Basel Committee
on Banking Supervision

STANDARDS

Minimum capital requirements for market risk

January 2016

BANK FOR INTERNATIONAL SETTLEMENTS

This publication is available on the BIS website (www.bis.org).

ISBN 978-92-9197-399-6 (print)

ISBN 978-92-9197-416-0 (online)

Minimum capital requirements for Market Risk

Contents

Minimum capital requirements for Market Risk

Executive Summary

This document sets out revised standards for minimum capital requirements for Market Risk by the Basel Committee on Banking Supervision ("the Committee"). The text herein is intended to replace the existing minimum capital requirements for market risk in the global regulatory framework, including amendments made after the June 2006 publication of *Basel II: International Convergence of Capital Measurement and Capital Standards - Comprehensive Version*.

Consistent with the policy rationales underpinning the Committee's three consultative papers on the *Fundamental Review of the Trading Book*,[1] the revised market risk framework consists of the following key enhancements:

- *A revised internal models-approach (IMA)*. The new approach introduces a more rigorous model approval process that enables supervisors to remove internal modelling permission for individual trading desks, more consistent identification and capitalisation of material risk factors across banks, and constraints on the capital-reducing effects of hedging and diversification.
- *A revised standardised approach (SA)*. The revisions fundamentally overhaul the standardised approach to make it sufficiently risk-sensitive to serve as a credible fallback for, as well as a floor to, the IMA, while still providing an appropriate standard for banks that do not require a sophisticated treatment for market risk.
- *A shift from Value-at-Risk (VaR) to an Expected Shortfall (ES) measure of risk under stress*. Use of ES will help to ensure a more prudent capture of "tail risk" and capital adequacy during periods of significant financial market stress.
- *Incorporation of the risk of market illiquidity*. Varying liquidity horizons are incorporated into the revised SA and IMA to mitigate the risk of a sudden and severe impairment of market liquidity across asset markets. These replace the static 10-day horizon assumed for all traded instruments under VaR in the current framework.
- *A revised boundary between the trading book and banking book*. Establishment of a more objective boundary will serve to reduce incentives to arbitrage between the regulatory banking and trading books, while still being aligned with banks' risk management practices.

Overview of the revised internal models approach for market risk

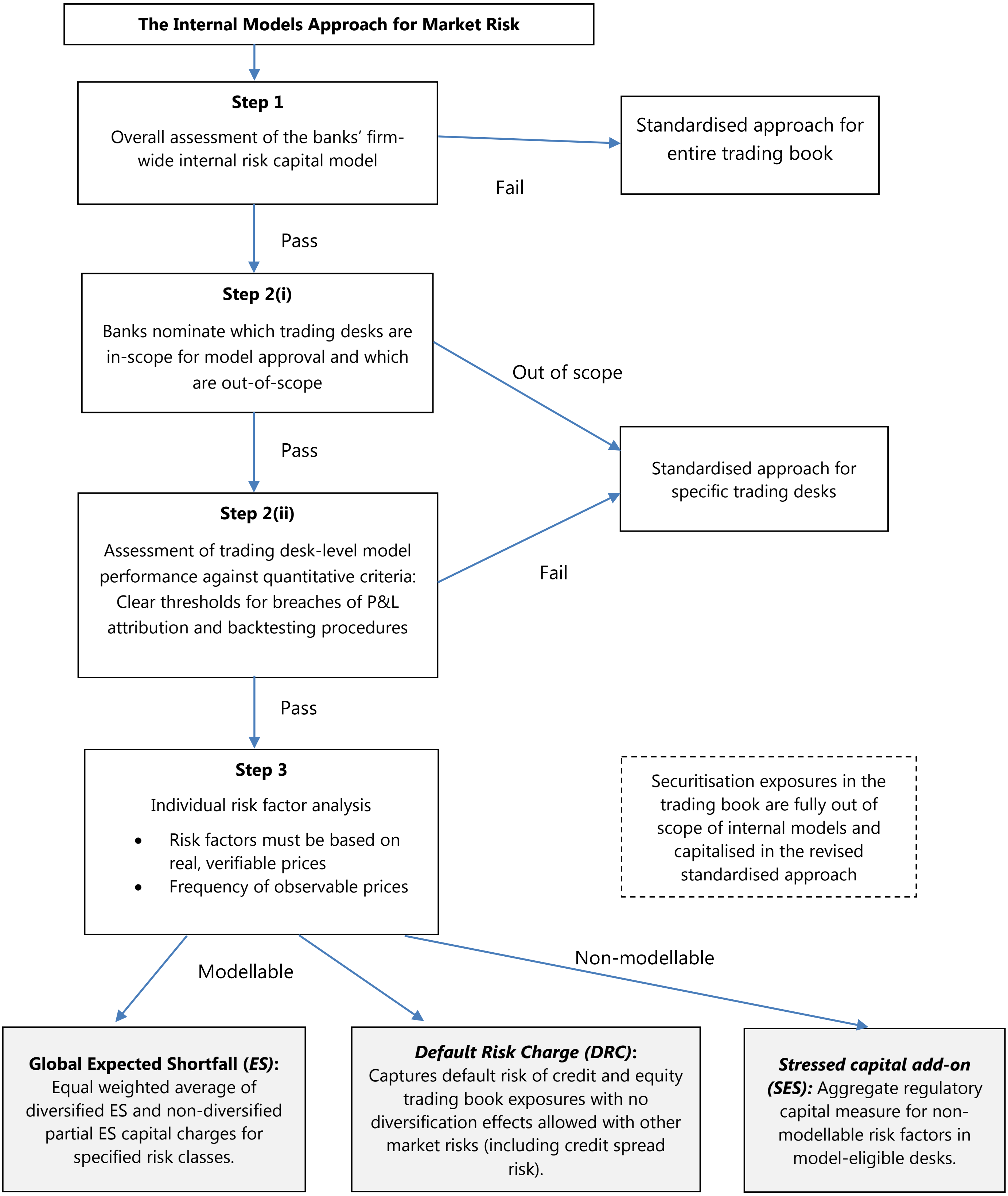
An illustration of the process and policy design of the internal models-based approaches (IMA) is set out in the diagram below. For a bank that has bank-wide internal model approval for capital requirements

[1] Basel Committee on Banking Supervision:

Fundamental review of the trading book, consultative document, May 2012, www.bis.org/publ/bcbs219.htm

Fundamental review of the trading book: A revised market risk framework, consultative document, October 2013, www.bis.org/publ/bcbs265.htm

Fundamental review of the trading book: Outstanding issues, consultative document, December 2014, www.bis.org/bcbs/publ/d305.htm for non-securitisations in the trading book, the total IMA capital requirement would be an aggregation of ES, the default risk charge (DRC) and stressed capital add-on (SES) for non-modellable risks.



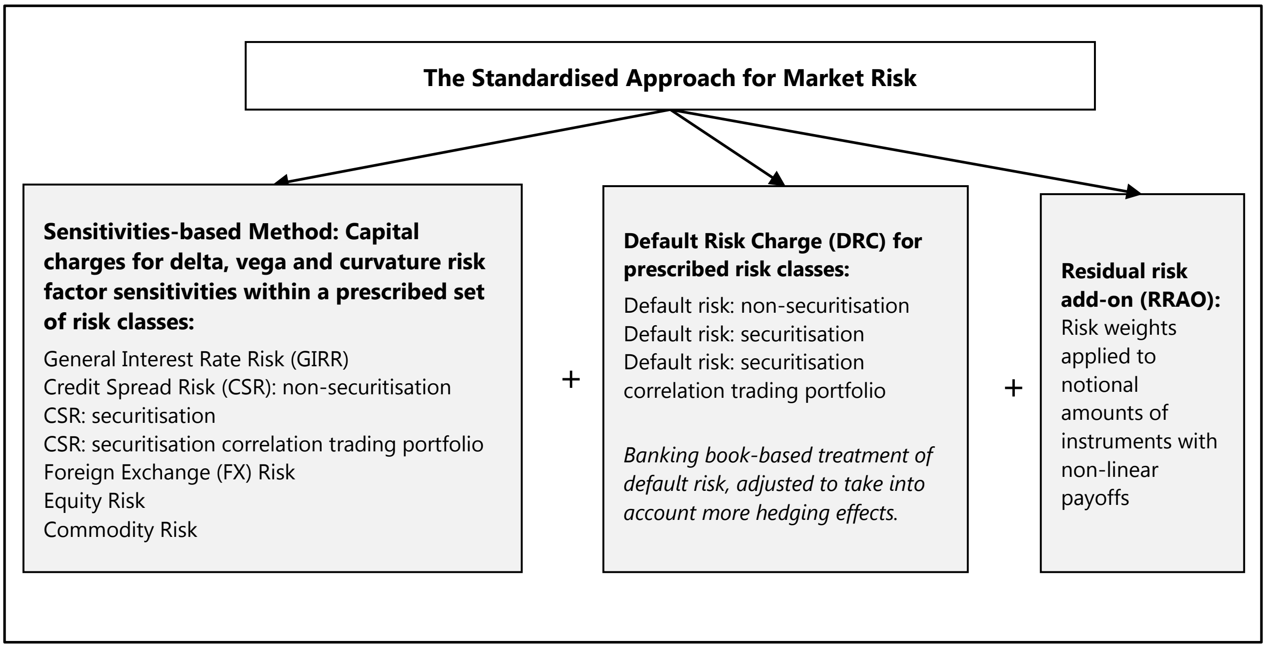
Overview of the revised standardised approach for market risk

The main components of the standardised capital requirement for non-securitisation and securitisation exposures in the trading book are outlined below.

The *Sensitivities based Method* builds on the elements of the former Standardised Measurement Method for market risk, which allowed for the use of sensitivities in some risk treatments within a risk class (eg the duration method for interest rate risk) and for certain instruments (eg the delta plus method for options). The Sensitivities based Method entails expanding the use of sensitivities across the standardised approach. The Committee believes that this sensitivities-based method creates a consistent and risk sensitive framework that can be applied uniformly across a wide spectrum of banks in different jurisdictions.

The standardised *Default Risk Charge* is calibrated to the credit risk treatment in the banking book to reduce the potential discrepancy in capital requirements for similar risk exposures across the banking book and trading book. As with the sensitivities based method, the Default Risk Charge allows for some limited hedging recognition.

The *Residual Risk Add-on* is introduced to capture any other risks beyond the main risk factors already captured in the sensitivities based method and the Default Risk Charge. It provides for a simple and conservative capital treatment for the universe of more sophisticated trading book instruments for which the Committee has refrained from detailed specification under the standardised approach, so as to limit excessive risk-taking and regulatory arbitrage incentives.



Overview of the revised boundary

The revised boundary treatment retains the link between the regulatory trading book and the set of instruments that banks generally hold for trading purposes. At the same time, it aims to address weaknesses previously seen in the boundary between the regulatory banking book and trading book by reducing the possibility of arbitrage across the two books and by providing more supervisory tools to help ensure more consistent implementation of the boundary across banks.

To develop a common understanding among supervisors regarding the types of instruments that would be included in the two books, the boundary treatment sets out guidance on which instruments must be included in the trading book or excluded from the trading book (owing to significant constraints on the ability of banks to liquidate these instruments and value them reliably on a daily basis), as well as on those instruments presumed to be included in the trading book. Supervisory oversight is provided for any deviations from this guidance and supervisors may initiate change from the trading book to the banking book or vice versa if an instrument is deemed to be improperly designated.

Capital arbitrage is mitigated by imposing strict limits on the movement of instruments between books, and, if the capital charge on an instrument or portfolio is reduced as a result of switching (in the rare instances where this is allowed), the difference in charges (measured at the point of the switch) is imposed on the bank as a fixed, additional disclosed Pillar 1 capital charge. Requirements for the treatment of internal risk transfers from the banking book to the trading book are clearly-defined for risk transfers of credit, equity and interest rate risk. Internal risk transfers from the trading book to the banking book are not recognised under the framework.

Implementation and monitoring

The Basel Committee will continue to monitor the impact of the capital requirements for market risk on banks as they move towards implementation, to ensure consistency in the overall calibration of the Pillar 1 capital framework (including credit risk, operational risk and market risk). Incentives for regulatory arbitrage between the trading book and the banking book will be assessed as further enhancements to the Pillar 1 capital framework are finalised. The revised internal model and standardised approaches, as well as the relationship between the two approaches, will be monitored by the Committee.

The Committee notes that it has underway several areas of ongoing work that may have an impact on the market risk capital requirements. In November 2015, the Committee issued a proposal for incorporating criteria for simple, transparent, and comparable securitisations into the Basel capital framework. Any final treatments in this regard will apply to both the banking book and the trading book and, thus, market risk capital standards for securitisations. The Committee also has outstanding a proposal on the application of the market risk framework to credit valuation adjustments (CVA). The finalised CVA standards will be incorporated into the framework, albeit on a stand-alone basis. In addition, other ongoing work to review the capital requirements for credit risk, treatment of sovereigns, and treatment of interest rate risk in the banking book may warrant periodic analysis on the calibration of capital requirements for the trading book. In addition, the Basel Committee will determine, as part of a broader review in 2016, whether any adjustments or exemptions to the existing Basel III threshold requirement for deductions of holdings of regulatory capital are warranted for certain bank activities (eg market-making) or instruments (eg TLAC holdings).

The Committee will continue to conduct further quantitative assessment on the profit and loss (P & L) attribution test required for the revised internal models approach. This will complement previous quantitative impact assessments to calibrate the P & L attribution test to a meaningful level. Appropriate calibration is important for this supervisory tool to ensure the robustness of banks' internal models at the trading desk level.

An important element of the Basel Capital Accord is the Pillar 3 disclosure standards. This document does not set out those requirements for market risk. Rather, these standards will be proposed for public consultation and finalised in a separate Basel Committee publication.

The transitional arrangements for the revised market risk framework are set out in the standards within this document. National supervisors are expected to finalise implementation of the revised market risk standards by January 2019, and to require their banks to report under the new standards by the end of 2019.

Minimum capital requirements for market risk

A. The boundary between the trading book and banking book and the scope of application of the minimum capital requirements for market risk

1. Scope of application and methods of measuring market risk

1. Market risk is defined as the risk of losses arising from movements in market prices. The risks subject to market risk capital charges include but are not limited to:

(a) Default risk, interest rate risk, credit spread risk, equity risk, foreign exchange risk and commodities risk for trading book instruments; and

(b) Foreign exchange risk and commodities risk for banking book instruments.

2. In determining its market risk for regulatory capital requirements, a bank may choose between two broad methodologies: the standardised approach and internal models approach for market risk, described in paragraphs 45 to 175 and 176 to 203, respectively, subject to the approval of the national authorities.

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

4. A matched currency risk position will protect a bank against loss from movements in exchange rates, but will not necessarily protect its capital adequacy ratio. If a bank has its capital denominated in its domestic currency and has a portfolio of foreign currency assets and liabilities that is completely matched, its capital/asset ratio will fall if the domestic currency depreciates. By running a short risk position in the domestic currency the bank can protect its capital adequacy ratio, although the risk position would lead to a loss if the domestic currency were to appreciate. Supervisory authorities are free to allow banks to protect their capital adequacy ratio in this way and exclude certain currency risk positions from the calculation of net open currency risk positions, subject to meeting each of the following conditions:

(a) The risk position is taken for the purpose of hedging partially or totally against the potential that changes in exchange rates could have an adverse effect on its capital ratio;

(b) The exclusion is limited to the maximum of:

- the amount of investments in affiliated but not consolidated entities denominated in foreign currencies; and/or
- the amount of investments in consolidated subsidiaries denominated in foreign currencies.

(c) The exclusion from the calculation is made for at least six months;

(d) Any changes in the amount are pre-approved by the national supervisor;

(e) Any exclusion of the risk position needs to be applied consistently, with the exclusionary treatment of the hedge remaining in place for the life of the assets or other items; and

(f) The bank is subject to a requirement by the national supervisor to document and have available for supervisory review the positions and amounts to be excluded from market risk capital requirements.

5. Holdings of the bank's own eligible regulatory capital instruments are deducted from capital. Holdings of other banks', securities firms', and other financial entities' eligible regulatory capital instruments, as well as intangible assets, will receive the same treatment as that set down by the national supervisor for such assets held in the banking book, which in many cases is deduction from capital. Where a bank demonstrates that it is an active market-maker, then a national supervisor may establish a dealer exception for holdings of other banks', securities firms', and other financial entities' capital instruments in the trading book. In order to qualify for the dealer exception, the bank must have adequate systems and controls surrounding the trading of financial institutions' eligible regulatory capital instruments. Holdings of capital instruments that are deducted or risk-weighted at 1250% are not allowed to be included in the market risk framework. The market-maker/dealer exemption set out in this paragraph is subject to change by the Basel Committee. The Basel III definition of capital requires banks to deduct their holdings of regulatory capital, subject to a threshold, but does not include an exemption for market-makers. The Basel Committee will determine, as part of a broader review, whether any adjustments or exemptions to the existing threshold requirement are warranted for certain bank activities or instruments (eg TLAC holdings).

6. In the same way as for credit risk and operational risk, the capital requirements for market risk apply on a worldwide consolidated basis. Supervisory authorities may permit banking and financial entities in a group which is running a global consolidated trading book and whose capital is being assessed on a global basis to include just the net short and net long risk positions no matter where they are booked.[2] Supervisory authorities may grant this treatment only when the revised standardised approach permits a full offset of the risk position (ie risk positions of opposite sign do not attract a capital charge). Nonetheless, there will be circumstances in which supervisory authorities demand that the individual risk positions be taken into the measurement system without any offsetting or netting against risk positions in the remainder of the group. This may be needed, for example, where there are obstacles to the quick repatriation of profits from a foreign subsidiary or where there are legal and procedural difficulties in carrying out the timely management of risks on a consolidated basis. Moreover, all supervisory authorities will retain the right to continue to monitor the market risks of individual entities on a non-consolidated basis to ensure that significant imbalances within a group do not escape supervision. Supervisory authorities will be especially vigilant in ensuring that banks do not conceal risk positions on reporting dates in such a way as to escape measurement.

7. The Committee does not believe that it is necessary to allow any *de minimis* exemptions from the capital requirements for market risk, except for those for foreign exchange risk set out in paragraph 4, because the Basel Framework applies only to internationally active banks, and then essentially on a consolidated basis; all of these banks are likely to be involved in trading to some extent.

2. Definition of the trading book

8. A trading book consists of all instruments that meet the specifications below ("trading book instruments").

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

9. Instruments comprise financial instruments, foreign exchange, and commodities. A financial instrument is any contract that gives rise to both a financial asset of one entity and a financial liability or equity instrument of another entity. Financial instruments include both primary financial instruments (or cash instruments) and derivative financial instruments. A financial asset is any asset that is cash, the right to receive cash or another financial asset or a commodity, or an equity instrument. A financial liability is the contractual obligation to deliver cash or another financial asset or a commodity. Commodities also include non-tangible (ie non-physical) goods such as electric power.

10. Banks may only include a financial instrument, foreign exchange, or a commodity in the trading book when there is no legal impediment against selling or fully hedging it.

11. Banks must fair-value daily any trading book instrument and recognise any valuation change in the profit and loss (P&L) account.

Standards for assigning instruments to the trading book

12. Any instrument a bank holds for one or more of the following purposes must be designated as a trading book instrument:

(a) short-term resale;

(b) profiting from short-term price movements;

(c) locking in arbitrage profits;

(d) hedging risks that arise from instruments meeting criteria (a), (b) or (c) above.

13. Any of the following instruments is seen as being held for at least one of the purposes listed in paragraph 12 and therefore must be included in the trading book:

(a) instrument in the correlation trading portfolio;

(b) instrument that is managed on a trading desk as defined by the criteria set out in paragraphs 22 to 26;

(c) instrument giving rise to a net short credit or equity position in the banking book;[3]

(d) instruments resulting from underwriting commitments.

14. Any instrument which is not held for any of the purposes listed in paragraph 12 at inception, nor seen as being held for these purposes according to paragraph 13, must be assigned to the banking book.

15. The following instruments must be assigned to the banking book, unless specifically provided otherwise in this framework:

(a) unlisted equities;

(b) instrument designated for securitisation warehousing;

(c) real estate holdings;

(d) retail and SME credit;

3 A bank will have a net short risk position for equity risk or credit risk in the banking book if the present value of the banking book increases when an equity price decreases or when a credit spread on an issuer or group of issuers of debt increases.

(e) equity investments in a fund, including but not limited to hedge funds, in which the bank cannot look through the fund daily or where the bank cannot obtain daily real prices for its equity investment in the fund;

(f) derivative instruments that have the above instrument types as underlying assets; or

(g) instruments held for the purpose of hedging a particular risk of a position in the types of instrument above.

16. There is a general presumption that any of the following instruments are being held for at least one of the purposes listed in paragraph 12 and therefore are trading book instruments, unless banks are allowed to deviate from the presumption according to the process in paragraph 17:[4]

(a) instruments held as accounting trading assets or liabilities;[5]

(b) instruments resulting from market-making activities;

(c) equity investment in a fund excluding paragraph 15(e);

(d) listed equities;[6]

(e) trading-related repo-style transaction; or

(f) options including bifurcated embedded derivatives[7] from instruments issued out of the banking book that relate to credit or equity risk.

17. If a bank believes that it needs to deviate from the presumptive list established in paragraph 16 for an instrument, it must submit a request to its supervisor and receive explicit approval. In its request, the bank must provide evidence that the instrument is not held for any of the purposes in paragraph 12. In cases where this approval is not given by the supervisor, the instrument must be designated as a trading book instrument. Banks must document any deviations from the presumptive list in detail on an on-going basis.

Supervisory powers

18. Notwithstanding the process established in paragraph 17 for instruments on the presumptive list, the supervisor may require the bank to provide evidence that an instrument in the trading book is held for at least one of the purposes of paragraph 12. If the supervisor is of the view that a bank has not provided enough evidence or if the supervisor believes the instrument customarily would belong in the banking book, it may require the bank to assign the instrument to the banking book, except if it is an instrument listed under paragraph 13.

4 The presumptions for designation of an instrument to the trading book or banking book set out in this text will be used where a designation of an instrument to the trading book or banking book is not otherwise specified in this text.

5 Under IFRS (IAS 39) and US GAAP, these instruments would be designated as "held for trading". Under IFRS 9, these instruments would be held within a trading business model. These instruments would be fair valued though the profit and loss (P&L) account.

6 Subject to supervisory review, certain listed equities may be excluded from the market risk framework. Examples of equities that may be excluded include, but are not limited to, equity positions arising from deferred compensation plans, convertible debt securities, loan products with interest paid in the form of "equity kickers", equities taken as a debt previously contracted, bank-owned life insurance products, and legislated programmes. The set of listed equities that the bank wishes to exclude from the market risk framework should be made available to, and discussed with, the national supervisor and should be managed by a desk that is separate from desks for proprietary or short-term buy/sell instruments.

7 The bifurcated derivative associated with the issued instrument should be recognised on the bank's balance sheet for accounting purposes.

19. The supervisor may require the bank to provide evidence that an instrument in the banking book is not held for any of the purposes of paragraph 12. If the supervisor is of the view that a bank has not provided enough evidence, or if the supervisor believes such instruments would customarily belong in the trading book, it may require the bank to assign the instrument to the trading book, except if it is an instrument listed under paragraph 15.

Documentation of instrument designation

20. A bank must have clearly defined policies, procedures and documented practices for determining which instruments to include in or to exclude from the trading book for purposes of calculating their regulatory capital, ensuring compliance with the criteria set forth in this section, and taking into account the bank's risk management capabilities and practices. A bank's internal control functions must conduct an ongoing evaluation of instruments both in and out of the trading book to assess whether its instruments are being properly designated initially as trading or non-trading instruments in the context of the bank's trading activities. Compliance with the policies and procedures must be fully documented and subject to periodic (at least yearly) internal audit and the results must be available for supervisory review.

3. Risk management policies for trading book instruments

21. Trading book instruments must be subject to clearly defined policies and procedures, approved by senior management, that are aimed at ensuring active risk management. The application of the policies and procedures must be thoroughly documented. Guidelines on the activities that are covered by these policies and procedures are set out in *Supervisory Review Process – The Second Pillar*.

