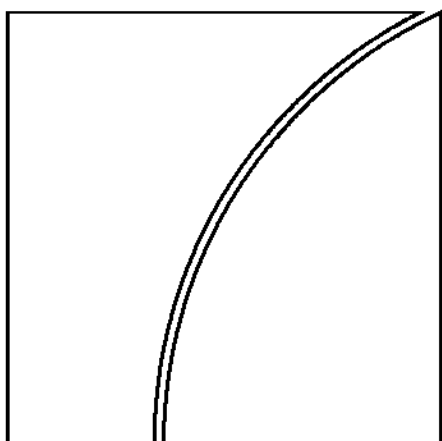


# Basel Committee on Banking Supervision



## Revisions to the Basel II market risk framework

Updated as of 31 December 2010.

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## Revisions to the Basel II market risk framework

Updated as of 31 December 2010 to reflect the adjustments to the Basel II market risk framework announced by the Basel Committee in its 18 June 2010 press release and the stress testing guidance for the correlation trading portfolio referred to in paragraph 9 of the July 2009 version of this document. Changes introduced by the Basel III framework are not yet reflected in the text.

1. Since the financial crisis began in mid-2007, an important source of losses and of the build up of leverage occurred in the trading book. A main contributing factor was that the current capital framework for market risk, based on the 1996 *Amendment to the Capital Accord to incorporate market risks*, does not capture some key risks. In response, the Basel Committee on Banking Supervision (“the Committee”)<sup>1</sup> supplements the current value-at-risk-based trading book framework with an incremental risk capital charge, which includes default risk as well as migration risk, for unsecuritised credit products. For securitised products, the capital charges of the banking book will apply with a limited exception for certain so-called correlation trading activities, where banks may be allowed by their supervisor to calculate a comprehensive risk capital charge subject to strict qualitative minimum requirements as well as stress testing requirements. These measures will reduce the incentive for regulatory arbitrage between the banking and trading books.

2. An additional response to the crisis is the introduction of a stressed value-at-risk requirement. Losses in most banks’ trading books during the financial crisis have been significantly higher than the minimum capital requirements under the former Pillar 1 market risk rules. The Committee therefore requires banks to calculate a stressed value-at-risk taking into account a one-year observation period relating to significant losses, which must be calculated in addition to the value-at-risk based on the most recent one-year observation period. The additional stressed value-at-risk requirement will also help reduce the procyclicality of the minimum capital requirements for market risk.

### I. Background and objectives

3. The Basel Committee/IOSCO Agreement reached in July 2005<sup>2</sup> contained several improvements to the capital regime for trading book positions. Among the revisions was a new requirement for banks that model specific risk to measure and hold capital against default risk that is incremental to any default risk captured in the bank’s value-at-risk model. The incremental default risk charge was incorporated into the trading book capital regime in response to the increasing amount of exposure in banks’ trading books to credit-risk related and often illiquid products whose risk is not reflected in value-at-risk. At its meeting in March

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<sup>1</sup> The Basel Committee on Banking Supervision consists of senior representatives of bank supervisory authorities and central banks from Argentina, Australia, Belgium, Brazil, Canada, China, France, Germany, Hong Kong SAR, India, Indonesia, Italy, Japan, Korea, Luxembourg, Mexico, the Netherlands, Russia, Saudi Arabia, Singapore, South Africa, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States. It usually meets at the Bank for International Settlements (BIS) in Basel, Switzerland, where its permanent Secretariat is located.

<sup>2</sup> Basel Committee on Banking Supervision, *The Application of Basel II to trading activities and the treatment of double default effects*, July 2005.

2008, the Committee decided to expand the scope of the capital charge, to improve the internal value-at-risk models for market risk and to update the prudent valuation guidance for positions accounted for at fair value.

4. Given the interest of both banks and securities firms in the potential solutions to these particular issues, the Committee has worked jointly with the International Organization of Securities Commissions (IOSCO) to consult with industry representatives and other supervisors on these matters. While this work was undertaken jointly by a working group from the Committee and IOSCO, the resulting proposal represents an effort by the Committee to find prudential treatments for certain exposures held by banks under the Basel II Framework. Consequently, this text frequently refers to rules for banks, banking groups, and other firms subject to prudential banking regulations. The Committee recognises that, in some cases, national authorities may decide to apply these rules not just to banks and banking groups, but also to investment firms, to groups of investment firms and to combined groups of banks and investment firms that are subject to prudential banking or securities firms' regulation.

5. In June 2006, the Committee published a comprehensive version of the Basel II Framework<sup>3</sup> which includes the June 2004 Basel II Framework, the elements of the 1988 Accord that were not revised during the Basel II process, the 1996 *Amendment to the Capital Accord to incorporate market risks*, and the July 2005 paper on *The application of Basel II to trading activities and the treatment of double default effects*. Unless stated otherwise, paragraph numbers in this document refer to paragraphs in the comprehensive version of the Basel II Framework.

6. The Committee released consultative documents on the revisions to the Basel II market risk framework and the guidelines for computing capital for incremental risk in the trading book in July 2008<sup>4</sup> and more recently in January 2009<sup>5</sup>. 30 comment letters have been provided by banks, industry associations, supervisory authorities and other interested institutions in the most recent consultation. Most of them are available on the Committee's website. The Committee and IOSCO wish to thank representatives of the industry for their fruitful comments. The Committee and IOSCO worked diligently, in close cooperation with representatives of the industry, to reflect their comments in the present paper and the Guidelines.

7. According to the proposed changes to the Basel II market risk framework outlined below, the trading book capital charge for a bank using the internal models approach for market risk will be subject to a general market risk capital charge (and a specific risk capital charge to the extent that the bank has approval to model specific risk) measured using a 10-day value-at-risk at the 99 percent confidence level and a stressed value-at-risk. A bank that has approval to model specific risk will also be subject to an incremental risk capital charge. The scope and implementation requirements for general market risk will remain unchanged from the current market risk regime. For a bank that has approval to model specific risk, the

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<sup>3</sup> Basel Committee on Banking Supervision, *Basel II: International convergence of capital measurement and capital standards: a revised framework, comprehensive version*, June 2006.

<sup>4</sup> Basel Committee on Banking Supervision, *Proposed revisions to the Basel II market risk framework*, consultative document, July 2008.

<sup>5</sup> Basel Committee on Banking Supervision, *Proposed revisions to the Basel II market risk framework*, consultative document, January 2009



10-day value-at-risk estimate will be subject to the same multiplier as for general market risk. The separate surcharge for specific risk under the current framework<sup>6</sup> will be eliminated.

