CA-8.1 Definition of the Trading Book

CA-8.1.1 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, profit 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.

Standards for Assigning Instruments to the Trading Book

CA-8.1.2 **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.

CA-8.1.3 **Any of the following instruments are seen as being held for at least one of the purposes listed in Paragraph CA-8.1.2 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 CA-10.2.1 to CA-10.2.5;
(c) Instrument giving rise to a net short credit or equity position in the banking book;
(d) Instruments resulting from underwriting commitments.

CA-8.1.4 **Any instrument which is not held for any of the purposes listed in Paragraph CA-8.1.2 at inception, nor seen as being held for these purposes according to Paragraph CA-8.1.3, must be assigned to the banking book.**

CA-8.1.5 **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;
(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;

CA-8.1 Definition of the Trading Book (continued)

(f) Shari'a compliant hedging instruments that have the above instrument types as underlying assets; or
(g) Instruments held for the purpose of hedging the particular risk of a position in the types of instrument above.

CA-8.1.6 There is a general presumption that any of the following instruments are being held for at least one of the purposes listed in Paragraph CA-8.1.2 and, therefore, are trading book instruments, unless banks are allowed to deviate from this presumption, according to the criteria in Paragraph CA-8.1.5:

(a) Instruments held as accounting trading assets or liabilities;
(b) Instruments resulting from market-making activities;
(c) Equity investment in a fund, excluding Paragraph CA-8.1.5(e);
(d) Listed equities;
(e) Trading-related repo-style transaction; or
(f) Options including bifurcated embedded Shari'a compliant hedging contracts from instruments issued out of the banking book that relate to credit or equity risk.

Supervisory Powers

CA-8.1.7 Notwithstanding the criteria established in Paragraph CA-8.1.5 for instruments on the presumptive list, the CBB 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 CA-8.1.2. If the CBB is of the view that a bank has not provided enough evidence, or that 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 CA-8.1.3.

CA-8.1.8 The CBB may require the bank to provide evidence that an instrument in the banking book is not held for any of the purposes of Paragraph CA-8.1.2. If the CBB is of the view that a bank has not provided enough evidence, or if it 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 CA-8.1.5.

CA-8.1 Definition of the Trading Book (continued)

Documentation of Instrument Designation

CA-8.1.9

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.

CA-8.1.10

The Internal Audit function of a bank must conduct an ongoing evaluation of instruments (both inside and outside 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 sent to the CBB for review.

Risk Management Policies for Trading Book Instruments

CA-8.1.11

Trading book instruments must be subject to clearly defined policies and procedures, reviewed by senior management and approved by the Board, that are aimed at ensuring active risk management. The application of the policies and procedures must be thoroughly documented.

CA-8.2 Restrictions on Moving Instruments between the Regulatory Books

CA-8.2.1 **There must be 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 CA-8.3.2 to CA-8.3.3. Switching instruments for regulatory arbitrage is strictly prohibited.**

CA-8.2.2 In practice, switching should be rare and will be permitted by the CBB 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 profit and loss statement ('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.

CA-8.2.3 **When switching positions, banks must ensure that the requirements in Paragraphs CA-8.1.2 to CA-8.1.7 are always strictly observed.**

CA-8.2.4 **Without exception, a capital benefit as a result of switching of positions, will not be allowed in any case or circumstance. This means that the bank must determine its total capital charge (across both the 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 CBB. 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.**

CA-8.2.5 **Any re-designation between books must be reviewed by senior management and approved by the Board, thoroughly documented, determined by internal review to be in compliance with the bank's policies; subject to prior approval by the CBB 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 CA-8.1.6 (a). Accordingly, in this case an automatic switch without approval of the CBB is acceptable.**

CA-8.2 Restrictions on Moving Instruments between the Regulatory Books (continued)

CA-8.2.6 A bank must adopt relevant policies for switching of positions that must be updated on an annual basis at least. Updates must be based on an analysis of all extraordinary events identified during the previous year. Updated policies, with changes highlighted, must be sent to the CBB. Policies must include the following:

(a) The re-designation restriction requirements in Paragraphs CA-8.2.1 to CA-8.2.3, 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.

