 8%; and

    (d) for options on commodities: the market value of the underlying should be multiplied by 15%.

(3) For the purpose of this calculation the following positions should be treated as the same underlying:

    (a) for interest rates,[39] each time-band as set out in MAR20.25;[40]

    (b) for equities and stock indices, each national market;

    (c) for foreign currencies and gold, each currency pair and gold;

    (d) for commodities, each individual commodity as defined in MAR20.66.

(4) Each option on the same underlying will have a gamma impact that is either positive or negative. These individual gamma impacts will be summed, resulting in a net gamma impact for each underlying that is either positive or negative. Only those net gamma impacts that are negative will be included in the capital requirement calculation.

(5) The total gamma risk capital requirement will be the sum of the absolute value of the net negative gamma impacts as calculated above.

(6) For volatility risk, banks will be required to calculate the capital requirements by multiplying the sum of the vega risks for all options on the same underlying, as defined above, by a proportional shift in volatility of ± 25%.

(7) The total capital requirement for vega risk will be the sum of the absolute value of the individual capital requirements that have been calculated for vega risk.

Footnotes

38	*The basic rules set out here for interest rate and equity options do not attempt to capture specific risk when calculating gamma capital requirements. However, national authorities may wish to require specific banks to do so.*
39	*Positions have to be slotted into separate maturity ladders by currency.*
40	*Banks using the duration method should use the time-bands as set out in MAR20.28.*

Scenario approach

20.80 More sophisticated banks may opt to base the market risk capital requirement for options portfolios and associated hedging positions on scenario matrix analysis. This will be accomplished by specifying a fixed range of changes in the option portfolio's risk factors and calculating changes in the value of the option portfolio at various points along this "grid". For the purpose of calculating the capital requirement, the bank will revalue the option portfolio using matrices for simultaneous changes in the option's underlying rate or price and in the volatility of that rate or price. A different matrix will be set up for each individual underlying as defined in MAR20.79. As an alternative, at the discretion of each national authority, banks which are significant traders in options will for interest-rate options be permitted to base the calculation on a minimum of six sets of time-bands. When using this method, not more than three of the time-bands as defined in MAR20.25 and MAR20.28 should be combined into any one set.

20.81 The options and related hedging positions will be evaluated over a specified range above and below the current value of the underlying. The range for interest rates is consistent with the assumed changes in yield in MAR20.25. Those banks using the alternative method for interest rate options set out in MAR20.80 above should use, for each set of time-bands, the highest of the assumed changes in yield applicable to the group to which the time-bands belong.[41] The other ranges are ± 8% for equities,[42] ± 8% for foreign exchange and gold, and ± 15% for commodities. For all risk categories, at least seven observations (including the current observation) should be used to divide the range into equally spaced intervals.

Footnotes

[41]   *If, for example, the time-bands 3 to 4 years, 4 to 5 years and 5 to 7 years are combined the highest assumed change in yield of these three bands would be 0.75.*

[42]   *The basic rules set out here for interest rate and equity options do not attempt to capture specific risk when calculating gamma capital requirements. However, national authorities may wish to require specific banks to do so.*

20.82 The second dimension of the matrix entails a change in the volatility of the underlying rate or price. A single change in the volatility of the underlying rate or price equal to a shift in volatility of +25% and -25% is expected to be sufficient in most cases. As circumstances warrant, however, the supervisory authority may choose to require that a different change in volatility be used and/or that intermediate points on the grid be calculated.

20.83 After calculating the matrix each cell contains the net profit or loss of the option and the underlying hedge instrument. The capital requirement for each underlying will then be calculated as the largest loss contained in the matrix.

20.84 The application of the scenario analysis by any specific bank will be subject to supervisory consent, particularly as regards the precise way that the analysis is constructed. Banks' use of scenario analysis as part of the standardised methodology will also be subject to validation by the national authority, and to those of the qualitative standards listed in MAR30.5 to MAR30.11 which are appropriate given the nature of the business.

20.85 Besides the options risks mentioned above, the Committee is conscious of the other risks also associated with options, eg rho (rate of change of the value of the option with respect to the interest rate) and theta (rate of change of the value of the option with respect to time). While not proposing a measurement system for those risks at present, it expects banks undertaking significant options business at the very least to monitor such risks closely. Additionally, banks will be permitted to incorporate rho into their capital calculations for interest rate risk, if they wish to do so.

MAR30

Internal models approach

This chapter sets out minimum requirements for banks to use internal models to calculate risk-weighted assets for market risk.

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First version in the format of the consolidated framework.

General criteria

30.1 The risk-weighted assets for market risk under the internal models approach are determined by multiplying the capital requirements calculated as set out in this chapter by 12.5.

30.2 The use of an internal model will be conditional upon the explicit approval of the bank's supervisory authority. Home and host country supervisory authorities of banks that carry out material trading activities in multiple jurisdictions intend to work co-operatively to ensure an efficient approval process. The supervisory authority will only give its approval if at a minimum:

(1) It is satisfied that the bank's risk management system is conceptually sound and is implemented with integrity;

(2) The bank has in the supervisory authority's view sufficient numbers of staff skilled in the use of sophisticated models not only in the trading area but also in the risk control, audit, and if necessary, back office areas;

(3) The bank's models have in the supervisory authority's judgement a proven track record of reasonable accuracy in measuring risk;

(4) The bank regularly conducts stress tests along the lines discussed in MAR30.18 to MAR30.25.

30.3 Supervisory authorities will have the right to insist on a period of initial monitoring and live testing of a bank's internal model before it is used for supervisory capital purposes.

30.4 In addition to these general criteria, banks using internal models for capital purposes will be subject to the requirements detailed in MAR30.5 to MAR30.71.

Qualitative standards

30.5 It is important that supervisory authorities are able to assure themselves that banks using models have market risk management systems that are conceptually sound and implemented with integrity. Accordingly, the supervisory authority will specify a number of qualitative criteria that banks would have to meet before they are permitted to use a models-based approach. The extent to which banks meet the qualitative criteria may influence the level at which supervisory authorities will set the multiplication factor referred to in MAR30.16. Only those banks whose models are in full compliance with the qualitative criteria will be eligible for application of the minimum multiplication factor. The qualitative criteria include:

(1) The bank should have an independent risk control unit that is responsible for the design and implementation of the bank's risk management system. The unit should produce and analyse daily reports on the output of the bank's risk measurement model, including an evaluation of the relationship between measures of risk exposure and trading limits. This unit must be independent from business trading units and should report directly to senior management of the bank.

(2) The unit should conduct a regular back-testing programme, ie an ex-post comparison of the risk measure generated by the model against actual daily changes in portfolio value over longer periods of time, as well as hypothetical changes based on static positions.

(3) The unit should also conduct the initial and on-going validation of the internal model.[1]

(4) Board of directors and senior management should be actively involved in the risk control process and must regard risk control as an essential aspect of the business to which significant resources need to be devoted. In this regard, the daily reports prepared by the independent risk control unit must be reviewed by a level of management with sufficient seniority and authority to enforce both reductions of positions taken by individual traders and reductions in the bank's overall risk exposure.

(5) The bank's internal risk measurement model must be closely integrated into the day-to-day risk management process of the bank. Its output should accordingly be an integral part of the process of planning, monitoring and controlling the bank's market risk profile.

(6) The risk measurement system should be used in conjunction with internal trading and exposure limits. In this regard, trading limits should be related to the bank's risk measurement model in a manner that is consistent over time and that is well understood by both traders and senior management.

(7) A routine and rigorous programme of stress testing[2] should be in place as a supplement to the risk analysis based on the day-to-day output of the bank's risk measurement model. The results of stress testing should be reviewed periodically by senior management, used in the internal assessment of capital adequacy, and reflected in the policies and limits set by management and the board of directors. Where stress tests reveal particular vulnerability to a given set of circumstances, prompt steps should be taken to manage those risks appropriately (eg by hedging against that outcome or reducing the size of the bank's exposures, or increasing capital).

(8) Banks should have a routine in place for ensuring compliance with a documented set of internal policies, controls and procedures concerning the operation of the risk measurement system. The bank's risk measurement system must be well documented, for example, through a risk management manual that describes the basic principles of the risk management system and that provides an explanation of the empirical techniques used to measure market risk.

(9) An independent review of the risk measurement system should be carried out regularly in the bank's own internal auditing process. This review should include both the activities of the business trading units and of the independent risk control unit. A review of the overall risk management process should take place at regular intervals (ideally not less than once a year) and should specifically address, at a minimum:

    (a) The adequacy of the documentation of the risk management system and process;

    (b) The organisation of the risk control unit;

    (c) The integration of market risk measures into daily risk management;

    (d) The approval process for risk pricing models and valuation systems used by front and back-office personnel;

    (e) The validation of any significant change in the risk measurement process;

    (f) The scope of market risks captured by the risk measurement model;

    (g) The integrity of the management information system;

    (h) The accuracy and completeness of position data;

    (i) The verification of the consistency, timeliness and reliability of data sources used to run internal models, including the independence of such data sources;

    (j) The accuracy and appropriateness of volatility and correlation assumptions;

    (k) The accuracy of valuation and risk transformation calculations;

    (l) The verification of the model's accuracy through frequent back-testing as described in MAR30.5(2) and in MAR99.

Specification of market risk factors

30.6   An important part of a bank's internal market risk measurement system is the specification of an appropriate set of market risk factors, ie the market rates and prices that affect the value of the bank's trading positions. The risk factors contained in a market risk measurement system should be sufficient to capture the risks inherent in the bank's portfolio of on- and off-balance sheet trading positions. Although banks will have some discretion in specifying the risk factors for their internal models, the following guidelines should be fulfilled.

30.7   Factors that are deemed relevant for pricing should be included as risk factors in the value-at-risk model. Where a risk factor is incorporated in a pricing model but not in the value-at-risk model, the bank must justify this omission to the satisfaction of its supervisor. In addition, the value-at-risk model must capture nonlinearities for options and other relevant products (eg mortgage-backed securities, tranched exposures or n-th-to-default credit derivatives), as well as correlation risk and basis risk (eg between credit default swaps and bonds). Moreover, the supervisor has to be satisfied that proxies are used which show a good track record for the actual position held (ie an equity index for a position in an individual stock).

FAQ

FAQ1   *The reference to mortgage-backed securities in [MAR30.7](#) suggests they can remain within an internal models based approach and in value-at-risk (VaR, the internal models approach); however, [MAR10.16](#) indicates that the standardised measurement method should be used for all securitised products except for certain correlation trading activities for which a comprehensive risk capital requirement can be calculated. Can non-correlation trading securitisations be incorporated in an internal models approach?*

        Securitisations which are not part of the correlation trading portfolio are subject to a general market risk capital requirement and the standardised capital requirement for specific risk. These positions must be included in the bank's VaR model for general market risk or be subject to the standardised approach capital requirement for general market risk. While the positions may be included in the bank's internal specific risk model, the specific risk capital requirement for securitisations according to the standardised approach will apply as well.

30.8   For interest rates, there must be a set of risk factors corresponding to interest rates in each currency in which the bank has interest-rate-sensitive on- or off-balance sheet positions.

(1)   The risk measurement system should model the yield curve using one of a number of generally accepted approaches, for example, by estimating forward rates of zero coupon yields. The yield curve should be divided into various maturity segments in order to capture variation in the volatility of rates along the yield curve; there will typically be one risk factor corresponding to each maturity segment. For material exposures to interest rate movements in the major currencies and markets, banks must model the yield curve using a minimum of six risk factors. However, the number of risk factors used should ultimately be driven by the nature of the bank's trading strategies. For instance, a bank with a portfolio of various types of securities across many points of the yield curve and that engages in complex arbitrage strategies would require a greater number of risk factors to capture interest rate risk accurately.

(2) The risk measurement system must incorporate separate risk factors to capture spread risk (eg between bonds and swaps). A variety of approaches may be used to capture the spread risk arising from less than perfectly correlated movements between government and other fixed-income interest rates, such as specifying a completely separate yield curve for non-government fixed-income instruments (for instance, swaps or municipal securities) or estimating the spread over government rates at various points along the yield curve.

30.9 For exchange rates (which may include gold), the risk measurement system should incorporate risk factors corresponding to the individual foreign currencies in which the bank's positions are denominated. Since the value-at-risk figure calculated by the risk measurement system will be expressed in the bank's domestic currency, any net position denominated in a foreign currency will introduce a foreign exchange risk. Thus, there must be risk factors corresponding to the exchange rate between the domestic currency and each foreign currency in which the bank has a significant exposure.

30.10 For equity prices, there should be risk factors corresponding to each of the equity markets in which the bank holds significant positions:

(1) At a minimum, there should be a risk factor that is designed to capture market-wide movements in equity prices (eg a market index). Positions in individual securities or in sector indices could be expressed in "beta-equivalents"[3] relative to this market-wide index;

(2) A somewhat more detailed approach would be to have risk factors corresponding to various sectors of the overall equity market (for instance, industry sectors or cyclical and non-cyclical sectors). As above, positions in individual stocks within each sector could be expressed in beta-equivalents relative to the sector index;

(3) The most extensive approach would be to have risk factors corresponding to the volatility of individual equity issues.

(4) The sophistication and nature of the modelling technique for a given market should correspond to the bank's exposure to the overall market as well as its concentration in individual equity issues in that market.

30.11 For commodity prices, there should be risk factors corresponding to each of the commodity markets in which the bank holds significant positions (also see MAR20.70):

(1)   For banks with relatively limited positions in commodity-based instruments, a straightforward specification of risk factors would be acceptable. Such a specification would likely entail one risk factor for each commodity price to which the bank is exposed. In cases where the aggregate positions are quite small, it might be acceptable to use a single risk factor for a relatively broad sub-category of commodities (for instance, a single risk factor for all types of oil);

(2)   For more active trading, the model must also take account of variation in the "convenience yield"[4] between derivatives positions such as forwards and swaps and cash positions in the commodity.

30.12 It is essential that the methodology used for commodities risk encompasses:

(1)   Directional risk, to capture the exposure from changes in spot prices arising from net open positions;

(2)   Forward gap and interest rate risk, to capture the exposure to changes in forward prices arising from maturity mismatches; and

(3)   Basis risk, to capture the exposure to changes in the price relationships between two similar, but not identical, commodities.

30.13 It is also particularly important that such models take proper account of market characteristics - notably delivery dates and the scope provided to traders to close out positions.

Quantitative standards: value-at-risk (VaR) and stressed value-at-risk (sVaR)

30.14 Banks will have flexibility in devising the precise nature of their models, but the following minimum standards will apply for the purpose of calculating their capital requirement. Individual banks or their supervisory authorities will have discretion to apply stricter standards.

(1) "Value-at-risk" must be computed on a daily basis.

(2) In calculating the value-at-risk, a 99th percentile, one-tailed confidence interval is to be used.

(3) In calculating value-at-risk, an instantaneous price shock equivalent to a 10 day movement in prices is to be used, ie the minimum "holding period" will be ten trading days. Banks may use value-at-risk numbers calculated according to shorter holding periods scaled up to ten days by, for example, the square root of time (for the treatment of options, also see MAR30.14(8)). A bank using this approach must periodically justify the reasonableness of its approach to the satisfaction of its supervisor.

(4) The choice of historical observation period (sample period) for calculating value-at-risk will be constrained to a minimum length of one year. For banks that use a weighting scheme or other methods for the historical observation period, the "effective" observation period must be at least one year (that is, the weighted average time lag of the individual observations cannot be less than 6 months).[5]

(5) Banks must update their data sets no less frequently than once every month and also reassess them whenever market prices are subject to material changes. This updating process must be flexible enough to allow for more frequent updates. The supervisory authority may also require a bank to calculate its value-at-risk using a shorter observation period if, in the supervisor's judgement, this is justified by a significant upsurge in price volatility.

(6) No particular type of model is prescribed. So long as each model used captures all the material risks run by the bank, as set out in MAR30.6 to MAR30.11, banks will be free to use models based, for example, on variance-covariance matrices, historical simulations, or Monte Carlo simulations.

(7) Banks will have discretion to recognise empirical correlations within broad risk categories (eg interest rates, exchange rates, equity prices and commodity prices, including related options volatilities in each risk factor category). The supervisory authority may also recognise empirical

correlations across broad risk factor categories, provided that the supervisory authority is satisfied that the bank's system for measuring correlations is sound and implemented with integrity.

(8) Banks' models must accurately capture the unique risks associated with options within each of the broad risk categories. The following criteria apply to the measurement of options risk:

    (a) Banks' models must capture the non-linear price characteristics of options positions;

    (b) Banks are expected to ultimately move towards the application of a full 10 day price shock to options positions or positions that display option-like characteristics. In the interim, national authorities may require banks to adjust their capital measure for options risk through other methods, eg periodic simulations or stress testing;

    (c) Each bank's risk measurement system must have a set of risk factors that captures the volatilities of the rates and prices underlying option positions, ie vega risk. Banks with relatively large and/or complex options portfolios should have detailed specifications of the relevant volatilities. This means that banks should measure the volatilities of options positions broken down by different maturities.

(9) In addition, a bank must calculate a stressed value-at-risk (sVaR) measure. This measure is intended to replicate a value-at-risk calculation that would be generated on the bank's current portfolio if the relevant market factors were experiencing a period of stress; and should therefore be based on the 10-day, 99th percentile, one-tailed confidence interval value-at-risk measure of the current portfolio, with model inputs calibrated to historical data from a continuous 12-month period of significant financial stress relevant to the bank's portfolio. The period used must be approved by the supervisor and regularly reviewed. As an example, for many portfolios, a 12-month period relating to significant losses in 2007/2008 would adequately reflect a period of such stress; although other periods relevant to the current portfolio must be considered by the bank.