8. The Committee has decided that the incremental risk capital charge should capture not only default risk but also migration risk. This decision is reflected in the proposed revisions to the Basel II market risk framework. Additional guidance on the incremental risk capital charge is provided in a separate document, the *Guidelines for computing capital for incremental risk in the trading book* (referred to as “the Guidelines”).<sup>7</sup>

9. The Committee as a whole has not yet agreed that currently existing methodologies used by banks adequately capture incremental risks of all securitised products. Until the Committee can be satisfied that a methodology adequately captures incremental risks for all securitised products, the capital charges of the standardised measurement method will in general be applied to these products. However, there will be a limited exception for certain correlation trading activities, where banks may be allowed by their supervisor to calculate a comprehensive risk capital charge subject to strict minimum requirements. In particular, 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. The precise number and composition of stress scenarios to be applied is outlined in the Annex to this document. Furthermore, the comprehensive risk capital charge is subject to a floor expressed as a percentage of the charge applicable under the standardised measurement method.

10. The improvements in the Basel II Framework concerning internal value-at-risk models in particular require banks to justify any factors used in pricing which are left out in the calculation of value-at-risk. They will also be required to use hypothetical backtesting at least for validation, to update market data at least monthly and to be in a position to update it in a more timely fashion if deemed necessary. Furthermore, the Committee clarifies that it is permissible to use a weighting scheme for historical data that is not fully consistent with the requirement that the “effective” observation period must be at least one year, as long as that method results in a capital charge at least as conservative as that calculated with an “effective” observation period of at least one year.

11. To complement the incremental risk capital framework, the Committee extends the scope of the prudent valuation guidance to all positions subject to fair value accounting and make the language more consistent with existing accounting guidance. The Committee clarifies that regulators retain the ability to require adjustments to current value beyond those required by financial reporting standards, in particular where there is uncertainty around the current realisable value of a position due to illiquidity. This guidance focuses on the current valuation of the position and is a separate concern from the risk that market conditions and/or variables will change before the position is liquidated (or closed out) causing a loss of value to positions held.

12. (deleted)

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<sup>6</sup> Basel Committee on Banking Supervision, *Modification of the Basle Capital Accord of July 1988, as amended in January 1996*, press release, 19 September 1997.

<sup>7</sup> Basel Committee on Banking Supervision, *Guidelines for computing capital for incremental risk in the trading book*, July 2009.

## II. Implementation date

13. Banks are expected to comply with the revised requirements by no later than 31 December 2011. This also applies to portfolios and products for which a bank has already received or applied for approval for using internal models for the calculation of market risk capital or specific risk model recognition before the implementation of these changes. National supervisory agencies should use the time between the announcement of this amendment and the implementation date to thoroughly validate and approve banks' internal models for calculating the incremental and comprehensive risk capital charges.

## III. Changes to the introduction of the Basel II framework

14. Footnote 3 to paragraph 16 of the Basel II framework will be changed as follows. Changed wording is underlined.

<sup>3</sup> The additional guidance does not modify the definition of the trading book set forth in the revised Framework. Rather, it focuses on policies and procedures that banks must have in place to includebook exposures in their trading books. However, it is the Committee's view that, at the present time, open equity stakes in hedge funds, private equity investments, positions in a securitisation warehouse and real estate holdings do not meet the definition of the trading book, owing to significant constraints on the ability of banks to liquidate these positions and value them reliably on a daily basis.

## IV. Changes to the standardised measurement method for market risk

15. After paragraph 689(iii) of the Basel II framework, the following definition of the correlation trading portfolio will be added:

689(iv). 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:

- 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
- All reference entities 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 entities. 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.

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

16. Paragraph 709(ii) of the Basel II Framework will be changed as follows, and a new paragraph 709(ii-1-) will be introduced. Changed and new wording is underlined.

709(ii). The minimum capital requirement is expressed in terms of two separately calculated charges, 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. The bank must, however, determine the specific risk capital charge for the correlation trading portfolio as follows: The bank computes (i) the total specific risk capital charges that would apply just to the net long positions from the net long correlation trading exposures combined, and (ii) the total specific risk capital charges that would apply just to the net short positions from the net short correlation trading exposures combined. The larger of these total amounts is then the specific risk capital charge for the correlation trading portfolio.

709(ii-1-). During a transitional period until 31 December 2013, the bank may exclude positions in securitisation instruments which are not included in the correlation trading portfolio from the calculation according to paragraph 709(ii) and determine the specific risk capital charge as follows: The bank computes (i) the total specific risk capital charge that would apply just to the net long positions in securitisation instruments in the trading book, and (ii) the total specific risk capital charge that would apply just to the net short positions in securitisation instruments in the trading book. The larger of these total amounts is then the specific risk capital charge for the securitisation positions in the trading book. This calculation must be undertaken separately from the calculation for the correlation trading portfolio.

17. Paragraph 712(ii) of the Basel II Framework will be changed as follows. Deleted wording is struck out.

712(ii). 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:

- To apply a higher specific risk charge to such instruments; and/or
- To disallow offsetting for the purposes of defining the extent of general market risk between such instruments and any other debt instruments.

~~In that respect, securitisation exposures that would be subject to a deduction treatment under the securitisation framework set forth in this Framework (e.g. equity tranches that absorb first loss), as well as securitisation exposures that are unrated liquidity lines or letters of credit should be subject to a capital charge that is no less than the charge set forth in the securitisation framework.~~

18. After paragraph 712(ii) of the Basel II Framework, the treatment of specific risk will be amended as follows:

*Specific risk rules for positions covered under the securitisation framework*

712(iii). The specific risk of securitisation positions as defined in paragraphs 538 to 542 which are held in the trading book is to be calculated according to the method used for such positions in the banking book unless specified otherwise below. To that effect, the risk weight has to be calculated as specified below and applied to the net positions in securitisation instruments in the trading book. The total specific risk capital charge for n-th-to-default credit derivatives is to be computed according to paragraph 718, and the total specific risk capital charge for securitisation exposures is to be computed according to paragraph 709(ii).

712(iv). The specific risk capital charges for positions covered under the standardised approach for securitisation exposures are defined in the table below. These charges must be applied by banks using the standardised approach for credit risk. For positions with long-term ratings of B+ and below and short-term ratings other than A-1/P-1, A-2/P-2, A-3/P-3, deduction from capital as defined in paragraph 561 is required. Deduction is also required for unrated positions with the exception of the circumstances described in paragraphs 571 to 575. The operational requirements for the recognition of external credit assessments outlined in paragraph 565 apply.