4. Definition of trading desk

22. For the purposes of market risk capital calculations, a trading desk is a group of traders or trading accounts that implements a well-defined business strategy operating within a clear risk management structure.

23. Trading desks are defined by the bank but subject to the regulatory approval of the supervisor for capital purposes. Within this supervisory-approved desk structure, banks may further define operational sub-desks without the need for supervisory approval. These sub-desks would be for internal operational purposes only and would not be used in the market risk capital framework.

24. The key attributes of a trading desk are as follows:

(a) A trading desk for the purposes of the regulatory capital charge is an unambiguously defined group of traders or trading accounts. Each individual trader or trading account must be assigned to only one trading desk.

(b) The desk must have a clear reporting line to senior management and must have a clear and formal compensation policy linked to its pre-established objectives.

(c) A trading desk must have a well-defined and documented business strategy, including an annual budget and regular management information reports (including revenue, costs and risk-weighted assets).

(d) A trading desk must have a clear risk management structure. This must include clearly defined trading limits based on the business strategy of the desk. The desk must also produce, at least weekly, appropriate risk management reports. This would include, at a minimum, profit and loss reports and internal and regulatory risk measurement reports.

Further detail on the definition of a trading desk for regulatory capital purposes is provided in Appendix A.

25. The bank must prepare, evaluate, and have available for supervisors the following for all trading desks:

(a) Inventory ageing reports;

(b) Daily limit reports including exposures, limit breaches, and follow-up action;

(c) Reports on intraday limits and respective utilisation and breaches for banks with active intraday trading; and

(d) Reports on the assessment of market liquidity.

26. Any foreign exchange or commodity positions held in the banking book must be included in the market risk charges. For regulatory capital calculation purposes, these positions will be treated as if they were held on notional trading desks within the trading book.

5. Restrictions on moving instruments between the regulatory books

27. There is a strict limit on the ability of banks to move instruments between the trading book and the banking book by their own choice after initial designation, which is subject to the process in paragraphs 28 to 29. Switching instruments for regulatory arbitrage is strictly prohibited. In practice, switching should be rare and will be allowed by supervisors only in extraordinary circumstances. Possible examples could be a major publicly announced event, such as a bank restructuring that results in permanent closure of trading desks, requiring termination of the business activity applicable to the instrument or portfolio or a change in accounting standards that allows an item to be fair-valued through the P&L. Market events, changes in the liquidity of a financial instrument, or a change of trading intent alone are not valid reasons for re-designating an instrument to a different book. When switching positions, banks must ensure that the standards in paragraphs 12 to 17 are always strictly observed.

28. Without exception, a capital benefit as a result of switching will not be allowed in any case or circumstance. This means that the bank must determine its total capital charge (across banking book and trading book) before and immediately after the switch. If this capital charge is reduced as a result of this switch, the difference as measured at the time of the switch will be imposed on the bank as a disclosed Pillar 1 capital surcharge. This surcharge will be allowed to run off as the positions mature or expire, in a manner agreed with the supervisor. To maintain operational simplicity, it is not envisaged that this additional charge would be recalculated on an ongoing basis although the positions would continue to also be subject to the ongoing capital requirements of the book into which they have been switched.

29. Any re-designation between books must be approved by senior management, thoroughly documented, determined by internal review to be in compliance with the bank's policies; subject to prior approval by the supervisor based on supporting documentation provided by the bank; and publicly disclosed. Any such re-designation is irrevocable. If an instrument is reclassified to be an accounting trading asset or liability there is a presumption that this instrument is in the trading book, as described in paragraph 16(a). Accordingly, in this case an automatic switch without approval of the supervisor is acceptable.

30. A bank must adopt relevant policies that must be updated at least yearly. Updates should be based on an analysis of all extraordinary events identified during the previous year. Updated policies with changes highlighted must be sent to the appropriate supervisor. Policies must include the following:

(a) The re-designation restriction requirements in paragraphs 27 to 29, especially the restriction that re-designation between the trading book and banking book may only be allowed in extraordinary circumstances, and a description of the circumstances or criteria where such a switch may be considered.

(b) The process for obtaining senior management and supervisory approval of such a transfer.

(c) How a bank identifies an extraordinary event.

(d) A requirement that re-designations into or out of the trading book be publicly disclosed at the earliest reporting date.

6. Treatment of internal risk transfers

31. An internal risk transfer is an internal written record of a transfer of risk within the banking book, between the banking and the trading book or within the trading book (between different desks).

32. There will be no regulatory capital recognition for internal risk transfers from the trading book to the banking book. Thus, if a bank engages in an internal risk transfer from the trading book to the banking book (eg for economic reasons) this internal risk transfer would not be taken into account when the regulatory capital requirements are determined.

33. For internal risk transfers from the banking book to the trading book paragraphs 34 to 36 apply.

34. When a bank hedges a banking book credit risk exposure using an internal risk transfer with the trading book, the banking book exposure is not deemed to be hedged for capital purposes unless:

(a) The trading book enters into an external hedge with an eligible third-party protection provider that exactly matches the internal risk transfer; and

(b) The external hedge meets the requirements of paragraphs 191 to 194 of the Basel II Framework vis-à-vis the banking book exposure.[8]

Where the requirements in paragraphs 34(a) and 34(b) hereinabove are fulfilled the banking book exposure is deemed to be hedged by the banking book leg of the internal risk transfer for capital purposes in the banking book. Moreover both the trading book leg of the internal risk transfer and the external hedge must be included in the market risk capital requirements.

Where the requirements in paragraphs 34(a) and 34(b) hereinabove are not fulfilled the banking book exposure is not deemed to be hedged by the banking book leg of the internal risk transfer for capital purposes in the banking book. Moreover the third-party external hedge must be fully included in the market risk capital requirements and the trading book leg of the internal risk transfer must be fully excluded from the market risk capital requirements.

A banking book short credit position created by an internal risk transfer[9] and not capitalised under banking book rules must be capitalised under the market risk rules together with the trading book exposure.

35. When a bank hedges a banking book equity risk exposure using a hedging instrument purchased from the market through its trading book, the banking book exposure is not deemed to be hedged for capital purposes unless:

8 With respect to paragraph 192 of the Basel II framework, the cap of 60% on a credit derivative without a restructuring obligation only applies with regard to recognition of credit risk mitigation of the banking book instrument for regulatory capital purposes and not with regard to the amount of the internal risk transfer.

9 Banking book instruments which are over-hedged by their respective documented internal risk transfer create a short (risk) position in the banking book.

(a) The trading book enters into an external hedge from an eligible third-party protection provider that exactly matches the internal risk transfer; and

(b) The external hedge is recognised as a hedge of a banking book equity exposure.

Where the requirements in paragraphs 35(a) and 35(b) hereinabove are fulfilled the banking book exposure is deemed to be hedged by the banking book leg of the internal risk transfer for capital purposes in the banking book. Moreover both the trading book leg of the internal risk transfer and the external hedge must be included in the market risk capital requirements.

Where the requirements in paragraphs 35(a) and 35(b) hereinabove are not fulfilled the banking book exposure is not deemed to be hedged by the banking book leg of the internal risk transfer for capital purposes in the banking book. Moreover the third-party external hedge must be fully included in the market risk capital requirements and the trading book leg of the internal risk transfer must be fully excluded from the market risk capital requirements.

A banking book short equity position created by an internal risk transfer and not capitalised under banking book standards must be capitalised under the market risk standards together with the trading book exposure.

36. When a bank hedges a banking book interest rate risk exposure using an internal risk transfer with its trading book, the trading book leg of the internal risk transfer is treated as a trading book instrument under the market risk framework if and only if:

(a) the internal risk transfer is documented with respect to the banking book interest rate risk being hedged and the sources of such risk;

(b) the internal risk transfer is conducted with a dedicated internal risk transfer trading desk which has been specifically approved by the supervisor for this purpose;

(c) the internal risk transfer must be subject to trading book capital requirements under the market risk framework on a stand-alone basis for the dedicated internal risk transfer desk, separate from any other GIRR or other market risks generated by activities in the trading book.

Where the requirements in paragraphs 36(a), 36(b) and 36(c) are fulfilled, the banking book leg of the internal risk transfer must be included in the banking book's measure of interest rate risk exposures for regulatory capital purposes.

The supervisor-approved internal risk transfer desk may include instruments purchased from the market (ie external parties to the bank). Such transactions may be executed directly between the internal risk transfer desk and the market. Alternatively, the internal risk transfer desk may obtain the external hedge from the market via a separate non- internal risk transfer trading desk acting as an agent, if and only if the GIRR internal risk transfer entered into with the non- internal risk transfer trading desk exactly matches the external hedge from the market. In this latter case the respective legs of the GIRR internal risk transfer are included in the internal risk transfer desk and the non- internal risk transfer desk.

37. Internal risk transfers between trading desks within the scope of application of the market risk charges (including foreign exchange risk and commodities risk in the banking book) will generally receive regulatory capital recognition. Internal risk transfers between the internal risk transfer desk and other trading desks will only receive regulatory capital recognition if the constraints in paragraph 36 are fulfilled.

38. The trading book leg of internal risk transfers must fulfil the same requirements as instruments in the trading book transacted with external counterparties.

39. Eligible hedges that are included in the credit valuation adjustment (CVA) capital charge must be removed from the bank's market risk charge calculation.

7. Treatment of counterparty credit risk in the trading book

40. Banks will be required to calculate the counterparty credit risk charge for OTC derivatives, repo-style and other transactions booked in the trading book, separate from the capital charge for general market risk. The risk weights to be used in this calculation must be consistent with those used for calculating the capital requirements in the banking book. Thus, banks using the standardised approach for credit risk in the banking book will use the standardised approach risk weights in the trading book and banks using the IRB approach in the banking book will use the internal ratings-based (IRB) risk weights in the trading book in a manner consistent with the IRB roll out situation in the banking book as described in paragraphs 256 to 262 of the Basel II Framework. For counterparties included in portfolios where the IRB approach is being used the IRB risk weights will be applied.

41. For repo-style transactions in the trading book, all instruments that are included in the trading book may be used as eligible collateral. Those instruments that fall outside the banking book definition of eligible collateral shall be subject to a haircut at the level applicable to non-main index equities listed on recognised exchanges as noted in paragraph 151 of Basel II Framework. However, banks that use their own estimates approach to haircutting may also apply it in the trading book in accordance with paragraphs 154 and 155 of the Basel II Framework. Consequently, for instruments that count as eligible collateral in the trading book, but not in the banking book, the haircuts must be calculated for each individual security. Banks that use a Value at Risk (VaR) approach to measure exposure for repo-style transactions may apply this approach in the trading book in accordance with paragraphs 178 to 181 (i) and Annex 4 of the Basel II Framework.

42. The calculation of the counterparty credit risk charge for collateralised OTC derivative transactions is the same as the rules prescribed for such transactions booked in the banking book.

43. The calculation of the counterparty charge for repo-style transactions will be conducted using the rules in paragraphs 147 to 181 (i) and Annex 4 of Basel II Framework spelt out for such transactions booked in the banking book. The firm-size adjustment for SMEs as set out in paragraph 273 of the Basel II Framework shall also be applicable in the trading book.

8. Transitional arrangements

44. The Basel Committee has agreed the following time-table for the implementation of the revised market risk framework:

- 1 January 2019: Deadline for revised market risk framework to be implemented as final rules under domestic legislation.
- 31 December 2019: Deadline for regulatory reporting by banks based on the revised market risk framework under the revised standardised approach or internal models approach, with use of the latter subject to the approval of the national authorities.

B. Market Risk – The Standardised Approach

1. General provisions

45. The standardised approach must be calculated by all banks and reported to their supervisor on a monthly basis.

46. A bank must determine its regulatory capital requirements for market risk according to the standardised approach for market risk at the demand of their supervisor.

2. Structure of the standardised approach

(i) Overview of the structure of the standardised approach

47. The standardised approach capital requirement is the simple sum of three components: the risk charges under the sensitivities based method, the default risk charge, and the residual risk add-on.

(a) The risk charge under the Sensitivities-based Method must be calculated by aggregating the following risk measures:

(i) *Delta*: A risk measure based on sensitivities of a bank's trading book to regulatory delta risk factors. Delta sensitivities are to be used as inputs into the aggregation formula which delivers the capital requirement for the Sensitivities-based method.

(ii) *Vega*: A risk measure that is also based on sensitivities to regulatory vega risk factors to be used as inputs to a similar aggregation formula as for Delta risks.

(iii) *Curvature*: A risk measure which captures the incremental risk not captured by the delta risk of price changes in the value of an option. Curvature risk is based on two stress scenarios involving an upward shock and a downward shock to a given risk factor. The worst loss of the two scenarios is the risk position (defined in paragraph 48) to be used as an input into the aggregation formula which delivers the capital charge.

(b) In order to address the risk that correlations may increase or decrease in periods of financial stress, three risk charge figures must be calculated for each risk class defined under the sensitivities based method (see paragraphs 54 to 55 for details), based on three different scenarios on the specified values for the correlation parameter ρ_{kl} (ie correlation between risk factors within a bucket) and γ_{bc} (ie correlation across buckets within a risk class). There must be no diversification benefit recognised between individual risk classes.

(c) The bank must determine each delta and vega sensitivity and curvature scenario based on instrument prices or pricing models that an independent risk control unit within a bank uses to report market risks or actual profits and losses to senior management.

(d) The default risk charge captures the jump-to-default risk in three independent capital charge computations for default risk of non-securitisations, securitisations (non-correlation trading portfolio) and securitisation correlation trading portfolio. It is calibrated based on the credit risk treatment in the banking book in order to reduce the potential discrepancy in capital requirements for similar risk exposures across the bank. Some hedging recognition is allowed within a risk weight bucket. There must be no diversification benefit recognised between different buckets.

(e) Additionally, the Committee acknowledges that not all market risks can be captured in the standardised approach, as this might necessitate an unduly complex regime. A residual risk add-on is thus introduced to ensure sufficient coverage of market risks.

(ii) Sensitivities-based Method: main definitions

48. The following definitions cover the main concepts of the standardised approach:

(a) Risk class: The seven risk classes defined for the Sensitivities-based Method are general interest rate risk, credit spread risk: non-securitisation, credit spread risk: securitisations (non-correlation trading portfolio), credit spread risk: securitisations (correlation trading portfolio), equity risk, commodity risk and foreign exchange risk (defined in Section 4).

(b) Risk factor: variables (eg a given vertex of a given interest rate curve or an equity price) within a pricing function decomposed from trading book instruments and which fall within scope of the risk factor definitions in Section 3. Risk factors are mapped to a risk class.

(c) Risk position: the main input that enters the risk charge computation. For delta and vega risks, it is a sensitivity to a risk factor. For curvature risk, it is the worst loss of two stress scenarios.

(d) Risk charge: the amount of capital that a bank should hold as a consequence of the risks it takes; it is computed as an aggregation of risk positions first at the bucket level, and then across buckets within a risk class defined for the Sensitivities-based Method.

(e) Bucket: a set of risk positions which are grouped together by common characteristics, as defined within Section 4, paragraphs 74 to 121.

(iii) Sensitivities-based Method: instruments subject to delta, vega and curvature

49. A key assumption of the standardised approach for market risk is that a bank's pricing model used in actual profit and loss reporting provide an appropriate basis for the determination of regulatory capital requirements for all market risks. To ensure such adequacy, banks must at a minimum establish a framework for prudent valuation practices that include the requirements of paragraph 718(c) to 718(cxii) of Basel II. Additionally:

(a) Each instrument with optionality[10] is subject to vega risk and curvature risk. Instruments without optionality are not subject to vega risk and curvature risk.

(b) An instrument with an embedded prepayment option[11] is an instrument with optionality according to paragraph 49(a). Accordingly, the embedded option is subject to vega and curvature risk with respect to the interest rate risk and credit spread risk (non-securitisation and securitisation) risk classes. When the prepayment option is a behavioural option the instrument may also be subject to the residual risk add-on as per paragraph 58. The pricing model of the bank must reflect such behavioural patterns where relevant. For securitisation tranches, instruments in the securitised portfolio may have embedded prepayment options as well. In this case the securitisation tranche may be subject to the residual risk add-on.

(c) Instruments whose cash flows can be written as a linear function of underlying notional are instruments without optionality (eg cash flows generated by a coupon bearing bond can be written as a linear function) are not subject to vega risk nor curvature risk charges. Similarly, the cash flows generated by a plain-vanilla option cannot be written as a linear function (as they are the maximum of the spot and the strike). Therefore all options are subject to vega risk and curvature risk.

(d) A non-exhaustive list of example instruments with optionality includes: calls, puts, caps, floors, swaptions, barrier options and exotic options.

(iv) Sensitivities-based Method: delta and vega

50. Delta and vega risks consist of a set of prescribed risk factors and sensitivities which are defined in Section 3. The *net sensitivities* for each risk factor within a risk class is multiplied by a respective risk weight provided in Section 4 and 5. These weighted sensitivities are then aggregated by prescribed formulae using correlations provided in Sections 4 and 5. This sub-section provides the aggregation

[10] For example, each instrument that is an option or that includes an option (eg an embedded option such as convertibility or rate dependent prepayment and that is subject to the capital requirements for market risk).

[11] An instrument with a prepayment option is a debt instrument which grants the debtor the right to repay part or the entire principal amount before the contractual maturity without having to compensate for any foregone interest. The debtor can exercise this option with a financial gain to can obtain funding over the remaining maturity of the instrument at a lower rate in other ways in the market.

formula for calculating the capital requirement within each bucket, as well as the formula for calculating the capital requirement across buckets, for each risk class that is covered under the delta and vega risk framework.

51. Delta and vega risks are computed using the same aggregation formulae on all relevant risk factors in the Sensitivities-based Method. However, delta and vega risks must be calculated separately, with no diversification benefit recognised between delta and vega risk factors. Delta and vega risks are captured using the same aggregation formulae through the following step-by-step approach:

(a) Find a net sensitivity s_k across instruments to each risk factor k (defined in Section 3). For instance, all sensitivities to the vertex 1 year of the swap curve Euribor 3 months should offset, irrespective of the instrument from which they derive.[12]

(b) The weighted sensitivity WS_k is the product of the net sensitivity s_k and the corresponding risk weight RW_k as defined in Sections 4 and 5 .

$$WS_k = RW_k s_k$$

(c) The risk position for Delta (respectively Vega) bucket b, K_b, must be determined by aggregating the weighted sensitivities to risk factors within the same bucket using the corresponding prescribed correlation ρ_{kl} set out in the following formula:

$$K_b = \sqrt{\sum_k WS_k^2 + \sum_k \sum_{k \neq l} \rho_{kl} WS_k WS_l}$$

where the quantity within the square root function is floored at zero.

(d) The Delta (respectively Vega) risk charge is determined from risk positions aggregated between the Delta (respectively Vega) buckets within each risk class, using the corresponding prescribed correlations γ_{bc} as set out in the following formula:

$$\text{Delta (respectively Vega)} = \sqrt{\sum_b K_b^2 + \sum_b \sum_{c \neq b} \gamma_{bc} S_b S_c}$$

where $S_b = \sum_k WS_k$ for all risk factors in bucket b and $S_c = \sum_k WS_k$ in bucket c.

If these values for S_b and S_c produce a negative number for the overall sum of $\sum_b K_b^2 + \sum_b \sum_{c \neq b} \gamma_{bc} S_b S_c$:

- The bank is to calculate the Delta (respectively Vega) risk charge using an alternative specification whereby $S_b = \max[\min(\sum_k WS_k, K_b), -K_b]$ for all risk factors in bucket b and $S_c = \max[\min(\sum_k WS_k, K_c), -K_c]$ for all risk factors in bucket c.

(v) Sensitivities-based Method: curvature

52. The curvature risk charge consists of a set of stress scenario on given risk factors which are defined in Section 3. Two stress scenarios are to be computed per risk factor (an upward shock and a downward shock) with the delta effect, already captured by the delta risk charge, being removed. The two scenarios are shocked by risk weights and the worst loss is aggregated by correlations provided in

[12] This example can be generalised as follows: if a bank's portfolio is made of two interest rate swaps on Euribor 3 months with the same fixed rate and same notional but of opposite direction, the general interest rate risk on that portfolio would be zero.

Section 6. The purpose of this subsection is to provide the aggregation formulae within buckets, and across buckets within a risk class.

53. The following step-by-step approach to capture curvature risk must be separately applied to each risk class (apart from default risk):

(a) Find a net curvature risk charge CVR_k across instruments to each curvature risk factor k. For instance, all vertices of all the curves within a given currency (eg Euribor 3 months, Euribor 6 months, Euribor 1 year, etc for Euro) must be shifted upward. The potential loss, after deduction of the delta risk positions, is the outcome of the first scenario. The same approach must be followed on a downward scenario. The worst loss (expressed as a positive quantity), after deduction of the delta risk position, is the curvature risk position for the considered risk factor. If the price of an option depends on several risk factors, the curvature risk is determined separately for each risk factor.

(b) The curvature risk charge for curvature risk factor *k* can be formally written as follows:

$$CVR_k = -\min\begin{bmatrix} \sum_i \left\{ V_i\left(x_k^{(RW^{(curvature)}+)}\right) - V_i(x_k) - RW_k^{(curvature)} \cdot s_{ik} \right\} \\ \sum_i \left\{ V_i\left(x_k^{(RW^{(curvature)}-)}\right) - V_i(x_k) + RW_k^{(curvature)} \cdot s_{ik} \right\} \end{bmatrix}$$

where:

- i is an instrument subject to curvature risks associated with risk factor *k*;
- x_k is the current levelof risk factor *k*;
- $V_i(x_k)$ is the price of instrument i depending on the current level of risk factor *k*;
- $V_i\left(x_k^{(RW^{(curvature)}+)}\right)$ and $V_i\left(x_k^{(RW^{(curvature)}-)}\right)$ both denote the price of instrument i after x_k is shifted (ie "shocked") upward and downward.
- under the FX and Equity risk classes:
  - $RW_k^{(curvature)}$ is the risk weight for curvature risk factor *k* for instrument *i* determined in accordance with paragraph 131.
  - s_{ik} is the delta sensitivity of instrument i with respect to the delta risk factor that corresponds to curvature risk factor *k*.
- under the GIRR, CSR and Commodity risk classes:
  - $RW_k^{(curvature)}$ is the risk weight for curvature risk factor *k* for instrument *i* determined in accordance with paragraph 132
  - s_{ik} is the sum of delta sensitivities to all tenors of the relevant curve of instrument i with respect to curvature risk factor *k*.

(c) The aggregation formula for curvature risk distinguishes between positive curvature and negative curvature risk exposures. The negative curvature risk exposures are ignored, unless they hedge a positive curvature risk exposure. If there is a negative net curvature risk exposure from an option exposure, the curvature risk charge is zero.

(d) The curvature risk exposure must be aggregated within each bucket using the corresponding prescribed correlation ρ_{kl} as set out in the following formula:

$$K_b = \sqrt{\max\left(0, \sum_k \max\left(CVR_k, 0\right)^2 + \sum_k \sum_{k \neq l} \rho_{kl} CVR_k CVR_l \psi\left(CVR_k, CVR_l\right)\right)}$$

where $\psi(CVR_k, CVR_l)$ is a function that takes the value 0 if CVR_k and CVR_l both have negative signs. In all other cases, $\psi(CVR_k, CVR_l)$ takes the value of 1.

(e) Curvature risk positions must then be aggregated across buckets within each risk class, using the corresponding prescribed correlations γ_{bc}.

$$\text{Curvature risk} = \sqrt{\sum_b K_b^2 + \sum_b \sum_{c \neq b} \gamma_{bc} S_b S_c \psi(S_b, S_c)}$$

where:

- $S_b = \sum_k CVR_k$ for all risk factors in bucket *b*, and $S_c = \sum_k CVR_k$ in bucket *c*; and
- $\psi(S_b, S_c)$ is a function that takes the value 0 if S_b and S_c both have negative signs. In all other cases, $\psi(S_b, S_c)$ takes the value of 1.