(10)   As no particular model is prescribed under MAR30.14(6), different techniques might need to be used to translate the model used for value-at-risk into one that delivers a stressed value-at-risk. For example, banks should consider applying anti-thetic[6] data, or applying absolute rather than relative volatilities to deliver an appropriate stressed value-at-risk. The stressed value-at-risk should be calculated at least weekly.

Footnotes

[5]   *A bank may calculate the value-at-risk estimate using a weighting scheme that is not fully consistent with MAR30.14(4) as long as that method results in a capital requirement at least as conservative as that calculated according to MAR30.14(4).*

[6]   *Firms should consider modelling valuation changes that are based on the magnitude of historic price movements, applied in both directions – irrespective of the direction of the historic movement.*

FAQ

FAQ1   *Does the sVaR apply to all risks included in the VaR model, or only to the general market risk component of that model?*

The sVaR applies to all risks (eg general interest rate risk; specific interest rate risk; commodity risk) for which the bank in question has approval from its supervisor to use an internal VaR model.

FAQ2   *Should the sVaR period be fixed (or stable) and the sVaR only respond to changes in the composition of the portfolio, or may the sVaR also adjust to changes in risk factors (and if so, how much)?*

The intention of the sVaR requirement is to deliver the charge that the bank's current VaR model would generate if the bank was experiencing a period of financial stress relevant to its portfolio. Therefore, the time-series data upon which the sVaR is calculated should be stable. However, the period used must be regularly reviewed by the bank and approved by the supervisor to ensure that it still represents a period of significant financial stress relevant to the bank's portfolio.

Also, to the extent that time series' data are used in the factor assessments, then these will also be fixed as a result of fixing the time series' data. However, to the extent that a bank changes its VaR engine, or risk factor approach, then these changes should be reflected in changes to the model used to calculate the sVaR measure.

FAQ3   *Does "using a weighting scheme that is not fully consistent with [MAR30.14](4) include various methods to render the VaR model more reactive to market changes like, for example, models with time-dependent volatilities which use a period of less than a year to calibrate current volatility?*

Yes.

FAQ4   *If a bank opts for such a weighting scheme as in [MAR30.14] FAQ3, should it then use the same reactive scheme also for sVaR?*

No. The weighting scheme should not be used for sVaR.

FAQ5   *[MAR30.14](9) requires "a continuous 12-month period of significant financial stress". Would this mean that supervisors exclude any period that would be less than 12 months even if particularly relevant to the portfolios and extremely stressful? Or are supervisors targeting a continuous 12-month period that includes a significant financial stress event (the latter lasting possibly less than 12 months)?*

The latter – supervisors are targeting a 12-month period that includes an appropriate financial stress.

FAQ6   *What exactly is meant by "anti-thetic" and "applying absolute rather than relative volatilities" in [MAR30.14](10)? In the latter case, what is the reference period for determining whether the data is absolute or relative?*

Anti-thetic in this context means that price movements are considered relevant irrespective of their direction. For example, if a time series included a significant upward spike in equity prices, the model could apply significant movements in equity prices both upwards and downwards. This might be particularly relevant if a bank's portfolio is the "right way" to a period of financial stress (ie is long equities in a period of stock market surge); the model used should reflect that open risk positions (in either direction) are vulnerable to stressed variables.

FAQ7   *If a bank should decide to use anti-thetic data to deliver the sVaR, should it also use it to select the stressed period? That might make selecting the stressed period considerably more difficult because of the many possible combinations of the risk factors.*

No, see [MAR30.14] FAQ8 below.

FAQ8

Regarding [MAR30.14](#) FAQ6 and [MAR30.14](#) FAQ7, does this mean that banks in calculating sVaR, given the time period of one year (250 observations), have to consider an additional 250 observations by changing the sign of the risk factor movements?

The sVaR charge is intended to deliver a capital requirement based on a measure of VaR that would be applicable to the bank's current portfolio in a period of stress relevant to that portfolio. In principle, the easiest way to do this is to run the current VaR model based on historical data from a period of financial stress. However, there are two particular cases where this might be inappropriate:

- *If a period of financial stress (which may be indicated by significantly higher volatilities) corresponds to directional moves which would lead to the bank making money, based on the current portfolio. In these circumstances, it might be appropriate to apply the risk factor movements in both the direction which is indicated by the historical data, and the opposite direction (anti-thetic) to ensure that the period of high volatility becomes more relevant to the bank's portfolio.*

- *In stressed periods, there are some price factors (eg credit spreads) which tend to have higher absolute values. Therefore, an increase in absolute volatility in these factors (ie large movements) might not correspond to significant increases in relative volatility (ie because the absolute level of the parameter is also higher). If the bank's current VaR model tracks relative shifts in these price factors, then the relevant period of stress applied in benign periods (ie when the absolute values of credit spreads are smaller) might not deliver a VaR measure which accurately reflects what the VaR would be in a period of stress. The bank should therefore consider modifying its VaR model to account for large absolute factor moves that can occur in times of stress.*

This does not mean that the bank needs to look at a different 250-day period or an additional 250-day period by changing the sign of risk factor movements, but that it needs to think intelligently about how it translates the data from a 250-day period of stress into a sVaR measure.

FAQ9   Is the sVaR also subject to a "use-test"?

Yes, the VaR engine used to generate sVaR is subject to a use-test through the use of the current VaR calculated using the same engine. However, it may be that the sVaR output is not used in the day-to-day risk management decisions, because a different VaR measure is used.

FAQ10   *Taking into account that both migration and default risks have to be captured in the incremental risk capital requirement, is it necessary to still model default and migration in VaR and sVaR?*

Not necessarily.

MAR30 footnote 7 states that, for specific risk modelling, banks need not capture default and migration risks for positions subject to the incremental risk capital requirement referred to in MAR30.33 and MAR30.34. This is also the case for sVaR, since VaR and sVaR methodologies should be aligned.

At the same time specific risk for credit spread models are meant to capture idiosyncratic risk in terms of credit spreads. Specific risk models can include spread jumps and may therefore include rating migrations. The same applies to VaR and sVaR though the impact in sVaR may be greater than in VaR.

30.15 A bank must meet, on a daily basis, a capital requirement calculated based on the value-at-risk measure and stressed value-at-risk measure (c) as follows, where the formula is expressed as the sum of:

(1)   The higher of:

(a)   its previous day's value-at-risk number measured according to the parameters specified in this chapter (VAR_{t-1}) and

(b)   an average of the daily value-at-risk measures on each of the preceding sixty business days (VAR_{avg}), multiplied by a multiplication factor (m_c); plus

(2) The higher of:

    (a) its latest available stressed-value-at-risk number calculated according to [MAR30.15](1)(a) ($sVaR_{t-1}$) and

    (b) an average of the stressed value-at-risk numbers calculated according to [MAR30.15](1)(b) over the preceding sixty business days ($sVaR_{avg}$), multiplied by a multiplication factor (m_s).

$$c = \max\left(VaR_{t-1}, m_c \times VaR_{avg}\right) + \max\left(sVaR_{t-1}, m_s \times sVaR_{avg}\right)$$

30.16 The multiplication factors m_{c-} and m_{-s-} in [MAR30.15](#) will be set by individual supervisory authorities on the basis of their assessment of the quality of the bank's risk management system, subject to an absolute minimum of 3 for m_{c-} and an absolute minimum of 3 for m_{-s-}. Banks will be required to add to these factors a "plus" directly related to the ex-post performance of the model, thereby introducing a built-in positive incentive to maintain the predictive quality of the model. The plus will range from 0 to 1 based on the outcome of the "backtesting". The backtesting results applicable for calculating the plus are based on value-at-risk only and not stressed value-at-risk. If the backtesting results are satisfactory and the bank meets all of the qualitative standards set out in [MAR30.5](#), the plus factor could be zero. [MAR99](#) presents in detail the approach to be applied for backtesting and the plus factor. Supervisors will have national discretion to require banks to perform backtesting on either hypothetical (ie using changes in portfolio value that would occur were end-of-day positions to remain unchanged), or actual trading (ie excluding fees, commissions, and net interest income) outcomes, or both.

30.17 Banks using models will also be subject to a capital charge to cover specific risk (as defined in [MAR20](#)) of interest rate related instruments and equity securities. The manner in which the specific risk capital requirement is to be calculated under the internal models approach is set out in [MAR10.15](#) to [MAR10.18](#) and [MAR30.28](#) to [MAR30.43](#).

Stress testing

30.18 Banks that use the internal models approach for meeting market risk capital requirements must have in place a rigorous and comprehensive stress testing program. Stress testing to identify events or influences that could greatly impact banks is a key component of a bank's assessment of its capital position.

30.19 Banks' stress scenarios need to cover a range of factors that can create extraordinary losses or gains in trading portfolios, or make the control of risk in those portfolios very difficult. These factors include low-probability events in all major types of risks, including the various components of market, credit, and operational risks. Stress scenarios need to shed light on the impact of such events on positions that display both linear and nonlinear price characteristics (ie options and instruments that have options-like characteristics).

30.20 Banks' stress tests should be both of a quantitative and qualitative nature, incorporating both market risk and liquidity aspects of market disturbances. Quantitative criteria should identify plausible stress scenarios to which banks could be exposed. Qualitative criteria should emphasise that two major goals of stress testing are to evaluate the capacity of the bank's capital to absorb potential large losses and to identify steps the bank can take to reduce its risk and conserve capital. This assessment is integral to setting and evaluating the bank's management strategy and the results of stress testing should be routinely communicated to senior management and, periodically, to the bank's board of directors.

30.21 Banks should combine the use of supervisory stress scenarios with stress tests developed by banks themselves to reflect their specific risk characteristics. Specifically, supervisory authorities may ask banks to provide information on stress testing in three broad areas, which are discussed in MAR30.22 to MAR30.25.

30.22 Supervisory scenarios requiring no simulations by the bank: banks should have information on the largest losses experienced during the reporting period available for supervisory review. This loss information could be compared to the level of capital that results from a bank's internal measurement system. For example, it could provide supervisory authorities with a picture of how many days of peak day losses would have been covered by a given value-at-risk estimate.

FAQ

*FAQ1   For the scenarios requiring no simulation from banks, [MAR30.22](#)
specifies that the loss information could be compared to the level of
capital that results from a bank's internal measurement system. It
should be specified whether this is only valid for the VaR component of
the capital requirement or for all components of the capital
requirement (VaR, sVaR, incremental risk capital requirement and
Comprehensive risk measure).*

*This paragraph is for supervisory use and could be used in a number of
different ways, depending upon the data requested by the relevant
supervisor. Supervisors would expect that the most relevant use would
be a comparison of losses to the overall capital requirement, but that
does not preclude individual supervisors asking for information in
different forms.*

30.23 Scenarios requiring a simulation by the bank: banks should subject their
portfolios to a series of simulated stress scenarios and provide supervisory
authorities with the results. These scenarios could include testing the current
portfolio against past periods of significant disturbance, for example, the 1987
equity 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, the
2000 bursting of the technology stock bubble or the 2007/2008 sub-prime crisis,
incorporating both the large price movements and the sharp reduction in
liquidity associated with these events. A second type of scenario would evaluate
the sensitivity of the bank's market risk exposure to changes in the assumptions
about volatilities and correlations. Applying this test would require an evaluation
of the historical range of variation for volatilities and correlations and evaluation
of the bank's current positions against the extreme values of the historical range.
Due consideration should be given to the sharp variation that at times has
occurred in a matter of days in periods of significant market disturbance. For
example, the above-mentioned situations involved correlations within risk factors
approaching the extreme values of 1 or -1 for several days at the height of the
disturbance.

30.24 Scenarios developed by the bank itself to capture the specific characteristics of its
portfolio: in addition to the scenarios prescribed by supervisory authorities under
[MAR30.22](#) and [MAR30.23](#), a bank should also develop its own stress tests which it
identifies as most adverse based on the characteristics of its portfolio (eg
problems in a key region of the world combined with a sharp move in oil prices).
Banks should provide supervisory authorities with a description of the
methodology used to identify and carry out the scenarios as well as with a
description of the results derived from these scenarios.

30.25 The results should be reviewed periodically by senior management and should be reflected in the policies and limits set by management and the board of directors. Moreover, if the testing reveals particular vulnerability to a given set of circumstances, the national authorities would expect the bank to take prompt steps to manage those risks appropriately (eg by hedging against that outcome or reducing the size of its exposures).

External validation

30.26 The validation of models' accuracy by external auditors and/or supervisory authorities should at a minimum include the following steps:

(1) Verifying that the internal validation processes described in [MAR30.5](9) are operating in a satisfactory manner;

(2) Ensuring that the formulae used in the calculation process as well as for the pricing of options and other complex instruments are validated by a qualified unit, which in all cases should be independent from the trading area;

(3) Checking that the structure of internal models is adequate with respect to the bank's activities and geographical coverage;

(4) Checking the results of the banks' back-testing of its internal measurement system (ie comparing value-at-risk estimates with actual profits and losses) to ensure that the model provides a reliable measure of potential losses over time. This means that banks should make the results as well as the underlying inputs to their value-at-risk calculations available to their supervisory authorities and/or external auditors on request;

(5) Making sure that data flows and processes associated with the risk measurement system are transparent and accessible. In particular, it is necessary that auditors or supervisory authorities are in a position to have easy access, whenever they judge it necessary and under appropriate procedures, to the models' specifications and parameters.

Model validation standards

30.27 It is important that banks have processes in place to ensure that their internal models have been adequately validated by suitably qualified parties independent of the development process to ensure that they are conceptually sound and adequately capture all material risks. This validation should be conducted when the model is initially developed and when any significant changes are made to the model. The validation should also be conducted on a periodic basis but especially where there have been any significant structural changes in the market or changes to the composition of the portfolio which might lead to the model no longer being adequate. More extensive model validation is particularly important where specific risk is also modelled and is required to meet the further specific risk criteria. As techniques and best practices evolve, banks should avail themselves of these advances. Model validation should not be limited to backtesting, but should, at a minimum, also include the following:

(1) Tests to demonstrate that any assumptions made within the internal model are appropriate and do not underestimate risk. This may include the assumption of the normal distribution, the use of the square root of time to scale from a one day holding period to a 10 day holding period or where extrapolation or interpolation techniques are used, or pricing models;

(2) Further to the regulatory backtesting programmes, testing for model validation must use hypothetical changes in portfolio value that would occur were end-of-day positions to remain unchanged. It therefore excludes fees, commissions, bid-ask spreads, net interest income and intra-day trading. Moreover, additional tests are required which may include, for instance:

(a) Testing carried out for longer periods than required for the regular backtesting programme (eg 3 years). The longer time period generally improves the power of the backtesting. A longer time period may not be desirable if the VaR model or market conditions have changed to the extent that historical data is no longer relevant;

(b) Testing carried out using confidence intervals other than the 99 percent interval required under the quantitative standards;

(c) Testing of portfolios below the overall bank level;

(3) The use of hypothetical portfolios to ensure that the model is able to account for particular structural features that may arise, for example:

    (a) Where data histories for a particular instrument do not meet the quantitative standards in MAR30.14 to MAR30.17 and where the bank has to map these positions to proxies, then the bank must ensure that

    the proxies produce conservative results under relevant market scenarios;

    (b) Ensuring that material basis risks are adequately captured. This may include mismatches between long and short positions by maturity or by issuer;

    (c) Ensuring that the model captures concentration risk that may arise in an undiversified portfolio.

Treatment of specific risk

30.28 The criteria for supervisory recognition of banks' modelling of specific risk require that a bank's model must capture all material components of price risk[7] and be responsive to changes in market conditions and compositions of portfolios. In particular, the model must:

(1) explain the historical price variation in the portfolio;[8]

(2) capture concentrations (magnitude and changes in composition);[9]

(3) be robust to an adverse environment;[10]

(4) capture name-related basis risk;[11]

(5) capture event risk;[12]

(6) be validated through backtesting.[13]

Footnotes

7   *Banks need not capture default and migration risks for positions subject to the incremental risk capital requirement referred to in [MAR30.33](#) and [MAR30.34](#).*

8   *The key ex ante measures of model quality are "goodness-of-fit" measures which address the question of how much of the historical variation in price value is explained by the risk factors included within the model. One measure of this type which can often be used is an R-squared measure from regression methodology. If this measure is to be used, the risk factors included in the bank's model would be expected to be able to explain a high percentage, such as 90%, of the historical price variation or the model should explicitly include estimates of the residual variability not captured in the factors included in this regression. For some types of models, it may not be feasible to calculate a goodness-of-fit measure. In such instance, a bank is expected to work with its national supervisor to define an acceptable alternative measure which would meet this regulatory objective.*

9   *The bank would be expected to demonstrate that the model is sensitive to changes in portfolio construction and that higher capital requirements are attracted for portfolios that have increasing concentrations in particular names or sectors.*

10   *The bank should be able to demonstrate that the model will signal rising risk in an adverse environment. This could be achieved by incorporating in the historical estimation period of the model at least one full credit cycle and ensuring that the model would not have been inaccurate in the downward portion of the cycle. Another approach for demonstrating this is through simulation of historical or plausible worst-case environments.*

11   *Banks should be able to demonstrate that the model is sensitive to material idiosyncratic differences between similar but not identical positions, for example debt positions with different levels of subordination, maturity mismatches, or credit derivatives with different default events.*

12   *For equity positions, events that are reflected in large changes or jumps in prices must be captured, eg merger break-ups/takeovers. In particular, firms must consider issues related to survivorship bias.*

13   *Aimed at assessing whether specific risk, as well as general market risk, is being captured adequately.*

30.29 The bank's model must conservatively assess the risk arising from less liquid positions and/or positions with limited price transparency under realistic market scenarios. In addition, the model must meet minimum data standards. Proxies may be used only where available data is insufficient or is not reflective of the true volatility of a position or portfolio, and only where they are appropriately conservative.