CA-8.3 Treatment of Internal Risk Transfers

CA-8.3.1 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).

CA-8.3.2 **There will be no regulatory capital recognition for internal risk transfers from the trading book to the banking book. As such, if a bank engages in an internal risk transfer from the trading book to the banking book (e.g. for economic reasons) this internal risk transfer must not be taken into account when the regulatory capital requirements are determined.**

CA-8.3.3 **For Internal Risk Transfers from the Banking Book to the Trading Book Paragraphs CA-8.3.4 to CA-8.3.6 apply.**

CA-8.3.4 **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 following requirements vis-à-vis the banking book exposure:

1) In order to be recognised, a credit Shari'a compliant hedging contract must satisfy the following conditions:

i) The credit events specified by the contracting parties must at a minimum cover:

- **Failure to pay the amounts due under terms of the underlying obligation that are in effect at the time of such failure (with a grace period that is closely in-line with the grace period in the underlying obligation);**
- **Bankruptcy, insolvency or inability of the obligor to pay its debts, or its failure or admission in writing of its inability, generally, to pay its debts as they become due, and analogous events; and**
- **Restructuring of the underlying obligation involving forgiveness or postponement of principal, profit or fees that results in a credit loss event (i.e. charge-off, specific provision or other similar debit to the P&L account). When restructuring is not specified as a credit event, refer to condition 2).**

ii) If the credit Shari'a compliant hedging contract covers obligations that do not include the underlying obligation, point vii) below governs whether the asset mismatch is permissible.

CA-8.3 Treatment of Internal Risk Transfers (continued)

iii) The credit Shari'a compliant hedging contract shall not terminate prior to expiration of any grace period required for a default on the underlying obligation to occur as a result of a failure to pay[1].

iv) Credit Shari'a compliant hedging contracts allowing for cash settlement are recognised for capital purposes, insofar as a robust valuation process is in place in order to estimate loss reliably. There must be a clearly specified period for obtaining post-credit event valuations of the underlying obligation. If the reference obligation specified in the credit Shari'a compliant hedging contract for purposes of cash settlement is different than the underlying obligation, point vii) below governs whether the asset mismatch is permissible.

v) If the protection purchaser's right/ability to transfer the underlying obligation to the protection provider is required for settlement, the terms of the underlying obligation must provide that any required consent to such transfer may not be unreasonably withheld.

vi) The identity of the parties responsible for determining whether a credit event has occurred must be clearly defined. This determination must not be the sole responsibility of the protection seller. The protection buyer must have the right/ability to inform the protection provider of the occurrence of a credit event.

vii) A mismatch between the underlying obligation and the reference obligation under the credit Shari'a compliant hedging contract (i.e. the obligation used for purposes of determining cash settlement value or the deliverable obligation) is permissible if; (1) the reference obligation ranks pari passu with, or is junior to, the underlying obligation; and, (2) the underlying obligation and reference obligation share the same obligor (i.e. the same legal entity) and legally enforceable cross-default or cross-acceleration clauses are in place.

[1] The maturity of the underlying exposure and the maturity of the hedge must both be defined conservatively. The effective maturity of the underlying must be gauged as the longest possible remaining time before the counterparty is scheduled to fulfil its obligation, taking into account any applicable grace period. For the hedge, embedded options which may reduce the term of the hedge must be taken into account so that the shortest possible effective maturity is used. Where a call is at the discretion of the protection seller, the maturity will always be at the first call date. If the call is at the discretion of the protection buying bank, but the terms of the arrangement at origination of the hedge contain a positive incentive for the bank to call the transaction before contractual maturity, the remaining time to the first call date will be deemed to be the effective maturity. For example, where there is a step-up in cost in conjunction with a call feature, or where the effective cost of cover increases over time, even if credit quality remains the same or increases, the effective maturity will be the remaining time to the first call.