If these values for S_b and S_c produce a negative number for the overall sum of $\sum_b K_b^2 + \sum_b \sum_{c \neq b} \gamma_{bc} S_b S_c \psi(S_b, S_c)$

- the bank is to calculate the curvature risk charge using an alternative specification whereby $S_b = max[\min(\sum_k CVR_k, K_b), -K_b]$ for all risk factors in bucket *b* and $S_c = max[\min(\sum_k CVR_k, K_c), -K_c]$ for all risk factors in bucket *c*.

(vi) Sensitivities-based Method: correlation scenarios and aggregation of risk charges

54. In order to address the risk that correlations increase or decrease in periods of financial stress, three risk charge figures are to be calculated for each risk class, corresponding to three different scenarios on the specified values for the correlation parameter ρ_{kl} (correlation between risk factors within a bucket) and γ_{bc} (correlation across buckets within a risk class).

(a) Under the first scenario, "high correlations", the correlation parameters ρ_{kl} and γ_{bc} that are specified in Sections 4, 5 and 6 are uniformly multiplied by 1.25, with ρ_{kl} and γ_{bc} subject to a cap at 100%.

(b) Under the second scenario, "medium correlations", the correlation parameters ρ_{kl} and γ_{bc} remain unchanged from those specified in Sections 4, 5 and 6.

(c) Under the third scenario, "low correlations", the corresponding prescribed correlations are the correlations given in Section 4, 5 and 6 uniformly multiplied by 0.75.

55. For each scenario, the bank must determine a scenario-related risk charge at the portfolio level as the simple sum of the risk charges at risk class level for that scenario. The ultimate portfolio level risk capital charge is the largest of the three scenario-related portfolio level risk capital charges.

(vii) The Default Risk Charge

56. The default risk charge is intended to capture jump-to-default-risk. It is described in detail in Section 7. The purpose of this subsection is to provide the offsetting rules as well as the hedging formula which can be applied within the default risk buckets.

57. The following step-by-step approach to capture jump-to-default risk must be followed:

(a) Compute the jump-to-default risk of each instrument separately. The jump-to-default risk is a function of notional amount (or face value) and market value of the instruments and prescribed LGD.

(b) Offsetting rules are specified in Section 7, which enables the derivation of "net jump-to-default" (net JTD) risk positions.

(c) Net JTD risk positions are then allocated to buckets and weighted by prescribed risk weights. For securitisation (both those in correlation trading portfolios and others), the risk weights are to be computed applying the banking book regime. Within a given default risk bucket, the weighted short risk positions can be deducted from the weighted long risk positions in a proportion equal to the ratio of the long divided by the sum of the long and short non-weighted risk positions. For non-securitisation and securitisation non-correlation trading portfolio, the default risk charge is then the simple sum of bucket level default risks. For the correlation trading portfolio, in order to constrain hedging benefit recognition, the default risk charge is the simple sum of the bucket level default risks when they are positive, and half the bucket level default risks when they are negative.

(viii) The Residual Risk Add-On

58. The residual risk add-on is to be calculated for all instruments bearing residual risk separately and in addition to other components of the capital requirement under the standardised approach for market risk.

(a) The residual risk add-on must be calculated in addition to any other capital requirements within the standardised approach.

(b) The scope of instruments that are subject to the residual risk add-on must not have an impact in terms of increasing or decreasing the scope of risk factors subject to the delta, vega, curvature or default risk capital treatments in the standardised approach.

(c) The residual risk add-on is the simple sum of gross notional amounts of the instruments bearing residual risks, multiplied by a risk weight of 1.0% for instruments with an exotic underlying and a risk weight of 0.1% for instruments bearing other residual risks.[13]

(d) Instruments with an exotic underlying are trading book instruments with an underlying exposure that is not within the scope of delta, vega or curvature risk treatment in any risk class under the Sensitivities-based Method or default risk charges in the standardised approach.[14]

(e) Instruments bearing other residual risks are those that meet criteria (i) and (ii) below:

   (i) instruments subject to vega or curvature risk capital charges in the trading book and with pay-offs that cannot be written or perfectly replicated as a finite linear combination of vanilla options with a single underlying equity price, commodity price, exchange rate, bond price, CDS price or interest rate swap; or

   (ii) instruments which fall under the definition of the Correlation Trading Portfolio (CTP) in paragraph 61, except for those instruments which are recognised in the Market Risk Framework as eligible hedges of risks within the CTP.

(f) In cases where a transaction exactly matches with a third-party transaction (ie a back-to-back transaction), the instruments used in both transactions must be excluded from the residual risk

[13] Where the bank cannot satisfy the supervisor that the residual risk add-on provides a sufficiently prudent capital charge, the supervisor will address any potentially under-capitalised risks by imposing a conservative additional capital charge under Pillar 2.

[14] Examples of exotic underlying exposures include: longevity risk, weather, natural disasters, future realised volatility (as an underlying exposure for a swap).

add-on charge. Any instrument that is listed and/or eligible for central clearing must be excluded from the residual risk add-on.

(g) A non-exhaustive list of other residual risks types and instruments that may fall within the criteria set out in paragraphs 58(e) include:

- *Gap risk*: risk of a significant change in vega parameters in options due to small movements in the underlying, which results in hedge slippage. Relevant instruments subject to gap risk include all path dependent options, such as barrier options, and Asian options, as well as all digital options.
- *Correlation risk*: risk of a change in a correlation parameter necessary for determination of the value of an instrument with multiple underlyings. Relevant instruments subject to correlation risk include all basket options, best-of-options, spread options, basis options, Bermudan options and quanto options.
- *Behavioural risk*: risk of a change in exercise/prepayment outcomes such as those that arise in fixed rate mortgage products where retail clients may make decisions motivated by factors other than pure financial gain (such as demographical features and/or and other social factors. A callable bond may only be seen as possibly having behavioural risk if the right to call lies with a retail client.

(h) When an instrument is subject to one or more of the following risk types, this by itself will not cause the instrument to be subject to the residual risk add-on:

(i) Risk from a cheapest-to-deliver option;

(ii) Smile risk – the risk of a change in an implied volatility parameter necessary for determination of the value of an instrument with optionality relative to the implied volatility of other instruments optionality with the same underlying and maturity, but different moneyness.

(iii) Correlation risk arising from multi-underlying European or American plain vanilla options where all underlyings have sensitivities for delta risk of the same sign, and from any options that can be written as a linear combination of such options. This exemption applies in particular to the relevant index options.

(iv) Dividend risk arising from a derivative instrument whose underlying does not consist solely of dividend payments.

3. Sensitivities-based Method: risk factor and sensitivity definitions

(i) Risk factor definitions

59. **General Interest Rate Risk (GIRR) risk factors**

(a) *Delta GIRR*: The GIRR delta risk factors are defined along two dimensions: a risk-free yield curve for each currency in which interest rate-sensitive instruments are denominated and the following vertices: 0.25 years, 0.5 years, 1 year, 2 years, 3 years, 5 years, 10 years, 15 years, 20 years, 30 years, to which delta risk factors are assigned.[15]

[15] Assignment of risk factors to the specified vertices should be performed by linear interpolation or a method that is most consistent with the pricing functions used by the independent risk control function of a bank to report market risks or profits and losses to senior management.

(i) The risk-free yield curve per currency should be constructed using money market instruments held in the trading book which have the lowest credit risk, such as overnight index swaps (OIS). Alternatively, the risk-free yield curve should be based on one or more market-implied swap curves used by the bank to mark positions to market. For example, interbank offered rate (BOR) swap curves.

(ii) When data on market-implied swap curves described in (a)(i) is insufficient, the risk-free yield curve may be derived from the most appropriate sovereign bond curve for a given currency. In such cases the sensitivities related to sovereign bonds is not exempt from the credit spread risk charge: when a bank cannot perform the decomposition $y=r+cs$, any sensitivity of cs to y is allocated to the GIRR and to CSR risk classes as appropriate with the risk factor and sensitivity definitions in the standardised approach. Applying swap curves to bond-derived sensitivities for GIRR will not change the requirement for basis risk to be captured between bond and CDS curves in the CSR risk class.

(iii) For the purpose of constructing the risk-free yield curve per currency, an OIS curve (such as Eonia) and a BOR swap curve (such as Euribor 3M) must be considered two different curves. Two BOR curves at different maturities (eg Euribor 3M and Euribor 6M) must be considered two different curves. An onshore and an offshore currency curve (eg onshore Indian rupee and offshore Indian rupee) must be considered two different curves.

(b) The GIRR delta risk factors also include a flat curve of market-implied inflation rates for each currency with term structure not recognised as a risk factor.

(i) The sensitivity to the inflation rate from the exposure to implied coupons in an inflation instrument gives rise to a specific capital requirement. All inflation risks for a currency must be aggregated to one number via simple sum.

(ii) This risk factor is only relevant for an instrument when a cash flow is functionally dependent on a measure of inflation (eg the notional amount or an interest payment depending on a consumer price index). GIRR risk factors other than for inflation risk will apply to such an instrument notwithstanding.

(iii) Inflation rate risk is considered in addition to the sensitivity to interest rates from the same instrument, which must be allocated, according to the GIRR framework, in the term structure of the relevant risk-free yield curve in the same currency.

(c) The GIRR delta risk factors also include one of two possible cross currency basis risk factors[16] for each currency (ie each GIRR bucket) with term structure not recognised as a risk factor (ie both cross currency basis curves are flat).

(i) The two cross currency basis risk factors are basis of each currency over USD or basis of each currency over EUR. For instance, an AUD-denominated bank trading a JPY/USD cross currency basis swap would have a sensitivity to the JPY/USD basis but not to the JPY/EUR basis.

[16] Cross currency basis are basis added to a yield curve in order to evaluate a swap for which the two legs are paid in two different currencies. They are in particular used by market participants to price cross currency interest rate swaps paying a fixed or a floating leg in one currency, receiving a fixed or a floating leg in a second currency, and including an exchange of the notional in the two currencies at the start date and at the end date of the swap.

(ii) Cross currency bases that do not relate to either basis over USD or basis over EUR must be computed either on “basis over USD” or “basis over EUR” but not both. GIRR risk factors other than for cross currency basis risk will apply to such an instrument notwithstanding.

(iii) Cross currency basis risk is considered in addition to the sensitivity to interest rates from the same instrument, which must be allocated, according to the GIRR framework, in the term structure of the relevant risk-free yield curve in the same currency.

(d) <u>*Vega GIRR*</u>*:* Within each currency, the GIRR vega risk factors are the implied volatilities of options that reference GIRR-sensitive underlyings; further defined along two dimensions:[17]

(i) *Maturity of the option:* The implied volatility of the option as mapped to one or several of the following maturity vertices: 0.5 years, 1 year, 3 years, 5 years, 10 years.

(ii) *Residual maturity of the underlying of the option at the expiry date of the option*: The implied volatility of the option as mapped to two (or one) of the following residual maturity vertices: 0.5 years, 1 year, 3 years, 5 years, 10 years.

(e) <u>*Curvature GIRR*</u>*:* The GIRR curvature risk factors are defined along only one dimension: the constructed risk-free yield curve (ie no term structure decomposition) per currency: For example, the Euro, Eonia, Euribor 3M and Euribor 6M curves must be shifted at the same time in order to compute the Euro-relevant risk-free yield curve curvature risk charge. All vertices (as defined for delta GIRR) are to be shifted in parallel. There is no curvature risk charge for inflation and cross currency basis risks.

(f) The treatment described in paragraph 59(a)(ii) for Delta GIRR also applies to Vega GIRR and Curvature GIRR risk factors.

60. **Credit Spread Risk (CSR) non-securitisation risk factors**

(a) <u>*Delta CSR non-securitisation*</u>*:* The CSR non-securitisation delta risk factors are defined along two dimensions: the relevant issuer credit spread curves (bond and CDS) and the following vertices: 0.5 years, 1 year, 3 years, 5 years, 10 years to which delta risk factors are assigned.

(b) <u>*Vega CSR non-securitisation*</u>*:* The vega risk factors are the implied volatilities of options that reference the relevant credit issuer names as underlyings (bond and CDS); further defined along one dimension:

(i) *Maturity of the option:* The implied volatility of the option as mapped to one or several of the following maturity vertices: 0.5 years, 1 year, 3 years, 5 years, 10 years.

(c) <u>*Curvature CSR non-securitisation*</u>*:* The CSR non-securitisation curvature risk factors are defined along one dimension: the relevant issuer credit spread curves (bond and CDS). For instance, the bond-inferred spread curve of Electricité de France and the CDS-inferred spread curve of Electricité de France should be considered a single spread curve. All vertices (as defined for CSR) are to be shifted in parallel.

[17] For example, an option with a forward-starting 12-month cap on USD 3-month LIBOR starting in one year will have four caplets with periods of three months each. The option maturity is 1 while the underlying maturity for each caplet should be 0.25, 0.5, 0.75 and 1 (expressed in years). These caplet vega contributions should therefore be mapped to the respective underlying maturity vertices 0.5 and 1 years and measured at each vertex point.

61. **Definition of the Correlation Trading Portfolio**

If criteria (a) to (e) in this paragraph are met, an instrument is deemed to be part of the "correlation trading portfolio" (CTP) and the CSR correlation trading delta risk factors are defined in paragraph 63, which must be computed with respect to the names underlying the securitisation or nth-to-default instrument:

(a) The instrument is not a resecuritisation position, nor derivatives of securitisation exposures that do not provide a pro rata share in the proceeds of a securitisation tranche.

(b) All reference entities are single-name products, including single-name credit derivatives, for which a liquid two-way market exists,[18] including traded indices on these reference entities.

(c) The instrument does not reference an underlying that is treated as a retail exposure, a residential mortgage exposure, or a commercial mortgage exposure under the standardised approach to credit risk.

(d) The instrument does not reference a claim on a special purpose entity.

(e) The instrument is not a securitisation position and that hedges a position described above.

If any of criteria (a) to (e) are not met, the instrument is deemed to be non-CTP and the CS01 must be calculated with respect to the spread of the tranche rather than the spread of the underlying of the instruments.

62. **CSR securitisation: non-Correlation Trading Portfolio ("non-CTP") risk factors**

(a) *Delta CSR securitisation (non-CTP):* the CSR securitisation delta risk factors are defined along two dimensions: tranche, credit spread curves and the following vertices: 0.5 years, 1 year, 3 years, 5 years, 10 years to which delta risk factors are assigned.

(b) *Vega CSR securitisation (non-CTP):* Vega risk factors are the implied volatilities of options that reference non-CTP credit spreads as underlyings (bond and CDS), further defined along one dimension:

    (i) *Maturity of the option:* The implied volatility of the option as mapped to one or several of the following maturity vertices: 0.5 years, 1 year, 3 years, 5 years, 10 years.

(c) *Curvature CSR securitisation (non-CTP):* the CSR securitisation curvature risk factors are defined along one dimension: the relevant tranche credit spread curves (bond and CDS). For instance, the bond-inferred spread curve of a given Spanish RMBS tranche and the CDS-inferred spread curve of that given Spanish RMBS tranche would be considered a single spread curve. All the vertices are to be shifted in parallel.

63. **CSR securitisation: Correlation Trading Portfolio ("CTP") risk factors**

(a) *Delta CSR securitisation (CTP):* The CSR correlation trading delta risk factors are defined along two dimensions: the relevant underlying credit spread curves (bond and CDS) and the following vertices: 0.5 years, 1 year, 3 years, 5 years, 10 years to which delta risk factors are assigned.

(b) *Vega CSR securitisation (CTP):* The vega risk factors are the implied volatilities of options that reference CTP credit spreads as underlyings (bond and CDS), further defined along one dimension:

[18] 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 the transaction settled at such price within a relatively short time frame in conformity with trade custom.

(i) *Maturity of the option:* The implied volatility of the option as mapped to one or several of the following maturity vertices: 0.5 years, 1 year, 3 years, 5 years, 10 years.

(c) *Curvature CSR securitisation (CTP):* The CSR correlation trading curvature risk factors are defined along one dimension: the relevant underlying credit spread curves (bond and CDS). For instance, the bond-inferred spread curve of a given name within an iTraxx series and the CDS-inferred spread curve of that given underlying would be considered a single spread curve. All the vertices are to be shifted in parallel.

64. **Equity risk factors**

(a) *Delta Equity:* The equity delta risk factors are all the equity spot prices and all the equity repurchase agreement rates (equity repo rates).

(b) *Vega Equity:* The equity vega risk factors are the implied volatilities of options that reference the equity spot prices as underlyings. There is no vega risk capital charge for equity repo rates. Vega risk factors are further defined along one dimension:

(i) *Maturity of the option:* The implied volatility of the option as mapped to one or several of the following maturity vertices: 0.5 years, 1 year, 3 years, 5 years, 10 years.

(c) *Curvature Equity:* The equity curvature risk factors are all the equity spot prices. There is no curvature risk charge for equity repo rates.

65. **Commodity risk factors**

(a) *Delta Commodity:* The commodity delta risk factors are all the commodity spot prices depending on contract grade[19] of the commodity, legal terms with respect to the delivery location[20] of the commodity and time to maturity of the traded instrument at the following vertices: 0 years, 0.25 years, 0.5 years, 1 year, 2 years, 3 years, 5 years, 10 years, 15 years, 20 years, 30 years.

(b) *Vega Commodity:* The commodity vega risk factors are the implied volatilities of options that reference commodity spot prices as underlyings. No differentiation between commodity spot prices by maturity of the underlying, grade or delivery location is required. The commodity vega risk factors are further defined along one dimension:

(i) *Maturity of the option:* The implied volatility of the option as mapped to one or several of the following maturity vertices: 0.5 years, 1 year, 3 years, 5 years, 10 years.

(c) *Curvature Commodity:* The commodity curvature risk factors are defined along only one dimension: the constructed curve (ie no term structure decomposition) per commodity spot prices. All vertices (as defined for delta Commodity) are to be shifted in parallel.

66. **Foreign exchange (FX) risk factors**

(a) *Delta FX:* All the exchange rates between the currency in which an instrument is denominated and the reporting currency.

[19] "Grade" refers to the contract grade of the commodity, sometimes known as the "basis grade" or "par grade". This is the minimum accepted standard that a commodity must meet to be accepted as the actual physical deliverable against the contract.

[20] For example, a contract that can be delivered in five ports can be considered having the same delivery location as another contract if and only if it can be delivered in the same five ports. However, it cannot be considered having the same delivery location as another contract that can be delivered in only four (or less) of those five ports.

(b) *Vega FX:* For the purpose of vega risk, the foreign exchange risk factors are the implied volatilities of options that reference exchange rates between currency pairs; further defined along one dimension:

(i) *Maturity of the option:* The implied volatility of the option as mapped to one or several of the following maturity vertices: 0.5 years, 1 year, 3 years, 5 years, 10 years.

(c) *Curvature FX:* All the exchange rates between the currency in which an instrument is denominated and the reporting currency.

(d) No distinction is required between onshore and offshore variants of a currency for all FX delta, vega and curvature risk factors.

(ii) Sensitivity definitions

67. Sensitivities for each risk class are expressed in the reporting currency of the bank.

67(a) **Delta GIRR:** Sensitivity is defined as the PV01 (sensitivity) of an instrument i with respect to vertex t of the risk-free yield curve (or curves, as appropriate) used to price the instrument i for the currency in which i is denominated. PV01 is determined by calculating the change in the market value of the instrument (V_i (.)) as a result of a 1 basis point shift in the interest rate r at vertex t (r_t) of the risk-free yield curve in a given currency, divided by 0.0001 (ie 0.01%). In notation form:

$$s_{k,r_t} = \frac{V_i(r_t + 0.0001, cs_t) - V_i(r_t, cs_t)}{0.0001}$$

where:

- r_t is the risk-free yield curve at vertex t;
- cs_t is the credit spread curve at vertex t;
- V_i (.) is the market value of the instrument i as a function of the risk-free interest rate curve and credit spread curve.

67(b) **Delta CSR non-securitisation:** Sensitivity is defined as CS01. The CS01 (sensitivity) of an instrument i is determined by calculating the change in the market value of the instrument (V_i (.)) as a result of a 1 basis point change to credit spread cs at vertex t (cs_t), divided by 0.0001 (ie 0.01%). In notation form:

$$s_{k,cs_t} = \frac{V_i(r_t, cs_t + 0.0001) - V_i(r_t, cs_t)}{0.0001}$$

67(c) **Delta CSR securitisation and nth-to-default:** Sensitivity is defined as the CS01, with no change to the sensitivity specification in the previous paragraph.

67(d) **Delta Equity spot:** The sensitivity is calculated by taking the value of a 1 percentage point change in equity spot price, divided by 0.01 (ie 1%). In notation form:

$$s_k = \frac{V_i(1.01\, EQ_k) - V_i(EQ_k)}{0.01}$$

where:

- k is a given equity;
- EQ_k is the market value of equity k; and
- V_i (.) is the market value of instrument i as a function of the price of equity k.

67(e) **Delta Equity repos:** The sensitivity is calculated by taking the value of a 1 basis point absolute translation of the equity repo rate term structure, divided by 0.0001 (ie 0.01%). In notation form:

$$s_k = \frac{V_i(RTS_k + 0.0001) - V_i(RTS_k)}{0.0001}$$

where:

- k is a given equity;
- RTS_k is the repo term structure of equity k; and
- V_i (.) is the market value of instrument i as a function of the repo term structure of equity k.

67(f) **Delta Commodity:** The sensitivity is calculated by taking the value of a 1 percentage point change in commodity spot price, divided by 0.01 (ie 1%):

$$s_k = \frac{V_i(1.01\ CTY_k) - V_i(CTY_k)}{0.01}$$

where:

- k is a given commodity;
- CTY_k is the market value of commodity k; and
- V_i (.) is the market value of instrument i as a function of the spot price of commodity k.

67(g) **Delta FX:** The sensitivity is calculated by taking the value of a 1 percentage point change in exchange rate, divided by 0.01 (ie 1%):

$$s_k = \frac{V_i(1.01\ FX_k) - V_i(FX_k)}{0.01}$$

where:

- k is a given currency;
- FX_k is the exchange rate between currency k and the reporting currency; and
- V_i (.) is the market value of instrument i as a function of the exchange rate k.

68. **Vega risk sensitivities:**

(a) The option-level vega risk sensitivity to a given risk factor is the product (ie multiplication) of the vega and implied volatility of the option.[21] To determine this product, the bank must use the instrument's vega and implied volatility contained within the pricing models used by the independent risk control unit of a bank.

(b) The portfolio-level vega risk sensitivity to a given vega risk factor is equal to the simple sum of option-level vega risk sensitivities to that risk factor, across all options in the portfolio.

(c) The following sets out how vega risk sensitivities are to be derived in specific cases:

(i) With regard to options that do not have a maturity, assign those options to the longest prescribed maturity vertex, and assign these options also to the residual risks add-on;

(ii) With regard to options that do not have a strike or barrier and options that have multiple strikes or barriers, apply the mapping to strikes and maturity used internally to price the option, and assign those instruments also to the residual risks add-on;

(iii) With regard to CTP securitisation tranches which do not have an implied volatility, do not compute vega risk for such an instrument. Such instruments may not, however, be exempt from delta and curvature risk charges.

(iii) Treatment of index instruments and multi-underlying options

69. In the delta risk context:

(a) For index instruments and multi-underlying options where all index constituents/option underlyings have delta risk sensitivities of the same sign, a look-through approach must be used. The sensitivities to constituent risk factors from index instruments and multi-underlying options are allowed to net with sensitivities to single name instruments without restrictions, although this does not apply to the correlation trading portfolio.

(b) As per the requirement in paragraph 15, an equity investment in a fund in which the bank cannot look through the fund daily must be assigned to the banking book.

70. In the delta and vega risk context:

(a) Multi-underlying options with delta risk sensitivities of different signs are exempted from delta and vega risk but may be subject to the residual risk add-on if they fall within the definitions set out in paragraph 58.