30.30 Further, as techniques and best practices evolve, banks should avail themselves of these advances.

30.31 Banks which apply modelled estimates of specific risk are required to conduct backtesting aimed at assessing whether specific risk is being accurately captured. The methodology a bank should use for validating its specific risk estimates is to perform separate backtests on sub-portfolios using daily data on subportfolios subject to specific risk. The key sub-portfolios for this purpose are traded-debt and equity positions. However, if a bank itself decomposes its trading portfolio into finer categories (eg emerging markets, traded corporate debt, etc.), it is appropriate to keep these distinctions for sub-portfolio backtesting purposes. Banks are required to commit to a sub-portfolio structure and stick to it unless it can be demonstrated to the supervisor that it would make sense to change the structure.

30.32 Banks are required to have in place a process to analyse exceptions identified through the backtesting of specific risk. This process is intended to serve as the fundamental way in which banks correct their models of specific risk in the event they become inaccurate. There will be a presumption that models that incorporate specific risk are "unacceptable" if the results at the sub-portfolio level produce a number of exceptions commensurate with the Red Zone as defined in MAR99. Banks with "unacceptable" specific risk models are expected to take immediate action to correct the problem in the model and to ensure that there is a sufficient capital buffer to absorb the risk that the backtest showed had not been adequately captured.

Incremental risk capital requirement and comprehensive risk measure

Overview of the incremental risk capital requirement

30.33 In addition, the bank must have an approach in place to capture in its regulatory capital default risk and migration risk in positions subject to a capital requirement for specific interest rate risk, with the exception of securitisation exposures and n-th-to-default credit derivatives, that are incremental to the risks captured by the VaR-based calculation as specified in MAR30.28 ("incremental risks"). No specific approach for capturing the incremental risks is prescribed.

30.34 The bank must demonstrate that the approach used to capture incremental risks meets a soundness standard comparable to that of the internal-ratings based (IRB) approach for credit risk as set forth in CRE30 to CRE36, under the assumption of a constant level of risk, and adjusted where appropriate to reflect the impact of liquidity, concentrations, hedging, and optionality. A bank that does not capture the incremental risks through an internally developed approach must use the specific risk capital requirements under the standardised measurement method as set out in MAR20.

FAQ

FAQ1   Normal copula assumptions: Is it accepted that banks model issuer interdependence assuming multivariate normal distributions or normal copula (eg between asset values, credit spreads or default times) or must they show that such model assumptions do not underestimate risk? It is very hard to find clear empirical support for any particular copula. Among various modelling choices, the normal copula is often chosen for its simplicity (for example within the regulatory IRB framework). However, it is known to provide very thin tails in the loss distribution and may thus provide significantly smaller loss estimates than other choices.

The onus is on the bank to justify the modelling choices and their impact to the national supervisor. Normal distributions or normal copula may not be assumed uncritically. The impact of such modelling choices must be analysed in the validation.

Comprehensive risk measure

30.35 Subject to supervisory approval, a bank may incorporate its correlation trading portfolio in an internally developed approach that adequately captures not only incremental default and migration risks, but all price risks ("comprehensive risk measure"). The value of such products is subject in particular to the following risks which must be adequately captured:

(1) the cumulative risk arising from multiple defaults, including the ordering of defaults, in tranched products;

(2) credit spread risk, including the gamma and cross-gamma effects;

(3) volatility of implied correlations, including the cross effect between spreads and correlations;

(4) basis risk, including both

    (a) the basis between the spread of an index and those of its constituent single names; and

    (b) the basis between the implied correlation of an index and that of bespoke portfolios;

(5) recovery rate volatility, as it relates to the propensity for recovery rates to affect tranche prices; and

(6) to the extent the comprehensive risk measure incorporates benefits from dynamic hedging, the risk of hedge slippage and the potential costs of rebalancing such hedges.

FAQ

FAQ1   *It would be important for banks to be allowed to enhance the incremental risk capital (IRC) requirement model to leave the correlation book inside (ie try to comply with the comprehensive risk measure but within the IRC requirement model). Would it be acceptable to extend the IRC requirement framework to comply with the comprehensive risk measure and perform a single calculation?*

    Banks are allowed to enhance the IRC requirement model to comply with the requirements for the comprehensive risk measure. However, they are not allowed to perform a single calculation covering exposures subject to the IRC requirement and exposures subject to the comprehensive risk measure. Disallowing a single calculation has the effect of not allowing any diversification between the portfolios.

FAQ2   *Do all of the correlation trading risks listed in MAR30.35 need to be included in a single model, or could a bank treat them outside the main modelling framework with supervisory approval? Can the bank use separate models for different products, or separate models for different risk factors?*

While in principle an integrated modelling approach is desirable, supervisors need to be realistic, and there are practical issues that banks will face to deliver an integrated model. Supervisors may permit approaches that capitalise different risks differently (eg via an add-on approach), provided that this can be undertaken conservatively and it does not undermine the strength of risk management. However, the capital requirements calculated with the different models would have to be added using a simple sum and banks should be strongly encouraged to develop an integrated approach over time.

FAQ3   *Referring to MAR30.35 FAQ2, should the comprehensive risk measure take all risk factors into account, and not only those explicitly listed in MAR30.35, hence, also foreign exchange, equity, commodity risk, etc?*

Yes. The implementation of a comprehensive risk measure is required to capture all material risks in a bank's portfolio, including significant basis risks, and should therefore take into account all (material) risk factors. Approaches which capitalise different risk factors differently (eg via add-ons) may be permitted, provided that this can be undertaken conservatively and it does not undermine the strength of risk management, as mentioned in the answer to MAR30.35 FAQ2.

FAQ4   *Would it be possible for an institution to use for purposes of the comprehensive risk measure a model substantially different from the IRC requirement model? For example, a VaR model (99.9%, 1 year).*

In principle, the model could be substantially different from that used for IRC requirement. However, a 99.9% one-year VaR would have serious shortcomings as a measure to capture the set of comprehensive risks required by this charge. These risks would need to be addressed if any bank were thinking of applying a VaR-type approach for the comprehensive risk measure. Just extending the current VaR measure to a 99.9% one-year VaR is not sufficient.

FAQ5   *MAR30.35 requires a bank to capture "the cumulative risk arising from multiple defaults, including the ordering of defaults, in tranched products". Is it really necessary to model the ordering of defaults? The value of a tranche at a predetermined date (eg at the liquidity horizon) should only depend on the number of defaults in this period but not on the order. Do we have any examples where the order of default determines the price (risk) of a tranche?*

If the order of defaults does not have a price impact, the comprehensive risk measure simulation does not need to take the order into account.

FAQ6   *Normal copula assumptions: Is it accepted that banks model issuer interdependence assuming multivariate normal distributions or normal copula (eg between asset values, credit spreads or default times) or must they show that such model assumptions do not underestimate risk? It is very hard to find clear empirical support for any particular copula. Among various modelling choices, the normal copula is often chosen for its simplicity (for example within the regulatory IRB framework). However, it is known to provide very thin tails in the loss distribution and may thus provide significantly smaller loss estimates than other choices.*

The onus is on the bank to justify the modelling choices and their impact to the national supervisor. Normal distributions or normal copula may not be assumed uncritically. The impact of such modelling choices must be analysed in the validation.

FAQ7   *Does [MAR30.44](#) to [MAR30.71](#) on dynamic hedging apply to the comprehensive risk measure and, if so, does it have identical implications for the comprehensive risk measure compared to IRC requirement?*

[MAR30.35](#)(6) states that, to the extent the comprehensive risk measure incorporates benefits from dynamic hedging, comprehensive risk measure modelling should capture the risk of hedge slippage and the potential costs of rebalancing such hedges. Thus, [MAR30.44](#) to [MAR30.71](#) applies to the comprehensive risk measure with the necessary modifications.

FAQ8   *Given ad hoc aspects of the treatment of the correlation trading portfolio, is there a use test requirement associated with the comprehensive risk measure?*

Supervisors would expect that the modelling engine used in the comprehensive risk measure as well as the inputs and outputs of the model to be used in risk management decisions.

FAQ9   *Do the more stringent modelling standards for the comprehensive risk model also apply to the specific VaR modelling of correlation trading products?*

The introduction of the comprehensive risk measure (as well as the IRC requirement) is a necessary development intended to address some of the known flaws embedded in the VaR methodology. Accordingly, VaR and the comprehensive risk measure methodologies are quite different

in nature. In particular, the comprehensive risk measure standards related to time horizon or level of confidence cannot be applied to specific VaR modelling. However, to the extent that both VaR and the comprehensive risk measure are required to capture all material risks in a portfolio, other aspects of the comprehensive risk measure standards, apart from liquidity horizon or level of confidence, related to risk capture might be relevant for specific VaR as well.

30.36 The approach for modelling specific risk of correlation trading portfolio specified in MAR30.35 must meet all of the requirements specified in MAR30.34, and MAR30.37 to MAR30.39. For the exposures that the bank does incorporate in this internally developed approach, the bank will be required to subject them to a capital requirement equal to the higher of the capital requirement according to this internally developed approach and 8% of the capital requirement for specific risk according to the standardised measurement method. It will not be required to subject these exposures to the treatment of the incremental risk capital (IRC) requirement as set out in MAR30.33 and MAR30.34. It must, however, incorporate them in both the value-at-risk and stressed value-at-risk measures.

FAQ

FAQ1   *Consider a risk position that is neither a securitisation position nor an n-th-to-default credit derivative, but which is included in the correlation trading portfolio (CTP) because a bank uses it to hedge a securitisation position or an n-th-to-default derivative of the CTP. The bank uses an internal model that incorporates specific risk and the risk position is included in this model. If the bank incorporates the CTP in a comprehensive risk measure as specified in MAR30.35, may it refrain from incorporating the risk position in the IRC requirement as specified in MAR30.33 and MAR30.34?*

Yes. MAR30.35 states: "For the exposures that the bank does incorporate in this internally developed approach, the bank will be required to subject them to a capital requirement equal to the higher of the capital requirement according to this internally developed approach and 8% of the capital requirement for specific risk according to the standardised measurement method. It will not be required to subject these exposures to the treatment according to MAR30.34." The reference to MAR30.34 should be read as referring to both MAR30.33 and MAR30.34, as these two paragraphs together define the IRC requirement.

FAQ2

Do MAR30.44 to MAR30.71 apply to the comprehensive risk modelling approach? There seems to be only a requirement to meet a standard comparable to IRB under the constant level of risk assumption.

Where relevant, yes.

FAQ3   *If a bank applies the comprehensive risk modelling approach to the correlation portfolio, does it also need to incorporate the specific risks of this model within its VaR and sVaR models?*

Yes. The IRC requirement, comprehensive risk measure and sVaR should be viewed as supplemental capital measures that generally do not affect the current capital framework for VaR and specific risk. However, banks need not capture default and migration risks for positions subject to the incremental risk capital requirement referred to in MAR30.33 and MAR30.34 (see MAR30 footnote 7].

In addition, the IRC requirement covers default and migration risks MAR30.33, whereas the comprehensive risk measure covers all price risks MAR30.35.

30.37 For a bank to apply this exception as set out in MAR30.35, it must

(1)   have sufficient market data to ensure that it fully captures the salient risks of these exposures in its comprehensive risk measure in accordance with the standards set forth above;

(2)   demonstrate (for example, through backtesting) that its risk measures can appropriately explain the historical price variation of these products; and

(3)   ensure that it can separate the positions for which it holds approval to incorporate them in its comprehensive risk measure from those positions for which it does not hold this approval.

30.38 In addition to these data and modelling criteria as set out in MAR30.37, for a bank to apply this exception it must regularly apply a set of specific, predetermined stress scenarios to the portfolio that receives internal model regulatory capital treatment (ie the correlation trading portfolio). MAR99 sets out stress testing guidance for the correlation trading portfolio. These stress scenarios will examine the implications of stresses to:

(1)   default rates;

(2)   recovery rates;

(3)   credit spreads; and

(4)   correlations on the correlation trading desk's profit and loss.

30.39 The bank must apply these stress scenarios at least weekly and report the results, including comparisons with the capital requirements implied by the banks' internal model for estimating comprehensive risks, at least quarterly to its supervisor. Any instances where the stress tests indicate a material shortfall of the comprehensive risk measure must be reported to the supervisor in a timely manner. Based on these stress testing results, the supervisor may impose a supplemental capital requirement against the correlation trading portfolio, to be added to the bank's internally modelled capital requirement.

Calculation of the IRC requirement and the comprehensive risk measure

30.40 A bank must calculate the IRC requirement according to MAR30.33 and the comprehensive risk measure according to MAR30.35 at least weekly, or more frequently as directed by its supervisor.

30.41 The capital requirement for incremental risk is given by a scaling factor of 1.0 times the maximum of

(1)   the average of the IRC requirements over 12 weeks; and

(2)   the most recent IRC requirement.

30.42 Likewise, the capital requirement for comprehensive risk is given by a scaling factor of 1.0 times the maximum of

(1)   the average of the comprehensive risk measures over 12 weeks; and

(2)   the most recent comprehensive risk measure.

30.43 Both capital requirements for incremental risk and comprehensive risk are added up. There will be no adjustment for double counting between the comprehensive risk measure and any other risk measures.

Specific treatment of the IRC requirement

30.44 According to MAR30.33, the IRC requirement encompasses all positions subject to a capital requirement for specific interest rate risk according to the internal models approach to specific market risk but not subject to the treatment outlined in MAR20.14, regardless of their perceived liquidity.

FAQ

FAQ1   *Should sovereign bonds be included in the IRC requirement?*

Yes.

The definition of specific risk in MAR20.4, is quite generic. Consequently, it does not scope out any particular securities. When an acceptable IRC model identifies sovereign bonds as subject to migration and default risk, the capital requirement should be determined accordingly. Even if certain sovereign bonds are subject to a risk weight of 0% under the standardised approach MAR20.5, they cannot be considered as free of default and migration risk. Therefore, sovereign risk should be included in the scope of the incremental risk capital requirement. Sovereign bonds must therefore be included in the relevant model. A general partial use of the standardised approach for sovereign bonds, ie exclusion of positions subject to a risk weight of 0% under the standardised approach from IRC requirement, will not be granted. Accordingly, they will attract a capital requirement under the IRC, except where the output of the model happens not to imply a capital requirement for these positions.

FAQ2   *Should Pfandbriefe (ie debt securities backed by cash flows from mortgage or public sector loans) be excluded from IRC requirement?*

Pfandbriefe and other covered bonds that do not qualify as securitisations should be included in IRC requirement.

FAQ3   *Should banks exclude positions (eg bonds, structured notes) issued by other group members from IRC requirement?*

No, positions issued by other group members should be included in the IRC requirement to ensure that the IRC captures a complete view of default and migration risk in the trading book.

FAQ4   *Should repos and reverse repos be included in the IRC requirement, or the comprehensive risk measure?*

Yes. A security used in a sale and repurchase agreement (repo) transaction should still attract a charge under the IRC requirement or the comprehensive risk measure , if it were to attract a capital requirement under the rules for market risk, including specific risk. This is because the repo transaction does not alter the migration or default risk from the point of the seller of the security. Receiving a security

through a reverse repo transaction will not, by itself, create a position in the security. The migration or default risk stays with the seller of the security.

FAQ5   *Should bonds that have already defaulted be excluded from IRC requirement? What about credit default swaps (CDS) that reference defaulted bonds?*

No, bonds that have defaulted may increase in value, or may be substituted by another bond that increases in value, later on. Also, the lack of a consistent and uniform definition of "default" makes it difficult to exclude positions based on this criterion. As long as the bond is held in the trading account it should be included in the IRC requirement. In terms of a CDS contract referencing a defaulted bond, these should also be included in the IRC requirement until such time that settlement occurs. If a credit event is deemed to occur by the determination committee and settlement occurs then it can be removed from the IRC requirement model.

30.45 With supervisory approval, a bank can choose consistently to include all listed equity and derivatives positions based on listed equity of a desk in its incremental risk model when such inclusion is consistent with how the bank internally measures and manages this risk at the trading desk level. If equity securities are included in the computation of incremental risk, default is deemed to occur if the related debt defaults (as defined in CRE36.69 and CRE36.70).

30.46 However, when computing the IRC requirement, a bank is not permitted to incorporate into its IRC requirement model any securitisation positions, even when securitisation positions are viewed as hedging underlying credit instruments held in the trading account.

30.47 For IRC requirement-covered positions, the IRC requirement captures:

(1) Default risk. This means the potential for direct loss due to an obligor's default as well as the potential for indirect losses that may arise from a default event;

(2) Credit migration risk. This means the potential for direct loss due to an internal/external rating downgrade or upgrade as well as the potential for indirect losses that may arise from a credit migration event.

FAQ1 *When we talk about migration risk captured in the IRC requirement, is it the risk of a downgrade of the internal rating that a bank gives to a debtor in the IRB framework, or is it the risk of the downgrade of an external rating of a debtor in the trading book? If it is external, should the bank choose a rating agency as the standard for the definition of migration?*

The credit migration risk part of the capital requirement can be determined on the basis of migrations of internal or external ratings. The bank's choice may be guided in particular by an assessment of which kind of ratings are closer related to the changes of credit spreads that the bank observes in the market. The bank must apply its methodology in a consistent and well-reasoned way. Subject to this constraint the bank need not give priority to any particular external rating agency.