**Specific risk capital charges under the standardised approach  
based on external credit ratings**

External Credit Assessment	AAA to AA- A-1/P-1	A+ to A- A-2/P-2	BBB+ to BBB- A-3/P-3	BB+ to BB-	Below BB- and below A-3/P-3 or unrated
<b>Securitisation exposures</b>	1.6%	4%	8%	28%	Deduction
<b>Resecuritisation exposures</b>	3.2%	8%	18%	52%	Deduction

712(v). The specific risk capital charges for rated positions covered under the internal ratings-based approach for securitisation exposures are defined in the table below. For positions with long-term ratings of B+ and below and short-term ratings other than A-1/P-1, A-2/P-2, A-3/P-3, deduction from capital as defined in paragraph 561 is required. The operational requirements for the recognition of external credit assessments outlined in paragraph 565 apply.

- (a) For securitisation exposures, banks may apply the capital charges defined in the table below for senior granular positions if the effective number of underlying exposures (N, as defined in paragraph 633) is 6 or more and the position is senior as defined in paragraph 613. When N is less than 6, the capital charges for non-granular securitisation exposures of the table below apply. In all other cases, the capital charges for non-senior granular securitisation exposures of the table below apply.
- (b) Resecuritisation exposures as defined in paragraph 541(i) are subject to specific risk capital charges depending on whether or not the exposure is senior as defined in paragraph 613.

### Specific risk capital charges based on external credit ratings

External rating (illustrative)	Securitisation exposures			Resecuritisation exposures	
	Senior, granular	Non-senior, granular	Non-granular	Senior	Non-senior
AAA/A-1/P-1	0.56%	0.96%	1.60%	1.60%	2.40%
AA	0.64%	1.20%	2.00%	2.00%	3.20%
A+	0.80%	1.44%	2.80%	2.80%	4.00%
A/A-2/P-2	0.96%	1.60%		3.20%	5.20%
A-	1.60%	2.80%		4.80%	8.00%
BBB+	2.80%	4.00%		8.00%	12.00%
BBB/A-3/P-3	4.80%	6.00%		12.00%	18.00%
BBB-	8.00%			16.00%	28.00%
BB+	20.00%			24.00%	40.00%
BB	34.00%			40.00%	52.00%
BB-	52.00%			60.00%	68.00%
Below BB-/A-3/P-3	Deduction				

712(vi). The specific risk capital charges for unrated positions covered under the securitisation framework as defined in paragraphs 538 to 542 will be calculated as set out below, subject to supervisory approval.

- (a) If a bank has approval for the internal ratings-based approach for the asset classes which include the underlying exposures, the bank may apply the supervisory formula approach (paragraphs 623 to 636). When estimating PDs and LGDs for calculating  $K_{IRB}$ , the bank must meet the minimum requirements for the IRB approach.
- (b) To the extent that a bank has approval to apply the internally developed approach referred to in paragraph 718(Lxxxvii-1-) to the underlying exposures and the bank derives estimates for PDs and LGDs from the internally developed approach specified in paragraphs 718(xcii) and 718(xciii) that are in line with the quantitative standards for the internal ratings-based approach, the bank may use these estimates for calculating  $K_{IRB}$  and, consequently, for applying the supervisory formula approach (paragraphs 623 to 636).
- (c) In all other cases the capital charge can be calculated as 8% of the weighted-average risk weight that would be applied to the securitised exposures under the standardised approach, multiplied by a concentration ratio. If the concentration ratio is 12.5 or higher the position has to be deducted from capital as defined in paragraph 561. This concentration ratio is equal to the sum of the nominal amounts of all the tranches divided by the sum of the nominal amounts of the tranches junior to or pari passu with the tranche in which the position is held including that tranche itself.

The resulting specific risk capital charge must not be lower than any specific risk capital charge applicable to a rated more senior tranche. If a bank is unable to determine the specific risk capital charge as described above or prefers not to apply the treatment described above to a position, it must deduct that position from capital.

712(vii). A position subject to deduction according to paragraph 712(iv) to 712(vi) may be excluded from the calculation of the capital charge for general market risk whether the bank applies the standardised measurement method or the internal models method for the calculation of its general market risk capital charge.

*Limitation of the specific risk capital charge to the maximum possible loss*

712(viii). Banks may limit the capital charge for an individual position in a credit derivative or securitisation instrument to the maximum possible loss. For a short risk position this limit could be calculated as a change in value due to the underlying names immediately becoming default risk-free. For a long risk position, the maximum possible loss could be calculated as the change in value in the event that all the underlying names were to default with zero recoveries. The maximum possible loss must be calculated for each individual position.

19. Paragraph 718 of the Basel II Framework will be replaced as follows.

718. 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.

- (a) The capital charge for specific risk for a first-to-default credit derivative is the lesser of (1) the sum of the specific risk capital charges for the individual reference credit instruments in the basket, and (2) the maximum possible credit event payment under the contract. 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 charge for specific risk for the reference credit instrument and that part of the capital charge 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 charge.
- (b) The capital charge for specific risk for an n-th-to-default credit derivative with n greater than one is the lesser of (1) the sum of the specific risk capital charges for the individual reference credit instruments in the basket but disregarding the (n-1) obligations with the lowest specific risk capital charges; and (2) 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 charge for specific risk with any underlying reference credit instrument is allowed.
- (c) If a first or other n-th-to-default credit derivative is externally rated, then the protection seller must calculate the specific risk capital charge using the rating of the derivative and apply the respective securitisation risk weights as specified in paragraphs 712(iv) or 712(v), as applicable.
- (d) The capital charge against each net n-th-to-default credit derivative position applies irrespective of whether the bank has a long or short position, i.e. obtains or provides protection.

20. Paragraph 718(xxi) with regard to the specific risk capital charge for equities of the Basel II Framework will be changed as follows. Changed wording is underlined.

718(xxi). The capital charge for *specific risk and for general market risk will each be 8%, ~~unless the portfolio is both liquid and well diversified, in which case the charge will be 4%. Given the different characteristics of national markets in terms of marketability and concentration, national authorities will have discretion to determine the criteria for liquid and diversified portfolios. The general market risk charge will be 8%.~~*

## V. Changes to the internal models approach to market risk

21. Section VI.D of Part 2 of the Basel II Framework outlining the internal models approach to market risk will be changed as follows. Changed wording is underlined. The original footnote numbers of the Basel II Framework are provided in brackets.

### 1. General criteria

718(LXX). 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.