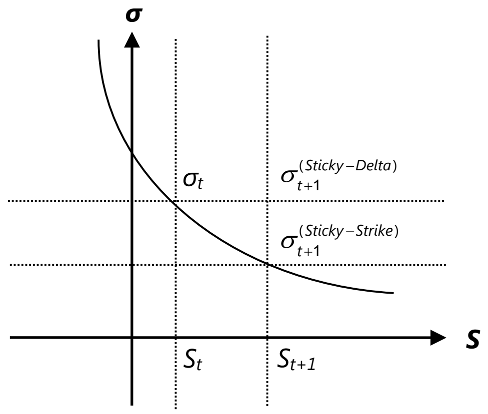
(b) Multi-underlying options (including index options) are usually priced based on the implied volatility of the option, rather than the implied volatility of its underlying constituents.[22]

[21] As specified in the vega risk factor definitions in Section 3, the implied volatility of the option must be mapped to one or more maturity vertices.

[22] As specified in the vega risk factor definitions in Section 3, the implied volatility of an option must be mapped to one or more maturity vertices.

(iv) Requirements on sensitivity computations

71. When computing a first-order sensitivity for instruments subject to optionality, banks should assume that the implied volatility remains constant, consistent with a "sticky delta" approach. This concept is illustrated in the following graph:



σ: implied volatility of the option

t: reporting date

S: underlying price

72. When computing a vega GIRR or CSR sensitivity, banks may use either the lognormal or normal assumptions. When computing a vega Equity, Commodity or FX sensitivity, banks must use the lognormal assumption.[23]

(a) If, for internal risk management, a bank computes sensitivities using definitions differing from the definitions provided in the present standards, this bank may use linear transformations to deduce from the sensitivities it computes the one to be used for the vega risk measure, knowing that the difference between these transformations and the exact price movements shall be captured through the curvature risk measure.

(b) All sensitivities must be computed ignoring the impact of Credit Valuation Adjustments (CVA).

4. Sensitivities-based Method: delta risk weights and correlations

73. The prescribed risk weights and correlations in this section have been calibrated to the liquidity adjusted time horizon related to each risk class.

(i) Delta GIRR

Buckets

74. Each bucket represents an individual currency exposure to GIRR.

[23] Since the vega ($\frac{\partial V}{\partial \sigma_i}$) on an instrument is multiplied by its implied volatility (σ_i), the vega risk sensitivity for that instrument will be the same under the lognormal assumption and the normal assumption. As a consequence, banks may use a lognormal or normal assumption for GIRR and CSR (in recognition of the trade-offs between constrained specification and computational burden for a standardised approach). For the other risk classes, banks must only use a lognormal assumption (in recognition that this is aligned with common practices across jurisdictions).

Risk weights

75. The risk weights are set as follows:

Vertex	0.25 year	0.5 year	1 year	2 year	3 year
Risk weight (percentage points)	2.4%	2.4%	2.25%	1.88%	1.73%

Vertex	5 year	10 year	15 year	20 year	30 year
Risk weight (percentage points)	1.5%	1.5%	1.5%	1.5%	1.5%

(a) A risk weight of 2.25% is set for the inflation risk factor and the cross currency basis risk factors, respectively.

(b) For selected currencies by the Basel Committee,[24] the above risk weights may at the discretion of the bank be divided by the square root of 2.

Correlations

76. The delta risk correlation ρ_{kl} is set at 99.90% between sensitivities WS_k and WS_l within the same bucket (ie same currency), same assigned vertex, but different curves.

77. The delta risk correlation ρ_{kl} between sensitivities WS_k and WS_l within the same bucket (ie same currency) with different vertex and same curve is set at $max\left[e^{\left(-\theta\cdot\frac{|T_k-T_l|}{min\{T_k;T_l\}}\right)};40\%\right]$,[25] where:

(a) T_k (respectively T_l) is the vertex that relates to WS_k (respectively WS_l)

(b) θ set at 3%.

78. Between two sensitivities WS_k and WS_l within the same bucket (ie same currency), different vertex and different curves, the correlation ρ_{kl} is equal to the correlation parameter specified in paragraph 77 multiplied by 99.90%.[26]

79. The delta risk correlation ρ_{kl} between a sensitivity WS_k to the inflation curve and a sensitivity WS_l to a given vertex of the relevant yield curve is 40%.

80. The delta risk correlation ρ_{kl} between a sensitivity WS_k to a cross currency basis curve and a sensitivity WS_l to either a given vertex of the relevant yield curve, the inflation curve or another cross currency basis curve (if relevant) is 0%.

81. The parameter γ_{bc} = 50% must be used for aggregating between different currencies.

[24] Selected currencies by the Basel Committee are: EUR, USD, GBP, AUD, JPY, SEK, CAD as well as the domestic reporting currency of a bank.

[25] For example, the correlation between a sensitivity to the vertex 1 year of the Eonia swap curve and the a sensitivity to the vertex 5 year of the Eonia swap curve in the same currency is $max\left[e^{\left(-3\%\cdot\frac{|1-5|}{min\{1;5\}}\right)};40\%\right]=88.69\%$.

[26] For example, the correlation between a sensitivity to the vertex 1 year of the Eonia swap curve and a sensitivity to the vertex 5 year of the Euribor 3M swap curve in the same currency is (88.69%) · (0.999) = 88.60%.

(ii) Delta CSR non-securitisations

Buckets

82. Sensitivities or risk exposures should first be assigned to a bucket according to the following table:

Bucket number	Credit quality	Sector
1	Investment grade (IG)	Sovereigns including central banks, multilateral development banks
2		Local government, government-backed non-financials, education, public administration
3		Financials including government-backed financials
4		Basic materials, energy, industrials, agriculture, manufacturing, mining and quarrying
5		Consumer goods and services, transportation and storage, administrative and support service activities
6		Technology, telecommunications
7		Health care, utilities, professional and technical activities
8		Covered bonds[27]
9	High yield (HY) & non-rated (NR)	Sovereigns including central banks, multilateral development banks
10		Local government, government-backed non-financials, education, public administration
11		Financials including government-backed financials
12		Basic materials, energy, industrials, agriculture, manufacturing, mining and quarrying
13		Consumer goods and services, transportation and storage, administrative and support service activities
14		Technology, telecommunications
15		Health care, utilities, professional and technical activities
16	Other sector[28]	

83. To assign a risk exposure to a sector, banks must rely on a classification that is commonly used in the market for grouping issuers by industry sector. The bank must assign each issuer to one and only one of the sector buckets in the table under paragraph 82. Risk positions from any issuer that a bank cannot assign to a sector in this fashion must be assigned to the "other sector" (ie bucket 16).

[27] Covered bonds must meet the definition provided in paragraphs 68, 70 and 71 in the following publication:

Basel Committee on Banking Supervision. *Standards Supervisory framework for measuring and controlling large exposures.* April 2014, www.bis.org/publ/bcbs283.pdf

[28] Credit quality is not a differentiating consideration for this bucket.

Risk weights

84. The risk weights for the buckets 1 to 16 are set out in the following table. Risk weights are the same for all vertices (ie 0.5 year, 1 year, 3 year, 5 year, 10 year) within each bucket:

Bucket number	Risk weight (percentage points)
1	0.5%
2	1.0%
3	5.0%
4	3.0%
5	3.0%
6	2.0%
7	1.5%
8	4.0%
9	3.0%
10	4.0%
11	12.0%
12	7.0%
13	8.5%
14	5.5%
15	5.0%
16	12.0%

Correlations

85. Between two sensitivities WS_k and WS_l within the same bucket, the correlation parameter $\rho_{kl}$is set as follows:

$$\rho_{kl} = \rho_{kl}^{(name)} \cdot \rho_{kl}^{(tenor)} \cdot \rho_{kl}^{(basis)}$$

where:

- $\rho_{kl}^{(name)}$ is equal to 1 where the two names of sensitivities k and l are identical, and 35% otherwise;
- $\rho_{kl}^{(tenor)}$ is equal to 1 if the two vertices of the sensitivities k and l are identical, and to 65% otherwise;
- $\rho_{kl}^{(basis)}$ is equal to 1 if the two sensitivities are related to same curves, and 99.90% otherwise.

For example, a sensitivity to the 5Y Apple bond curve and a sensitivity to the 10Y Google CDS curve would be 35% · 65% · 99.90% = 22.73%.

86. Consistently with paragraph 60(c), the correlation parameter ρ_{kl} as defined in paragraphs 85 is not applicable in the curvature risk context.

87. The correlations above do not apply to the other sector bucket. The within "other sector" bucket capital requirement for the delta and vega risk aggregation formula would be equal to the simple sum of the absolute values of the net weighted sensitivities allocated to this bucket:

$$K_{b(other\ bucket)} = \sum_k |WS_k|$$

This "other sector" bucket level capital will be added to the overall risk class level capital, with no diversification or hedging effects recognised with any bucket.

88. The correlation parameter γ_{bc} is set as follows:

$$\gamma_{bc} = \gamma_{bc}^{(rating)} \cdot \gamma_{bc}^{(sector)}$$

where:

- $\gamma_{bc}^{(rating)}$ is equal to 1 where the two buckets b and c have the same rating category (either IG or HY/NR), and 50% otherwise;
- $\gamma_{bc}^{(sector)}$ is equal to 1 if the two buckets have the same sector, and to the following numbers otherwise:

Bucket	1 / 9	2 / 10	3 / 11	4 / 12	5 / 13	6 / 14	7 / 15	8
1 / 9		75%	10%	20%	25%	20%	15%	10%
2 / 10			5%	15%	20%	15%	10%	10%
3 / 11				5%	15%	20%	5%	20%
4 / 12					20%	25%	5%	5%
5 / 13						25%	5%	15%
6 / 14							5%	20%
7 / 15								5%
8								

(iii) Delta CSR Securitisations (correlation trading portfolio)

Buckets

89. Sensitivities to CSR arising from the correlation trading portfolio and its hedges are treated as a separate risk class, for which the same bucket structure and correlation structure apply as those for the CSR non-securitisation framework, but for which the risk weights and correlations of the Delta CSR non-securitisations are modified to reflect longer liquidity horizons and larger basis risk.

Risk weights

90. Risk weights are the same for all vertices (ie 0.5 yr, 1 yr, 3 yr, 5 yr, 10 yr) within each bucket:

Bucket number	Risk weight (in percentage points)
1	4.0%
2	4.0%
3	8.0%
4	5.0%
5	4.0%
6	3.0%
7	2.0%
8	6.0%
9	13.0%
10	13.0%
11	16.0%
12	10.0%
13	12.0%
14	12.0%
15	12.0%
16	13.0%

Correlations

91. The delta risk correlation ρ_{kl} is derived the same way as in paragraph 85, except that $\rho_{kl}^{(basis)}$ is now equal to 1 if the two sensitivities are related to same curves, and 99.00% otherwise.

92. Otherwise, the correlation parameters for ρ_{kl} and γ_{bc} are identical to CSR non-securitisation.

(iv) Delta CSR Securitisations (non-correlation trading portfolio)

Buckets

93. Sensitivities or risk exposures must first be assigned to a bucket according to the following table:

Bucket number	Credit quality	Sector
1	Senior Investment grade (IG)	RMBS – Prime
2		RMBS – Mid-Prime
3		RMBS – Sub-Prime
4		CMBS
5		ABS – Student loans
6		ABS – Credit cards
7		ABS – Auto
8		CLO non-correlation trading portfolio
9	Non-Senior Investment grade (IG)	RMBS – Prime
10		RMBS – Mid-Prime
11		RMBS – Sub-Prime
12		CMBS
13		ABS – Student loans
14		ABS – Credit cards
15		ABS – Auto
16		CLO non-correlation trading portfolio
17	High yield (HY) & non-rated (NR)	RMBS – Prime
18		RMBS – Mid-Prime
19		RMBS – Sub-Prime
20		CMBS
21		ABS – Student loans
22		ABS – Credit cards
23		ABS – Auto
24		CLO non-correlation trading portfolio
25	Other sector[29]	

[29] Credit quality is not a differentiating consideration for this bucket.

94. To assign a risk exposure to a sector, banks must rely on a classification that is commonly used in the market for grouping tranches by type. The bank must assign each tranche to one of the sector buckets in the table under paragraph 93. Risk positions from any tranche that a bank cannot assign to a sector in this fashion must be assigned to the "other sector" (ie bucket 25).

Risk weights

95. The risk weights for the buckets 1 to 8 (Senior Investment Grade) are set out in the following table:

Bucket number	Risk weight (in percentage points)
1	0.9%
2	1.5%
3	2.0%
4	2.0%
5	0.8%
6	1.2%
7	1.2%
8	1.4%

96. The risk weights for the buckets 9 to 16 (Non-Senior Investment grade) are then equal to the corresponding risk weights for the buckets 1 to 8 scaled up by a multiplication by 1.25. For instance, the risk weight for the bucket 9 is equal to $1.25 \times 0.9\% = 1.125\%$.

97. The risk weights for the buckets 17 to 24 (High yield & non-rated) are then equal to the corresponding risk weights for the buckets 1 to 8 scaled up by a multiplication by 1.75 For instance, the risk weight for the bucket 17 is equal to $1.75 \times 0.9\% = 1.575\%$.

98. The risk weight for bucket 25 is set at 3.5%.

Correlations

99. Between two sensitivities WS_k and WS_l within the same bucket, the correlation parameter $\rho_{kl}$is set as follows:

$$\rho_{kl} = \rho_{kl}^{(tranche)} \cdot \rho_{kl}^{(tenor)} \cdot \rho_{kl}^{(basis)}$$

Where:

- $\rho_{kl}^{(tranche)}$ is equal to 1 where the two names of sensitivities *k* and *l* are within the same bucket and related to the same securitisation tranche (more than 80% overlap in notional terms), and 40% otherwise;
- $\rho_{kl}^{(tenor)}$ is equal to 1 if the two vertices of the sensitivities *k* and *l* are identical, and to 80% otherwise;
- $\rho_{kl}^{(basis)}$ is equal to 1 if the two sensitivities are related to same curves, and 99.90% otherwise.

100. The correlations above do not apply to the "other sector" bucket. The "other sector" bucket capital requirement for the delta and vega risk aggregation formula would be equal to the simple sum of the absolute values of the net weighted sensitivities allocated to this bucket:

$$K_{b(other\ bucket)} = \sum_k |WS_k|$$

This within "other sector" bucket level capital will be added to the overall risk class level capital, with no diversification or hedging effects recognised with any bucket.

101. The correlation parameter γ_{bc} applies to the aggregation of sensitivities between different buckets. It is set as 0%.

(v) Equity risk

Buckets

102. Sensitivities must first be assigned to a bucket as defined in the following table:

<table>
<tr><th>Bucket number</th><th>Market cap</th><th>Economy</th><th>Sector</th></tr>
<tr><td>1</td><td rowspan="8">Large</td><td rowspan="4">Emerging market economy</td><td>Consumer goods and services, transportation and storage, administrative and support service activities, healthcare, utilities</td></tr>
<tr><td>2</td><td>Telecommunications, industrials</td></tr>
<tr><td>3</td><td>Basic materials, energy, agriculture, manufacturing, mining and quarrying</td></tr>
<tr><td>4</td><td>Financials including government-backed financials, real estate activities, technology</td></tr>
<tr><td>5</td><td rowspan="4">Advanced economy</td><td>Consumer goods and services, transportation and storage, administrative and support service activities, healthcare, utilities</td></tr>
<tr><td>6</td><td>Telecommunications, industrials</td></tr>
<tr><td>7</td><td>Basic materials, energy, agriculture, manufacturing, mining and quarrying</td></tr>
<tr><td>8</td><td>Financials including government-backed financials, real estate activities, technology</td></tr>
<tr><td>9</td><td rowspan="2">Small</td><td>Emerging market economy</td><td>All sectors described under bucket numbers 1, 2, 3 and 4</td></tr>
<tr><td>10</td><td>Advanced economy</td><td>All sectors described under bucket numbers 5, 6, 7 and 8</td></tr>
<tr><td>11</td><td colspan="3">Other sector[30]</td></tr>
</table>

103. Market capitalisation ("market cap") is defined as the sum of the market capitalisations of the same legal entity or group of legal entities across all stock markets globally.

104. "Large market cap" is defined as a market capitalisation equal to or greater than USD 2 billion and "small market cap" is defined as a market capitalisation of less than USD 2 billion.

105. The advanced economies are Canada, the United States, Mexico, the euro area, the non-euro area western European countries (the United Kingdom, Norway, Sweden, Denmark and Switzerland), Japan, Oceania (Australia and New Zealand), Singapore and Hong Kong SAR.

106. To assign a risk exposure to a sector, banks must rely on a classification that is commonly used in the market for grouping issuers by industry sector. The bank must assign each issuer to one of the

[30] Market capitalisation or economy (ie advanced or emerging market) is not a differentiating consideration for this bucket.

sector buckets in the table under paragraph 102 and it must assign all issuers from the same industry to the same sector. Risk positions from any issuer that a bank cannot assign to a sector in this fashion must be assigned to the "other sector" (ie bucket 11). For multinational multi-sector equity issuers, the allocation to a particular bucket must be done according to the most material region and sector in which the issuer operates.

Risk weights

107. The risk weights for the sensitivities to Equity spot price and Equity repo rate for buckets 1 to 11 are set out in the following table:

Bucket number	Risk weight for Equity spot price (percentage points)	Risk weight for Equity repo rate (percentage points)
1	55%	0.55%
2	60%	0.60%
3	45%	0.45%
4	55%	0.55%
5	30%	0.30%
6	35%	0.35%
7	40%	0.40%
8	50%	0.50%
9	70%	0.70%
10	50%	0.50%
11	70%	0.70%

Correlations

108. The delta risk correlation parameter ρ_{kl} set at 99.90% between two sensitivities WS_k and WS_l within the same bucket where one is a sensitivity to an Equity spot price and the other a sensitivity to an Equity repo rate, where both are related to the same Equity issuer name.

109. Otherwise, the correlation parameter ρ_{kl} between two sensitivities WS_k and WS_l to Equity spot price within the same bucket are defined in (a) to (d) below:

(a) 15% between two sensitivities within the same bucket that fall under large market cap, emerging market economy (bucket number 1, 2, 3 or 4).

(b) 25% between two sensitivities within the same bucket that fall under large market cap, advanced economy (bucket number 5, 6, 7, or 8).

(c) 7.5% between two sensitivities within the same bucket that fall under small market cap, emerging market economy (bucket number 9).

(d) 12.5% between two sensitivities within the same bucket that fall under small market cap, advanced economy (bucket number 10).

110. The correlation parameter ρ_{kl} between two sensitivities WS_k and WS_l to Equity repo rate within the same bucket is also defined according to paragraph 109(a) to 109(d).

111. Between two sensitivities WS_k and WS_l within the same bucket where one is a sensitivity to an Equity spot price and the other a sensitivity to an Equity repo rate and both sensitivities relate to a different Equity issuer name, the correlation parameter ρ_{kl} is set at the correlations specified in paragraphs 109(a) to 109(d) multiplied by 99.90%.

112. The correlations above do not apply to the "other sector" bucket. The within "other sector" bucket capital requirement for the delta and vega risk aggregation formula would be equal to the simple sum of the absolute values of the net weighted sensitivities allocated to this bucket:

$$K_{b(other\ bucket)} = \sum_{k} |WS_k|$$

This "other sector" bucket level capital will be added to the overall risk class level capital, with no diversification or hedging effects recognised with any bucket.

113. The correlation parameter γ_{bc} applies to the aggregation of sensitivities between different buckets. γ_{bc} is set at 15% if bucket *b* and bucket *c* fall within bucket numbers 1 to 10.

(vi) Commodity risk

Buckets

114. Eleven buckets are defined for commodity risk and set out in the next paragraph.

Risk weights

115. The risk weights depend on the commodity bucket (which group individual commodities by common characteristics) as set out in the following table:

Bucket	Commodity bucket	Examples of commodities allocated to each commodity bucket (non-exhaustive)	Risk weight (percentage points)
1	Energy - Solid combustibles	coal, charcoal, wood pellets, nuclear fuel (such as uranium)	30%
2	Energy - Liquid combustibles	crude oil (such as Light-sweet, heavy, WTI and Brent); biofuels (such as bioethanol and biodiesel); petrochemicals (such as propane, ethane, gasoline, methanol and butane); refined fuels (such as jet fuel, kerosene, gasoil, fuel oil, naptha, heating oil and diesel)	35%
3	Energy - Electricity and carbon trading	electricity (such as spot, day-ahead, peak and off-peak); carbon emissions trading (such as certified emissions reductions, in-delivery month EUA, RGGI CO2 allowance and renewable energy certificates)	60%
4	Freight	dry-bulk route (such as capesize, panamex, handysize and supramax); liquid-bulk/gas shipping route (such as suezmax, aframax and very large crude carriers)	80%
5	Metals – non-precious	base metal (such as aluminium, copper, lead, nickel, tin and zinc); steel raw materials (such as steel billet, steel wire, steel coil, steel scrap and steel rebar, iron ore, tungsten, vanadium, titanium and tantalum); minor metals (such as cobalt, manganese, molybdenum)	40%
6	Gaseous combustibles	natural gas; liquefied natural gas	45%
7	Precious metals (including gold)	gold; silver; platinum; palladium	20%
8	Grains & oilseed	corn; wheat; soybean (such as soybean seed, soybean oil and soybean meal); oats; palm oil; canola; barley; rapeseed (such as rapeseed seed, rapeseed oil, and rapeseed meal); red bean, sorghum; coconut oil; olive oil; peanut oil; sunflower oil; rice	35%
9	Livestock & dairy	cattle (such as live and feeder); hog; poultry; lamb; fish; shrimp; dairy (such as milk, whey, eggs, butter and cheese)	25%
10	Softs and other agriculturals	cocoa; coffee (such as arabica and robusta); tea; citrus and orange juice; potatoes; sugar; cotton; wool; lumber and pulp; rubber	35%
11	Other commodity	industrial minerals (such as potash, fertilizer and phosphate rocks), rare earths; terephthalic acid; flat glass	50%

Correlations

116. For the purpose of correlation recognition, any two commodities are considered distinct commodities if there exists in the market two contracts differentiated only by the underlying commodity to be delivered against each contract. For example, in bucket 2 ("Energy – Liquid Combustibles") WTI and Brent would typically be treated as distinct commodities.

117. Formally, between two sensitivities WS_k and WS_l within the same bucket, the correlation parameter $\rho_{kl}$is set as follows:

$$\rho_{kl} = \rho_{kl}^{(cty)} \cdot \rho_{kl}^{(tenor)} \cdot \rho_{kl}^{(basis)}$$

Where:

- $\rho_{kl}^{(cty)}$ is equal to 1 where the two commodities of sensitivities k and l are identical, and to the intra-bucket correlations in the table below otherwise;
- $\rho_{kl}^{(tenor)}$ is equal to 1 if the two vertices of the sensitivities k and l are identical, and to 99.00% otherwise;
- $\rho_{kl}^{(basis)}$ is equal to 1 if the two sensitivities are identical in both (i) contract grade of the commodity, and (ii) delivery location of a commodity, and 99.90% otherwise.

For example, the correlation between the sensitivity to Brent, tenor 1Y, for delivery in Le Havre and the sensitivity to WTI, tenor 5Y, for delivery in Oklahoma is $95\% \cdot 99.00\% \cdot 99.90\% = 93.96\%$.

Bucket	Commodity bucket	Correlation (ρ_{kl})
1	Energy - Solid combustibles	55%
2	Energy - Liquid combustibles	95%
3	Energy - Electricity and carbon trading	40%
4	Freight	80%
5	Metals – non-precious	60%
6	Gaseous combustibles	65%
7	Precious metals (including gold)	55%
8	Grains & oilseed	45%
9	Livestock & dairy	15%
10	Softs and other agriculturals	40%
11	Other commodity	15%

118. The correlation parameters γ_{bc} applying to sensitivity or risk exposure pairs between different buckets is set at:

(a) 20% if bucket *b* and bucket *c* fall within bucket numbers 1 to 10.

(b) 0% if either bucket *b* or bucket *c* is bucket number 11.