FAQ2 *Definition of migration risk as opposed to market risk: Migration risk is often modelled by assuming that a rating migration goes together with a change in credit spread from the average spread level of rating 1 to the average spread level of rating 2. Is this sufficient to cover migration risk in IRC requirement or must IRC requirement include the risk of losses due to temporary and/or idiosyncratic deviations of credit spreads from average spread levels? One could argue that these are market risks and are already captured in VaR. The question is particularly material in relation to the basis between long and short positions.*

It is acceptable to define migration risk as the risk of a change in credit spread from an average spread level 1 to an average spread level 2. The reason is that the Basel framework implicitly includes a capital requirement for a change of credit spreads from rating migrations. It does not include a capital requirement for changes of credit spreads that may occur without a rating migration (see [MAR30.34](#) and [MAR30.48](#)).

Moreover, it would be difficult to capture idiosyncratic risk in the one-year IRC requirement horizon.

In the context of this question, the bank should specifically evaluate the representativeness of the average spread levels, mappings from ratings to credit spreads, rating transition matrices, spread homogeneity in the partition class (eg a rating group) etc.

The method for establishing ratings should fully reflect positions in the bank's portfolios.

> *FAQ3* *Taking into account that both migration and default risks have to be captured in IRC requirement, is it necessary to still model default and migration in VaR and sVaR?*
>
> *Not necessarily.*
>
> *MAR30 footnote 7 states that, for specific risk modelling, banks need not capture default and migration risks for positions subject to the iIRC requirement referred to in MAR30.33 and MAR30.34. This is also the case for stressed VaR, since VaR and sVaR methodologies should be aligned.*
>
> *At the same time specific risk for credit spread models are meant to capture idiosyncratic risk in terms of credit spreads. Specific risk models can include spread jumps and may therefore include rating migrations. The same applies to VaR and sVaR though the impact in sVaR may be greater than in VaR.*

30.48 For all IRC requirement-covered positions, a bank's IRC requirement model must measure losses due to default and migration at the 99.9 percent confidence interval over a capital horizon of one year, taking into account the liquidity horizons applicable to individual trading positions or sets of positions. Losses caused by broader market-wide events affecting multiple issues/issuers are encompassed by this definition.

> *FAQ*
>
> *FAQ1* *Are there any specific regulatory requirements on the level of pro-cyclicality of an IRC requirement model (on the continuum between reactive "point-in-time" and stable "through-the-cycle")?*
>
> *There are no particular regulatory standards on what level of cyclicality of the estimates from an IRC requirement model are acceptable.*
>
> *FAQ2* *Which roles should be played by parameters such as IRB loss-given-default (LGD) and other (issuer- or position-specific) estimates of loss rates, credit spreads, market price variations, etc in the IRC requirement model?*

If multiple modelling choices are deemed feasible, banks should at least estimate their impact on the IRC requirement figure. For instance, banks could compare approaches using issuer-specific downturn LGDs (taken from the IRB context) with approaches relevant using historical market price movements of positions which are deemed representative. Furthermore, the bank's evaluation of the prudence of its assumptions could encompass elements such as the lengths of historical time series, the coverage of stressed historical time periods and the functions used for fitting.

30.49 As described immediately below, for each IRC requirement-covered position the 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 capital horizon. The model may incorporate correlation effects among the modelled risk factors, subject to validation standards set forth in MAR30.68. The trading portfolio's IRC requirement equals the IRC requirement model's estimate of losses at the 99.9 percent confidence level.

IRC requirement: Constant level of risk over one-year capital horizon

30.50 An IRC requirement model should be based on the assumption of a constant level of risk over the one-year capital horizon.[14]

Footnotes

[14]   *This assumption is consistent with the capital computations in the CRE standard. In all cases (loans, derivatives and repos), the CRE standard defines exposure at default in a way that reflects a roll-over of existing exposures when they mature. The combination of the constant level of risk assumption and the one-year capital horizon reflects supervisors' assessment of the appropriate capital needed to support the risk in the trading portfolio. It also reflects the importance to the financial markets of banks having the capital capacity to continue providing liquidity to the financial markets in spite of trading losses. Consistent with a "going concern" view of a bank, this assumption is appropriate because a bank must continue to take risks to support its income-producing activities. For regulatory capital adequacy purposes, it is not appropriate to assume that a bank would reduce its VaR to zero at a short-term horizon in reaction to large trading losses. It also is not appropriate to rely on the prospect that a bank could raise additional Tier 1 capital during stressed market conditions.*

30.51 This constant level of risk assumption implies that a bank rebalances, or rolls over, its trading positions over the one-year capital horizon in a manner that maintains the initial risk level, as indicated by a metric such as VaR or the profile of exposure by credit rating and concentration. This means incorporating the effect of replacing positions whose credit characteristics have improved or deteriorated over the liquidity horizon with positions that have risk characteristics equivalent to those that the original position had at the start of the liquidity horizon. The frequency of the assumed rebalancing must be governed by the liquidity horizon for a given position.

30.52 Rebalancing positions does not imply, as the IRB approach for the banking book does, that the same positions will be maintained throughout the capital horizon. Particularly for more liquid and more highly rated positions, this provides a benefit relative to the treatment under the IRB framework. However, a bank may elect to use a one-year constant position assumption, as long as it does so consistently across all portfolios.

IRC requirement: Liquidity horizon

30.53 Stressed credit market events have shown that firms cannot assume that markets remain liquid under those conditions. Banks experienced significant illiquidity in a wide range of credit products held in the trading book, including leveraged loans. Under these circumstances, liquidity in many parts of the securitisation markets dried up, forcing banks to retain exposures in securitisation pipelines for prolonged periods of time. The Committee therefore expects firms to pay particular attention to the appropriate liquidity horizon assumptions within their IRC requirement models.

30.54 The liquidity horizon represents the time required to sell the position or to hedge all material risks covered by the IRC requirement model in a stressed market. The liquidity horizon must be measured under conservative assumptions and should be sufficiently long that the act of selling or hedging, in itself, does not materially affect market prices. The determination of the appropriate liquidity horizon for a position or set of positions may take into account a bank's internal policies relating to, for example, prudent valuation (as per the prudent valuation guidance of CAP50), valuation adjustments[15] and the management of stale positions.

Footnotes

[15]   *For establishing prudent valuation adjustments, see also CAP50.*

30.55 The liquidity horizon for a position or set of positions has a floor of three months.

30.56 In general, within a given product type a non-investment-grade position is expected to have a longer assumed liquidity horizon than an investment-grade position. Conservative assumptions regarding the liquidity horizon for non-investment-grade positions are warranted until further evidence is gained regarding the market's liquidity during systematic and idiosyncratic stress situations. Firms also need to apply conservative liquidity horizon assumptions for products, regardless of rating, where secondary market liquidity is not deep, particularly during periods of financial market volatility and investor risk aversion. The application of prudent liquidity assumptions is particularly important for rapidly growing product classes that have not been tested in a downturn.

30.57 A bank can assess liquidity by position or on an aggregated basis ("buckets"). If an aggregated basis is used (eg investment-grade European corporate exposures not part of a core credit default swap index), the aggregation criteria would be defined in a way that meaningfully reflect differences in liquidity.

30.58 The liquidity horizon is expected to be greater for positions that are concentrated, reflecting the longer period needed to liquidate such positions. This longer liquidity horizon for concentrated positions is necessary to provide adequate capital against two types of concentration: issuer concentration and market concentration.

> *FAQ*
>
> *FAQ1*   *What is the link between the liquidity horizon and issuer concentration? Would it be better to address issuer concentration through the correlation assumptions?*
>
>   *No. Where a bank has concentrated positions in terms of the market this should be reflected in a longer liquidity horizon – consistent with the view that it takes longer to liquidate concentrated positions. Concentrated positions in terms of the bank's portfolio would be reflected in the correlations inherent in the model.*

IRC requirement: Correlations and diversification

30.59 Economic and financial dependence among obligors causes a clustering of default and migration events. Accordingly, the IRC requirement includes the impact of correlations between default and migration events among obligors and a bank's IRC requirement model must include the impact of such clustering of default and migration events.

30.60

> The impact of diversification between default or migration risks in the trading book and other risks in the trading book is not currently well understood. Therefore, the impact of diversification between default or migration events and other market variables would not be reflected in the computation of capital for incremental risk. This is consistent with the Basel framework, which does not allow for the benefit of diversification when combining capital requirements for credit risk and market risk. Accordingly, the capital requirement for incremental default and migration losses is added to the VaR-based capital requirement for market risk.

IRC requirement: Concentration

30.61 A bank's IRC requirement model must appropriately reflect issuer and market concentrations. Thus, other things being equal, a concentrated portfolio should attract a higher capital requirement than a more granular portfolio (see also MAR30.58). Concentrations that can arise within and across product classes under stressed conditions must also be reflected.

IRC requirement: Risk mitigation and diversification effects

30.62 Within the IRC requirement model, exposure amounts may be netted only when long and short positions refer to the same financial instrument. Otherwise, exposure amounts must be captured on a gross (ie non-netted) basis. Thus, hedging or diversification effects associated with long and short positions involving different instruments or different securities of the same obligor ("intra-obligor hedges"), as well as long and short positions in different issuers ("inter-obligor hedges"), may not be recognised through netting of exposure amounts. Rather, such effects may only be recognised by capturing and modelling separately the gross long and short positions in the different instruments or securities.

30.63 Significant basis risks by product, seniority in the capital structure, internal or external rating, maturity, vintage for offsetting positions as well as differences between offsetting instruments, such as different payout triggers and procedures, should be reflected in the IRC requirement model.

30.64 If an instrument has a shorter maturity than the liquidity horizon or a maturity longer than the liquidity horizon is not contractually assured, the IRC requirement must, where material, include the impact of potential risks that could occur during the interval between the maturity of the instrument and the liquidity horizon.

30.65 For trading book risk positions that are typically hedged via dynamic hedging strategies, a rebalancing of the hedge within the liquidity horizon of the hedged position may also be recognised. Such recognition is only admissible if the bank

(1) chooses to model rebalancing of the hedge consistently over the relevant set of trading book risk positions,

(2) demonstrates that the inclusion of rebalancing results in a better risk measurement, and

(3) demonstrates that the markets for the instruments serving as hedge are liquid enough to allow for this kind of rebalancing even during periods of stress.

30.66 Any residual risks resulting from dynamic hedging strategies must be reflected in the capital requirement. A bank should validate its approach to capture such residual risks to the satisfaction of its supervisor.

30.67 The IRC requirement model must reflect the impact of optionality. Accordingly, banks' models should include the nonlinear impact of options and other positions with material nonlinear behaviour with respect to price changes. The bank should also have due regard to the amount of model risk inherent in the valuation and estimation of price risks associated with such products.

IRC requirement: Validation

30.68 Banks should apply the validation principles described in MAR30.27 in designing, testing and maintaining their IRC requirement models. This includes evaluating conceptual soundness, ongoing monitoring that includes process verification and benchmarking, and outcomes analysis. Some factors that should be considered in the validation process include:

(1) Liquidity horizons should reflect actual practice and experience during periods of both systematic and idiosyncratic stresses.

(2) The IRC requirement model for measuring default and migration risks over the liquidity horizon should take into account objective data over the relevant horizon and include comparison of risk estimates for a rebalanced portfolio with that of a portfolio with fixed positions.

(3) Correlation assumptions must be supported by analysis of objective data in a conceptually sound framework. If a bank uses a multi-period model to compute incremental risk, it should evaluate the implied annual correlations to ensure they are reasonable and in line with observed annual correlations. A bank must validate that its modelling approach for correlations is appropriate for its portfolio, including the choice and weights of its

systematic risk factors. A bank must document its modelling approach so that its correlation and other modelling assumptions are transparent to supervisors.

(4) Owing to the high confidence standard and long capital horizon of the IRC requirement, robust direct validation of the IRC requirement model through standard backtesting methods at the 99.9%/one-year soundness standard will not be possible. Accordingly, validation of an IRC requirement model necessarily must rely more heavily on indirect methods including but not limited to stress tests, sensitivity analyses and scenario analyses, to assess its qualitative and quantitative reasonableness, particularly with regard to the model's treatment of concentrations. Given the nature of the IRC requirement soundness standard such tests must not be limited to the range of events experienced historically. The validation of an IRC requirement model represents an ongoing process in which supervisors and firms jointly determine the exact set of validation procedures to be employed.

(5) Firms should strive to develop relevant internal modelling benchmarks to assess the overall accuracy of their IRC requirement models.

FAQ

FAQ1   *Are banks expected to perform their own evaluation of the (joint) distributional assumptions in their IRC requirement model (including the structure of stochastic dependencies and copulas/correlations, as well as the number of stochastic factors)?*

Yes. Despite the relatively limited amount of relevant historical data, the (joint) distributional assumptions in an IRC requirement model should not remain unchallenged, because of their material impact on the IRC requirement figure.

The justification of these distributional assumptions forms an element in the justification of the IRC model's design, since the entirety of interlinked modelling choices establishes whether an IRC requirement model is suitable for estimating losses at the 99.9% confidence level.

FAQ2   *An IRC requirement model could employ input parameters which are related to IRB parameters (such as probabilities of default, or PDs, or LGDs) or come from external sources (such as credit spreads and estimates of default/loss rates). Should banks justify the applicability of such exposure-dependent inputs within their IRC requirement model?*

Yes. Banks should evidence the appropriateness of exposure-related parameters as inputs to their IRC requirement model. Depending on their IRC requirement model's design, this could concern parameters such as credit rating data, IRB PDs/LGDs and other estimates of default /loss rates, credit spreads, mappings (eg from ratings to credit spreads), rating transition matrices, etc.

As mentioned in the answer on [MAR30.68](FAQ1) the justification of the parameters employed forms an element in the justification of the IRC requirement model's design.

Furthermore, [MAR30.63](MAR30.63) explicitly requires that significant basis risks should be reflected in the IRC requirement model.

FAQ3   *Should banks underpin that, if applicable, the number of Monte Carlo simulations within their IRC requirement model is sufficiently high (for instance by providing a convergence graph to demonstrate that the intermediate results become relatively stable), and that – if applicable – the discretisation (of a continuous evolution equation) is sufficiently fine-grained?*

Yes. The onus is on the bank to justify such choices and their impact to the national supervisor. Whichever approach a bank chooses, it must demonstrate in the validation of the model that the choice is prudent. Furthermore, referring to the answer to [MAR30.68](MAR30.68) (FAQ4), banks are encouraged to quantify all model uncertainties, including any simulation and discretisation errors.

FAQ4   *How should banks deal with the IRC requirement figure's sensitivity with respect to the diverse model choices? Which benchmarks could banks use as yardsticks to substantiate that, despite the model uncertainty, the resulting IRC requirement figure is representative for sufficiently stressed circumstances?*

Banks are encouraged to review and provide evidence on the uncertainty around the outcomes of their IRC requirement model, for example by identifying the most significant assumptions, evaluating

the (statistical) techniques employed, assessing alternatives, estimating uncertainty bounds and quantifying the resulting impact on the IRC requirement figure.

FAQ5   *How should the IRC requirement model be backtested?*

Owing to the high confidence standard and long capital horizon of the IRC requirement, robust direct validation of the IRC requirement model through standard backtesting methods at the 99.9%/one-year soundness standard will not be possible. Accordingly, validation of an IRC requirement model necessarily must rely more heavily on indirect methods including but not limited to stress tests, sensitivity analyses and scenario analyses, to assess its qualitative and quantitative reasonableness. Also, supervisors would in general look at the validation process regarding the input parameters to the models.

FAQ6   *What is meant by [MAR30.68](#) which states that the IRC requirement model for measuring default and migration risks over the liquidity horizon should include comparison of risk estimates for a rebalanced portfolio with that of a portfolio with fixed positions?*

This refers to the fact that a bank might be able to make assumptions of portfolio rebalancing in its assessment of IRC requirement. If this is the case, then this requirement relates to the bank comparing those results with the results that would have applied if the positions were held constant over the relevant liquidity horizon.

IRC requirement: Use of internal risk measurement models to compute the IRC requirement

30.69 As noted above, the market risk framework does not prescribe any specific modelling approach for capturing incremental risk. Because a consensus does not yet exist with respect to measuring risk for potentially illiquid trading positions, it is anticipated that banks will develop different IRC requirement modelling approaches.

30.70 The approach that a bank uses to measure the IRC requirement is subject to the "use test". Specifically, the approach must be consistent with the bank's internal risk management methodologies for identifying, measuring, and managing trading risks.

30.71 Ideally, the supervisory principles set forth in [MAR30.44](#) to [MAR30.71](#) would be incorporated within a bank's internal models for measuring trading book risks

and assigning an internal capital requirement to these risks. However, in practice a bank's internal approach for measuring trading book risks may not map directly into the above supervisory principles in terms of capital horizon, constant level of risk, rollover assumptions or other factors. In this case, the bank must demonstrate that the resulting internal capital requirement would deliver a charge at least as high as the charge produced by a model that directly applies the supervisory principles.

MAR50

Credit valuation adjustment framework

This chapter sets out how to calculate capital requirements to cover credit valuation adjustment risk.

Version effective as of 15 Dec 2019

First version in the format of the consolidated framework.

Credit valuation adjustment risk capital requirement

50.1 The risk-weighted assets (RWA) for credit valuation adjustment (CVA) risk are determined by multiplying the capital requirements calculated as set out in this chapter by 12.5.

50.2 In addition to the default risk capital requirements for counterparty credit risk determined based on the standardised or internal ratings-based (IRB) approaches for credit risk, a bank must add a capital requirement to cover the risk of mark-to-market losses on the expected counterparty risk (such losses being known as CVA) to over-the-counter (OTC) derivatives. The CVA capital requirement will be calculated in the manner set forth below depending on the bank's approved method of calculating capital requirements for counterparty credit risk and specific interest rate risk. A bank is not required to include in this capital requirement:

(1) transactions with a qualifying central counterparty; and

(2) securities financing transactions (SFTs), unless their supervisor determines that the bank's CVA loss exposures arising from SFT transactions are material.