718(LXXi). The supervisory authority will only give its approval if at a minimum:

- It is satisfied that the bank's risk management system is conceptually sound and is implemented with integrity;
- 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;
- The bank's models have in the supervisory authority's judgement a proven track record of reasonable accuracy in measuring risk;
- The bank regularly conducts stress tests along the lines discussed in paragraphs 718(LXXvii) to 718(LXXXiv) below.

718(LXXii). 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.

718(LXXiii). In addition to these general criteria, banks using internal models for capital purposes will be subject to the requirements detailed in paragraphs 718(LXXiv) to 718(xcix).

### 2. Qualitative standards

718(LXXiv). 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 paragraph 718(Lxxvi) (j) below. 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:

- (a) 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.
- (b) The unit should conduct a regular back-testing programme, i.e. 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.
- (c) The unit should also conduct the initial and on-going validation of the internal model.<sup>8</sup>
- (d) 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.<sup>9</sup> 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.
- (e) 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.
- (f) 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.
- (g) A routine and rigorous programme of stress testing<sup>10</sup> 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 (e.g. by hedging against that outcome or reducing the size of the bank's exposures, or increasing capital).

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<sup>8</sup> [159] Further guidance regarding the standards that supervisory authorities will expect can be found in paragraph 718(xcix).

<sup>9</sup> [160] The report, *Risk management guidelines for derivatives*, issued by the Basel Committee in July 1994 further discusses the responsibilities of the board of directors and senior management.

<sup>10</sup> [161] Though banks will have some discretion as to how they conduct stress tests, their supervisory authorities will wish to see that they follow the general lines set out in paragraphs 718(Lxxvii) to 718(Lxxxiii).



- (h) 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.
- (i) 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:
- The adequacy of the documentation of the risk management system and process;
  - The organisation of the risk control unit;
  - The integration of market risk measures into daily risk management;
  - The approval process for risk pricing models and valuation systems used by front and back-office personnel;
  - The validation of any significant change in the risk measurement process;
  - The scope of market risks captured by the risk measurement model;
  - The integrity of the management information system;
  - The accuracy and completeness of position data;
  - The verification of the consistency, timeliness and reliability of data sources used to run internal models, including the independence of such data sources;
  - The accuracy and appropriateness of volatility and correlation assumptions;
  - The accuracy of valuation and risk transformation calculations;
  - The verification of the model's accuracy through frequent back-testing as described in 718(LXXIV) (b) above and in the accompanying document: *Supervisory framework for the use of backtesting in conjunction with the internal models approach to market risk capital requirements*.

### **3. Specification of market risk factors**

718(LXXV). An important part of a bank's internal market risk measurement system is the specification of an appropriate set of market risk factors, i.e. 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.

- (a) 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 (e.g. mortgage-backed securities, tranch exposures or n-th-to-default credit derivatives), as well as correlation risk and basis risk (e.g. 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 (i.e. an equity index for a position in an individual stock).
- (b) 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.
- 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.
  - The risk measurement system must incorporate separate risk factors to capture spread risk (e.g. 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.
- (c) 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.
- (d) For equity prices, there should be risk factors corresponding to each of the equity markets in which the bank holds significant positions:

- At a minimum, there should be a risk factor that is designed to capture market-wide movements in equity prices (e.g. a market index). Positions in individual securities or in sector indices could be expressed in “beta-equivalents”<sup>11</sup> relative to this market-wide index;
  - 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<sup>49</sup> relative to the sector index;
  - The most extensive approach would be to have risk factors corresponding to the volatility of individual equity issues.
  - 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.
- (e) For commodity prices, there should be risk factors corresponding to each of the commodity markets in which the bank holds significant positions (also see paragraph 718(xLvi) above):
- 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);
  - For more active trading, the model must also take account of variation in the “convenience yield”<sup>12</sup> between derivatives positions such as forwards and swaps and cash positions in the commodity.

#### **4. Quantitative standards**

718(Lxxvi). 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 charge. Individual banks or their supervisory authorities will have discretion to apply stricter standards.

- (a) “Value-at-risk” must be computed on a daily basis.
- (b) In calculating the value-at-risk, a 99th percentile, one-tailed confidence interval is to be used.

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<sup>11</sup> [162] A “beta-equivalent” position would be calculated from a market model of equity price returns (such as the CAPM model) by regressing the return on the individual stock or sector index on the risk-free rate of return and the return on the market index.

<sup>12</sup> [163] The convenience yield reflects the benefits from direct ownership of the physical commodity (for example, the ability to profit from temporary market shortages), and is affected both by market conditions and by factors such as physical storage costs.

- (c) In calculating value-at-risk, an instantaneous price shock equivalent to a 10 day movement in prices is to be used, i.e. 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 718(Lxxvi) (h) below). A bank using this approach must periodically justify the reasonableness of its approach to the satisfaction of its supervisor.
- (d) 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).<sup>13</sup>
- (e) Banks ~~should~~must update their data sets no less frequently than once every ~~three~~ months and 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.
- (f) 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 paragraph 718(Lxxv), banks will be free to use models based, for example, on variance-covariance matrices, historical simulations, or Monte Carlo simulations.
- (g) Banks will have discretion to recognise empirical correlations within broad risk categories (e.g. 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.
- (h) 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:
- Banks’ models must capture the *non-linear price characteristics* of options positions;
  - 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, e.g. periodic simulations or stress testing;
  - 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, i.e. vega risk. Banks with relatively large and/or complex options portfolios should have detailed specifications of the relevant

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<sup>13</sup> A bank may calculate the value-at-risk estimate using a weighting scheme that is not fully consistent with (d) as long as that method results in a capital charge at least as conservative as that calculated according to (d).

volatilities. This means that banks should measure the volatilities of options positions broken down by different maturities.

- (i) In addition, a bank must calculate a ‘stressed value-at-risk’ 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.
- (j) As no particular model is prescribed under paragraph (f) above, 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<sup>14</sup> 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.
- (k) Each bank must meet, on a daily basis, a capital requirement expressed as the sum of:
- The higher of (1) its previous day’s value-at-risk number measured according to the parameters specified in this section ( $VaR_{t-1}$ ); and (2) 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-
- The higher of (1) its latest available stressed-value-at-risk number calculated according to (i) above ( $sVaR_{t-1}$ ); and (2) an average of the stressed value-at-risk numbers calculated according to (i) above over the preceding sixty business days ( $sVaR_{avg}$ ), multiplied by a multiplication factor ( $m_s$ ).