119. Further definitions related to delivery time are as follows:

- For bucket 3, each time interval at which the electricity can be delivered and that is subject to a contract that is made on a financial market is considered a distinct electricity commodity (just as silver and gold are considered distinct precious metals). Electricity produced in various areas such as Electricity NE, Electricity SE, Electricity North should also be considered distinct electricity commodities and therefore the correlation parameters in the preceding paragraphs should apply between sensitivities to each of those electricity types. In addition, the electricity risk factor can either be the spot or the forward price, as transactions on the forward price are more frequent than transactions on spot price.

- For bucket 4 ("Freight"), each combination of freight route and each week at which a good has to be delivered is a distinct commodity.

(vii) Foreign exchange risk

Risk weights

120. A unique relative risk weight equal to 30% applies to all the FX sensitivities or risk exposures.

(a) For the specified currency pairs by the Basel Committee,[31] the above risk weight may at the discretion of the bank be divided by the square root of 2.

Correlations

121. A uniform correlation parameter γ_{bc} equal to 60% applies to FX sensitivity or risk exposure pairs.

5. Sensitivities-based Method: vega risk weights and correlations

(i) The vega buckets

122. The delta buckets are replicated in the vega context, unless specified otherwise in the preceding paragraphs within Section 3 and Section 4.

123. The bucket remains the first level of aggregation between vega risk positions within a risk class, ie the steps in paragraph 51 are to be performed.

(ii) The vega risk weights

124. The risk of market illiquidity is incorporated into the determination of vega risk factors, through the assignment of different liquidity horizons for each risk class. The risk weight for a given vega risk factor k (RW_k) is determined by the following function:

$$RW_k = \min\left[RW_\sigma \cdot \frac{\sqrt{LH_{risk\ class}}}{\sqrt{10}}; 100\%\right]$$

where:

- RW_σ is set at 55%;
- $LH_{risk\ class}$ is the regulatory liquidity horizon to be prescribed in the determination of each vega risk factor k. $LH_{risk\ class}$ is specified as follows:

[31] Selected currency pairs by the Basel Committee are: USD/EUR, USD/JPY, USD/GBP, USD/AUD, USD/CAD, USD/CHF, USD/MXN, USD/CNY, USD/NZD, USD/RUB, USD/HKD, USD/SGD, USD/TRY, USD/KRW, USD/SEK, USD/ZAR, USD/INR, USD/NOK, USD/BRL, EUR/JPY, EUR/GBP, EUR/CHF and JPY/AUD.

Risk class	$LH_{risk\ class}$
GIRR	60
CSR non-securitisations	120
CSR securitisations (CTP)	120
CSR securitisations (non-CTP)	120
Equity (large cap)	20
Equity (small cap)	60
Commodity	120
FX	40

(iii) The vega correlations

125. Between vega risk sensitivities within the same bucket of the GIRR risk class, the correlation parameter ρ_{kl} is set as follows:

$$\rho_{kl} = min\left[\rho_{kl}^{(option\ maturity)} \cdot \rho_{kl}^{(underlying\ maturity)}; 1\right]$$

where:

- $\rho_{kl}^{(option\ maturity)}$ is equal to $e^{-\alpha \cdot \frac{|T_k - T_l|}{min\{T_k; T_l\}}}$ where α is set at 1%, T_k (respectively T_l) is the maturity of the option from which the vega sensitivity VR_k (VR_l) is derived, expressed as a number of years;
- $\rho_{kl}^{(underlying\ maturity)}$ is equal to $e^{-\alpha \cdot \frac{|T_k^U - T_l^U|}{min\{T_k^U; T_l^U\}}}$, where α is set at 1%, T_k^U (respectively T_l^U) is the maturity of the underlying of the option from which the sensitivity VR_k (VR_l) is derived, expressed as a number of years after the maturity of the option.

126. Between vega risk sensitivities within a bucket of the other risk classes (ie not GIRR), the correlation parameter ρ_{kl} is set as follows:

$$\rho_{kl} = min\left[\rho_{kl}^{(DELTA)} \cdot \rho_{kl}^{(option\ maturity)}; 1\right]$$

where:

- $\rho_{kl}^{(DELTA)}$ is equal to the correlation that applies between the delta risk factors that correspond to vega risk factors *k* and *l*. For instance, if *k* is the vega risk factor from equity option X and *l* is the vega risk factor from equity option Y then $\rho_{kl}^{(DELTA)}$ is the delta correlation applicable between X and Y; and
- $\rho_{kl}^{(option\ maturity)}$ is defined as in paragraph 125.

127. With regard to vega risk sensitivities between buckets within a risk class (GIRR and non-GIRR), the same correlation parameters for γ_{bc}, as specified for delta correlations for each risk class in Section 4, are to be used in the vega risk context (eg γ_{bc} = 50% is to be used for aggregation of vega risk sensitivities across different GIRR buckets).

128. There is no diversification or hedging benefit recognised in the standardised approach between vega and delta risk factors. Vega and delta risk charges are aggregated by simple summation.

6. Sensitivities-based Method: curvature risk weights and correlations

(i) The curvature buckets

129. The delta buckets are replicated in the curvature context, unless specified otherwise in the preceding paragraphs within Section 3 and Section 4.

130. The bucket remains the first level of aggregation between curvature risk positions within each risk class.

(ii) The curvature risk weights

131. For FX and Equity curvature risk factors, the curvature risk weights are relative shifts ("shocks") equal to the delta risk weights.

132. For GIRR, CSR and Commodity curvature risk factors, the curvature risk weight is the parallel shift of all the vertices for each curve based on the highest prescribed delta risk weight for each risk class. For example, in the case of GIRR the risk weight assigned to the 0.25 year vertex (ie most punitive vertex risk weight) is applied to all the vertices simultaneously for each risk-free yield curve (consistent with a "translation", or "parallel shift" risk calculation).

(iii) The curvature correlations

133. Between curvature exposures, each delta correlation parameters ρ_{kl} and γ_{bc} should be squared. For instance, between CVR_{EUR} and CVR_{USD} in the GIRR context, the correlation should be $50\%^2 = 25\%$.

7. The Default Risk Charge

134. The approach for the standardised default risk capital charge comprises a multi-step procedure. In the first step, JTD loss amounts for each instrument subject to default risk are determined; second, offsetting of the JTD amounts of long and short exposures with respect to the same obligor (where permissible) produces net long and net short amounts in distinct obligors; third, the net short exposures are discounted by a hedge benefit ratio; and finally, default risk weights are applied to arrive at the capital charge. The procedure is specified in the material below. In the procedure, offsetting refers to the netting of exposures to the same obligor (where a short exposure may be subtracted in full from a long exposure), while hedging refers to the application of a partial hedge benefit from the short exposures (where the risk of long and short exposures in distinct obligors do not fully offset due to basis or correlation risks).

135. The default risk charge for non-securitisations and securitisations is independent from the other capital charges in the Standardised Approach for Market Risk; in particular it is independent from the CSR capital charge.

136. For the correlation trading portfolio (CTP), the capital charge includes the default risk for securitisation exposures and for non-securitisation hedges. These hedges are to be removed from the default risk non-securitisation calculations. There must be no diversification benefit between the default risk charge for non-securitisations, default risk charge for securitisations (non-correlation trading portfolio) and default risk charge for the securitisation correlation trading portfolio.

137. In line with criteria set out in other parts of the Capital Accord, at national discretion claims on sovereigns, public sector entities and multilateral development banks may be subject to a zero default risk weight. National authorities may apply a non-zero risk weight to securities issued by certain foreign governments, including to securities denominated in a currency other than that of the issuing government.

138. For traded non-securitisation credit and equity derivatives, JTD amounts by individual constituent issuer legal entity should be determined by applying a look-through approach.

(i) Default Risk Charge for non-securitisations

Gross Jump-to-default risk positions (gross JTD)

139. As a first step, the gross JTD risk is computed, exposure by exposure. For instance, if a bank is long a bond on Apple, and short another bond on Apple, it must compute two JTD exposures.

140. The determination of the long/short direction of positions must be on the basis of long or short with respect to the underlying credit exposure. Specifically, a long exposure results from an instrument for which the default of the underlying obligor results in a loss. In the case of derivative contracts, the long/short direction is determined by whether the contract has long or short exposure to the underlying credit exposure as defined in the previous sentence (ie not bought/sold option, and not bought/sold CDS). Thus, a sold put option on a bond is a long credit exposure, since a default results in a loss to the seller of the option.

141. For the capitalisation of JTD risk, the representation of positions uses notional amounts and market values. This approach is different from the use of credit spread sensitivities in the capitalisation of credit spread risk. The default risk charge is intended to capture stress events in the tail of the default distribution which may not be captured by credit spread shocks in mark-to-market risk. The use of credit spread sensitivities underestimates the loss from jump-to-default, because credit spreads are a measure of the expected loss from default, which by definition is less severe that the default loss in the tail of the default distribution, and it is the default severity in the tail of the default distribution that is covered by the default risk charge. Similarly, for credit options, using the delta equivalent to represent positions for default risk underestimate the loss at default, because the definition of an option's delta employs an expected value calculation with respect to the entire default distribution which by its nature is an underestimate of the risk of default loss in the tail of the default distribution.

142. The gross JTD is a function of the LGD, notional amount (or face value) and the cumulative P&L already realised on the position:

$$\text{JTD (long)} = \max(\text{LGD} \times \text{notional} + \text{P\&L}, 0)$$

$$\text{JTD (short)} = \min(\text{LGD} \times \text{notional} + \text{P\&L}, 0)$$

where *notional* is the bond-equivalent notional (or face value) of the position and P&L is the cumulative mark-to-market loss (or gain) already taken on the exposure. In more detail,

$$\text{P\&L} = \text{market value} - \text{notional},$$

where market value is the current market value of the position.

143. In the equations, the notional of an instrument that gives rise to a long (short) exposure is recorded as a positive (negative) value, while the P&L loss (gain) is recorded as a negative (positive) value. If the contractual/legal terms of the derivative allow for the unwinding of the instrument with no exposure to default risk, then the JTD is equal to zero.

144. Equity instruments and non-senior debt instruments are assigned an LGD of 100%. Senior debt instruments are assigned an LGD of 75%. Covered bonds, as defined within paragraph 82, are assigned an LGD of 25%. When the price of the instrument is not linked to the recovery rate of the defaulter (eg an FX-credit hybrid option where the cash flows are swap of cash flows, long EUR coupons and short USD coupons with a knockout feature that ends cash flows on an event of default of a particular obligor), there should be no multiplication of the notional by the LGD.

145. The starting point is the notional amount and mark-to-market loss already realised on a credit position. The notional amount is used to determine the loss of principal at default, and the mark-to-market loss is used to determine the net loss so as to not double-count the mark-to-market loss already

recorded in the market value of the position. For all instruments, the notional amount is the notional amount of the instrument relative to which the loss of principal is determined. For instance, the notional amount of a bond is the face value, while for credit derivatives the notional amount of a CDS contract or a put option on a bond is the notional amount of the derivative contract. In the case of a call option on a bond, however, the notional amount to be used in the JTD equation is zero (since, in the event of default, the call option will not be exercised). In this case, a jump-to-default would extinguish the call option's value and this loss would be captured through the mark-to-market P&L term in the JTD equation. The table below provides an illustration of the use of notional amounts and market values in the JTD equation:

Examples of components for a long credit position in the JTD equation

Instrument	Notional	Bond-equivalent market value	P&L
Bond	Face value of bond	Market value of bond	Market value – face value
CDS	Notional of CDS	Notional of CDS – | MtM value of CDS|	–| MtM value of CDS |
Sold put option on a bond	Notional of option	Strike amount – MtM value of option	(Strike – MtM value of option) – Notional
Bought call option on a bond	0	MtM value of option	MtM value of option

The bond-equivalent market value is an intermediate step in determining the P&L for derivative instruments.

Loss=bond equivalent market value-notional.

JTD = max (LGD × notional + P&L, 0), in the case of a long position (see definition above for the case of a short position).

In the expressions above, the MtM values of CDS and options are absolute values.

Strike amount of bond option in terms of bond price (not the yield).

With this representation of the P&L for a sold put option, a lower strike results in a lower JTD loss.

The examples above are for long credit positions with a MtM loss.

146. To account for defaults within the one year capital horizon, the JTD for all exposures of maturity less than one year and their hedges are scaled by a fraction of a year. No scaling is applied to the JTD for exposures of one year or greater.[32] For example, the JTD for a position with a six month maturity would be weighted by one-half, while the JTD for a position with a one year maturity would have no scaling applied to the JTD.

147. Cash equity positions (ie stocks) are assigned to a maturity of either more than one year, or 3 months, at firms' discretion.

148. For derivative exposures, the maturity of the derivative contract is considered in determining the offsetting criterion, not the maturity of the underlying instrument.

149. The maturity weighting applied to the JTD for any sort of product with maturity less than 3 months (such as short term lending) is floored at a weighting factor of one-fourth or, equivalently, 3 months (that means that the positions having shorter-than-3M remaining maturity would be regarded as having a remaining maturity of 3M for the purpose of the DRC).

[32] Note that this paragraph refers to the scaling of gross JTD (ie not net JTD).

Net Jump-to-default risk positions (net JTD)

150. The gross JTD amounts of long and short exposures to the same obligor may be offset where the short exposure has the same or lower seniority relative to the long exposure. For example, a short exposure in an equity may offset a long exposure in a bond, but a short exposure in a bond cannot offset a long exposure in the equity. Exposures of different maturities that meet this offsetting criterion may be offset as follows. Exposures with maturities longer than the capital horizon (one year) may be fully offset. An exposure to an obligor comprising a mix of long and short exposures with a maturity less than the capital horizon (equal to one year) must be weighted by the ratio of the exposure's maturity relative to the capital horizon. For example, with the one-year capital horizon, a three-month short exposure would be weighted so that its benefit against long exposures of longer-than-one-year maturity would be reduced to one quarter of the exposure size.[33]

151. In the case of long and short offsetting exposures where both have a maturity under one year, the scaling can be applied to both the long and short exposures. Finally, the offsetting may result in net long JTD amounts and net short JTD amounts. The net long and net short JTD amounts are aggregated separately as described below.

Default risk charge for non-securitisations

152. Default risk weights are assigned to net JTD by credit quality categories (ie rating bands), irrespective of the type of counterparty, as in the following table:

Credit quality category	Default risk weight
AAA	0.5%
AA	2%
A	3%
BBB	6%
BB	15%
B	30%
CCC	50%
Unrated	15%
Defaulted	100%

153. The weighted net JTD are then allocated to buckets. The three buckets for this purpose are corporates, sovereigns, and local governments/municipalities.

154. In order to recognise hedging relationship between long and short positions within a bucket, a hedge benefit ratio is computed.

(a) A simple sum of the net (not risk-weighted) long JTD amounts must be calculated, where the summation is across the credit quality categories (ie rating bands). The aggregated amount is used in the numerator and denominator of the expression of the *WtS* below.

(b) A simple sum of the net (not risk-weighted) short JTD amounts must be calculated, where the summation is across the credit quality categories (ie rating bands). The aggregated amount is used in the denominator of the expression of the *WtS* below.

(c) The hedge benefit ratio (Weighted to Short ratio, or *WtS*) is the ratio of long to gross long and short JTD amounts:

$$WtS = \frac{\sum net\ JTD_{long}}{\sum net\ JTD_{long} + \sum |net\ JTD_{short}|}$$

155. The overall capital charge for each bucket is to be calculated as the combination of the sum of the risk-weighted long net JTD, where the summation is across the credit quality categories (ie rating bands), the WtS, and the sum of the risk-weighted short net JTD, where the summation is across the credit quality categories (ie rating bands):

$$DRC_b = max\left[\left(\sum_{i \in Long} RW_i \cdot net\ JTD_i\right) - WtS \cdot \left(\sum_{i \in Short} RW_i \cdot |net\ JTD_i|\right); 0\right]$$

Where DRC stands for "default risk charge", and *i* refers to an instrument belonging to bucket *b*.

156. No hedging is recognised between different buckets. Therefore, the total capital charge for default risk non-securitisations must be calculated as a simple sum of the bucket-level capital charges. For example, no hedging or diversification is recognised across corporate and sovereign debt, and the total capital charge is the sum of the corporate capital charge and the sovereign capital charge.

(ii) Default Risk Charge for securitisations (non-correlation trading portfolio)

Gross Jump-to-default risk positions (gross JTD)

157. For the computation of gross JTD on securitisations, the same approach must be followed as for default risk (non-securitisations), except that an LGD ratio is not applied to the exposure. Because the LGD is already included in the default risk weights for securitisations to be applied to the securitisation exposure (see below), to avoid double counting of LGD the JTD for securitisations is simply the market value of the securitisation exposure (ie the JtD for tranche positions is their market value).

158. For the purposes of offsetting and hedging in this section, positions in underlying names or a non-tranched index position may be decomposed proportionately into the equivalent replicating tranches that span the entire tranche structure. When underlying names are used in this way, they must be removed from the non-securitisation default risk treatment.

Net Jump-to-default risk positions (net JTD)

159. For default risk (securitisations), offsetting is limited to a specific securitisation exposure (ie tranches with the same underlying asset pool). This means that:

(a) no offsetting is permitted between securitisation exposures with different underlying securitised portfolio (ie underlying asset pools), even if the attachment and detachment points are the same; and

(b) no offsetting is permitted between securitisation exposures arising from different tranches with the same securitised portfolio.

160. Securitisation exposures that are otherwise identical except for maturity may be offset, subject to the same restriction as for positions of less than one year described above for non-securitisations. Securitisation exposures that can be perfectly replicated through decomposition may be offset. Specifically, if a collection of long securitisation exposures can be replicated by a collection of short securitisation exposures, then the securitisation exposures may be offset. Furthermore, when a long securitisation exposure can be replicated by a collection of short securitisation exposures with different securitised portfolios, then the securitisation exposure with the "mixed" securitisation portfolio may be offset by the combination of replicating securitisation exposures. After the decomposition, the offsetting

rules would apply as in any other case. As in the case of default risk (non-securitisations), long and short securitisation exposures should be determined from the perspective of long or short the underlying credit, eg the bank making losses on a long securitisation exposure if there is a default on debt in the securitised portfolio.

Default risk charge for securitisations (non-CTP)

161. The default risk charge for securitisation exposures is determined in the same approach as for default risk (non-securitisations), except that securitisation exposures are sorted by tranche instead of credit quality. The default risk weights for securitisation exposures are based on the risk weights in the corresponding treatment for the banking book, which is available in a separate Basel Committee publication.[34] To avoid double-counting of risks in the maturity adjustment (of the banking book approach) since migration risk in the trading book will be captured in the credit spread charge, the maturity component in the banking book securitisation framework is set to zero, ie a maturity of one year is assumed. Following the corresponding treatment in the banking book, the hierarchy of approaches in determining the risk weights should be applied at the underlying pool level. The SA capital charge for an individual cash securitisation position can be capped at the fair value of the transaction.

162. For default risk (securitisations), the buckets are defined as follows:

(a) Corporates constitute a unique bucket, taking into account all the regions.

(b) The other buckets are defined along the two dimensions asset class and region. The 11 asset classes are ABCP, Auto Loans/Leases, RMBS, Credit Cards, CMBS, Collateralised Loan Obligations, CDO-squared, Small and Medium Enterprises, Student loans, Other retail, Other wholesale. The 4 regions are Asia, Europe, North America, and All other.

163. To assign a securitisation exposure to a bucket, banks must rely on a classification that is commonly used in the market for grouping securitisation exposures by type and region of underlying. The bank must assign each securitisation exposure to one and only one of the buckets above and it must assign all securitisations with the same type and region of underlying to the same bucket. Any securitisation exposure that a bank cannot assign to a type or region of underlying in this fashion must be assigned to the "other bucket".

164. Within buckets, the capital charge for default risk (securitisations) is determined in a similar approach to that for non-securitisations. The hedge benefit discount *WtS*, as defined in paragraph 154, is applied to net short securitisation exposures in that bucket, and the capital charge is calculated as in paragraph 155.

165. No hedging is recognised between different buckets. Therefore, the total capital charge for default risk securitisations must be calculated as a simple sum of the bucket-level capital charges.

(iii) Default Risk Charge for securitisations (correlation trading portfolio)

Gross Jump-to-default risk positions (gross JTD)

166. For the computation of gross JTD on securitisations, the same approach must be followed as for default risk-securitisations (non-CTP) as described in paragraph 151.

[34] Basel Committee on Banking Supervision, *Revisions to the securitisation framework*, December 2014, www.bis.org/bcbs/publ/d303.htm.

167. The definition of JTD for non-securitisations in the CTP (ie single-name and index hedges) positions is their market value.

168. Nth-to-default products should be treated as tranched products with attachment and detachment points defined as:

(a) attachment point = (N – 1) / Total Names

(b) detachment point = N / Total Names

where "Total Names" is the total number of names in the underlying basket or pool.

Net Jump-to-default risk positions (net JTD)

169. Exposures that are otherwise identical except for maturity may be offset but with the same specifications for exposures of less than one year as described in the section on default risk (non-securitisations). Specifically, exposures longer than the capital horizon (one year) may be fully offset, but in the case of longer-than-one-year vs less-than-one-year exposures, the offset benefit of the less-than-one-year exposure must be reduced as described above.

(a) For index products, for the exact same index family (eg CDX NA IG), series (eg series 18) and tranche (eg 0–3%), securitisation exposures should be offset (netted) across maturities (subject to the offsetting allowance as described above).

- Long/short exposures that are perfect replications through decomposition may be offset as follows. When the offsetting involves decomposing single name equivalent exposures, decomposition using a valuation model would be allowed in certain cases as follows. Such decomposition is the sensitivity of the security's value to the default of the underlying single name obligor. Decomposition with a valuation model is defined as follows: a single name equivalent constituent of a securitisation (eg tranched position) is the difference between the unconditional value of the securitisation and the conditional value of the securitisation assuming that the single name defaults, with zero recovery, where the value is determined by a valuation model. In such cases, the decomposition into single-name equivalent exposures must account for the effect of marginal defaults of the single names in the securitisation, where in particular the sum of the decomposed single name amounts must the consistent with the undecomposed value of the securitisation. Further, such decomposition is restricted to "vanilla" securitisations (eg vanilla CDOs, index tranches or bespokes); while the decomposition of "exotic" securitisations (eg CDO-squared) is prohibited.

(b) Moreover, for long/short positions in index tranches, and indices (non-tranched), if the exposures are to the exact same series of the index, then offsetting is allowed by replication and decomposition. For instance, a long securitisation exposure in a 10–15% tranche vs combined short securitisation exposures in 10–12% and 12–15% tranches on the same index/series can be offset against each other. Similarly, long securitisation exposures in the various tranches that, when combined perfectly, replicate a position in the index series (non-tranched) can be offset against a short securitisation exposure in the index series if all the positions are to the exact same index and series (eg CDX NA IG series 18). Long/short positions in indices and single-name constituents in the index may also be offset by decomposition. For instance, single-name long securitisation exposures that perfectly replicate an index may be offset against a short securitisation exposure in the index. When a perfect replication is not possible, then offsetting is not allowed except as indicated in the next sentence. Where the long/short securitisation exposures are otherwise equivalent except for a residual component, the net amount must show the residual exposure. For instance, a long securitisation exposure in an index of 125 names, and short securitisation exposures of the appropriate replicating amounts in 124 of the names, would result in a net long securitisation exposure in the missing 125th name of the index.

(c) Different tranches of the same index or series may not be offset (netted), different series of the same index may not be offset, and different index families may not be offset.

Default risk charge for securitisations (CTP)

170. The default risk weights for securitisations applied to tranches are based on the risk weights in the corresponding treatment for the banking book, which is available in a separate Basel Committee publication.[35] To avoid double-counting of risks in the maturity adjustment (of the banking book approach) since migration risk in the trading book will be captured in the credit spread charge, the maturity component in the banking book securitisation framework is set to zero, ie a maturity of one year is assumed.