FAQ

FAQ1 *Can the Basel Committee clarify whether the 1.06 scaling factor applied to RWA for credit risk CRE30.4 will apply to the CVA RWA category? Our expectation is that the calculation of CVA RWA is a market risk calculation and the 1.06 scaling factor should not be applied.*

The 1.06 scaling factor does not apply. The CVA volatility formula multiplied with the factor 3 (under the quantitative standards described in MAR30.16) produces a capital number directly, rather than an RWA. Multiplying the CVA volatility charge by 12.5 to get an RWA equivalent would then not involve the 1.06 scalar.

FAQ2 *The counterparty credit risk rules in CRE50 to CRE55 include a number of areas that have not previously received regulatory scrutiny. Does the Basel Committee consider that supervisory approvals will be required for Basel III, specifically in the areas of: (1) proxy models in respect of credit default swap (CDS) spread used where no direct CDS available; (2) applicability of index hedges to obtain the base 50% offset of the new CVA capital requirement; (3) if the basis risk requirement for index hedges is sufficient to satisfy the supervisor, will this automatically*

enable a 100% offset or is it intended to be a sliding scale between 50% and 100%; (4) overall system and process infrastructure to deliver the Basel III changes, even if covered by existing approved models and processes; (5) choice of stress periods to ensure industry consistency (in this regard, for value-at-risk, or VaR, calculation purposes, how should the one year period within the three year stress period be identified); and (6) the fundamental review of the Trading Book will include further analysis of the new CVA volatility charge - is there any indication as to implementation date and, in the meantime, should CVA market risk sensitivities be included in the bank's VaR calculation.

The use of an advanced or standardised CVA risk capital requirement method depends on whether banks have existing regulatory approvals for both internal models method and specific risk of debt instruments in their VaR model. Supervisors will review each element of banks' CVA risk capital requirement framework based on each national supervisor's normal supervisory review process.

FAQ3   *How should purchased credit derivative protection against a banking book exposure that is subject to the double-default framework [CRE32.27](#) or the substitution approach [CRE22.32](#) to [CRE22.34](#) be treated in the context of the CVA capital requirement?*

Purchased credit derivative protection against a banking book exposure that is subject to the double default framework ([CRE32.27](#)) or the substitution approach ([CRE22.32](#) to [CRE22.34](#)) and where the banking book exposure itself is not subject to the CVA capital requirement, will also not enter the CVA capital requirement. This purchased credit derivative protection may not be recognised as hedge for any other exposure. (This is consistent with [CRE51.16](#) that says that the exposure at default, or EAD, for counterparty credit risk from such instruments is zero. It is also consistent in the sense that hedging should not increase the capital requirement.)

FAQ4   *How should purchased credit derivative protection against a counterparty credit risk exposure that is subject to the double-default framework ([CRE32.27](#)) or the substitution approach ([CRE22.32](#) to [CRE22.34](#)) be treated in the context of the CVA capital-charge?*

For purchased protection against a counterparty credit risk exposure that is itself subject to the CVA capital requirement, the procedure is analogous to the substitution approach. That is:

a)   in the advanced CVA charge, the exposure time-profile (EE_i) of the original counterparty credit risk gets reduced by the protected

amount and the exposure profile to the protection seller gets increased by the amount for which it has sold protection. This substitution is done for time buckets whose valuation time (t_i) is smaller than the maturity of the purchased protection but not for the buckets with larger valuation times.

b)   In the standardised CVA capital requirement, the protected amount times the residual maturity of the protection gets deducted from the M x EAD of the original counterparty credit risk and added to the M x EAD of the protection seller.

Alternatively, if the purchased protection is an eligible hedge within the CVA capital requirement (MAR50.13 and MAR50.14), then the credit protection may be recognised as a CDS hedge as specified in the rules for the CVA capital requirement. In the latter case, the CVA capital requirement must also reflect the CVA-risk of the credit protection. That is, despite CRE51.16 which still applies in the context of the default-risk charge, the counterparty credit risk exposure towards the protection seller may not be set to zero in the context of the CVA capital requirement.

FAQ5   *Is a bank required to calculate the CVA capital requirement daily?*

Banks should discuss the frequency with which the CVA capital requirement needs to be computed with their national supervisor. To receive regulatory approval to use the advanced CVA approach, banks are generally expected to have the systems' capability to calculate the CVA capital requirement on a daily basis, but would not be expected or required to calculate it on a daily basis. Instead, banks are required to calculate the CVA capital requirement at least on a monthly basis in which expected exposure is also required to be calculated. In this case, banks are to calculate VaR and stressed VaR by taking the average over a quarter.

FAQ6   *We seek clarification of whether the reduction in EAD by incurred CVA extends to the calculation of expected loss amounts for banks applying IRB risk weights. We would expect the reduction in EAD to be extended to expected loss (EL) but this would necessitate amendments to other requirements (eg CRE35.2). Could the Committee confirm that amendments to the calculation of CVA risk and default risk capital will be clarified to refer to expected loss capital deduction as well as RWA?*

The Committee confirms that, after the quantitative impact study undertaken after the release of the Basel III Accord, incurred CVA will be recognised as a reduction in EAD when calculating the default risk

capital. Incurred CVA is not permitted to be counted as eligible provisions under CAP30.13, ie banks that are currently recognising CVA as general provisions to offset expected loss in the IRB framework should no longer count CVA as provisions. Nevertheless, EL can be calculated based on the reduced "outstanding EAD" which reflects incurred CVA (see CRE51.12). That is, for derivatives, the EL is calculated as PD*LGD*(outstanding EAD).

FAQ7   *Could the treatment of defaulted exposures in terms of CVA capital requirement and incurred CVA be clarified?*

Banks are not required to calculate the CVA capital requirement for defaulted counterparties, where the loss due to default has been recognised for accounting and reporting purposes and provided that, as a result of the default, the derivative contracts have been transformed into a simple claim and no longer have the characteristics of a derivative.

FAQ8   *Is an intercompany transaction with a zero risk weight subject to a CVA capital requirement? Industry members would like confirmation on a technical note that, as with the downgrade-and-default charge within the Basel II framework, the CVA-variability charge associated with affiliate exposures will net out under group consolidated reporting.*

As per the group consolidated reporting, no regulatory capital requirement (including a CVA capital requirement) applies to intercompany transactions. This should include the relevant CVA hedge that is only with an internal desk; internal hedges are not recognised for regulatory capital purposes because they are eliminated in consolidation.

Advanced CVA risk capital requirement

50.3   Banks with internal models method (IMM) approval for counterparty credit risk and approval to use the market risk internal models approach for the specific interest-rate risk of bonds must calculate this additional capital requirement by modelling the impact of changes in the counterparties' credit spreads on the CVAs of all OTC derivative counterparties, together with eligible CVA hedges according to MAR50.12 to MAR50.14, using the bank's VaR model for bonds. This value-at-risk (VaR) model is restricted to changes in the counterparties' credit spreads and does not model the sensitivity of CVA to changes in other market factors, such as changes in the value of the reference asset, commodity, currency or interest rate of a derivative. Regardless of the accounting valuation method a bank uses for determining CVA, the CVA capital requirement calculation must be based on the following formula for the CVA of each counterparty, where:

(1) t_i is the time of the i-th revaluation time bucket, starting from $t_0=0$.

(2) t_T is the longest contractual maturity across the netting sets with the counterparty.

(3) s_i is the credit spread of the counterparty at tenor t_i, used to calculate the CVA of the counterparty. Whenever the credit default swap (CDS) spread of the counterparty is available, this must be used. Whenever such a CDS spread is not available, the bank must use a proxy spread that is appropriate based on the rating, industry and region of the counterparty.

(4) LGD_{MKT} is the loss-given-default of the counterparty and should be based on the spread of a market instrument of the counterparty (or where a counterparty instrument is not available, based on the proxy spread that is appropriate based on the rating, industry and region of the counterparty). It should be noted that this LGD_{MKT}, which inputs into the calculation of the CVA risk capital requirement, is different from the loss-given-default (LGD) that is determined for the IRB and counterparty credit risk (CCR) default risk charge, as this LGD_{MKT} is a market assessment rather than an internal estimate.

(5)   The first factor within the sum represents an approximation of the market implied marginal probability of a default occurring between times t_{i-1} and t_i.

Market implied default probability (also known as risk-neutral probability) represents the market price of buying protection against a default and is in general different from the real-world likelihood of a default.

(6) EE_i is the expected exposure to the counterparty at revaluation time t_i, as defined in CRE53.12 (regulatory expected exposure), where exposures of different netting sets for such counterparty are added, and where the longest maturity of each netting set is given by the longest contractual maturity inside the netting set.

(7) D_i is the default risk-free discount factor at time t_i, where $D_0 = 1$.

$$CVA = \left(LGD_{MKT}\right) \cdot \sum_{i=1}^{T} Max\left(0; exp\left(-\frac{s_{i-1} \cdot t_{i-1}}{LGD_{MKT}}\right) - exp\left(-\frac{s_i \cdot t_i}{LGD_{MKT}}\right)\right) \cdot \left(\frac{EE_{i-1} \cdot D_{i-1} + EE_i \cdot D_i}{2}\right)$$

FAQ

FAQ1   *MAR50.3 permits the use of proxy CDS spreads. As the majority of banks have portfolios that extend well beyond the scope of bond issuers, proxying a CDS spread will be the norm rather than the exception. We consider this approach to be acceptable given an appropriate model. Is this correct?*

Yes, that is correct. To the extent that single-name CDS spread data is not available, banks should use a proxy spread, the methodology for determining the proxy being part of the approved internal model for specific interest rate risk.

FAQ2   *We seek clarification of the calculation of LGD for the purposes of MAR50.3 where market instruments or proxy market information is not available). For example, for sovereign entities the identification of a market spread or a proxy spread is often not possible other than in distressed scenarios. Also, we seek clarity on how to take into account potential security packages or other credit enhancement provisions that could be available in the Credit Support Annex or the trade confirmation.*

While the Committee recognises that there is often limited market information of LGD_{MKT} (or equivalently the market implied recovery rate), the use of LGD_{MKT} for CVA purposes is deemed most appropriate given the market convention of CVA. As it is also the market convention to use a fixed recovery rate for CDS pricing purposes, banks may use that information for purposes of the CVA risk capital requirement in the absence of other information. In cases where a netting set of derivatives has a different seniority than those derivative instruments that trade in the market from which LGD_{MKT} is inferred, a

bank may adjust LGD_{MKT} to reflect this difference in seniority. Note that bank specific risk mitigants are not used for this calculation.

FAQ3   MAR50.3 states: "Whenever such a CDS spread is not available, the bank must use a proxy spread that is appropriate based on the rating, industry and region of the counterparty." For counterparties (eg small or medium-sized entities) where no market data is available, neither CDS spreads nor traded debt, VaR modelling based on proxy index spreads is hard to validate. Is it left to the national supervisor to decide whether these may be modelled in advanced CVA or should standardised CVA be compulsory? The recognition of index hedges is very different in advanced CVA and standardised CVA, so this could lead to material differences in implementation.

Yes, it is left to national supervisors to decide.

FAQ4   The regulatory CVA formula contains the terms EE_i and D_i which assume in the case of interest rate related exposures (eg interest rate swaps) that the discount factor and IR exposures are independent. Is the bank allowed to replace the terms EE_i x D_i by E [discount factor x max (0, V(t))]?

No, the regulatory formula is not to be changed.

50.4   The formula in MAR50.3 must be the basis for all inputs into the bank's approved VaR model for bonds when calculating the CVA risk capital requirement for a counterparty. For example, if this approved VaR model is based on full repricing, then the formula must be used directly. If the bank's approved VaR model is based on credit spread sensitivities for specific tenors, the bank must base each credit spread sensitivity on the following formula:

$$Regulatory\ CS01_i = 0.0001 \cdot t_i \cdot exp\left(-\frac{s_i \cdot t_i}{LGD_{MKT}}\right) \cdot \left(\frac{EE_{i-1} \cdot D_{i-1} - EE_{i+1} \cdot D_{i+1}}{2}\right)$$

50.5   This derivation of the formula in MAR50.3 assumes positive marginal default probabilities before and after time bucket t_i and is valid for i<T. For the final time bucket i=T, the corresponding formula is as follows:

$$Regulatory\ CS01_T = 0.0001 \cdot t_T \cdot exp\left(-\frac{s_T \cdot t_T}{LGD_{MKT}}\right) \cdot \left(\frac{EE_{T-1} \cdot D_{T-1} + EE_T \cdot D_T}{2}\right)$$

50.6

If the bank's approved VaR model uses credit spread sensitivities to parallel shifts in credit spreads (Regulatory CS01), then the bank must use the following formula (the derivation of which assumes positive marginal default probabilities):

$$Regulatory\ CS01 = 0.0001 \cdot \sum_{i=1}^{T} \left(t_i \cdot exp\left(-\frac{s_i \cdot t_i}{LGD_{MKT}}\right) - t_{i-1} \cdot exp\left(-\frac{s_{i-1} \cdot t_{i-1}}{LGD_{MKT}}\right) \right) \cdot \left(\frac{EE_{i-1} \cdot D_{i-1} + EE_i \cdot D_i}{2} \right)$$

50.7 If the bank's approved VaR model uses second-order sensitivities to shifts in credit spreads (spread gamma), the gammas must be calculated based on the formula in MAR50.3.

50.8 Banks with IMM approval for the majority of their businesses, but which use the standardised approach for counterparty credit risk (SA-CCR) for certain smaller portfolios, and which have approval to use the market risk internal models approach for the specific interest rate risk of bonds, will include these non-IMM netting sets into the CVA risk capital requirement, according to MAR50.3, unless the national supervisor decides that MAR50.15 should apply for these portfolios. Non-IMM netting sets are included into the advanced CVA risk capital requirement by assuming a constant expected exposure (EE) profile, where EE is set equal to the exposure-at-default (EAD) as computed under the SA-CCR for a maturity equal to the maximum of: (i) half of the longest maturity occurring in the netting set; and (ii) the notional weighted average maturity of all transactions inside the netting set. The same approach applies where the IMM model does not produce an EE profile.

50.9 For exposures to certain counterparties, the bank's approved market risk VaR model may not reflect the risk of credit spread changes appropriately, because the bank's market risk VaR model does not appropriately reflect the specific risk of debt instruments issued by the counterparty. For such exposures, the bank is not allowed to use the advanced CVA risk charge. Instead, for these exposures the bank must determine the CVA risk charge by application of the standardised method in MAR50.15 and MAR50.16. Only exposures to counterparties for which the bank has supervisory approval for modelling the specific risk of debt instruments are to be included into the advanced CVA risk charge.

50.10 The CVA risk capital requirement consists of both general and specific credit spread risks, including stressed VaR but excluding the incremental risk capital requirement. The VaR figure should be determined in accordance with the quantitative standards described in MAR30.12 to MAR30.15. It is thus determined as the sum of the non-stressed VaR component and the stressed VaR component. For the calculation of each component:

(1) When calculating the non-stressed VaR, current parameter calibrations for expected exposure must be used.

(2) When calculating the stressed VaR future counterparty EE profiles (according to the stressed exposure parameter calibrations as defined in CRE53.51) must be used. The period of stress for the credit spread parameters should be the most severe one-year stress period contained within the three-year stress period used for the exposure parameters.[1]

Footnotes

[1]   *Note that the three-times multiplier inherent in the calculation of a bond VaR and a stressed VaR will apply to these calculations.*

 FAQ

FAQ1   *MAR50.10 requires a period of stress for credit spread parameters to be used in determining future counterparty EE profiles under the stressed VaR capital component of the advanced CVA risk capital requirement. We seek confirmation that the credit spread of the counterparty input into the CVA and regulatory CS01 formulae (ie s_i) is not impacted by this. That is, the s_i inputs remain the same for both the VaR and stressed VaR capital calculations of the CVA risk capital requirement.*

It depends on the specific risk VaR model. If the VaR model uses a sensitivity (or Greek) based approach, the credit spread values in the 1st and 2nd-order sensitivities (as in MAR50.7) are the current levels ("as of valuation date") for both unstressed VaR and stressed VaR. In contrast, if the VaR model uses a full-revaluation approach using the CVA formula as in MAR50.3, the credit spread inputs should be based on the relevant stress scenarios.

FAQ2   *Does a specific backtesting on the CVA VaR need to be conducted or is the backtesting of the market VaR considered as relevant also for the CVA VaR? In particular, MAR50 (footnote 1) says that "the three-times multiplier inherent in the calculation of a bond VaR and a stressed VaR will apply to these calculations." Does it mean that the multipliers applied to the CVA VaR have to be the same as the multipliers applied to the market risk VaR (ie at least 3 + backtesting of market risk VaR) or does a specific multiplier for the CVA capital requirement need to be calculated depending on the results of the backtesting of the CVA VaR?*

Banks are not required to conduct a separate VaR backtesting for purposes of the CVA capital requirement. MAR50 (Footnote 1) was

intended to require banks to apply at least a three-times multiplier and a potentially higher multiplier for CVA purposes where appropriate.