Therefore, the capital requirement (c) is calculated according to the following formula:

$$c = \max \{ VaR_{t-1}; m_c \cdot VaR_{avg} \} + \max \{ sVaR_{t-1}; m_s \cdot sVaR_{avg} \}$$

- (l) The multiplication factors  $m_c$  and  $m_s$  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 so-called “backtesting.” The backtesting results applicable for calculating the plus are

<sup>14</sup> 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.

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 paragraph 718(Lxxiv) above, the plus factor could be zero. ~~The~~ Annex 10a of this Framework 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 (i.e. using changes in portfolio value that would occur were end-of-day positions to remain unchanged), or actual trading (i.e. excluding fees, commissions, and net interest income) outcomes, or both.

- (m) Banks using models will also be subject to a capital charge to cover specific risk (as defined under the standardised approach for market risk) of interest rate related instruments and equity securities. The manner in which the specific risk capital charge is to be calculated is set out in paragraphs 718(Lxxxvii) to 718(xcviii).

## **5. Stress testing**

718(Lxxvii). 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.

718(Lxxviii). 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 (i.e. options and instruments that have options-like characteristics).

718(Lxxix). 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.

718(Lxxx). 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 turn below.

### *(i) Supervisory scenarios requiring no simulations by the bank*

718(Lxxxix). 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.

(ii) *Scenarios requiring a simulation by the bank*

718(Lxxxii). 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 (ERM) crises of 1992 and 1993 ~~or~~, 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. ~~The 1987 equity crash, the suspension of the ERM, or the fall in bond markets in the first quarter of 1994, for~~ 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.

(iii) *Scenarios developed by the bank itself to capture the specific characteristics of its portfolio.*

718(Lxxxiii). In addition to the scenarios prescribed by supervisory authorities under paragraphs 718(Lxxxii) and 718(Lxxxiii) above, a bank should also develop its own stress tests which it identifies as most adverse based on the characteristics of its portfolio (e.g. 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.

718(Lxxxiv). 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 (e.g. by hedging against that outcome or reducing the size of its exposures).

## **6. External validation**

718(Lxxxv). The validation of models' accuracy by external auditors and/or supervisory authorities should at a minimum include the following steps:

- (a) Verifying that the *internal validation processes* described in paragraph 718(Lxxxiv) (i) are operating in a satisfactory manner;
- (b) 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;
- (c) Checking that the *structure* of internal models is adequate with respect to the bank's activities and geographical coverage;

- (d) Checking the results of the banks' *back-testing* of its internal measurement system (i.e. 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;
- (e) 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.

## **7. Combination of internal models and the standardised methodology**

718(Lxxxvi). 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 (i.e. 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 a models-based approach, no specific time limit will be set for banks which use a combination of internal models and the standardised methodology to move to a comprehensive model. The following conditions will apply to banks using such combinations:

- (a) Each broad risk factor category must be assessed using a single approach (either internal models or the standardised approach), i.e. 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 paragraph 708(i) above);<sup>15</sup>
- (b) All the criteria laid down in paragraphs 718(Lxx) to 718(xcix) of this Framework will apply to the models being used;
- (c) 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;
- (d) No element of market risk may escape measurement, i.e. the exposure for all the various risk factors, whether calculated according to the standardised approach or internal models, would have to be captured;
- (e) The capital charges assessed under the standardised approach and under the models approach are to be aggregated according to the simple sum method.

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<sup>15</sup> [164] 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.



## 8. Treatment of specific risk

718(Lxxxvii). Where a bank has a VaR measure that incorporates specific risk from equity risk positions and where 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 paragraphs 718(Lxxxviii) to 718(xci-2-) below, the bank is not required to subject its equity positions to the capital charge according to the standardised measurement method as specified in paragraphs 718(xix) to 718(xxviii). ~~it may base its charge on modelled estimates, provided the measure is based on models that meet the additional criteria and requirements set out below. Banks which are unable to meet these additional criteria and requirements will be required to base their specific risk capital charge on the full amount of the specific risk charge calculated under the standardised method.~~

718(Lxxxvii-1-). 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 charge for specific risk, as specified in paragraphs 709(ii) to 718, when all of the following conditions hold:

- (a) The bank has a value-at-risk 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 paragraphs 718(Lxxxviii) to 718(xci-2-) below; and
- (b) 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 paragraphs 718(xcii) and 718(xciii) below.

The bank is allowed to include its securitisation exposures and n-th-to-default credit derivatives in its value-at-risk measure. Notwithstanding, it is still required to hold additional capital for these products according to the standardised measurement methodology, with the exceptions noted in paragraphs 718(xcv) to 718(xcviii) below.

718(Lxxxviii). 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<sup>16</sup> and be responsive to changes in market conditions and compositions of portfolios. In particular, the model must:

- explain the historical price variation in the portfolio;<sup>17</sup>
- capture concentrations (magnitude and changes in composition);<sup>18</sup>

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<sup>16</sup> Banks need not capture default and migration risks for positions subject to the incremental risk capital charge referred to in paragraphs 718(xcii) and 718(xciii).

<sup>17</sup> [165] 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.

- be robust to an adverse environment;<sup>19</sup>
- capture name-related basis risk;<sup>20</sup>
- capture event risk;<sup>21</sup>
- be validated through backtesting.<sup>22</sup>

718(Lxxxix). ~~(deleted) Where a bank is subject to event risk that is not reflected in its VaR measure, because it is beyond the 10-day holding period and 99 percent confidence interval (i.e. low probability and high severity events), banks must ensure that the impact of such events is factored in to its internal capital assessment, for example through its stress testing.~~

718(xc). 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.

718(xci). Further, as techniques and best practices evolve, banks should avail themselves of these advances.

718(xci-1). 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 sub-portfolios 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 (e.g. 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.

718(xci-2). 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

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<sup>18</sup> [166] The bank would be expected to demonstrate that the model is sensitive to changes in portfolio construction and that higher capital charges are attracted for portfolios that have increasing concentrations in particular names or sectors.

<sup>19</sup> [167] 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.

<sup>20</sup> [168] 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.

<sup>21</sup> [169] For equity positions, events that are reflected in large changes or jumps in prices must be captured, e.g. merger break-ups/takeovers. In particular, firms must consider issues related to survivorship bias.

<sup>22</sup> [170] Aimed at assessing whether specific risk, as well as general market risk, is being captured adequately.

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 Annex 10a of this Framework. 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.