171. For default risk (CTP), each index is regarded as a bucket of its own. A non-exhaustive list of indices is: CDX North America IG, iTraxx Europe IG, CDX HY, iTraxx XO, LCDX (loan index), iTraxx LevX (loan index), Asia Corp, Latin America Corp, Other Regions Corp, Major Sovereign (G7 and Western Europe), Other Sovereign.

172. Bespoke securitisation exposures should be allocated to the index bucket of the index they are a bespoke tranche of. For instance, the bespoke tranche 5% - 8% of a given index should be allocated to the bucket of that index.

173. For the tranched products, use the risk weight as per paragraph 152. For the non-tranched products, banks must derive the risk weight using the banking book treatment.

174. Within buckets (ie for each index), the capital charge for default risk (CTP) is determined in a similar approach to that for non-securitisations. The hedge benefit ratio *WtS*, as defined in paragraph 154, is applied to net short positions in that bucket as in the equation below. In this case, however, the hedge ratio (*WtS*) is determined using the combined long and short positions across all indices in the CTP (ie not only the long and short positions of the bucket by itself). A deviation from the approach used for non-securitisation is that no floor at 0 is made at bucket level, and as a consequence, the default risk charge at index level (DRC_b) can be negative:

$$DRC_b = \left(\sum\nolimits_{i \in Long} RW_i \cdot net\ JTD_i\right) - \mathrm{WtS}_{ctp} \cdot \left(\sum\nolimits_{i \in Short} RW_i \cdot |net\ JTD_i|\right)$$

The summation of risk weighted amounts in the equation spans all exposures relating to the index (ie index tranche, bespoke, non-tranche index, or single name). The subscript *ctp* for the term WtS_{ctp} indicates that the hedge benefit ratio is calculated using the combined long and short positions across the entire CTP and not just the positions in the particular bucket.

175. The bucket-level capital amounts are then aggregated as follows:

$$DRC_{CTP} = \max[\sum_b (\max[DRC_b, 0] + 0.5 \times \min[DRC_b, 0]), 0]$$

For instance, if the default risk charge for the index CDX North America IG is +100 and the default risk charge for the index Major Sovereign (G7 and Western Europe) is -100, the total default risk charge for the correlation trading portfolio is $100 - 0.5 \times 100 = 50$.[36]

[35] Basel Committee on Banking Supervision, *Revisions to the securitisation framework*, December 2014, www.bis.org/bcbs/publ/d303.htm.

[36] The procedure for the *DRCb* and *DRCctp* terms accounts for the basis risk in cross index hedges, as the hedge benefit from cross-index short positions is discounted twice, first by the hedge benefit ratio *WtS* in *DRCb*, and again by the term 0.5 in the *DRCctp* equation.

C. Market risk – The Internal Models Approach

1. General criteria

176. The use of an internal model for the purposes of regulatory capital determination 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 cooperatively to ensure an efficient approval process.

177. The supervisory authority will only give its approval if at a minimum:

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

(b) 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;

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

(d) The bank regularly conducts stress tests along the lines discussed in paragraphs 195 to 202 below; and

(e) The positions included in the internal model for regulatory capital determination are held in approved trading desks that have passed the required tests described in paragraph 182.

178. Supervisory authorities will be able 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.

179. In addition to these general criteria, banks using internal models for capital purposes will be subject to the additional requirements detailed below.

2. Qualitative standards

180. Supervisory authorities must be able to assure themselves that banks using internal models have market risk management systems that are conceptually sound and implemented with integrity. Accordingly, the bank must meet the following *qualitative criteria* on an ongoing basis. Supervisors must assess that banks have met the criteria before they are permitted to use a models-based approach. These qualitative criteria include:

(a) The bank must 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 must conduct regular backtesting and profit and loss (P&L) attribution programmes, ie an ex-post comparison of the risk measure and P&L values generated by the model against actual daily changes in portfolio values over longer periods of time, as well as hypothetical changes based on static positions. Both of these exercises must be conducted at a trading desk level, while regular backtesting must also be conducted on the firm-wide internal model for regulatory capital determination level.

(c) A distinct unit must conduct the initial and ongoing validation of all internal models. Internal models must be validated on at least an annual basis.

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

(e) Internal models used to calculate market risk charges are likely to differ from those used by banks in their day-to-day internal management functions. Nevertheless, the starting point for the design of both the regulatory and the internal risk models should be the same. In particular, the valuation models that are embedded in both should be similar. These valuation models must be an integral part of the internal identification, measurement, management and internal reporting of price risks within the firm. As well, internal risk models should, at a minimum, cover the positions covered by the regulatory models, although they may cover more. In the construction of their regulatory capital models, banks must start from the methodologies used in their internal models with regard to risk factor identification, parameter estimation and proxy concept and deviate only if this is appropriate due to regulatory constraints. It is expected that the same risk factors are covered in the regulatory models as in the internal models.

(f) A routine and rigorous programme of stress testing is required as a supplement to the risk analysis based on the output of the bank's risk measurement model. The results of stress testing must be reviewed at least monthly 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 must be taken to mitigate those risks appropriately (eg by hedging against that outcome or reducing the size of the bank's exposures, or increasing capital).

(g) Banks need to 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 comprehensive risk management manual that describes the basic principles of the risk management system and that provides a detailed explanation of the empirical techniques used to measure market risk.

(h) Any significant changes to a regulatory-approved model must be approved by the supervisor prior to being implemented.

(i) Risk measures must be calculated on the full set of positions which are in the scope of application of the model. The risk measures must be based on a sound theoretical basis, calculated correctly, and reported accurately.

(j) An independent review of the risk measurement system must be carried out regularly by either the bank's own internal auditing process or an external auditor. This review must include both the activities of the business trading units and of the independent risk control unit. The review must be sufficiently detailed to determine for any failings which desks are impacted. A review of the overall risk management process should take place at regular intervals (not less than once a year) and must specifically address, at a minimum:

- The organisation of the risk control unit;
- The adequacy of the documentation of the risk management system and process;
- The accuracy and appropriateness of the risk measurement system (including any significant changes);
- The verification of the consistency, timeliness and reliability of data sources used to run internal models, including the independence of such data sources;

- The approval process for risk pricing models and valuation systems used by front and back-office personnel;
- 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 accuracy and appropriateness of volatility and correlation assumptions;
- The accuracy of valuation and risk transformation calculations; and
- The verification of the model's accuracy through frequent backtesting and P&L attribution as described in Appendix B: *Supervisory framework for the use of backtesting in conjunction with the internal models approach to market risk capital requirements*.

3. Quantitative standards

181. 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) "*Expected shortfall*" must be computed on a daily basis for the bank-wide internal model for regulatory capital purposes. Expected shortfall must also be computed on a daily basis for each trading desk that a bank wishes to include within the scope for the internal model for regulatory capital purposes.

(b) In calculating the expected shortfall, a 97.5th percentile, one-tailed confidence level is to be used.

(c) In calculating the expected shortfall, the liquidity horizons described in paragraph 181(k) must be reflected by scaling an expected shortfall calculated on a base horizon. The expected shortfall for a liquidity horizon **must** be calculated from an expected shortfall at a base liquidity horizon of 10 days with scaling applied to this base horizon result as follows:

$$ES = \sqrt{\left(ES_T(P)\right)^2 + \sum_{j\geq 2}\left(ES_T(P,j)\sqrt{\frac{(LH_j - LH_{j-1})}{T}}\right)^2}$$

where:

- ES is the regulatory liquidity-adjusted expected shortfall;
- T is the length of the base horizon, ie 10 days;
- $ES_T(P)$ is the expected shortfall at horizon T of a portfolio with positions $P = (p_i)$ with respect to shocks to all risk factors that the positions P are exposed to;
- $ES_T(P, j)$ is the expected shortfall at horizon T of a portfolio with positions $P = (p_i)$ with respect to shocks for each position p_i in the subset of risk factors $Q(p_i, j)$, with all other risk factors held constant;
- the ES at horizon T, $ES_T(P)$ must be calculated for changes in the risk factors, and $ES_T(P, j)$ must be calculated for changes in the relevant subset $Q(p_i, j)$ of risk factors, over the time interval T without scaling from a shorter horizon;
- $Q(p_i, j)_j$ is the subset of risk factors whose liquidity horizons, as specified in paragraph 181(k), for the desk where p_i is booked are at least as long as LH_j according to the table

below. For example, $Q(p_i,4)$ is the set of risk factors with a 60-day horizon and a 120-day liquidity horizon. Note that $Q(p_i, j)$ is a subset of $Q(p_i, j-1)$;

- the time series of changes in risk factors over the base time interval T may be determined by overlapping observations; and
- LH_j is the liquidity horizon j, with lengths in the following table:

j	LH_j
1	10
2	20
3	40
4	60
5	120

(d) The expected shortfall measure must be calibrated to a period of stress. Specifically, the measure must replicate an expected shortfall charge that would be generated on the bank's current portfolio if the relevant risk factors were experiencing a period of stress. This is a joint assessment across all relevant risk factors, which will capture stressed correlation measures. This calibration is to be based on an "indirect" approach using a reduced set of risk factors. Banks are to specify a reduced set of risk factors that are relevant for their portfolio and for which there is a sufficiently long history of observations. This reduced set of risk factors is subject to supervisory approval and must meet the data quality requirements for a modellable risk factor as outlined in paragraph 183(c). The identified reduced set of risk factors must be able to explain a minimum of 75% of the variation of the full ES model (ie the ES of the reduced set of risk factors should be at least equal to 75% of the fully specified ES model on average measured over the preceding 12 week period).

The expected shortfall for the portfolio using this set of risk factors, calibrated to the most severe 12-month period of stress available over the observation horizon, is calculated. That value is then scaled up by the ratio of the current expected shortfall using the full set of risk factors to the current expected shortfall measure using the reduced set of factors. The expected shortfall for risk capital purposes is therefore:

$$ES = ES_{R,S} \cdot \frac{ES_{F,C}}{ES_{R,C}}$$

where the expected shortfall for capital purposes (ES) is equal to the expected shortfall based on a stressed observation period using a reduced set of risk factors ($ES_{R,S}$) multiplied by the ratio of the expected shortfall measure based on the current (most recent) 12-month observation period with a full set of risk factors ($ES_{F,C}$) and the expected shortfall measure based on the current period with a reduced set of risk factors ($ES_{R,C}$). For the purpose of this calculation, the ratio is floored at 1.

(e) For measures based on current observations ($ES_{F,C}$), banks must update their *data sets* no less frequently than once every month and must also reassess them whenever market prices are subject to material changes. This updating process must be flexible enough to allow for more frequent updates. The supervisory authority may also require a bank to calculate its Expected Shortfall using a shorter observation period if, in the supervisor's judgement; this is justified by a significant upsurge in price volatility. In this case, however, the period should be no shorter than 6 months.

(f) For measures based on stressed observations ($ES_{R,S}$), banks must identify the 12-month period of stress over the observation horizon in which the portfolio experiences the largest loss. The observation horizon for determining the most stressful 12 months must, at a minimum, span back to and including 2007. Observations within this period must be equally weighted. Banks must update their 12-month stressed periods no less than monthly, or whenever there are material changes in the risk factors in the portfolio.

(g) No particular type of expected shortfall model is prescribed. So long as each model used captures all the material risks run by the bank, as confirmed through P&L attribution and backtesting, and conforms to each of the requirements set out above and below, supervisors may permit banks to use models based on either historical simulation, Monte Carlo simulation, or other appropriate analytical methods.

(h) Banks will have discretion to recognise empirical *correlations* within broad regulatory risk factor classes (interest rate risk, equity risk, foreign exchange risk, commodity risk and credit risk, including related options volatilities in each risk factor category). Empirical correlations across broad risk factor categories will be constrained by the supervisory aggregation scheme, as described in paragraph 189, and must be calculated and used in a manner consistent with the applicable liquidity horizons, clearly documented and able to be explained to supervisors on request.

(i) 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;
- Each bank's risk measurement system must have a set of risk factors that captures the *volatilities of the rates and prices* underlying option positions, ie vega risk. Banks with relatively large and/or complex options portfolios must have detailed specifications of the relevant volatilities. This means that banks must model the volatility surface across both strike price and vertex (ie tenor).

(j) Each bank must meet, on a daily basis, a *capital requirement* C_A expressed as the higher of (1) its previous day's aggregate capital charge for market risk; and (2) an average of the daily capital measures in the preceding 60 business days according to the parameters specified in paragraphs 187 to 194 for the following formula:

$$C_A = max\{IMCC_{t-1} + SES_{t-1};\ m_c \cdot IMCC_{avg} + SES_{avg}\}$$

(k) As set out in paragraph 181(c), a scaled expected shortfall must be calculated based on the liquidity horizon *n* defined below. *n* is calculated using the following conditions:

- banks must map each risk factor on to one of the risk factor categories shown below using consistent and clearly documented procedures;
- the mapping must be (i) set out in writing; (ii) validated by the bank's risk management; (iii) made available to supervisors; and (iv) subject to internal audit; and
- *n* is determined for each broad category of risk factor as set out in the following table. However, on a desk-by-desk basis *n* can be increased relative to the values in the table below (ie the liquidity horizon specified below can be treated as a floor). Where *n* is increased, the increased horizon must be 20, 40, 60 or 120 days and the rationale must be documented and be subject to supervisory approval. Furthermore, liquidity horizons should be capped at the maturity of the related instrument:

Risk factor category	n	Risk factor category	n
Interest rate: specified currencies - EUR, USD, GBP, AUD, JPY, SEK, CAD and domestic currency of a bank	10	Equity price (small cap): volatility	60
Interest rate: – unspecified currencies	20	Equity: other types	60
Interest rate: volatility	60	FX rate: specified currency pairs[37]	10
Interest rate: other types	60	FX rate: currency pairs	20
Credit spread: sovereign (IG)	20	FX: volatility	40
Credit spread: sovereign (HY)	40	FX: other types	40
Credit spread: corporate (IG)	40	Energy and carbon emissions trading price	20
Credit spread: corporate (HY)	60	Precious metals and non-ferrous metals price	20
Credit spread: volatility	120	Other commodities price	60
Credit spread: other types	120	Energy and carbon emissions trading price: volatility	60
		Precious metals and non-ferrous metals price: volatility	60
Equity price (large cap)	10	Other commodities price: volatility	120
Equity price (small cap)	20	Commodity: other types	120
Equity price (large cap): volatility	20		

4. Model validation standards

182. Banks must 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 must be conducted when the model is initially developed and when any significant changes are made to the model. Models must be periodically revalidated, particularly when there have been significant structural changes in the market or changes to the composition of the portfolio which might lead to the model no longer being adequate. Model validation must not be limited to P&L attribution and backtesting, but must, 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 and any pricing models.

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

[37] USD/EUR, USD/JPY, USD/GBP, USD/AUD, USD/CAD, USD/CHF, USD/MXN, USD/CNY, USD/NZD, USD/RUB, USD/HKD, USD/SGD, USD/TRY, USD/KRW, USD/SEK, USD/ZAR, USD/INR, USD/NOK, USD/BRL, EUR/JPY, EUR/GBP, EUR/CHF and JPY/AUD.

- Testing carried out for longer periods than required for the regular backtesting programme (eg three years); or
- Testing carried out using the entire forecasting distribution using the p-value of the desk's profit or loss on each day. For example the bank could be required to use in validation and make available to the supervisor the following information for each desk for each business day over the previous three years, with no more than a 60-day lag:
  - (i) Two daily VaR's for the desk calibrated to a one-tail 99.0 and 97.5 percent confidence level , and a daily ES calibrated to 97.5;
  - (ii) The daily profit or loss for the desk (that is, the net change in price of the positions held in the portfolio at the end of the previous business day); and
  - (iii) The p-value of the profit or loss on each day for the desk (that is, the probability of observing a profit that is less than, or a loss that is greater than the amount reported according to the model used to calculate ES).
- Testing of portfolios must be done at both the trading desk and bank-wide level; and
- Testing of the necessary inputs for a DRC VaR measure at the 99.9% 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 181 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 should 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.

5. Determining the eligibility of trading activities

183. The process for determining the eligibility of trading activities for the internal models-based approach is based on a three-stage approach.

(a) The first step is the overall assessment of both the bank's organisational infrastructure (including the definition and structure of trading desks) and its firm-wide internal risk capital model. These evaluations are based on both qualitative and quantitative factors. The quantitative factors are based on backtesting and are detailed further in Appendix B, ie *The supervisory framework for the use of backtesting and profit and loss attribution in conjunction with the internal models approach to market risk capital measurement*.

(b) The second step breaks the model approval process into smaller, more discrete, elements – the regulatory trading desks, as defined in paragraphs 22 to 26. At this stage, banks must nominate which trading desks are in-scope for model approval and which trading desks are out-of-scope. Banks must specify in writing the basis for the nomination. Banks must not nominate desks to be out-of-scope due to standardised approach capital charges being less than the modelled requirements. Desks that are out-of-scope will be capitalised according to the standardised approach on a portfolio basis. Desks that opt out of the internal models approach at this stage must remain ineligible for model inclusion for a period of at least one year.

For those desks that the bank has deemed to be in-scope for the internal models approach, model approval is required at the trading desk level. Each trading desk must satisfy P&L attribution and backtesting requirements on an ongoing basis.

Backtesting requirements are based on comparing each desk's 1-day static value-at-risk measure (calibrated to the most recent 12 months' data, equally weighted) at both the 97.5th percentile and the 99th percentile, using at least one year of current observations of the desk's one-day P&L.[38] If any given desk experiences either more than 12 exceptions at the 99th percentile or 30 exceptions at the 97.5th percentile in the most recent 12-month period, all of its positions must be capitalised using the standardised approach.[39] Positions must continue to be capitalised using the standardised method until the desk no longer exceeds the above thresholds over the prior 12 months.

P&L attribution requirements are based on two metrics: mean unexplained daily P&L (ie risk-theoretical P&L minus hypothetical P&L) over the standard deviation of hypothetical daily P&L and the ratio of variances of unexplained daily P&L and hypothetical daily P&L. These ratios are calculated monthly and reported prior to the end of the following month. If the first ratio is outside of the range of -10% to +10% or if the second ratio were in excess of 20% then the desk experiences a breach. If the desk experiences four or more breaches within the prior 12 months then it must be capitalised under the standardised approach. The desk must remain on the standardised approach until it can pass the monthly P&L attribution requirement and provided it has satisfied its backtesting exceptions requirements over the prior 12 months. Trading desks that do not satisfy the minimum backtesting and P&L attribution requirements are ineligible for capitalisation using the internal models approach. Risk exposures within these ineligible desks must be included with the out-of-scope desks and capitalised according to the standardised methodology on a portfolio basis.

There may on very rare occasions be a valid reason why a series of accurate desk level models across different banks will produce many backtesting exceptions or inadequately track P&L attribution to the front office pricing model (for instance, during periods of significant cross-border financial market stress affecting several banks or when financial markets are subjected to a major regime shift). One possible supervisory response in this instance would be to permit the relevant desks within each affected bank to remain capitalised under the internal model approach but require each desk's model to take account of the regime shift or significant market stress as quickly as it can while maintaining the integrity of its procedures for updating the model. It should be emphasised, however, that the Committee believes that this supervisory discretion should only be allowed under the most extraordinary, systemic circumstances.

For an institution to remain eligible for capitalisation under the internal models approach, a minimum of 10% of the bank's aggregated market risk charges must be based on positions held in desks that qualify for inclusion in the bank's internal model for regulatory capital.

(c) Step three is a risk factor analysis. Following the identification of eligible trading desks, this step will determine which risk factors within the identified desks are eligible to be included in the bank's internal models for regulatory capital. For a risk factor to be classified as modellable by a bank, there must be continuously available "real" prices for a sufficient set of representative transactions. A price will be considered "real" if:

- It is a price at which the institution has conducted a transaction;

[38] Risk factors that are captured in the CVA capital framework can be excluded from the P&L for the purpose of the backtesting requirements in the market risk framework.

[39] Desks with exposure to issuer default risk must pass a two-stage approval process. First, the market risk model must pass backtesting and P&L attribution. Conditional on approval of the market risk model, the desk may then apply for approval to model default risk as described in paragraph 186. Desks that fail either test must be capitalised under the standardised approach.

- It is a verifiable price for an actual transaction between other arms-length parties; or
- The price is obtained from a committed quote.
- If the price is obtained from a third-party vendor, where: (i) the transaction has been processed through the vendor; (ii) the vendor agrees to provide evidence of the transaction to supervisors upon request; and (iii) the price meets the three criteria immediately listed above, then it is considered to be real for the purposes of the modellable classification.

To be considered to have continuously available "real" prices, a risk factor must have at least 24 observable "real" prices per year (measured over the period used to calibrate the current expected shortfall model) with a maximum period of one month between two consecutive observations.[40] The above criteria must be assessed on a monthly basis. Any "real" price that is observed for a transaction should be counted as an observation for all of the risk factors concerned (ie all risk factors which are used to model the risk of the instrument that is bought, sold or generated through the transaction as part of the overall portfolio).

Risk factors derived solely from a combination of modellable risk factors are modellable. For example, risk factors derived through multi-factor beta models whose inputs and calibrations are based solely on modellable risk factors, can be classified as modellable and **can** be included within the Expected Shortfall.

Once a risk factor is deemed modellable, the bank should choose the most appropriate data to calibrate its model – the data used for calibration does not need to be the same data used to prove that the risk factor is modellable.

Where a risk factor deemed modellable is not available during the historical period used for stressed calibration, proxy data can be used provided the general approach for generating old missing data is documented and part of the independent review of the internal model by the bank's supervisory authority.

With supervisory approval, some risk factors that would be considered modellable under the above criteria may be temporarily excluded from a bank's firm-wide regulatory capital model. In these circumstances, the bank will be given 12 months to include the relevant risk factors in the regulatory capital model.

6. Interaction with the standardised approach methodology

184. Banks must calculate the standardised capital charge for each trading desk as if it were a standalone regulatory portfolio. This calculation must be performed at least monthly and will:

(a) Serve as an indication of the fallback capital charge for those desks that fail the eligibility criteria for inclusion in the bank's internal model as outlined in paragraphs 180 and 181.

(b) Generate information on the capital outcomes of the internal models relative to a consistent benchmark and facilitate comparison in implementation between banks and/or across jurisdictions.

40 In particular, a bank may add modellable risk factors, and replace non-modellable risk factors by a basis between these additional modellable risk factors and these non-modellable risk factors. This basis will then be considered as a non-modellable risk factor. A combination between modellable and non-modellable risk factors will be a non-modellable risk factor.

(c) Monitor over time the relative calibration of standardised and modelled approaches, facilitating adjustments as needed.

(d) Provide macroprudential insight in an ex ante consistent format.

7. Specification of market risk factors

185. An important part of a bank's internal market risk measurement system is the specification of an appropriate set of market risk factors, ie the market rates and prices that affect the value of the bank's trading positions. The risk factors contained in a market risk measurement system must 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 requirements must be fulfilled.

(a) Factors that are deemed relevant for pricing should be included as risk factors in the bank's internal models. Where a risk factor is incorporated in a pricing model but not in the risk capital model, the bank must justify this omission to the satisfaction of its supervisor. Similarly, the ES model must include all risk factors corresponding to the regulatory risk factors specified under each risk class in the Standardised Approach, set out in paragraphs 45 to 175, or prove to its supervisor the immateriality of these risk factors for its trading positions. In addition, the ES model and any stress scenarios calculated for non-modellable risk factors must capture non-linearities for options and other relevant products (eg mortgage-backed securities), as well as correlation risk and relevant basis risks (eg between credit default swaps and bonds). Moreover, the supervisor has to be satisfied that proxies are used which show a good track record for the actual position held (ie an equity index for a position in an individual stock).

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

(c) For *exchange rates*, the risk measurement system must incorporate risk factors corresponding to the individual foreign currencies in which the bank's positions are denominated. Since the expected shortfall 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 must be risk factors corresponding to each of the equity markets in which the bank holds significant positions:

- At a minimum, there must be a risk factor that is designed to capture market-wide movements in equity prices (eg a market index). Positions in individual securities or in sector indices could be expressed in "beta-equivalents" 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 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 must be risk factors corresponding to each of the commodity markets in which the bank holds significant positions.