FAQ3   *From MAR50.10, our understanding is that the periods involved in the calculation of stressed Effective expected positive exposure (EPE) and the CVA capital requirement, according to MAR50.10(2), are as follows:*

- *A period of stress to the credit default spreads of a bank's counterparties. The length of this period is not defined (in CRE53. 51);*
- *A three-year period containing period (1). This three-year period is used for calibration when calculating stressed Effective EPE;*
- *The one-year period of most severe stress to credit spreads within period (2). This one-year period is used when calculating stressed VaR, as described in MAR50.10(2). In general, period (3) will be different from the one-year period used to calculate stressed VaR, as described in MAR30.14 to MAR30.17. The difference is due to period (3) being a period of stress to credit spreads, whereas the market risk one-year period is a period of stress to the bank's portfolio and therefore to all types of market risk factor that affect the portfolio.*

Please confirm our understanding of the above.

Yes, this is correct. The one-year period of stress used for the stressed CVA VaR calculation is the most severe year within the three-year period used for the stressed Effective EPE calculation. This one-year period may, and will probably, be different to the one-year period used for market risk calculations.

50.11 This additional CVA risk capital requirement is the standalone market risk charge, calculated on the set of CVAs (as specified in MAR50.3) for all OTC derivatives counterparties, collateralised and uncollateralised, together with eligible CVA hedges. Within this standalone CVA risk capital requirement, no offset against other instruments on the bank's balance sheet will be permitted (except as otherwise expressly provided herein).

FAQ1 *A strict interpretation of [MAR50.12](#) and [MAR50.13](#) suggests that market LGDs (based on bond recovery rates) should be used instead of LGDs that reflect internal experience, potential security packages or other credit enhancement that could be available in the Credit Support Annex or the trade confirmation. Is this strict interpretation intended by the Committee?*

Yes, market LGDs (LGD_{MKT}) based on market recovery rates are used as inputs into the CVA risk capital requirement calculation. LGD_{MKT} is a market assessment of LGD that is used for pricing the CVA, which might be different from the LGD that is internally determined for the IRB and CCR default risk charge. In other words, LGD_{MKT} needs to be consistent with the derivation of the hazard rates – and therefore must reflect market expectations of recovery rather than mitigants or experience specific to the bank.

50.12 Only hedges used for the purpose of mitigating CVA risk, and managed as such, are eligible to be included in the VaR model used to calculate the above CVA capital requirement or in the standardised CVA risk capital requirement set forth in [MAR50.15](#) and [MAR50.16](#). For example, if a CDS referencing an issuer is in the bank's inventory and that issuer also happens to be an OTC counterparty but the CDS is not managed as a hedge of CVA, then such a CDS is not eligible to offset the CVA within the standalone VaR calculation of the CVA risk capital requirement.

FAQ

FAQ1 *We seek clarity on the treatment of internal trades and CVA VaR. There is a concern that if a CVA desk buys protection from another desk (within the bank) which faces "the street" it would not get CVA credit although the CVA VAR would be flat ([MAR50.12](#)).*

Only hedges that are with external counterparties are eligible to reduce CVA. A hedge that is only with an internal desk cannot be used to reduce CVA.

50.13 The only eligible hedges that can be included in the calculation of the CVA risk capital requirement under MAR50.3 or MAR50.15 and MAR50.16 are single-name CDSs, single-name contingent CDSs, other equivalent hedging instruments referencing the counterparty directly, and index CDSs. In case of index CDSs, the following restrictions apply:

(1) The basis between any individual counterparty spread and the spreads of index CDS hedges must be reflected in the VaR. This requirement also applies to cases where a proxy is used for the spread of a counterparty, since idiosyncratic basis still needs to be reflected in such situations. For all counterparties with no available spread, the bank must use reasonable basis time series out of a representative bucket of similar names for which a spread is available.

(2) If the basis is not reflected to the satisfaction of the supervisor, then the bank must reflect only 50% of the notional amount of index hedges in the VaR.

FAQ

FAQ1 *With regard to MAR50.3: we seek confirmation as to whether the risk mitigation available for EE profiles remains unchanged. Specifically, please confirm our understanding that the post risk mitigated exposure values are used in the CVA capital requirement, whilst the additional mitigation is also allowed for the CVA capital requirement itself, via eligible CVA hedges, which is undertaken post any EE mitigation available.*

The EEs or the EADs used as inputs in the advanced and standardised CVA risk capital requirement must not have been subject to any adjustments arising from credit protection that a firm intends to include as an eligible hedge in the CVA risk capital requirement (see MAR50.12 to MAR50.14). However, the use of other types of credit risk mitigation (eg collateral and/or netting) reducing the EE or the EAD amounts in the CCR framework can be maintained when these EE or EAD feed the CVA risk capital requirement.

FAQ2 *Industry seeks clarification as to whether (i) CDS swaptions are eligible CVA hedge instruments; and if so, (ii) whether both single name and index CDS swaptions are eligible.*

A CDS swaption can be considered as an equivalent hedging instrument, and therefore CDS swaptions are eligible hedge instruments, in both single-name and index CDS cases, insofar as the contract does not contain a knock-out clause, ie the option contract is

not terminated following a credit event. As per banks applying the advanced CVA risk capital requirement (see [MAR50.3](#) to [MAR50.14](#)), their VaR model should properly capture the non-linear risk of swaptions. As regards banks that use the standardised CVA approach, they may apply the delta-adjusted notional to reflect the moneyness of the option into the standardised CVA formula.

FAQ3   *Industry seeks further clarifications as to how the following two cases of different risk characteristics associated with CVA hedge providers should be treated for CVA capital requirement purposes. Is a single name CDS (or a basket of CDS that is not tranched) an eligible CVA hedge if the entity that provides protection is any kind of special purpose entity (SPE), private equity fund, pension fund, or any other non-bank financial entity? Does the answer change if the bank is providing a liquidity facility or another kind of credit enhancement to the protection provider, whereby the bank is effectively exposed to a certain tranche of the underlying default risk? (That is, a bank buys CDS protection, while an additional transaction or facility is transferring a tranche of the default risk back to the bank.) The liquidity facility or credit enhancement would be on accrual accounting so that no CVA risk is transferred back to the bank via that facility.*

There are no specific restrictions on the protection provider for the purposes of the CVA hedges. Eligible CVA hedges can be bought from SPEs, private equity funds, pension funds, or other non-bank financial entities as long as the general eligibility criteria set by the Basel framework (see in particular [CRE22.90](#)) are met. If the bank remains effectively exposed to a tranche of the underlying default risk by providing any form of credit enhancement to the protection provider, then the CDS is not an eligible CVA hedge because, in economic substance, the transaction becomes a tranched CDS protection, regardless of whether the credit enhancement is on accrual accounting. All kinds of engagement between the bank and the protection provider need to be taken into account in order to determine whether the protection is effectively tranched.

FAQ4   *What are the eligible hedges for the CVA volatility charge when a transaction has securitisations as underlying and the firm is not allowed to use a VaR model to calculate market risk capital for securitisations?*

While it is true that banks are not allowed to use a specific risk VaR model for securitised products, this is not applicable for CVA capital requirement purposes. Different product types of derivatives (including securitised products) form expected exposures underpinning CVA to a

certain counterparty, whereas the eligible hedge instruments apply to those credit hedges referencing a bank's counterparties (via either single-name or index). The supervisory approval of the market risk VaR model for advanced CVA risk capital requirement purposes should apply to specific interest risk VaR, ie a VaR model for debt instruments. This VaR can be used to reflect the risk of credit spread changes for single-name CDS products, including those referencing debt instruments issued by the counterparty. Hence, banks should not encounter any issues of calculating the advanced CVA even if the regulatory approval for specific risk VaR model for securitised products is not available.

FAQ5   *When hedging CVA, given the underlying derivatives portfolio (netting sets) is changing over time, excess CDS hedges bought cannot always be unwound and are sometimes "cancelled" by selling protection (ie the CVA desk is selling protection). The eligible CVA over-hedge is the hedge to this protection sold. How is this to be recognised under Basel III?*

Since the dedication of CDS-bought protection for the purpose of CVA hedging needs to be done explicitly, the same process, documentation and controls can be and are expected to be applied for bought protection as well by partial unwinding the excess CDS hedges by making use of the same instrument via the opposite position; this being based on approval of the national supervisor.

If the national supervisor does not agree to recognise the inclusion of sold protection in the framework (standalone portfolio) of CVA calculation and CVA hedging, respective trades are treated as any other derivative or any CDS that is not part of CVA hedging.

FAQ6   *From [MAR50.13](), we would like clarification in terms of eligibility of hedges. Is a CDS indirectly referencing a counterparty (eg a related entity) an eligible hedge? Can you confirm inclusion of sovereigns in the CVA capital requirement and ability to use sovereign CDS as hedges?*

Any instrument of which the associated payment depends on cross default (such as a related entity hedged with a reference entity CDS and CDS triggers) is not considered as an eligible hedge. When restructuring is not included as a credit event in the CDS contract, for the purposes of calculating the advanced CVA capital requirement, the CDS will be recognised as in the market risk framework for VaR. For the purposes of the Standardised CVA capital requirement, the recognition of the CDS hedge will be done according to the

standardised measurement method in the market risk framework. The Committee confirms that sovereigns are included in the CVA capital requirement, and sovereign CDS is recognised as an eligible hedge.

FAQ7   *Industry seeks further clarification as to whether a single-name CDS for which the bank uses proxies can also be considered as eligible hedges. The answer to [MAR50.13](FAQ6) states: "Any instrument of which the associated payment depends on cross default (such as a related entity hedged with a reference entity CDS and CDS triggers) is not considered as an eligible hedge." A question has arisen whether this means that a single-name CDS cannot be recognised against an exposure to a related counterparty (for example a sovereign CDS against a province in the same country) even if the VaR model captures the basis risk between the exposure and the hedge, or was this clause aimed at instruments other than single-name CDS, that pay out only if there is more than one default event.*

Single -ame proxy hedges cannot be recognised in the advanced CVA capital requirement, irrespective of whether the basis risk between the exposure and the hedge is appropriately captured in the model. In fact, [MAR50.13](https://) admits as eligible hedges only instruments (such as CDSs and contingent CDSs) referencing the counterparty directly or index CDSs. As an example, consider an exposure to counterparty B with no CDS traded on its name (eg a province within a country) whose spread is approximated by that of counterparty A (eg the central government of that country). The only eligible hedge of the exposure to counterparty B would be an index C containing counterparty A, provided the bank can incorporate the basis between C and A into its VaR model to the satisfaction of its supervisor.

Index C

A ← - - - - - - **Hedge allowed** - - - - - - A
(provided basis C/A captured)

Proxy allowed

X

Hedge NOT allowed

Hedge allowed
(provided basis C/A* captured)

B
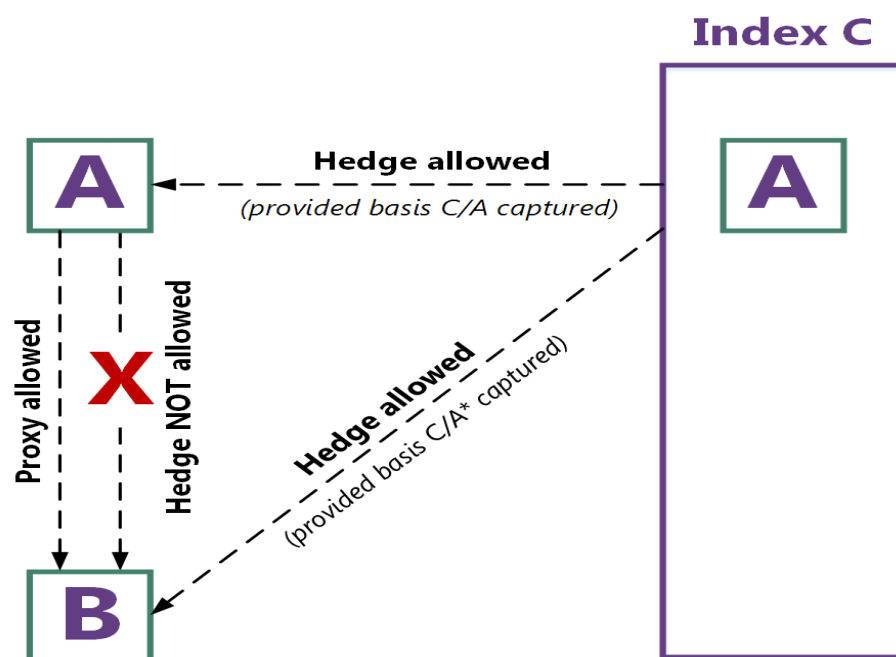
* Or another reasonable basis time series out of a representative bucket of similar names for which a spread is available

Further, to the extent that single-name proxy hedges are not to be recognised in the advanced CVA capital requirement on one hand, but a proxy spread is required to be used whenever the relevant CDS spread is not available on the other hand, banks should be further noted that they are prohibited from, or should derecognise, over hedging on a single-name level.

To illustrate this, in the above example, whenever the bank over hedges its exposure to A, these hedges on A will effectively act as a proxy hedge for the exposure to B; this is true irrespective of whether B is mapped to the CDS spread of A or not. Therefore, the firm should set a cap on the recognition of all single-name hedges.

50.14 Other types of counterparty risk hedges (ie those not listed in MAR50.13) must not be reflected within the calculation of the CVA capital requirement, and these other hedges must be treated as any other instrument in the bank's inventory for regulatory capital purposes. Tranched or nth-to-default CDSs are not eligible CVA hedges. Eligible hedges that are included in the CVA capital requirement must be removed from the bank's market risk capital requirement calculation.

FAQ1   *With respect to identifying eligible hedges to the CVA risk capital requirement, the Basel III provisions state that "tranched or nth-to-default CDSs are not eligible CVA hedges" ([MAR50.14](#)). Can the Basel Committee confirm that this does not refer to tranched CDS referencing a bank's actual counterparty exposures and refers only to tranched index CDS hedges? Also, can the Committee clarify that Risk Protection Agreements, credit-linked notes, short bond positions as CVA hedges, and First Loss on single or baskets of entities can be included as eligible hedges?*

All tranched or nth-to-default CDS are not eligible. In particular, credit-linked notes and first loss are also not eligible. Single name short bond positions may be eligible hedges if the basis risk is captured. When further clarifications are needed, banks should consult with supervisors.

Standardised CVA risk capital requirement

50.15   When a bank does not have the required approvals to use [MAR50.3](#) to calculate a CVA capital requirement for its counterparties, the bank must calculate a portfolio capital requirement using the following formula, where:

(1)   h is the one-year risk horizon (in units of a year), h = 1.

(2) w_i is the weight applicable to counterparty i. Counterparty i must be mapped to one of the seven weights w_i based on its external rating, as shown in the table below. When a counterparty does not have an external rating, the bank must, subject to supervisory approval, map the internal rating of the counterparty to one of the external ratings.

(3) EAD_i^{total} is the EAD of counterparty i (summed across its netting sets), including the effect of collateral as per the existing IMM or SA-CCR rules as applicable to the calculation of counterparty risk capital requirements for such counterparty by the bank. For non-IMM banks the exposure should be discounted by applying the factor $\dfrac{\left(1 - e^{-0.05 \times M_i}\right)}{\left(0.05 \times M_i\right)}$. For IMM banks, no such discount should be applied as the discount factor is already included in M_i.

(4) B_i is the notional of purchased single-name CDS hedges (summed if more than one position) referencing counterparty i, and used to hedge CVA risk.

This notional amount should be discounted by applying the factor

$$\frac{\left(1 - e^{-0.05 \times M_i^{hedge}}\right)}{\left(0.05 \times M_i^{hedge}\right)} \ .$$

(5) B_{ind} is the full notional of one or more index CDS of purchased protection, used to hedge CVA risk. This notional amount should be discounted by applying the factor $\dfrac{\left(1 - e^{-0.05 \times M_{ind}}\right)}{\left(0.05 \times M_{ind}\right)}$

(6) w_{ind} is the weight applicable to index hedges. The bank must map indices to one of the seven weights w_i based on the average spread of index 'ind'.

(7) M_i is the effective maturity of the transactions with counterparty 'i'. For IMM-banks, M_i is to be calculated as per [CRE53.20](). For non-IMM banks, M_i is the notional weighted average maturity as referred to in [CRE32.44](). However, for this purpose, M_i should not be capped at 5 years.

(8) M_i^{hedge} is the maturity of the hedge instrument with notional B_i (the quantities $M_i^{hedge} \times B_i$ are to be summed if these are several positions).

(9) M^{ind} is the maturity of the index hedge "ind". In case of more than one index hedge position, it is the notional weighted average maturity.

(10) For any counterparty that is also a constituent of an index on which a CDS is used for hedging CCR, the notional amount attributable to that single name (as per its reference entity weight) may, with supervisory approval, be subtracted from the index CDS notional amount and treated as a single name hedge (B_i) of the individual counterparty with maturity based on the maturity of the index.

$$K = 2.33 \cdot \sqrt{h} \cdot \sqrt{\left(\sum_i 0.5 \cdot w_i \cdot \left(M_i \cdot EAD_i^{total} - M_i^{hedge} B_i\right) - \sum w_{ind} \cdot M_{ind} \cdot B_{ind}\right)^2 + \sum_i 0.75 \cdot w_i^2 \cdot \left(M_i \cdot EAD_i^{total} - M_i^{hedge} B_i\right)^2}$$

FAQ1 [MAR50.15](#) *states that, in the case of index CDSs, the following restrictions apply: "M_i is the effective maturity of the transactions with counterparty i. For IMM banks, M_i is to be calculated as per [CRE53.20](#). For non-IMM banks, M_i is the notional weighted average maturity as referred to in [CRE32.44](#)". [CRE32.41](#) includes in it a cap which means that M will not be greater than 5 years. Can the Basel Committee provide clarity on whether this cap still applies for the purpose of calculating M_i above?*

For CVA purposes, the 5-year cap of the effective maturity will not be applied. This applies to all transactions with the counterparty, not only to index CDSs. Maturity will be capped at the longest contractual remaining maturity in the netting set.