718(xcii). In addition, the bank must have an approach in place to capture in its regulatory capital default risk and migration risk of in positions its subject to a capital charge for specific interest rate risk, with the exception of securitisation exposures and n-th-to-default credit derivatives, trading book positions that is are incremental to the risks captured by the VaR-based calculation as specified in paragraph 718(Lxxxviii) above (“incremental risks”). ~~To avoid double counting a bank may, when calculating its incremental default charge, take into account the extent to which default risk has already been incorporated into the VaR calculation, especially for risk positions that could and would be closed within 10 days in the event of adverse market conditions or other indications of deterioration in the credit environment.~~ No specific approach for capturing the incremental default risks is prescribed; it may be part of the bank’s internal model or a surcharge from a separate calculation. Where a bank captures its incremental risk through a surcharge, the surcharge will not be subject to a multiplier or regulatory backtesting, although the bank should be able to demonstrate that the surcharge meets its aim. The Committee provides guidelines to specify the positions and risks to be covered by this incremental risk capital charge.

718(xciii). ~~Whichever approach is used, t~~The bank must demonstrate that it the approach used to capture incremental risks meets a soundness standard comparable to that of the internal-ratings based approach for credit risk as set forth in this Framework, 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 default risks through an internally developed approach must use the specific risk capital charges under the standardised measurement method as set out in paragraphs 710 to 718 and 718(xxi) the fallback of calculating the surcharge through an approach consistent with that for credit risk as set forth in this Framework.

718(xciv). ~~(deleted) Whichever approach is used, cash or synthetic exposures that would be subject to a deduction treatment under the securitisation framework set forth in this Framework (e.g. equity tranches that absorb first losses),<sup>23</sup> as well as securitisation exposures that are unrated liquidity lines or letters of credit, would be subject to a capital charge that is no less than that set forth in the securitisation framework.~~

718(xcv). 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:

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<sup>23</sup> [171] These include risk equivalent positions, e.g. inventories of credit exposures that the bank intends to sell through cash securitisations and for which it has in place tranching credit protections so that it retains an exposure that would be subject to deduction under the securitisation framework.

- the cumulative risk arising from multiple defaults, including the ordering of defaults, in tranching products;
- credit spread risk, including the gamma and cross-gamma effects;
- volatility of implied correlations, including the cross effect between spreads and correlations;
- basis risk, including both
  - the basis between the spread of an index and those of its constituent single names; and
  - the basis between the implied correlation of an index and that of bespoke portfolios;
- recovery rate volatility, as it relates to the propensity for recovery rates to affect tranche prices; and
- 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.

The approach must meet all of the requirements specified in paragraphs 718(xciii), 718(xcvi) and 718(xcvii). This exception only applies to banks that are active in buying and selling these products. For the exposures that the bank does incorporate in this internally developed approach, the bank will be required to subject them to a capital charge equal to the higher of the capital charge according to this internally developed approach and 8% of the capital charge for specific risk according to the standardised measurement method. It will not be required to subject these exposures to the treatment according to paragraph 718(xciii). It must, however, incorporate them in both the value-at-risk and stressed value-at-risk measures.

~~An exception to this treatment could be afforded to banks that are dealers in the above exposures where they can demonstrate, in addition to trading intent, that a liquid two-way market exists for the securitisation exposures or, in the case of synthetic securitisations that rely solely on credit derivatives, for the securitisation exposures themselves or all their constituent risk components. For purposes of this section 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.~~

718(xcvi). For a bank to apply this exception, it must

- 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;
- Demonstrate (for example, through backtesting) that its risk measures can appropriately explain the historical price variation of these products; and
- 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. ~~The bank may also incorporate any position in this internally developed approach that are jointly managed with these positions.~~

~~Banks that already have received specific risk model recognition for particular portfolios or lines of business should agree a timetable with their supervisors to bring their model in line with the new standards in a timely manner as is practicable.~~

718(xcvii). In addition to these data and modelling criteria, 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 (i.e., the 'correlation trading portfolio'). These stress scenarios will examine the implications of stresses to (i) default rates, (ii) recovery rates, (iii) credit spreads, and (iv) correlations on the correlation trading desk's P&L. The bank must apply these stress scenarios at least weekly and report the results, including comparisons with the capital charges 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 charge against the correlation trading portfolio, to be added to the bank's internally modelled capital requirement.

718(xcviii). A bank must calculate the incremental risk measure according to paragraph 718(xcii) and the comprehensive risk measure according to paragraph 718(xcv) at least weekly, or more frequently as directed by its supervisor. The capital charge for incremental risk is given by a scaling factor of 1.0 times the maximum of (i) the average of the incremental risk measures over 12 weeks; and (ii) the most recent incremental risk measure. Likewise, the capital charge for comprehensive risk is given by a scaling factor of 1.0 times the maximum of (i) the average of the comprehensive risk measures over 12 weeks; and (ii) the most recent comprehensive risk measure. Both capital charges are added up. There will be no adjustment for double counting between the comprehensive risk measure and any other risk measures.

## **9. Model validation standards**

718(xcix). 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:

- (a) 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;

- (b) Further to the regulatory backtesting programmes, testing for model validation ~~should~~ must use ~~additional tests, which may include for instance: Testing carried out using~~ 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:
- Testing carried out for longer periods than required for the regular backtesting programme (e.g. 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;
  - Testing carried out using confidence intervals other than the 99 percent interval required under the quantitative standards;
  - Testing of portfolios below the overall bank level;
- (c) The use of hypothetical portfolios to ensure that the model is able to account for particular structural features that may arise, for example:
- Where data histories for a particular instrument do not meet the quantitative standards in paragraph 718(Lxxvi) 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;
  - Ensuring that material basis risks are adequately captured. This may include mismatches between long and short positions by maturity or by issuer;

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

## VI. Changes to the supervisory review process for market risk

22. In order to ensure consistency with the revised name of the incremental risk capital charge, paragraph 778(iv) of the Basel II Framework will be changed as follows. Changed wording is underlined.

778(iv). For banks wishing to model the specific risk arising from their trading activities, additional criteria have been set out ~~in paragraph 718(Lxxxix)~~, including conservatively assessing the risk arising from less liquid positions and/or positions with limited price transparency under realistic market scenarios. Where supervisors consider that limited liquidity or price transparency undermines the effectiveness of a bank's model to capture the specific risk, they will take appropriate measures, including requiring the exclusion of positions from the bank's specific risk model. Supervisors should review the adequacy of the bank's measure of the ~~default~~ incremental risk ~~sur~~capital charge; where the bank's approach is inadequate, the use of the standardised specific risk charges will be required.

## VII. Changes to the disclosure requirements for market risk

23. The disclosure requirements for market risk set out in Pillar 3, Section II.D.3, of Part 4 of the Basel II Framework (Tables 10 and 11) are amended as follows. Changed wording is underlined.