- 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 (including different risk factors for different geographies where relevant). 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"[41] between derivatives positions such as forwards and swaps and cash positions in the commodity.

(f) All securitised products are ineligible for inclusion in the internal models-based capital charge and must be capitalised using the standardised approach.

8. Default risk

186. Banks must have a separate internal model to measure the default risk of trading book positions. The general criteria in paragraphs 176 to 179 and the qualitative standards in paragraph 180 also apply to the default risk model.

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

(b) Default risk must be measured using a VaR model. Banks must use a default simulation model with two types of systematic risk factors. Default correlations must be based on credit spreads or on listed equity prices. Banks must have clear policies and procedures that describe the correlation calibration process, documenting in particular in which cases credit spreads or equity prices are used. Correlations must be based on data covering a period of 10 years that

[41] 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.

includes a period of stress as defined in paragraph 181(d), and based on a one-year liquidity horizon. Banks have the discretion to apply a minimum liquidity horizon of 60 days to the determination of default risk charges for equity sub-portfolios. The VaR calculation must be done weekly and be based on a one-year time horizon at a one-tail, 99.9 percentile confidence level.

(c) All positions subject to the market risk framework that have default risk as defined in paragraph 186(a), with the exception of those positions subject to standardised charges are subject to the default risk charge model. Therefore, sovereign exposures (including those denominated in the sovereign's domestic currency), equity positions and defaulted debt positions must be included in the model. For equity positions, the default of an issuer must be modelled as resulting in the equity price dropping to zero.

(d) The default risk charge model capital requirement is the greater of: (1) the average of the default risk charge model measures over the previous 12 weeks; or (2) the most recent default risk charge model measure.

(e) A bank must assume constant positions over the one-year horizon, or 60 days in the context of designated equity sub-portfolios.

(f) Default risk must be measured for each obligor.

- PDs implied from market prices are not acceptable unless they are corrected to obtain an objective probability of default.[42]
- PDs are subject to a floor of 0.03%.

(g) The model may reflect netting of long and short exposures to the same obligor, and if such exposures span different instruments with exposure to the same obligor, the effect of the netting must account for different losses in the different instruments (eg differences in seniority).

(h) The basis risk between long and short exposures of different obligors must be modelled explicitly. The potential for offsetting default risk among long and short exposures across different obligors must be included through the modelling of defaults. The pre-netting of positions before input into the model other than as described in paragraph 186(g) is not allowed.

(i) The default risk charge model must recognise the impact of correlations between defaults among obligors, including the effect on correlations of periods of stress as described in paragraph 186(b).

- These correlations must be based on objective data and not chosen in an opportunistic way where a higher correlation is used for portfolios with a mix of long and short positions and a low correlation used for portfolios with long only exposures.
- A bank must validate that its modelling approach for these correlations is appropriate for its portfolio, including the choice and weights of its systematic risk factors. A bank must document its modelling approach and the period of time used to calibrate the model.
- These correlations must be measured over a liquidity horizon of one year.
- These correlations must be calibrated over a period of at least 10 years.

42 In other words, market implied PDs are not acceptable.

- Firms need to reflect all significant basis risks in recognising these correlations, including, for example, maturity mismatches, internal or external ratings, vintage etc.

(j) The model must capture any material mismatch between a position and its hedge. With respect to default risk within the one-year capital horizon, the model must account for the risk in the timing of defaults to capture the relative risk from the maturity mismatch of long and short positions of less than one year maturity.

(k) The model must reflect the effect of issuer and market concentrations, as well as concentrations that can arise within and across product classes during stressed conditions.

(l) As part of this default risk charge model, the bank must calculate, for each and every position subjected to the model, an incremental loss amount relative to the current valuation that the bank would incur in the event that the obligor of the position defaults.

(m) These loss estimates must reflect the economic cycle; for example, the model must incorporate the dependence of the recovery on the systemic risk factors.

(n) The model must reflect the non-linear impact of options and other positions with material non-linear behaviour with respect to default. In the case of equity derivatives positions with multiple underlyings, simplified modelling approaches (for example modelling approaches that rely solely on individual jump-to-default sensitivities to estimate losses when multiple underlyings default) may be applied (subject to supervisory approval).

(o) Default risk must be assessed from the perspective of the incremental loss from default in excess of the mark-to-market losses already taken into account in the current valuation.

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

(q) Firms should strive to develop relevant internal modelling benchmarks to assess the overall accuracy of their DRC models.

(r) Due to the unique relationship between credit spread and default risk, banks must seek approval for each desk with exposure to these risks, both for credit spread risk and default risk. Desks which do not receive approval will be deemed ineligible for internal modelling standards and be subject to the standardised capital framework.

(s) PD estimates must adhere to the following standards:

- Where an institution has approved PD estimates as part of the internal ratings-based (IRB) approach, this data must be used. Where such estimates do not exist, or the Supervisor determines that they are not sufficiently robust, PDs must be computed using a methodology consistent with the IRB methodology unless otherwise specified below.
- Risk neutral PDs should not be used as estimates of observed (historical) PDs.
- PDs must be measured based on historical default data including both formal default events and price declines equivalent to default losses. Where possible, this data should be based on publicly traded securities over a complete economic cycle. The minimum historical observation period for calibration purposes is 5 years.

- PDs must be estimated based on historical data of default frequency over a one year period. The PD may also be calculated on a theoretical basis (eg geometric scaling) provided that the bank is able to demonstrate that such theoretical derivations are in line with historical default experience.
- PDs provided by external sources may also be used by institutions, provided they can be shown to be relevant for the bank's portfolio.

(t) LGD[43] estimates must adhere to the following standards:

- Where an institution has approved LGD estimates as part of the internal ratings based (IRB) approach, this data must be used. Where such estimates do not exist, or the supervisor determines that they are not sufficiently robust, LGDs must be computed using a methodology consistent with the IRB methodology unless otherwise specified below.
- LGDs must be determined from a market perspective, based on a position's current market value less the position's expected market value subsequent to default. The LGD should reflect the type and seniority of the position and cannot be less than zero.
- LGDs must be based on an amount of historical data that is sufficient to derive robust, accurate estimates.
- LGDs provided by external sources may also be used by institutions, provided they can be shown to be relevant for the bank's portfolio.

(u) Banks must establish a hierarchy ranking their preferred sources for PDs and LGDs, in order to avoid the cherry-picking of parameters.

9. Capitalisation of risk factors

187. For those desks that are permitted to be on the internal models approach, all risk factors that are deemed to be "modellable" must be included in the bank's internal, firm-wide, expected shortfall model. The bank must calculate its internally modelled capital charge at the bank-wide level using this model, with no supervisory constraints on cross risk class correlations (*IMCC(C)*).

188. The bank must calculate a series of partial expected shortfall charges (ie all other risk factors must be held constant) for the range of broad regulatory risk classes (interest rate risk, equity risk, foreign exchange risk, commodity risk and credit spread risk). These partial, non-diversifiable (constrained) expected shortfall values ($IMCC(C_i)$) will then be summed to provide an aggregated risk class expected shortfall charge.

189. The aggregate capital charge for modellable risk factors (*IMCC*) is based on the weighted average of the constrained and unconstrained expected shortfall charges.

$$IMCC = \rho\left(IMCC\left(C\right)\right) + \left(1-\rho\right)\left(\sum_{i=1}^{R} IMCC\left(C_i\right)\right)$$

where $IMCC\left(C\right) = ES_{R,S} \times \dfrac{ES_{F,C}}{ES_{R,C}}$ and $IMCC\left(C_i\right) = ES_{R,S,\,i} \times \dfrac{ES_{F,C,\,i}}{ES_{R,C,\,i}}$.

[43] LGD should be interpreted in this context as 1 – recovery rate.

The stress period used in the risk class-level $ES_{R,S,i}$ should be the same as that used to calculate the portfolio-wide $ES_{R,S}$.

ρ is the relative weight assigned to the firm's internal model. The value of ρ is 0.5.

For regulatory capital purposes, the aggregated charge associated with approved desks (C_A) is equal the maximum of the most recent observation and a weighted average of the previous 60 days scaled by a multiplier (m_c).

$$C_A = max\{IMCC_{t-1} + SES_{t-1};\ m_c \cdot IMCC_{avg} + SES_{avg}\}$$

where *SES* is the aggregate regulatory capital measure for *K* risk factors in model-eligible desks that are non-modellable.

The multiplication factor m_c will be 1.5 or 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 1.5. Banks must add to this factor 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 0.5 based on the outcome of the backtesting of the bank's *daily VaR at the 99th percentile* based on current observations on the full set of risk factors *(VaR_{FC})*. If the backtesting results are satisfactory and the bank meets all of the qualitative standards set out in paragraph 180, the plus factor could be zero. Appendix B presents in detail the approach to be applied for backtesting and the plus factor. Banks must develop the capability to perform backtests using both hypothetical (ie using changes in portfolio value that would occur were end-of-day positions to remain unchanged) and actual trading (excluding fees and commissions) outcomes.[44] The multiplication factor will be based upon the maximum of the exceptions generated by the two backtesting results.

190. Each non-modellable risk factor is to be capitalised using a stress scenario that is calibrated to be at least as prudent as the expected shortfall calibration used for modelled risks (ie a loss calibrated to a 97.5% confidence threshold over a period of extreme stress for the given risk factor). For each non-modellable risk factor, the liquidity horizon of the stress scenario must be the greater of the largest time interval between two consecutive price observations over the prior year and the liquidity horizon assigned to the risk factor in paragraph 181. For non-modellable risk factors arising from idiosyncratic credit spread risk, banks may apply the same stress scenario. Additionally, a zero correlation assumption may be made when aggregating gains and losses provided the bank conducts analysis to demonstrate to its supervisor that this is appropriate. For example, analysis on the residuals and showing that residual distributions from factor models are homogeneous within each residual distribution and heterogeneous against others, and do not exhibit serial correlation in the time series.[45] No correlation or diversification effect between other non-modellable risk factors is permitted. In the event that a bank cannot provide a

[44] To the extent that risk factors are captured in the CVA capital framework, their impact on the CVA component of the fair value of financial instruments has to be excluded from the P&L for the purpose of the market risk framework. In addition, the impact on the DVA component of the fair value of financial instruments also have to be excluded from the P&L. Any other fair value adjustments need to be included in the P&L.

[45] The tests are generally done on the residuals of panel regressions where the dependent variable is the change in issuer spread while the independent variables can be either a change in a market factor or a dummy variable for sector and/or region. The assumption is that the data on the names used to estimate the model suitably proxies the names in the portfolio and the idiosyncratic residual component captures the multifactor-name basis. If the model is missing systematic explanatory factors or the data suffers from measurement error, then the residuals would exhibit heteroscedasticity (which can be tested via White, Breuche Pagan tests, etc.) and/or serial correlation (which can be tested with Durbin Watson, LM tests, etc.) and/or cross-sectional correlation (clustering).

stress scenario which is acceptable for the supervisor, the bank will have to use the maximum possible loss as the stress scenario.

The aggregate regulatory capital measure for L (non-modellable idiosyncratic credit spread risk factors that have been demonstrated to be appropriate to aggregate with zero correlation) and K (risk factors in model-eligible desks that are non-modellable *(SES)*) is:

$$SES = \sqrt{\sum_{i=1}^{L} ISES_{NM,i}^{2}} + \sum_{j=1}^{K} SES_{NM,j}$$

where $ISES_{NM,i}$ is the stress scenario capital charge for idiosyncratic credit spread non-modellable risk i from the L risk factors aggregated with zero correlation; and $SES_{NM,j}$ is the stress scenario capital charge for non-modellable risk j.

191. The additional regulatory capital charge for modellable risk positions subject to default risk is *DRC* as described in paragraph 186 above.

192. The aggregate capital charge for those desks eligible for the internal models approach is equal to the aggregate capital charge for modellable risk factors ($C_{A,M}$) plus the sum of the individual capital requirements for non-modellable risk factors ($C_{A,U}$) plus the charge for default risk charge model (*DRC*).

193. The regulatory capital charge associated with risks from model-ineligible (ie unapproved) desks (C_u) is to be calculated by aggregating all such risks and applying the standardised charge.

194. The aggregate capital charge for market risk (*ACC*) is equal to the aggregate capital requirement for eligible trading desks plus the standardised capital charge for risks from unapproved trading desks.

$$ACC = C_A + DRC + C_U$$

10. Stress testing

195. Banks that use the internal models approach for meeting market risk capital requirements must have in place a rigorous and comprehensive stress testing program at both the trading desk and bank-wide level. 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.

196. 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 risk, 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 non-linear price characteristics (ie options and instruments that have option-like characteristics).

197. 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.

198. 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.

Supervisory scenarios requiring no simulations by the bank

199. Banks should have information on the largest losses experienced during the reporting period and should make this 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 expected shortfall estimate.

Scenarios requiring a simulation by the bank

200. Banks should subject their portfolios to a series of simulated stress scenarios and provide supervisory authorities with the results. These scenarios could include testing the current portfolio against past periods of significant disturbance, for example, the 1987 equity crash, the Exchange Rate Mechanism crises of 1992 and 1993, the increase in interest rates in the first quarter of 1994, the 1998 Russian financial crisis, the 2000 bursting of the technology stock bubble, the 2007–08 sub-prime crisis, or the 2011–12 euro zone crisis, incorporating both the large price movements and the sharp reduction in liquidity associated with these events. A second type of scenario would evaluate the sensitivity of the bank's market risk exposure to changes in the assumptions about volatilities and correlations. Applying this test would require an evaluation of the historical range of variation for volatilities and correlations and evaluation of the bank's current positions against the extreme values of the historical range. Due consideration should be given to the sharp variation that at times has occurred in a matter of days in periods of significant market disturbance. For example, the above-mentioned situations involved correlations within risk factors approaching the extreme values of 1 or –1 for several days at the height of the disturbance.

Scenarios developed by the bank itself to capture the specific characteristics of its portfolio.

201. In addition to the scenarios prescribed by supervisory authorities under paragraphs 199 and 200, a bank should also develop its own stress tests which it identifies as most adverse based on the characteristics of its portfolio (eg problems in a key region of the world combined with a sharp move in oil prices). Banks should provide supervisory authorities with a description of the methodology used to identify and carry out the scenarios as well as with a description of the results derived from these scenarios.

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

11. External validation

203. 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 182 and 183 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 both the banks' *backtesting* of its internal measurement system (ie comparing expected shortfall estimates with actual profits and losses) and its *P&L attribution* process to ensure that the models provide a reliable measure of potential losses over time. This means that banks should make the results as well as the underlying inputs to their expected shortfall calculations and details of the P&L attribution exercise available to their supervisory authorities and/or external auditors on request; and

(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 and 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.

Appendix A

Trading desk definitions

For the purpose of regulatory capital calculations, a "trading desk" is defined as a group of traders or trading accounts (key element #1 below) that implements a well-defined business strategy (key element #2 below), operating within a clear risk management structure (key element #3 below), defined by the bank but with the definition approved by supervisors for capital purposes (key element #4 below).

Key element #1: a "trading desk" for the purposes of the regulatory capital framework is an unambiguously defined **group of traders or trading accounts**.

- An individual trader or trading account is an **indisputable and unambiguous unit of observation** in accounting for trading activity.
- The desk must have a **Head Trader**.
  - The head trader must have direct oversight of the group of traders or trading accounts.
  - Each trader or each trading account in the desk must have a clearly defined specialty(ies).
- **Each trader or each trading account must be assigned to only one trading desk.** For the Head Trader, his role may cut across several businesses. Nonetheless, a given trader can only be the Head Trader at one desk and not multiple desks.
- The desk must have a clear reporting line to bank senior management, and should have a clear and formal compensation policy clearly linked to the pre-established objectives of the desk.

Key element #2: a "trading desk" must have a **well-defined business strategy.**

- There must be a clear description of the **economics** of the business strategy for the desk, its **primary activities** and **trading/hedging strategies**:
  - Economics: what is the economics behind the strategy (eg trading on shape of the yield curve)? How much of the activities are customer-driven? Does it entail trade origination and structuring, or execution services, or both?
  - Primary activities: what is the list of **permissible instruments** and, out of this list, which are the instruments most frequently traded?
  - Trading/hedging strategies: how would these instruments be hedged, what are the expected slippages and mismatches of hedges, and what is the expected holding period for positions?
- The management team at the desk (starting from the Head Trader) must have a clear annual plan for the budgeting and staffing of the desk.
- Regular Management Information reports, covering revenue, costs and risk-weighted assets for the desk.

Key element #3: a "trading desk" must have **a clear risk management structure**.

- Risk management responsibilities: the bank must identify key groups and personnel responsible for overseeing the risk-taking activities at the desk.
- Limits setting: the desk must have

  - Well defined trading limits or directional exposures at the desk level that are based on the appropriate market risk metric (eg CS01 and/or JTD for a credit desk), or just overall notional limit.
  - Well defined trader mandates.
  - These limits must be reviewed at least annually by senior management at the firm.
- Risk reporting: the desk must produce, at least once a week
  - **P&L reports**, which would be periodically reviewed, validated and modified (if necessary) by Product Control.
  - I**nternal and regulatory risk measure reports**, including desk VaR/ES, desk VaR/ES sensitivities to risk factors, backtesting and p-value.

Key element #4: a "trading desk" must be **proposed by the bank** but **approved by supervisors**.

- The bank should be allowed to propose the trading desk structure per their organisational structure, consistent with the requirements in key elements #1 to #3 above.
- The bank must prepare a policy document for each desk it defines, documenting how the desk satisfies key elements #1 to #3 above.
- Supervisors will treat the definition of the trading desk as part of the initial model approval for the desk, as well as ongoing approval:
  - Supervisors may determine, based on the size of the bank's overall trading operations, whether the proposed desk definitions are sufficiently granular.
  - Supervisors should check that the bank's proposed definition of trading desk meets the criteria listed in Key elements #1, #2 and #3.

Appendix B

Supervisory framework for the use of backtesting and profit and loss attribution in conjunction with the internal models approach to market risk capital requirements

I. Introduction

This appendix presents the framework for incorporating backtesting and profit and loss (P&L) attribution into the internal models approach to market risk capital requirements. It represents an elaboration of paragraph 183 of the internal models Accord text.

P&L attribution and backtesting are critical components of the revised internal models approach for capitalising trading activities. In order for a bank to obtain approval to use internal models to capitalise its trading exposures, it must meet several qualitative and quantitative criteria outlined in paragraphs 180 and 181. A key component of these requirements is that the bank demonstrates that its internal models, both at the firm-wide level and for individual trading desks, can model P&L behaviour with an appropriate degree of accuracy.

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

The Committee believes that the framework outlined in this document strikes an appropriate balance between recognition of the potential limitations of P&L attribution and backtesting and the need to put in place appropriate constraints on the use of internal models (as well as incentives for model improvement).

The remainder of this appendix describes the P&L attribution/backtesting framework that accompanies the internal models capital requirement. The next section deals with the nature of the tests themselves, while the section that follows concerns the supervisory interpretation of the results and sets out the agreed standards of the Committee in this regard.

II. Description of the P&L attribution and backtesting frameworks at the trading desk level

The P&L attribution and backtesting frameworks developed by the Committee consist of a periodic comparison of the bank's daily risk measures (expected shortfall or value at risk) with the subsequent daily profit or loss ("trading outcome"). The risk measures are intended to be larger than all but a certain fraction of the trading outcomes, where that fraction is determined by the confidence level of the risk measure. Comparing the risk measures with the trading outcomes for backtesting purposes simply means that the bank counts the number of times that the risk measures were larger than the trading outcome. The fraction actually covered can then be compared with the intended level of coverage to gauge the performance of the bank's risk model.

P&L attribution

The P&L attribution assessment is designed to identify whether a bank's trading desk risk management model includes a sufficient number of the risk factors that drive the trading desk's daily P&L. For the assessment, all of the instruments held within a particular trading desk should be identified and considered as a distinct portfolio. The risk factors for that portfolio that are included in the desk's risk management model must be used to calculate a "risk-theoretical" P&L. This "risk-theoretical" P&L is the P&L that would be produced by the bank's pricing models for the desk if they only included the risk factors used in the risk management model.

The desk's risk management model includes all risk factors which the bank includes in its internal ES model. These may include any risk factors that the supervisor subsequently deems to be non-modellable and for which capital requirements are calculated based on individual stress scenarios. Movements in all risk factors contained in the trading desk's risk management model may be included, even if the forecasting component of the internal model uses data that incorporates additional residual risk. For example, a firm using a multi factor beta-based index model to capture event risk might include alternative data in the calibration of the residual component (possibly reflecting grade or asset type) to reflect potential events not observed in the name-specific historical time series. The fact that the name is a risk factor in the model, albeit modelled in a multi-factor model environment, means that, in the P&L attribution, the firm would include the actual return of the name in both the hypothetical P&L and risk theoretical P&L and get recognition for the risk factor coverage of the model.

This risk-theoretical P&L would be compared to the hypothetical daily desk-level P&L, based on the mark-to-market value of the trading desk's instruments derived from the bank's pricing models including all risk factors. The risk theoretical P&L used in P&L attribution must not take into account any risk factors that the bank does not include in its desk's risk management model.

This comparison between the risk-theoretical and hypothetical P&L is performed to determine whether the risk factors included in the desk's risk management model capture the material drivers of the bank's P&L derived from the bank's pricing models; and determine if there is a significant degree of association between the two P&L measures observed over a suitable time period. The Committee accepts that the risk-theoretical P&L can vary from the hypothetical daily P&L for a number of reasons. However, the rationale for this assessment is that a desk's risk management model should provide a reasonably accurate assessment of the risks of a trading desk to be deemed eligible for the internal models-based approach.

The P&L attribution requirements are based on two metrics:

- The mean of the difference between the risk-theoretical and hypothetical P&L (unexplained P&L) divided by the standard deviation of the hypothetical P&L; and
- The variance of the unexplained P&L divided by the variance of the hypothetical P&L.

Banks are required to estimate and report these ratios for each trading desk on a monthly basis. The decision to include or exclude a specific desk in the perimeter of the internal model would be taken if the averages of the proposed measures are inside supervisory-specified thresholds as defined in paragraph 183 over a given period.

Backtesting assessment

In addition to P&L attribution, the performance of a trading desk's risk management models will be tested through daily backtesting. The backtesting assessment is considered to be complementary to the P&L attribution assessment when determining the eligibility of a trading desk for the internal models-based approach. The backtests to be applied compare whether the observed percentage of outcomes covered by the risk measure is consistent with both a *97.5% and 99% level of confidence*. The number of permitted exceptions is detailed in paragraph 183.

Together, P&L attribution and backtesting thresholds would be used to determine which trading desks are eligible for internal model treatment for regulatory capital purposes. The designation of being ineligible for internal modelling is not, however, envisaged as being permanent. If P&L attribution and backtesting performance sufficiently improved for a sufficient period of time, the designation for the relevant internal models-based approach could be changed from ineligible to eligible.

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

While this is straightforward in theory, in practice it complicates the issue of backtesting. For instance, it is often argued that neither expected shortfall nor value-at-risk measures can be compared against actual trading outcomes, since the actual outcomes will reflect changes in portfolio composition during the holding period. According to this view, the inclusion of fee income together with trading gains and losses resulting from changes in the composition of the portfolio should not be included in the definition of the trading outcome because they do not relate to the risk inherent in the static portfolio that was assumed in constructing the value-at-risk measure.

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

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

On the one hand, intraday trading will tend to increase the volatility of trading outcomes, and may result in cases where the overall trading outcome exceeds the risk measure. This event clearly does not imply a problem with the methods used to calculate the risk measure; rather, it is simply outside the scope of what the measure is intended to capture. On the other hand, including fee income may similarly distort the backtest, but in the other direction, since fee income often has annuity-like characteristics. Since this fee income is not typically included in the calculation of the risk measure, problems with the risk measurement model could be masked by including fee income in the definition of the trading outcome used for backtesting purposes.

To the extent that backtesting programs are viewed purely as a statistical test of the integrity of the calculation of the risk measures, it is appropriate to employ a definition of daily trading outcome that allows for an "uncontaminated" test. To meet this standard, banks must have the capability to perform the tests based on the hypothetical changes in portfolio value that would occur were end-of-day positions to remain unchanged.