FAQ2 [MAR50.15](#)*(7) talks about effective maturity at a counterparty level. In rolling up effective maturity from netting sets to counterparty, do we apply the one-year floor first and then do a weighted average by notional, or do we calculate the weighted average by notional at counterparty level and then apply the floor?*

The 1-year floor applies at a netting set level. If there is more than one netting set to the same counterparty, an effective maturity (M) should be determined separately for each netting set, the EAD of each netting set should be discounted according to its individual maturity and the quantities M x EAD should be summed.

FAQ3 *If a bank has more than one CDS contract on the same counterparty, the instructions for the standardised CVA capital requirement demand a different discounting than in the case of several index CDS. For single-name CDS, each contract gets discounted using its individual maturity and the quantities M x B are to be summed. In contrast, for index-CDS, the full notional (summed over all index contracts) must be discounted using the average maturity. Is there a reason for this difference in the treatment of single-name vs index hedges?*

For index CDS, the same treatment should be applied as described for single-name CDS. That is, each index contract gets discounted using its individual maturity and the quantities M x B are to be added.

FAQ4 *In the standardised CVA capital requirement formula, there are "weights" for individual counterparties (w_i) and for credit indexes (w_{ind}*

). "Weights" w_i are uniquely determined by the counterparty's rating from the table in MAR50.15. How should one determine "weights" w_{ind}?

Banks should first look through index constituents' ratings so as to determine the corresponding weight for each constituent, which then should be weight-averaged for determining the weight for the index.

50.16 The weights referenced in MAR50.15 above are set out in the following table, and are based on the external rating of the counterparty:[2]

Rating	Weight w_i
AAA	0.7%
AA	0.7%
A	0.8%
BBB	1.0%
BB	2.0%
B	3.0%
CCC	10.0%

Footnotes

[2]   *The notations follow the methodology used by one institution, Standard & Poor's. The use of Standard & Poor's credit ratings is an example only; those of some other approved external credit assessment institutions could be used on an equivalent basis. The ratings used throughout this document, therefore, do not express any preferences or determinations on external assessment institutions by the Committee.*

MAR99

Application guidance

This chapter describes the stress testing required by banks using the comprehensive risk modelling approach to calculate specific risk capital charges for the correlation trading portfolio and a supervisory framework for backtesting under the internal models approach.

Version effective as of 15 Dec 2019

First version in the format of the consolidated framework.

Stress testing guidance for the correlation trading portfolio

99.1 The goal of the stress testing standards described in [MAR99.2](#) to [MAR99.18](#) is to provide estimates of the mark-to-market (MTM) changes that would be experienced by the current correlation trading portfolio (CTP) in the event of credit-related shocks. The standards encompass both prescribed regulatory stress scenarios and high-level principles governing a bank's internal stress testing. The prescribed scenarios are not intended to capture all potential sources of stress. Rather, their primary focus is on valuation changes involving large, broad-based movements in spreads for single-name bonds and credit default swaps, such as could accompany major systemic financial or macroeconomic shocks, and associated spillovers to prices for index and bespoke tranches and other complex correlation positions. In addition to the prescribed scenarios, a bank is expected to implement a rigorous internal stress testing process to address other potential correlation trading risks, including bank-specific risks related to its underlying business model and hedging strategies.

Prescribed stress tests: historical reference periods

99.2 The prescribed stress scenarios below are framed in terms of risk factor movements affecting credit spreads over specific historical reference periods. The term 'risk factor' encompasses any parameter or input within the pricing model that can vary over time. Examples include, but are not limited to, single-name risk-neutral default rates/intensities, recovery rates; market-implied correlations for index tranches; parameters used to infer market-implied correlations for bespoke tranches from those for index tranches; index-single name basis risks; and index-tranche basis risks.

99.3 The prescribed stress tests refer to specific historical reference periods. These periods correspond to historical intervals of three-months or less over which spreads for single-name and tranched credit products have exhibited very large, broad based increases or decreases. As described more fully in [MAR99.4](#) to [MAR99.15](#), for each stress test the historical reference period is used to calibrate the sizes of the assumed shocks to credit-related risk factors. This approach to calibrating the sizes of shocks is intended to accommodate the wide range of pricing models observed in practice.

99.4 The specific historical reference periods are as follows:

(1)   Periods of sharply rising credit spreads

    (a)   4 June 2007 through 30 July 2007;

    (b)   10 December 2007 through 10 March 2008;

    (c)   8 September 2008 through 5 December 2008.

(2)   Periods of sharply falling credit spreads

    (a)   14 March 2008 through 13 June 2008;

    (b)   12 March 2009 through 11 June 2009.

99.5   In the future, the Committee may modify the historical reference periods specified in MAR99.4, or specify additional reference periods, as it deems appropriate in light of developments in correlation trading markets. In addition, at their discretion national supervisors may require banks to perform stress tests based on additional reference periods, or may require additional stress tests based on methodologies different from those described herein.

Prescribed stress tests: Historical stress tests

99.6   For each historical reference period, several stress tests are to be undertaken. Each stress scenario involves replicating historical movements in all credit-related risk factors over the reference period. In these exercises, only credit-related risk factors are shocked; for example, non-credit-related risk factors driving default-free term structures of interest rates and foreign exchange rates should be fixed at current levels.

99.7   This description presumes that the bank's pricing model can be used to decompose historical movements in credit spreads into changes in risk factors. If the pricing model does not take this form explicitly, the bank will need to translate the stress scenarios into equivalent risk factor representations that are compatible with the structure of its pricing model. As with all aspects of the standards set forth in this guidance, such translations should be made in consultation with supervisors and are subject to supervisory approval.

Prescribed stress tests: Jumps to default

99.8 The preceding stress scenarios encompass changes in credit spreads, but abstract from defaults of individual firms. The final set of stress tests incorporates assumptions of actual defaults into the sector shock scenarios. For each historical scenario in MAR99.6, four jump-to-default (JTD) stress tests should be performed. In the first, the bank should assume an instantaneous JTD with zero recovery of

that corporate name in the current CTP having the largest JTD01 measure. In the second stress test the bank should assume JTDs with zero recovery of the two corporate names having the largest JTD01 measures. Similarly, in the third (fourth) stress test, the bank should assume JTDs with zero recovery of the three (four) corporate names having the largest JTD01 measures. (JTD01 is defined as the estimated decline in the MTM value of the CTP portfolio associated with a JTD of that entity, assuming a zero recovery rate for the entity's liabilities.)

Prescribed stress tests: Additional technical guidance

99.9 A given historical reference period is identified by its start date (t) and end date (t+M).

99.10 When calculating movements in risk factors over the historical reference period, the values of risk factors on dates t and t+M should be calibrated to be consistent with the bank's current pricing model and with actual market prices on those days.

99.11 In carrying out the stress tests, the bank's methodology should reflect the current credit quality of specific names, rather than the name's credit quality during the historical reference period. For example, if the current credit quality of a particular firm is worse than during the historical reference period, the shocks to risk factors for that firm should be consistent with those for similar quality firms over the reference period. Subject to supervisory approval, proxies for credit quality may be based on external ratings, implied ratings from credit spreads, or possibly other methods.

99.12 The current CTP's stressed MTM loss should be calculated as the difference between its current MTM value and its stressed MTM value.

99.13 MTM values should be based on full portfolio revaluation (eg no delta approximations).

99.14 Stress tests should be performed under the following assumptions. This treatment presumes that each stress scenario generates price effects that are internally consistent (eg positive spreads, no arbitrage opportunities). If this is not the case, a simple rescaling of certain risk factors may address the issue (eg a re-parameterisation to ensure that implied correlations and risk-neutral default rates and recoveries remain bounded between zero and one).

(1) Portfolio positions are held static at their current levels (eg no recognition of dynamic hedging within the period).

(2) All credit-related risk factors are instantaneously shocked.

(3) Risk factors not directly related to credit risk (eg foreign exchange rates, commodity prices, risk-free term structures of interest rates, etc.) are fixed at current levels.

(4) In general, within the prescribed stress tests, the difference between the shocked value and the current value of each risk factor should be set equal to its absolute (as opposed to relative) change between dates t and t+M. Exceptions are to be approved by the supervisor.

99.15 In cases where the historical value of a risk factor at date t or t+M is not known (perhaps because the current pricing model differs from that used over the interval t to t+M), the risk factor value will need to be 'backfilled'. Subject to supervisory approval, the backfilling method used by the bank should be consistent with the current pricing model and observed historical prices at t and t+M.

Internal stress testing

99.16 In addition to the prescribed stress tests set forth in MAR99.2 through MAR99.15, banks applying the comprehensive risk measure approach are expected to implement a rigorous internal stress testing process for the CTP. Subject to supervisory review, a bank's internal stress testing for the CTP should identify stress scenarios and then assess the effects of the scenarios on the MTM value of the CTP. The framework is intended to be flexible. Scenarios may be historical, hypothetical, or model-based, and may be deterministic or stochastic. Key variables specified in a scenario may include, for example, default rates, recovery rates, credit spreads, and correlations, or they might focus directly on price changes for CTP positions. A bank may choose to have scenarios apply to the entire correlation trading portfolio, or it may identify scenarios specific to sub-portfolios of the correlation trading portfolio.

99.17 The internal stress tests should be economically meaningful, taking into account the current composition of the CTP, the bank's business model for this desk, and the nature of its hedging activities. The form and severity of the stress scenarios should be developed with an eye toward their applicability to the unique characteristics (and vulnerabilities) of the current CTP including, but not limited to, concentration risks associated with particular geographic regions, economic sectors, and individual corporate names.

99.18

Taking into account the specific nature of the bank's CTP, the internal stress tests should not be limited to the historical reference periods used for the prescribed stress tests described in MAR99.2 through MAR99.15. The bank should consider relevant historical experience over other time intervals, as well, including periods within, around, or subsequent to the historical reference periods specified in MAR99.4.

Supervisory framework for the use of "backtesting" in conjunction with the internal models approach to market risk capital requirements

99.19 This section elaborates the requirements of MAR30.16 for incorporating backtesting into the internal models approach to market risk capital requirements. The aim of this framework is the promotion of more rigorous approaches to backtesting and the supervisory interpretation of backtesting results.

99.20 Many banks that have adopted an internal model-based approach to market risk measurement routinely compare daily profits and losses with model-generated risk measures to gauge the quality and accuracy of their risk measurement systems. This process, known as "backtesting", has been found useful by many institutions as they have developed and introduced their risk measurement models.

99.21 The essence of all backtesting efforts is the comparison of actual trading results with model-generated risk measures. If this comparison is close enough, the backtest raises no issues regarding the quality of the risk measurement model. In some cases, however, the comparison uncovers sufficient differences that problems almost certainly must exist, either with the model or with the assumptions of the backtest. In between these two cases is a grey area where the test results are, on their own, inconclusive.

Description of the backtesting framework

99.22 The backtesting framework developed by the Committee is based on that adopted by many of the banks that use internal market risk measurement models. These backtesting programs typically consist of a periodic comparison of the bank's daily value-at-risk measures with the subsequent daily profit or loss ("trading outcome"). The value-at-risk measures are intended to be larger than all but a certain fraction of the trading outcomes, where that fraction is determined by the confidence level of the value-at-risk measure. Comparing the risk measures with the trading outcomes simply means that the bank counts the number of times that the risk measures were larger than the trading outcome.

The fraction actually covered can then be compared with the intended level of coverage to gauge the performance of the bank's risk model. In some cases, this last step is relatively informal, although there are a number of statistical tests that may also be applied. The supervisory framework for backtesting in MAR99.19 to MAR99.69 involves all of these steps, and attempts to set out as consistent an interpretation of each step as is feasible without imposing unnecessary burdens.

99.23 Under the value-at-risk framework, the risk measure is an estimate of the amount that could be lost on a set of positions due to general market movements over a given holding period, measured using a specified confidence level. The backtests to be applied compare whether the observed percentage of outcomes covered by the risk measure is consistent with a 99% level of confidence. That is, they attempt to determine if a bank's 99th percentile risk measures truly cover 99% of the firm's trading outcomes.

99.24 An additional consideration in specifying the appropriate risk measures and trading outcomes for backtesting arises because the value-at-risk approach to risk measurement is generally based on the sensitivity of a static portfolio to instantaneous price shocks. That is, end-of-day trading positions are input into the risk measurement model, which assesses the possible change in the value of this static portfolio due to price and rate movements over the assumed holding period.

99.25 While this is straightforward in theory, in practice it complicates the issue of backtesting. For instance, it is often argued that value-at-risk measures cannot be compared against actual trading outcomes, since the actual outcomes will inevitably be "contaminated" by changes in portfolio composition during the holding period. According to this view, the inclusion of fee income together with trading gains and losses resulting from changes in the composition of the portfolio should not be included in the definition of the trading outcome because they do not relate to the risk inherent in the static portfolio that was assumed in constructing the value-at-risk measure.

99.26 This argument is persuasive with regard to the use of value-at-risk measures based on price shocks calibrated to longer holding periods. That is, comparing the ten-day, 99th percentile risk measures from the internal models capital requirement with actual ten-day trading outcomes would probably not be a meaningful exercise. In particular, in any given ten day period, significant changes in portfolio composition relative to the initial positions are common at major trading institutions. For this reason, the backtesting framework described here involves the use of risk measures calibrated to a one-day holding period. Other than the restrictions mentioned in this paper, the test would be based on how banks model risk internally.

99.27 Given the use of one-day risk measures, it is appropriate to employ one-day trading outcomes as the benchmark to use in the backtesting program. The same concerns about "contamination" of the trading outcomes discussed above continue to be relevant, however, even for one-day trading outcomes. That is, there is a concern that the overall one-day trading outcome is not a suitable point of comparison, because it reflects the effects of intra-day trading, possibly including fee income that is booked in connection with the sale of new products.

99.28 On the one hand, intra-day trading will tend to increase the volatility of trading outcomes, and may result in cases where the overall trading outcome exceeds the risk measure. This event clearly does not imply a problem with the methods used to calculate the risk measure; rather, it is simply outside the scope of what the value-at-risk method is intended to capture. On the other hand, including fee income may similarly distort the backtest, but in the other direction, since fee income often has annuity-like characteristics.

99.29 Since this fee income is not typically included in the calculation of the risk measure, problems with the risk measurement model could be masked by including fee income in the definition of the trading outcome used for backtesting purposes.

99.30 Some have argued that the actual trading outcomes experienced by the bank are the most important and relevant figures for risk management purposes, and that the risk measures should be benchmarked against this reality, even if the assumptions behind their calculations are limited in this regard. Others have also argued that the issue of fee income can be addressed sufficiently, albeit crudely, by simply removing the mean of the trading outcomes from their time series before performing the backtests. A more sophisticated approach would involve a detailed attribution of income by source, including fees, spreads, market movements, and intra-day trading results.

99.31 To the extent that the backtesting program is viewed purely as a statistical test of the integrity of the calculation of the value-at-risk measure, it is clearly most appropriate to employ a definition of daily trading outcome that allows for an

"uncontaminated" test. To meet this standard, banks should develop the capability to perform backtests based on the hypothetical changes in portfolio value that would occur were end-of-day positions to remain unchanged.

99.32 Backtesting using actual daily profits and losses is also a useful exercise since it can uncover cases where the risk measures are not accurately capturing trading volatility in spite of being calculated with integrity.

99.33 For these reasons, the Committee urges banks to develop the capability to perform backtests using both hypothetical and actual trading outcomes. Although national supervisors may differ in the emphasis that they wish to place on these different approaches to backtesting, it is clear that each approach has value. In combination, the two approaches are likely to provide a strong understanding of the relation between calculated risk measures and trading outcomes.

99.34 The next step in specifying the backtesting program concerns the nature of the backtest itself, and the frequency with which it is to be performed. The framework adopted by the Committee, which is also the most straightforward procedure for comparing the risk measures with the trading outcomes, is simply to calculate the number of times that the trading outcomes are not covered by the risk measures ("exceptions"). For example, over 200 trading days, a 99% daily risk measure should cover, on average, 198 of the 200 trading outcomes, leaving two exceptions.

99.35 With regard to the frequency of the backtest, the desire to base the backtest on as many observations as possible must be balanced against the desire to perform the test on a regular basis. The backtesting framework to be applied entails a formal testing and accounting of exceptions on a quarterly basis using the most recent twelve months of data.

99.36 Using the most recent twelve months of data yields approximately 250 daily observations for the purposes of backtesting. The national supervisor will use the number of exceptions (out of 250) generated by the bank's model as the basis for a supervisory response. In many cases, there will be no response. In other cases, the supervisor may initiate a dialogue with the bank to determine if there is a problem with a bank's model. In the most serious cases, the supervisor may impose an increase in a bank's capital requirement or disallow use of the model.

99.37 The appeal of using the number of exceptions as the primary reference point in the backtesting process is the simplicity and straightforwardness of this approach. From a statistical point of view, using the number of exceptions as the basis for appraising a bank's model requires relatively few strong assumptions. In particular, the primary assumption is that each day's test (exception/no exception) is independent of the outcome of any of the others.

99.38 The Committee of course recognises that tests of this type are limited in their power to distinguish an accurate model from an inaccurate model. To a statistician, this means that it is not possible to calibrate the test so that it correctly signals all the problematic models without giving false signals of trouble at many others. This limitation has been a prominent consideration in the design of the framework presented here, and should also be prominent among the considerations of national supervisors in interpreting the results of a bank's backtesting program. However, the Committee does not view this limitation as a decisive objection to the use of backtesting. Rather, conditioning supervisory standards on a clear framework, though limited and imperfect, is seen as preferable to a purely judgmental standard or one with no incentive features whatsoever.