### 3. Market risk

Table 10

#### Market risk: disclosures for banks using the standardised approach<sup>24</sup>

<b>Qualitative disclosures</b>	(a)	The general qualitative disclosure requirement (paragraph 824) for market risk including the portfolios covered by the standardised approach.
<b>Quantitative disclosures</b>	(b)	The capital requirements for: <ul style="list-style-type: none"><li>• interest rate risk;<sup>25</sup></li><li>• equity position risk;</li><li>• foreign exchange risk; and</li><li>• commodity risk.</li></ul>

<sup>24</sup> The standardised approach here refers to the “standardised measurement method” as defined in Part 2, Section VI C.

<sup>25</sup> [Separate disclosures are required for the capital requirements on securitisation positions under Table 9.](#)

Table 11

**Market risk: disclosures for banks using the internal models approach (IMA) for trading portfolios**

<b>Qualitative disclosures</b>	(a)	The general qualitative disclosure requirement (paragraph 824) for market risk including the portfolios covered by the IMA. In addition, a discussion of the extent of and methodologies for compliance with the “Prudent valuation guidance” for positions held in the trading book (paragraphs 690 to 701).
	(b)	The discussion should include an articulation of the soundness standards on which the bank’s internal capital adequacy assessment is based. It should also include a description of the methodologies used to achieve a capital adequacy assessment that is consistent with the soundness standards.
	(c)	For each portfolio covered by the IMA: <ul style="list-style-type: none"> <li>• the characteristics of the models used;</li> <li>• a description of stress testing applied to the portfolio; and</li> <li>• a description of the approach used for backtesting/validating the accuracy and consistency of the internal models and modelling processes.</li> </ul>
	(d)	The scope of acceptance by the supervisor.
	(e)	<u>For the incremental risk capital charge and the comprehensive risk capital charge the methodologies used and the risks measured through the use of internal models. Included in the qualitative description should be:</u> <ul style="list-style-type: none"> <li>• <u>the approach used by the bank to determine liquidity horizons;</u></li> <li>• <u>the methodologies used to achieve a capital assessment that is consistent with the required soundness standard; and</u></li> <li>• <u>the approaches used in the validation of the models.</u></li> </ul>
<b>Quantitative disclosures</b>	(ef)	For trading portfolios under the IMA: <ul style="list-style-type: none"> <li>• The high, mean and low VaR values over the reporting period and period-end;</li> <li>• <u>The high, mean and low stressed VaR values over the reporting period and period-end;</u></li> <li>• <u>The high, mean and low incremental and comprehensive risk capital charges over the reporting period and period-end;</u> and</li> <li>• A comparison of VaR estimates with actual gains/losses experienced by the bank, with analysis of important “outliers” in backtest results.</li> </ul>



## VIII. Treatment for illiquid positions

24. Section VI.A.2 of Part 2 of the Basel II Framework outlining the prudent valuation guidance will be moved to a new Section VII since the scope has been expanded from positions in the trading book to all positions that are accounted for at fair value, whether they are in the trading book or in the banking book. This captures the original objective of the requirement which was defined when only instruments in the trading book were accounted for at fair value. The paragraphs are changed as follows. Changed wording compared to the previous paragraphs 690 to 699 is underlined.

## VII. Treatment for illiquid positions

### A. Prudent valuation guidance

718(c). This section provides banks with guidance on prudent valuation for positions that are accounted for at fair value, whether they are in the trading book or in the banking book. This guidance is especially important for positions without actual market prices or observable inputs to valuation, as well as less liquid positions which, ~~although they will not be excluded from the trading book solely on grounds of lesser liquidity,~~ raise supervisory concerns about prudent valuation. The valuation guidance set forth below is not intended to require banks to change valuation procedures for financial reporting purposes. Supervisors should assess a bank's valuation procedures for consistency with this guidance. One factor in a supervisor's assessment of whether a bank must take a valuation adjustment for regulatory purposes under paragraphs 718(cx) to 718(cxii) should be the degree of consistency between the bank's valuation procedures and these guidelines.

718(ci). A framework for prudent valuation practices should at a minimum include the following:

#### 1. Systems and controls

718(cii). Banks must establish and maintain adequate systems and controls sufficient to give management and supervisors the confidence that their valuation estimates are prudent and reliable. These systems must be integrated with other risk management systems within the organisation (such as credit analysis). Such systems must include:

- Documented policies and procedures for the process of valuation. This includes clearly defined responsibilities of the various areas involved in the determination of the valuation, sources of market information and review of their appropriateness, guidelines for the use of unobservable inputs reflecting the bank's assumptions of what market participants would use in pricing the position, frequency of independent valuation, timing of closing prices, procedures for adjusting valuations, end of the month and ad-hoc verification procedures; and
- Clear and independent (ie independent of front office) reporting lines for the department accountable for the valuation process. The reporting line should ultimately be to a main board executive director.

## 2. Valuation methodologies

### **Marking to market**

718(ciii). Marking-to-market is at least the daily valuation of positions at readily available close out prices in orderly transactions that are sourced independently. Examples of readily available close out prices include exchange prices, screen prices, or quotes from several independent reputable brokers.

718(civ). Banks must mark-to-market as much as possible. The more prudent side of bid/offer ~~must-should~~ be used unless the institution is a significant market maker in a particular position type and it can close out at mid-market. Banks should maximise the use of relevant observable inputs and minimise the use of unobservable inputs when estimating fair value using a valuation technique. However, observable inputs or transactions may not be relevant, such as in a forced liquidation or distressed sale, or transactions may not be observable, such as when markets are inactive. In such cases, the observable data should be considered, but may not be determinative.

### **Marking to model**

718(cv). ~~Where-Only where~~ marking-to-market is not possible, should banks ~~may~~ mark-to-model, ~~but where~~ this ~~can-must~~ be demonstrated to be prudent. Marking-to-model is defined as any valuation which has to be benchmarked, extrapolated or otherwise calculated from a market input. When marking to model, an extra degree of conservatism is appropriate. Supervisory authorities will consider the following in assessing whether a mark-to-model valuation is prudent:

- Senior management should be aware of the elements of the trading book or of other fair-valued positions which are subject to mark to model and should understand the materiality of the uncertainty this creates in the reporting of the risk/performance of the business.
- Market inputs should be sourced, to the extent possible, in line with market prices (as discussed above). The appropriateness of the market inputs for the particular position being valued should be reviewed regularly.
- Where available, generally accepted valuation methodologies for particular products should be used as far as possible.
- Where the model is developed by the institution itself, it should be based on appropriate assumptions, which have been assessed and challenged by suitably qualified parties independent of the development process. The model should be developed or approved independently of the front office. It should be independently tested. This includes validating the mathematics, the assumptions and the software implementation.
- There should be formal change control procedures in place and a secure copy of the model should be held and periodically used to check valuations.
- Risk management should be aware of the weaknesses of the models used and how best to reflect those in the valuation output.