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

For these reasons, *the Committee requires banks to develop the capability to perform these tests using both hypothetical and actual trading outcomes*. In combination, the two approaches are likely to provide a strong understanding of the relation between calculated risk measures and trading outcomes. The total number of backtesting exceptions for the purpose of the thresholds in paragraph 183 must be calculated as the maximum of the exceptions generate under hypothetical or actual trading outcomes.

The implementation of the P&L attribution and backtesting programme must formally begin on the date that the internal models capital requirement becomes effective. However, the model should be under observation until a one-year backtesting and P&L attribution report can confirm the quality of the model submitted for approval. During this period, a multiplier of 1 must be applied in the calculation of capital requirements for that specific trading desk. *This does not preclude national supervisors from requesting backtesting and P&L attribution results prior to that date, and in particular does not preclude their usage, at national discretion, as part of the internal model approval process. Using the most recent 12 months of data yields approximately 250 daily observations for the purposes of backtesting. The national supervisor will use the number of exceptions, out of 250, generated by the bank's model as the basis for a supervisory response*. In many cases, there will be no response. In other cases, the supervisor may initiate a dialogue with the bank to determine if there is a problem with a bank's model. In the most serious cases, the supervisor will impose an increase in a bank's capital requirement or disallow use of the model.

III. Supervisory framework for the interpretation of backtesting results for the firm-wide risk model

(a) Definition of a backtesting exception / outlier

Backtesting the firm-wide risk model will be based on a VaR measure calibrated at a 99th percentile confidence level. An exception or an outlier occurs when either the actual or hypothetical loss of a trading desk or of the firm-wide trading book registered in a day of the backtesting period is higher than the corresponding daily risk measure given by the model.[46] In the case when either the P&L or the risk measure is not available or impossible to compute, it will count as an outlier.

In the case where an outlier can be shown by the firm to relate to a non-modellable risk factor, and the capital requirement for that non-modellable risk factor exceeds the actual or hypothetical loss for that day, it may be disregarded for the purpose of the overall backtesting process if the national supervisor is notified accordingly and does not object to this treatment. In these cases firms must document the history of the movement of the value of the relevant non-modellable risk factor, and have supporting evidence that the non-modellable risk factor has caused the relevant loss.

[46] To the extent that risk factors are captured in the CVA capital framework, these can be excluded from the P&L for the purpose of the backtesting framework.

(b) Description of three-zone approach

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

The Committee has agreed to standards regarding the definitions of these zones in respect of the number of exceptions generated in the backtesting program, and these are set forth below. To place these definitions in proper perspective, however, it is useful to examine the probabilities of obtaining various numbers of exceptions under different assumptions about the accuracy of a bank's risk measurement model.

(c) Statistical considerations in defining the zones

Three zones have been delineated and their boundaries chosen in order to balance two types of statistical error: (1) the possibility that an accurate risk model would be classified as inaccurate on the basis of its backtesting result, and (2) the possibility that an inaccurate model would not be classified that way based on its backtesting result.

Table 1 below reports the probabilities of obtaining a particular number of exceptions from a sample of 250 independent observations under several assumptions about the actual percentage of outcomes that the model captures (that is, these are binomial probabilities). For example, the left-hand portion of the Table 1 reports probabilities associated with an accurate model (that is, a true coverage level of 99%). Under these assumptions, the column labelled "exact" reports that exactly five exceptions can be expected in 6.7% of the samples.

Table 2

Model is accurate			Model is inaccurate: Possible alternative levels of coverage							
	Coverage = 99%		Coverage = 98%		Coverage = 97%		Coverage = 96%		Coverage = 95%	
	exact	type 1	exact	type 2	exact	type 2	exact	type 2	exact	type 2
0	8.1%	100.0%	0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
1	20.5%	91.9%	3.3%	0.6%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%
2	25.7%	71.4%	8.3%	3.9%	1.5%	0.4%	0.2%	0.0%	0.0%	0.0%
3	21.5%	45.7%	14.0%	12.2%	3.8%	1.9%	0.7%	0.2%	0.1%	0.0%
4	13.4%	24.2%	17.7%	26.2%	7.2%	5.7%	1.8%	0.9%	0.3%	0.1%
5	6.7%	10.8%	17.7%	43.9%	10.9%	12.8%	3.6%	2.7%	0.9%	0.5%
6	2.7%	4.1%	14.8%	61.6%	13.8%	23.7%	6.2%	6.3%	1.8%	1.3%
7	1.0%	1.4%	10.5%	76.4%	14.9%	37.5%	9.0%	12.5%	3.4%	3.1%
8	0.3%	0.4%	6.5%	86.9%	14.0%	52.4%	11.3%	21.5%	5.4%	6.5%
9	0.1%	0.1%	3.6%	93.4%	11.6%	66.3%	12.7%	32.8%	7.6%	11.9%
10	0.0%	0.0%	1.8%	97.0%	8.6%	77.9%	12.8%	45.5%	9.6%	19.5%
11	0.0%	0.0%	0.8%	98.7%	5.8%	86.6%	11.6%	58.3%	11.1%	29.1%
12	0.0%	0.0%	0.3%	99.5%	3.6%	92.4%	9.6%	69.9%	11.6%	40.2%
13	0.0%	0.0%	0.1%	99.8%	2.0%	96.0%	7.3%	79.5%	11.2%	51.8%
14	0.0%	0.0%	0.0%	99.9%	1.1%	98.0%	5.2%	86.9%	10.0%	62.9%
15	0.0%	0.0%	0.0%	100.0%	0.5%	99.1%	3.4%	92.1%	8.2%	72.9%

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

The left-hand portion of the table pertains to the case where the model is accurate and its true level of coverage is 99%. Thus, the probability of any given observation being an exception is 1% (100% – 99% = 1%). The column labelled "exact" reports the probability of obtaining exactly the number of exceptions shown under this assumption in a sample of 250 independent observations. The column labelled "type 1" reports the probability that using a given number of exceptions as the cut-off for rejecting a model will imply erroneous rejection of an accurate model using a sample of 250 independent observations. For example, if the cut-off level is set at five or more exceptions, the type 1 column reports the probability of falsely rejecting an accurate model with 250 independent observations is 10.8%.

The right-hand portion of the table pertains to models that are inaccurate. In particular, the table concentrates of four specific inaccurate models, namely models whose true levels of coverage are 98%, 97%, 96% and 95% respectively. For each inaccurate model, the "exact" column reports the probability of obtaining exactly the number of exceptions shown under this assumption in a sample of 250 independent observations. The columns labelled "type 2" report the probability that using a given number of exceptions as the cut-off for rejecting a model will imply erroneous acceptance of an inaccurate model with the assumed level of coverage using a sample of 250 independent observations. For example, if the cut-off level is set at five or more exceptions, the type 2 column for an assumed coverage level of 97% reports the probability of falsely accepting a model with only 97% coverage with 250 independent observations is 12.8%.

The right-hand portion of the table reports probabilities associated with several possible inaccurate models, namely models whose true levels of coverage are 98%, 97%, 96%, and 95%, respectively. Thus, the column labelled “exact” under an assumed coverage level of 97% shows that five exceptions would then be expected in 10.9% of the samples.

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

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

(d) Definition of the green, yellow, and red zones

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

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

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

Similarly, the beginning of the red zone is defined as the point such that the probability of obtaining that number or fewer exceptions equals or exceeds 99.99%. Table 2 shows that for a sample of 250 observations and a true coverage level of 99%, this occurs with 10 exceptions.

Table 2

Zone	Number of exceptions	multiplier	Cumulative probability
Green zone	0	1.50	8.11%
	1	1.50	28.58%
	2	1.50	54.32%
	3	1.50	75.81%
	4	1.50	89.22%
Yellow zone	5	1.70	95.88%
	6	1.76	98.63%
	7	1.83	99.60%
	8	1.88	99.89%
	9	1.92	99.97%
Red zone	10 or more	2.00	99.99%

Notes to Table 2: The table defines the green, yellow and red zones that supervisors will use to assess backtesting results in conjunction with the internal models approach to market risk capital requirements. The boundaries shown in the table are based on a sample of 250 observations. For other sample sizes, the yellow zone begins at the point where the cumulative probability equals or exceeds 95%, and the red zone begins at the point where the cumulative probability equals or exceeds 99.99%.

The cumulative probability is simply the probability of obtaining a given number or fewer exceptions in a sample of 250 observations when the true coverage level is 99%. For example, the cumulative probability shown for four exceptions is the probability of obtaining between zero and four exceptions.

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

(e) The green zone

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

(f) The yellow zone

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

The Committee has agreed that, within the yellow zone, the number of exceptions should generally guide the size of potential supervisory increases in a firm’s capital requirement. Table 2 sets out the Committee’s agreed guidelines for increases in the multiplication factor applicable to the internal models capital requirement, resulting from backtesting results in the yellow zone.

These particular values reflect the general idea that the increase in the multiplication factor should be sufficient to return the model to a 99th percentile standard. For example, five exceptions in a sample of 250 imply only 98% coverage. Thus, the increase in the multiplication factor should be sufficient to transform a model with 98% coverage into one with 99% coverage. Needless to say, precise calculations of this sort require additional statistical assumptions that are not likely to hold in all cases.

For example, if the distribution of trading outcomes is assumed to be normal, then the ratio of the 99th percentile to the 98th percentile is approximately 1.14, and the increase needed in the multiplication factor is therefore approximately 1.13 for a multiplier of 1. If the actual distribution is not normal, but instead has "fat tails", then larger increases may be required to reach the 99th percentile standard. The concern about fat tails was also an important factor in the choice of the specific increments set out in Table 2.

Banks must also document all of the exceptions generated from their ongoing backtesting program, including an explanation for the exception. Banks may also implement backtesting for confidence intervals other than the 99th percentile, or may perform other statistical tests not considered here. Naturally, this information could also prove very helpful in assessing their model.

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

Basic integrity of the model

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

2) Model volatilities and/or correlations were calculated incorrectly.

Model's accuracy could be improved

3) The risk measurement model is not assessing the risk of some instruments with sufficient precision (eg too few maturity buckets or an omitted spread).

"Bad luck" or markets moved in fashion unanticipated by the model

4) Random chance (a very low probability event).

5) Markets moved by more than the model predicted was likely (ie volatility was significantly higher than expected).

6) Markets did not move together as expected (ie correlations were significantly different than what was assumed by the model).

Intraday trading

7) There was a large (and money-losing) change in the bank's positions or some other income event between the end of the first day (when the risk estimate was calculated) and the end of the second day (when trading results were tabulated).

The supervisor will impose a higher capital requirement for any outcomes that place the bank in the yellow zone. In the case of severe problems with the basic integrity of the model, however, the supervisor should consider whether to disallow the use of the model for capital purposes altogether.

(g) The red zone

Finally, outcomes in the red zone (10 or more exceptions) should generally lead to an automatic presumption that a problem exists with a bank's model. This is because it is extremely unlikely that an accurate model would independently generate 10 or more exceptions from a sample of 250 trading outcomes.

In general, therefore, if a bank's model falls into the red zone, the supervisor should automatically increase the multiplication factor applicable to a firm's model by a third (from 1.5 to 2)).

Needless to say, the supervisor should also begin investigating the reasons why the bank's model produced such a large number of misses, and should require the bank to begin work on improving its model immediately.

IV. Conclusion

The above framework is intended to set out a consistent approach for incorporating P&L attribution and backtesting into the internal models approach to market risk capital requirements. The goal is to build appropriate and necessary incentives into a framework that relies heavily on the efforts of banks themselves to calculate the risks they face, to do so in a way that respects the inherent limitations of the available tools, and to keep the burden and costs of the imposed procedures to a minimum.

The Basel Committee believes that the framework described above strikes the right balance in this regard. Perhaps more importantly, however, the Committee believes that this approach represents the first, and therefore critical, step toward a tighter integration of supervisory guidelines with verifiable measures of bank performance.

D. Treatment for illiquid positions

1. 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 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) of the Basel II Framework 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:

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.

Valuation methodologies

Marking to market

718(ciii). Marking to market is at least the daily valuation of positions at readily available close out prices 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 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) Only where marking to market is not possible should banks mark to model, but this 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) of the Basel II Framework).

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.

Valuation adjustments

718(cviii) As part of their procedures for marking to market, banks must establish and maintain procedures for considering valuation adjustments. 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.

2. 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 assumptions made about liquidity in the market risk charge may not be consistent with the bank's ability to sell or hedge out less liquid positions, where appropriate, banks must take an adjustment to the current valuation of these positions, and review their continued appropriateness on an ongoing basis. Reduced liquidity may have arisen from market events. Additionally, close-out prices for concentrated positions and/or stale positions should be considered in establishing the adjustment. Banks must consider all relevant factors when determining the appropriateness of 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 ageing 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) of the Basel II Framework.

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) 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 standards and paragraphs 718(cviii) and 718(cix).

E. Supervisory Review Process – The Second Pillar

Market risk

1. Policies and procedures for trading book eligibility

1. Clear policies and procedures used to determine the exposures that may be included in, and those that should be excluded from, the trading book for purposes of calculating regulatory capital are critical to ensure the consistency and integrity of a firm's trading book. Such policies must conform to this Framework. Supervisors should be satisfied that the policies and procedures clearly delineate the boundaries of the firm's trading book, in compliance with the general principles set forth in this Framework, and consistent with the bank's risk management capabilities and practices. Supervisors should also be satisfied that transfers of positions between banking and trading books can only occur in a very limited set of circumstances. A supervisor will require a firm to modify its policies and procedures when they prove insufficient for preventing the booking in the trading book of positions that are not compliant with the general principles set forth in this Framework, or not consistent with the bank's risk management capabilities and practices.

2. Instruments held in the trading book must be subject to clearly defined policies and procedures, approved by senior management, that are aimed at ensuring active risk management. The application of the policies and procedures must be thoroughly documented. These policies and procedures should, at a minimum, address the following:

(a) The activities the bank considers to be trading or hedging of covered instruments;

- Trading strategies (including expected holding horizon and possible reactions if this limit is breached) for every covered instrument or portfolio;
- Standards regarding the extent to which a bank's portfolio of covered instruments must be marked-to-market daily by reference to an active, liquid two-way market;
- For covered instruments that are marked-to-model, the standards for:
  - (i) Identifying the material risks of the covered instruments;
  - (ii) Hedging the material risks of the covered instruments and the extent to which hedging instruments would have an active, liquid two-way market; and
  - (iii) Reliably deriving estimates for the key assumptions and parameters used in the model.
- The extent to which the bank is required to generate valuations for the covered instruments that can be validated externally in a consistent manner;
- The extent to which instruments may have operational requirements that could impede the bank's ability to effect an immediate liquidation of the covered instrument;
- The processes constituting active management of covered instruments, which must include:
  - (i) The setting of limits and ongoing monitoring for appropriateness;
  - (ii) The requirement that each trading desk have a documented trading strategy and the process for monitoring covered instruments against the bank's trading strategy, including that:
    - o for any given trading desk, bank senior management assume the responsibility that a given covered instrument or portfolio be managed with trading intent and in accordance with the trading strategy document.
    - o the monitoring process includes evaluation of turnover and "stale positions" in order to determine compliance with specified holding periods.

(iii) The degree of autonomy a trader has to enter into or manage covered instruments within agreed limits and according to the agreed strategy;

(iv) The process for reporting to senior management as an integral part of the institution's risk management process; and

(v) The active monitoring of instruments and risk positions with reference to market information sources, including:

- Assessment of market liquidity and the ability to hedge instruments, risk positions or the portfolio risk profile;
- Analysis of changes in the market values of instruments and sensitivities due to changes in market risk factors; and
- Evaluation of the quality and availability of market inputs with respect to the valuation process, the level of market turnover, and the relative size of instruments traded in the market.

3. Policies and procedures for internal risk transfers from banking book to trading book

3. The bank must:

(i) document all internal risk transfer (IRT) with its trading book, with respect to the banking book risk being hedged and the amount of such risk;

(ii) document the details of any external third party matching hedge;

(iii) submit a list to its supervisor of the procedures and strategies to manage the risks that the internal risk transfer desks undertake. This list must be approved by the bank's senior management;

(iv) ensure regular and consistent reporting of its internal risk transfer activities for risk management and control purposes. The bank must report this information to its supervisor on a regular basis.

4. The trading desks engaged in internal risk transfers must document all actions that have been implemented, along with contributory analysis and independent review in order to manage the risks they undertake.

5. The bank must have a consistent methodology for identifying and quantifying the banking book risk to be hedged through internal risk transfers. This methodology must be properly integrated in the bank's risk management framework. The methodology must include all qualitative and quantitative regulatory requirements pertaining to trading book desks. Any material changes in the methodology must be approved by a specialised bank's committee (eg ALM). The supervisor must be notified of such changes and approve of any material changes beforehand.

6. A bank must have a set of consistent risk management methods and internal controls in order to ensure and control the effectiveness of risk mitigation for its internal risk transfer transactions. These methods and controls must reflect the amount, types, and risks of the bank's internal risk transfer activities and must be regularly reviewed by the bank's risk management and control units.

4. Valuation

7. Prudent valuation policies and procedures form the foundation on which any robust assessment of market risk capital adequacy should be built. For a well diversified portfolio consisting of highly liquid cash instruments, and without market concentration, the valuation of the portfolio, combined with the minimum quantitative standards set out in this framework, may deliver sufficient capital to enable a bank, in adverse market conditions, to close out or hedge its exposures within the liquidity horizon period set out for that exposure in this framework. However, for less well diversified

portfolios, for portfolios containing less liquid instruments, for portfolios with concentrations in relation to market turnover, and/or for portfolios which contain large numbers of positions that are marked to model this is less likely to be the case. In such circumstances, supervisors will consider whether a bank has sufficient capital. To the extent there is a shortfall the supervisor will react appropriately. This will usually require the bank to reduce its risks and/or hold an additional amount of capital.

5. Stress testing under the internal models approach

8. A bank must ensure that it has sufficient capital to meet the minimum capital requirements and to cover the results of its stress testing requirements specified in this framework. Supervisors will consider whether a bank has sufficient capital for these purposes, taking into account the nature and scale of the bank's trading activities and any other relevant factors such as valuation adjustments made by the bank. To the extent that there is a shortfall, or if supervisors are not satisfied with the premise upon which the bank's assessment of internal market risk capital adequacy is based, supervisors will take the appropriate measures. This will usually involve requiring the bank to reduce its risk exposures and/or to hold an additional amount of capital, so that its overall capital resources at least cover the Pillar 1 requirements plus the result of a stress test acceptable to the supervisor.

9. Where supervisors consider that limited liquidity or price transparency undermine the effectiveness of a bank's model to capture risk, they will take appropriate measures, including requiring the exclusion of positions from the bank's model. Supervisors should review the adequacy of the bank's measure of the default risk charge; where the bank's approach is inadequate, the use of the standardised charges will be required.

Glossary

Actual daily P&L: The daily economic P&L based on the marking to market of the books and records of the bank excluding fees and commissions.

Backtesting: The process of comparing daily profits and losses with model-generated risk measures to gauge the quality and accuracy of risk measurement systems.

Basis risk: The risk that prices of financial instruments in a hedging strategy will move in a way that reduces the effectiveness of the hedging strategy.

Benchmark (in the context of the relationship between the standardised approach and internal models-based approach):

The use of capital charges under the standardised approach as a consistent metric of comparison of capital charges calculated using internal models-based approaches both across banks and through time.

Component risk factor: An instrument is decomposed into individual component risk factors that are then mapped to a risk class

"Cross-cutting" risk factor: A risk factor that affects the valuation of a large number of instruments across the trading book. Examples include exchange rates and interest rates from money market or swap curves.

Credit Valuation Adjustment (CVA): An adjustment to the valuation of a derivative transaction to account for the credit risk of contracting parties.

Current expected shortfall: ES based on current data history of the risk factors (in contrast to the stressed data history).

CVA risk: The risk of changes to CVA arising from changes in credit spreads of the contracting parties, perhaps compounded by changes to the value of the underlying of the derivative transaction.

Desk's risk management model: The desk's risk management model includes all risk factors that are included in the bank's internal ES with supervisory parameters. Risk factors deemed not modellable by the supervisor in Step 3, and which are therefore not included in the ES for calculating the respective regulatory capital charge, might be still included in the bank's internal ES.

Diversification: The process of constructing a portfolio of long or short positions in different instruments that are relatively uncorrelated with one another, in order to minimise exposure to individual risks, such as issuers or risk classes.

Expected holding period: The time period banks expect to hold risk positions as part of their documented trading strategies.

Endogenous liquidity: The relative effect on the sale price from the act of liquidating exposures or portfolios within a certain amount of time.

Fallback (in the context of the SMM /internal models-based approach relationship): The process of requiring banks to switch to the SMM when internal models are not performing to adequate standards.

Financial instrument: Any contract that gives rise to both a financial asset of one entity and a financial liability or equity instrument of another entity. Financial instruments include both primary financial instruments (or cash instruments) and derivative financial instruments.

Floor (in the context of the standardised approach to internal models-based approach relationship): A level of capital charges (calculated as a percentage of the capital charges under the standardised approach) acting as a minimum to the Pillar 1 capital charges under the internal models approach.

Hedge: The process of counterbalancing risks from exposure to long and short positions in correlated instruments.

Hypothetical P&L: The P&L produced by revaluing the positions held at the end of the previous day using the market data at the end of the current day

Instrument: The term used to describe financial instruments and commodities (including electric power).

Liquidity horizon: The time required to exit or hedge a risk position without materially affecting market prices in stressed market conditions.

Liquidity premium: The additional premium demanded by investors to hold financial instruments that cannot be readily liquidated in the market.

Market risk: The risk of losses in on- and off-balance sheet risk positions arising from movements in market prices.

Notional value: The notional value of a derivative instrument is equal to the number of units underlying the instrument, multiplied by the current market value of each unit of the underlying.

Offset: The process of counterbalancing risks from exposure to long and short positions in the same instrument.

Pricing model: A model that is used to determine the value of an instrument (mark-to-market or mark-to-model) as a function of pricing parameters or to determine the change in the value of an instrument as a function of risk factors. The latter kind of pricing model may be simpler than the former. A pricing model may be the combination of several calculations; for example a first valuation technique to compute a price, followed by valuation adjustments for risks that are not incorporated in the first step.

Primary risk class: A set of trading desks that are exposed to largely similar primary risk factors.

Primary risk factor: The risk factor which is most important for a specific instrument.

Profit and loss (P&L) attribution: A backtesting method for assessing the robustness of banks' risk management models by comparing the hypothetical P&L predicted by risk management models with the actual P&L.

"Real" prices: A criterion for assessing whether risk factors will be amendable to modelling. A price will be considered "real" if: it is a price from an actual transaction conducted by the bank; it is a price from an actual transaction between other parties (eg at an exchange); or it is a price taken from a firm quote (ie a price at which the bank could transact).

Risk factor: A principal determinant of the change in value of a transaction that is used for the quantification of risk. Risk positions are modelled by risk factors.

Risk position: A risk position is a conceptual construct that represents a particular aspect of risk associated with a transaction within a market risk model or a standardised approach for market risk. Example: A bond denominated in a currency different to a bank's reporting currency may be mapped to a risk position for FX risk, a number of risk positions for interest rate risk (in the foreign currency) and one or more risk positions for credit risk.

"Risk-theoretical" P&L: The daily desk-level P&L that is predicted by the risk management model conditional on a realisation of all relevant risk factors that enter the model.

Trading desk: A separately managed business line within a bank that follows defined trading strategies with certain instruments, with the goal of generating revenues or maintaining market presence while from assuming and managing risk.

Surcharge (in the context of the standardised/internal models-based approach relationship): A Pillar 1 capital charge (calculated as a percentage of the capital charges under the standardised approach) required in addition to the capital charge under the internal models approach.

Interest rate risk in the banking book: The exposure of a bank's financial condition to adverse movements in interest rates stemming from banking book assets and liabilities.