Supervisory framework for the interpretation of backtesting results

99.39 It is with the statistical limitations of backtesting in mind that the Committee is introducing a framework for the supervisory interpretation of backtesting results that encompasses a range of possible responses, depending on the strength of the signal generated from the backtest. These responses are classified into three zones, distinguished by colours into a hierarchy of responses. The green zone corresponds to backtesting results that do not themselves suggest a problem with the quality or accuracy of a bank's model. The yellow zone encompasses results that do raise questions in this regard, but where such a conclusion is not definitive. The red zone indicates a backtesting result that almost certainly indicates a problem with a bank's risk model.

99.40 These zones are defined in respect of the number of exceptions generated in the backtesting program as set forth in MAR99.41 to MAR99.69. To place these definitions in proper perspective, however, it is useful to examine the probabilities of obtaining various numbers of exceptions under different assumptions about the accuracy of a bank's risk measurement model.

99.41 Three zones have been delineated and their boundaries chosen in order to balance two types of statistical error:

(1) the possibility that an accurate risk model would be classified as inaccurate on the basis of its backtesting result, and

(2) the possibility that an inaccurate model would not be classified that way based on its backtesting result.

99.42 Table 1 in [MAR99.45](#) reports the probabilities of obtaining a particular number of exceptions from a sample of 250 independent observations under several assumptions about the actual percentage of outcomes that the model captures (that is, these are binomial probabilities). For example, the left-hand portion of Table 1 reports probabilities associated with an accurate model (that is, a true coverage level of 99%). Under these assumptions, the column labelled "exact" reports that exactly five exceptions can be expected in 6.7% of the samples. The right-hand portion of Table 1 reports probabilities associated with several possible inaccurate models, namely models whose true levels of coverage are 98%, 97%, 96%, and 95%, respectively. Thus, the column labelled "exact" under an assumed coverage level of 97% shows that five exceptions would then be expected in 10.9% of the samples.

99.43 Table 1 also reports several important error probabilities. For the assumption that the model covers 99% of outcomes (the desired level of coverage), the table reports the probability that selecting a given number of exceptions as a threshold for rejecting the accuracy of the model will result in an erroneous rejection of an accurate model ("type 1" error). For example, if the threshold is set as low as one exception, then accurate models will be rejected fully 91.9% of the time, because they will escape rejection only in the 8.1% of cases where they generate zero exceptions. As the threshold number of exceptions is increased, the probability of making this type of error declines.

99.44 Under the assumptions that the model's true level of coverage is not 99%, Table 1 reports the probability that selecting a given number of exceptions as a threshold for rejecting the accuracy of the model will result in an erroneous acceptance of a model with the assumed (inaccurate) level of coverage ("type 2" error). For example, if the model's actual level of coverage is 97%, and the threshold for rejection is set at seven or more exceptions, the table indicates that this model would be erroneously accepted 37.5% of the time.

99.45 In interpreting the information in Table 1, it is also important to understand that although the alternative models appear close to the desired standard in probability terms (97% is close to 99%), the difference between these models in terms of the size of the risk measures generated can be substantial. That is, a bank's risk measure could be substantially less than that of an accurate model and still cover 97% of the trading outcomes. For example, in the case of normally distributed trading outcomes, the 97th percentile corresponds to 1.88 standard deviations, while the 99th percentile corresponds to 2.33 standard deviations, an

increase of nearly 25%. Thus, the supervisory desire to distinguish between models providing 99% coverage, and those providing say, 97% coverage, is a very real one.

Probabilities of exceptions   Table 1

| Exceptions (out of 250) | Model is accurate | | Model is inaccurate: possible alternative levels of coverage | | | | | | | |
| | Coverage = 99% | | Coverage = 98% | | Coverage = 97% | | Coverage = 96% | | Coverage = 95% | |
	Exact	Type 1	Exact	Type 2	Exact	Type 2	Exact	Type 2	Exact	Type 2
0	8.1 %	100.0%	0.6%	0.0%	0.0%	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %
1	20.5 %	91.9 %	3.3%	0.6%	0.4%	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %
2	25.7 %	71.4 %	8.3%	3.9%	1.5%	0.4 %	0.2 %	0.0 %	0.0 %	0.0 %
3	21.5 %	45.7 %	14.0%	12.2%	3.8%	1.9 %	0.7 %	0.2 %	0.1 %	0.0 %
4	13.4 %	24.2 %	17.7%	26.2%	7.2%	5.7 %	1.8 %	0.9 %	0.3 %	0.1 %
5	6.7%	10.8 %	17.7%	43.9%	10.9%	12.8 %	3.6 %	2.7 %	0.9 %	0.5 %
6	2.7 %	4.1 %	14.8%	61.6%	13.8%	23.7 %	6.2 %	6.3 %	1.8 %	1.3 %
7	1.0 %	1.4 %	10.5%	76.4%	14.9%	37.5 %	9.0 %	12.5 %	3.4 %	3.1 %
8	0.3 %	0.4 %	6.5%	86.9%	14.0%	52.4 %	11.3 %	21.5 %	5.4 %	6.5 %
9	0.1 %	0.1 %	3.6%	93.4%	11.6%	66.3 %	12.7 %	32.8 %	7.6 %	11.9 %

10	0.0 %	0.0 %	1.8%	97.0%	8.6%	77.9 %	12.8 %	45.5 %	9.6 %	19.5 %
11	0.0 %	0.0 %	0.8%	98.7%	5.8%	86.6 %	11.6 %	58.3 %	11.1 %	29.1 %
12	0.0 %	0.0 %	0.3%	99.5%	3.6%	92.4 %	9.6 %	69.9 %	11.6 %	40.2 %
13	0.0 %	0.0 %	0.1%	99.8%	2.0%	96.0 %	7.3 %	79.5 %	11.2 %	51.8 %
14	0.0 %	0.0 %	0.0%	99.9%	1.1%	98.0 %	5.2 %	86.9 %	10.0 %	62.9 %
15	0.0 %	0.0 %	0.0%	100.0%	0.5%	99.1%	3.4%	92.1%	8.2%	72.9%

The table reports both exact probabilities of obtaining a certain number of exceptions from a sample of 250 independent observations under several assumptions about the true level of coverage, as well as type 1 or type 2 error probabilities derived from these exact probabilities as set out in MAR99.41 to MAR99.45.

99.46 The results in Table 1 also demonstrate some of the statistical limitations of backtesting. In particular, there is no threshold number of exceptions that yields both a low probability of erroneously rejecting an accurate model and a low probability of erroneously accepting all of the relevant inaccurate models. It is for this reason that the Committee has rejected an approach that contains only a single threshold.

99.47 Given these limitations, the Committee has classified outcomes into three categories. In the first category, the test results are consistent with an accurate model, and the possibility of erroneously accepting an inaccurate model is low (green zone). At the other extreme, the test results are extremely unlikely to have resulted from an accurate model, and the probability of erroneously rejecting an accurate model on this basis is remote (red zone). In between these two cases, however, is a zone where the backtesting results could be consistent with either accurate or inaccurate models, and the supervisor should encourage a bank to present additional information about its model before taking action (yellow zone).

99.48 Table 2 below sets out the Committee's agreed boundaries for these zones and the presumptive supervisory response for each backtesting outcome, based on a sample of 250 observations. For other sample sizes, the boundaries should be deduced by calculating the binomial probabilities associated with true coverage of 99%, as in Table 1. The yellow zone begins at the point such that the cumulative probabilities, that is the probability of obtaining that number or fewer exceptions, equals or exceeds 95%. Table 2 reports these cumulative probabilities for each number of exceptions. For 250 observations, it can be seen that five or fewer exceptions will be obtained 95.88% of the time when the true level of coverage is 99%. Thus, the yellow zone begins at five exceptions.

99.49 Similarly, the beginning of the red zone is defined as the point such that the probability of obtaining that number or fewer exceptions equals or exceeds 99.99%. Table 2 shows that for a sample of 250 observations and a true coverage level of 99%, this occurs with ten exceptions.

Zone	Number of exceptions	Plus to the multiplication factor	Cumulative probability
Green zone	0	0.00	8.11%
	1	0.00	28.58%
	2	0.00	54.32%
	3	0.00	75.81%
	4	0.00	89.22%
Yellow zone	5	0.40	95.88%
	6	0.50	98.63%
	7	0.65	99.60%
	8	0.75	99.89%
	9	0.85	99.97%
Red zone	10 or more	1.00	99.99%

The table defines the green, yellow and red zones that supervisors will use to assess backtesting results in conjunction with the internal models approach to market risk capital requirements. The boundaries shown in the table are based on a sample of 250 observations. For other sample sizes, the yellow zone begins at the point where the cumulative probability equals or exceeds 95%, and the red zone begins at the point where the cumulative probability equals or exceeds 99.99% as set out in MAR99.48 and MAR99.49.

Plus to the multiplication factor ranges from zero to one based on the outcome of the backtesting as set out in MAR30.16 and MAR99.51 to MAR99.65.

Note that these cumulative probabilities and the type 1 error probabilities reported in Table 1 do not sum to one because the cumulative probability for a given number of exceptions includes the possibility of obtaining exactly that number of exceptions, as does the type 1 error probability. Thus, the sum of these two probabilities exceeds one by the amount of the probability of obtaining exactly that number of exceptions.

99.50 The green zone needs little explanation. Since a model that truly provides 99% coverage would be quite likely to produce as many as four exceptions in a sample of 250 outcomes, there is little reason for concern raised by backtesting results that fall in this range. This is reinforced by the results in Table 1, which indicate that accepting outcomes in this range leads to only a small chance of erroneously accepting an inaccurate model.

99.51 The range from five to nine exceptions constitutes the yellow zone. Outcomes in this range are plausible for both accurate and inaccurate models, although Table 1 suggests that they are generally more likely for inaccurate models than for accurate models. Moreover, the results in Table 1 indicate that the presumption that the model is inaccurate should grow as the number of exceptions increases in the range from five to nine.

99.52 Within the yellow zone, the number of exceptions should generally guide the size of potential supervisory increases in a firm's capital requirement. Table 2 sets out the guidelines for the value of the "plus" factor in the multiplication factors applicable to the internal models capital requirement as set out in MAR30.16, resulting from backtesting results in the yellow zone. These guidelines help in maintaining the appropriate structure of incentives applicable to the internal models approach. In particular, the potential supervisory penalty increases with the number of exceptions. The results in Table 1 generally support the notion that nine exceptions is a more troubling result than five exceptions, and these steps are meant to reflect that.

99.53 These particular values reflect the general idea that the increase in the multiplication factor should be sufficient to return the model to a 99th percentile standard. For example, five exceptions in a sample of 250 implies only 98% coverage. Thus, the increase in the multiplication factor should be sufficient to transform a model with 98% coverage into one with 99% coverage. Needless to say, precise calculations of this sort require additional statistical assumptions that are not likely to hold in all cases. For example, if the distribution of trading outcomes is assumed to be normal, then the ratio of the 99th percentile to the 98th percentile is approximately 1.14, and the increase needed in the multiplication factor is therefore approximately 0.40 for a scaling factor of 3. If the actual distribution is not normal, but instead has "fat tails", then larger increases may be required to reach the 99th percentile standard. The concern about fat tails was also an important factor in the choice of the specific increments set out in Table 2.

99.54 It is important to stress, however, that these increases are not meant to be purely automatic. The results in Table 1 indicate that results in the yellow zone do not always imply an inaccurate model, and the Committee has no interest in penalising banks solely for bad luck. Nevertheless, to keep the incentives aligned properly, backtesting results in the yellow zone should generally be presumed to imply an increase in the multiplication factor unless the bank can demonstrate that such an increase is not warranted.

99.55 In other words, the burden of proof in these situations should not be on the supervisor to prove that a problem exists, but rather should be on the bank to prove that their model is fundamentally sound. In such a situation, there are many different types of additional information that might be relevant to an assessment of the bank's model.

99.56 For example, it would then be particularly valuable to see the results of backtests covering disaggregated subsets of the bank's overall trading activities. Many banks that engage in regular backtesting programs break up their overall trading portfolio into trading units organised around risk factors or product categories. Disaggregating in this fashion could allow the tracking of a problem that surfaced at the aggregate level back to its source at the level of a specific trading unit or risk model.

99.57 Banks should also document all of the exceptions generated from their ongoing backtesting program, including an explanation for the exception. This documentation is important to determining an appropriate supervisory response to a backtesting result in the yellow zone. Banks may also implement backtesting for confidence intervals other than the 99th percentile, or may perform other statistical tests not considered here. Naturally, this information could also prove very helpful in assessing their model.

99.58 In practice, there are several possible explanations for a backtesting exception, some of which go to the basic integrity of the model, some of which suggest an under-specified or low-quality model, and some of which suggest either bad luck or poor intra-day trading results. Classifying the exceptions generated by a bank's model into these categories can be a very useful exercise.

(1) Basic integrity of the model:

(a) The bank's systems simply are not capturing the risk of the positions themselves (eg the positions of an overseas office are being reported incorrectly).

(b) Model volatilities and/or correlations were calculated incorrectly (eg the computer is dividing by 250 when it should be dividing by 225).

(2) Model's accuracy could be improved:

The risk measurement model is not assessing the risk of some instruments with sufficient precision (eg too few maturity buckets or an omitted spread).

(3) Bad luck or markets moved in fashion unanticipated by the model:

(a) Random chance (a very low probability event).

(b) Markets moved by more than the model predicted was likely (i.e. volatility was significantly higher than expected).

(c) Markets did not move together as expected (i.e. correlations were significantly different than what was assumed by the model).

(4) Intraday trading: There was a large (and money-losing) change in the bank's positions or some other income event between the end of the first day (when the risk estimate was calculated) and the end of the second day (when trading results were tabulated).

99.59 In general, problems relating to the basic integrity of the risk measurement model are potentially the most serious. If there are exceptions attributed to this category for a particular trading unit, the plus should apply. In addition, the model may be in need of substantial review and/or adjustment, and the supervisor would be expected to take appropriate action to ensure that this occurs.

99.60 The second category of problem (lack of model precision) is one that can be expected to occur at least part of the time with most risk measurement models. No model can hope to achieve infinite precision, and thus all models involve some amount of approximation. If, however, a particular bank's model appears more prone to this type of problem than others, the supervisor should impose the plus factor and also consider what other incentives are needed to spur improvements.

99.61 The third category of problems (markets moved in a fashion unanticipated by the model) should also be expected to occur at least some of the time with value-at-risk models. In particular, even an accurate model is not expected to cover 100% of trading outcomes. Some exceptions are surely the random 1% that the model can be expected not to cover. In other cases, the behaviour of the markets may shift so that previous estimates of volatility and correlation are less appropriate. No value-at-risk model will be immune from this type of problem; it is inherent in the reliance on past market behaviour as a means of gauging the risk of future market movements.

99.62 Finally, depending on the definition of trading outcomes employed for the purpose of backtesting, exceptions could also be generated by intra-day trading results or an unusual event in trading income other than from positioning. Although exceptions for these reasons would not necessarily suggest a problem with the bank's value-at-risk model, they could still be cause for supervisory concern and the imposition of the plus should be considered.

99.63 The extent to which a trading outcome exceeds the risk measure is another relevant piece of information. All else equal, exceptions generated by trading outcomes far in excess of the risk measure are a matter of greater concern than are outcomes only slightly larger than the risk measure.

99.64 In deciding whether or not to apply increases in a bank's capital requirement, it is envisioned that the supervisor could weigh these factors as well as others, including an appraisal of the bank's compliance with applicable qualitative standards of risk management. Based on the additional information provided by the bank, the supervisor will decide on the appropriate course of action.

99.65 In general, the imposition of a higher capital requirement for outcomes in the yellow zone is an appropriate response when the supervisor believes the reason for being in the yellow zone is a correctable problem in a bank's model. This can be contrasted with the case of an unexpected bout of high market volatility, which nearly all models may fail to predict. While these episodes may be stressful, they do not necessarily indicate that a bank's risk model is in need of redesign. Finally, in the case of severe problems with the basic integrity of the model, the supervisor should consider whether to disallow the use of the model for capital purposes altogether.

99.66 Finally, in contrast to the yellow zone where the supervisor may exercise judgement in interpreting the backtesting results, outcomes in the red zone (ten or more exceptions) should generally lead to an automatic presumption that a problem exists with a bank's model. This is because it is extremely unlikely that an accurate model would independently generate ten or more exceptions from a sample of 250 trading outcomes.

99.67 In general, therefore, if a bank's model falls into the red zone, the supervisor should automatically increase the multiplication factor applicable to a firm's model by one (from three to four). Needless to say, the supervisor should also begin investigating the reasons why the bank's model produced such a large number of misses, and should require the bank to begin work on improving its model immediately.

99.68 Although ten exceptions is a very high number for 250 observations, there will on very rare occasions be a valid reason why an accurate model will produce so many exceptions. In particular, when financial markets are subjected to a major regime shift, many volatilities and correlations can be expected to shift as well, perhaps substantially. Unless a bank is prepared to update its volatility and correlation estimates instantaneously, such a regime shift could generate a number of exceptions in a short period of time. In essence, however, these exceptions would all be occurring for the same reason, and therefore the appropriate supervisory reaction might not be the same as if there were ten exceptions, but each from a separate incident. For example, one possible supervisory response in this instance would be to simply require the bank's model to take account of the regime shift as quickly as it can while maintaining the integrity of its procedures for updating the model.

99.69 It should be stressed, however, that the Committee believes that this exception should be allowed only under the most extraordinary circumstances, and that it is committed to an automatic and non-discretionary increase in a bank's capital requirement for backtesting results that fall into the red zone.