- The model should be subject to periodic review to determine the accuracy of its performance (eg assessing continued appropriateness of the assumptions, analysis of P&L versus risk factors, comparison of actual close out values to model outputs).
- Valuation adjustments should be made as appropriate, for example, to cover the uncertainty of the model valuation (see also valuation adjustments in [paragraphs](#) 718 (cviii) to 718 (cxii)).

### ***Independent price verification***

718(cvi). Independent price verification is distinct from daily mark-to-market. It is the process by which market prices or model inputs are regularly verified for accuracy. While daily marking-to-market may be performed by dealers, verification of market prices or model inputs should be performed by a unit independent of the dealing room, at least monthly (or, depending on the nature of the market/trading activity, more frequently). It need not be performed as frequently as daily mark-to-market, since the objective, ie independent, marking of positions should reveal any error or bias in pricing, which should result in the elimination of inaccurate daily marks.

718(cvii). Independent price verification entails a higher standard of accuracy in that the market prices or model inputs are used to determine profit and loss figures, whereas daily marks are used primarily for management reporting in between reporting dates. For independent price verification, where pricing sources are more subjective, eg only one available broker quote, prudent measures such as valuation adjustments may be appropriate.

### **3. Valuation adjustments ~~or reserves~~**

718(cviii). ~~Banks~~ As part of their procedures for marking to market, banks must establish and maintain procedures for considering valuation adjustments/~~reserves~~. Supervisory authorities expect banks using third-party valuations to consider whether valuation adjustments are necessary. Such considerations are also necessary when marking to model.

718(cix). Supervisory authorities expect the following valuation adjustments/~~reserves~~ to be formally considered at a minimum: unearned credit spreads, close-out costs, operational risks, early termination, investing and funding costs, and future administrative costs and, where appropriate, model risk.

## **B. Adjustment to the current valuation of less liquid positions for regulatory capital purposes**

718(cx). Banks must establish and maintain procedures for judging the necessity of and calculating an adjustment to the current valuation of less liquid positions for regulatory capital purposes. This adjustment may be in addition to any changes to the value of the position required for financial reporting purposes and should be designed to reflect the illiquidity of the position. Supervisory authorities expect banks to consider the need for an adjustment to a position's valuation to reflect current illiquidity whether the position is marked to market using market prices or observable inputs, third-party valuations or marked to model.

718(cxi). Bearing in mind that the underlying 10-day assumptions made about liquidity in the market risk capital charge in paragraph 718(lxxvi) (c) may not be consistent with the bank's ability to sell or hedge out less liquid positions under normal market conditions, where appropriate, banks must make downward valuation adjustments/reserves take an adjustment to the current valuation of these less liquid positions, and to review their continued appropriateness on an on-going basis. Reduced liquidity could may have arisen from market events. Additionally, close-out prices for concentrated positions and/or stale positions should be considered in establishing those valuation adjustments/reserves the adjustment. Banks must consider all relevant factors when determining the appropriateness of valuation adjustments/reserves the adjustment for less liquid positions. These factors may include, but are not limited to, the amount of time it would take to hedge out the position/risks within the position, the average volatility of bid/offer spreads, the availability of independent market quotes (number and identity of market makers), the average and volatility of trading volumes (including trading volumes during periods of market stress), market concentrations, the aging of positions, the extent to which valuation relies on marking-to-model, and the impact of other model risks not included in paragraph 718 (cx).

718(cxi-1-) For complex products including, but not limited to, securitisation exposures and n-th-to-default credit derivatives, banks must explicitly assess the need for valuation adjustments to reflect two forms of model risk: the model risk associated with using a possibly incorrect valuation methodology; and the risk associated with using unobservable (and possibly incorrect) calibration parameters in the valuation model.

718(cxii). Valuation adjustments/reserves The adjustment to the current valuation of less liquid positions made under paragraph 718 (cxi) must impact Tier 1 regulatory capital and may exceed those valuation adjustments made under financial reporting accounting standards and paragraphs 718 (cviii) and 718 (cix).

## Annex

### Stress testing guidance for the correlation trading portfolio

#### 1. Introduction

1. The *Revisions to the Basel II market risk framework* permit banks meeting certain conditions to calculate specific risk capital charges for the correlation trading portfolio (CTP) using a comprehensive risk modelling (CRM) approach. One of these conditions is that a bank using the CRM approach must conduct, at least weekly, a set of pre-determined stress tests for the CTP encompassing shocks to default rates, recovery rates, credit spreads, and correlations. This Annex provides guidance on the stress testing that should be undertaken to satisfy this requirement.

#### 2. Overview

2. The goal of the stress testing standards described below is to provide estimates of the mark-to-market (MTM) changes that would be experienced by the current 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 (CDS), 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.

#### 3. Prescribed stress tests

3. 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.

### **3.1 Historical reference periods**

4. 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 tranching credit products have exhibited very large, broad based increases or decreases. As described more fully in subsequent sections of this guidance, 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.

5. The specific historical reference periods are as follows:

- 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.
- Periods of sharply falling credit spreads
  - (d) 14 March 2008 through 13 June 2008;
  - (e) 12 March 2009 through 11 June 2009.

6. In the future, the Committee may modify the above historical reference periods, 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.

### **3.2 Historical stress tests**

7. 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.

8. 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.

### **3.3 Jumps to default**

9. 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 (7), 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.)

### 3.4 Additional technical guidance

10. Below, a given historical reference period is identified by its start date ( $t$ ) and end date ( $t+M$ ).

11. 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.

12. 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.

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

14. MTM values should be based on full portfolio revaluation (e.g., no delta approximations).

15. Stress tests should be performed under the following assumptions:

- (a) Portfolio positions are held static at their current levels (e.g., no recognition of dynamic hedging within the period).
- (b) All credit-related risk factors are instantaneously shocked.
- (c) Risk factors not directly related to credit risk (e.g., foreign exchange rates, commodity prices, risk-free term structures of interest rates, etc.) are fixed at current levels.
- (d) 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.

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

16. 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  $t+M$ .

#### **4. Internal stress testing**

17. In addition to the prescribed stress tests set forth above, banks applying the CRM 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.

18. 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.

19. 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 Section 3. 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 above.