CA-8.3 Treatment of Internal Risk Transfers (continued)

viii) A mismatch between the underlying obligation and the obligation used for the purposes of determining whether a credit event has occurred, is permissible if; (1) the latter obligation ranks pari passu with or is junior to the underlying obligation; and, (2) the underlying obligation and reference obligation share the same obligor (i.e. the same legal entity) and legally enforceable cross-default or cross acceleration clauses are in place.

2) When the restructuring of the underlying obligation is not covered by the credit Shari'a compliant hedging contract, but the other requirements in condition 1 are met, partial recognition of the credit Shari'a compliant hedging contract will be allowed. If the amount of the credit Shari'a compliant hedging contract is less than, or equal to, the amount of the underlying obligation, 60 percent of the amount of the hedge can be recognised as covered. If the amount of the credit Shari'a compliant hedging contract is larger than that of the underlying obligation, then the amount of eligible hedge is capped at 60 percent of the amount of the underlying obligation[2].

3) Only credit default swaps and total return swaps that provide credit protection equivalent to guarantees will be eligible for recognition. The following exception applies: Where a bank buys credit protection through a total return swap and records the net payments received on the swap as net income, but does not record offsetting deterioration in the value of the asset that is protected (either through reductions in fair value or by an addition to reserves), the credit protection will not be recognised.

c) Where the requirements in Paragraphs CA-8.3.4 (a) and CA-8.3.4 (b), as outlined above, 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.

d) Where the requirements in Paragraphs CA-8.3.4 (a) and CA-8.3.4 (b) as outlined above 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.

[2] The cap of 60 percent on a credit Shari'a compliant hedging contract 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.

CA-8.3 Treatment of Internal Risk Transfers (continued)

(i)A banking book short credit position, created by an internal risk transfer and not capitalised under banking book rules, must be capitalised under the market risk rules together with the trading book exposure.

CA-8.3.5

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:

(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.

(i) Where the requirements in Paragraphs CA-8.3.5(a) and CA-8.3.5(b), as outlined above 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.

(ii) Where the requirements in Paragraphs CA-8.3.5(a) and CA-8.3.5(b), as outlined above 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. Furthermore, 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.

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

CA-8.3.6

When a bank hedges a banking book profit 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 profit rate risk being hedged, and the sources of such risk;

(b) The internal risk transfer is conducted through a dedicated internal risk transfer trading desk, which has been specifically approved by the CBB for this purpose;

CA-8.3 Treatment of Internal Risk Transfers (continued)

(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 general profit rate risk (GPRR) or other market risks generated by activities in the trading book.

CA-8.3.7 **Where the requirements in Paragraphs CA-8.3.6(a), CA-8.3.6(b) and CA-8.3.6(c) are fulfilled, the banking book leg of the internal risk transfer must be included in the banking book's measure of profit rate risk exposures for regulatory capital purposes.**

CA-8.3.8 The CBB-approved internal risk transfer desk may include instruments purchased from the market (i.e. external parties to the bank). Such transactions may be executed directly between the internal risk transfer desk and the market.

CA-8.3.9 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 GPRR 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 GPRR internal risk transfer are included in the internal risk transfer desk and the non-internal risk transfer desk.

CA-8.3.10 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 CA-8.3.6 are fulfilled.

CA-8.3.11 **The trading book leg of internal risk transfers must fulfil the same requirements as instruments in the trading book transacted with external counterparties.**

CA-8.3.12 **Eligible hedges that are included in the credit valuation adjustment (CVA) capital charge must be removed from the bank's market risk charge calculation.**

CA-8.4 Treatment of Counterparty Credit Risk in the Trading Book

CA-8.4.1 **Banks will be required to calculate the counterparty credit risk charge for over-the-counter (OTC) Shari'a compliant hedging contracts, repo-style and other transactions booked in the trading book, separately 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.**

CA-8.4.2 **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 must be subject to a 25 percent haircut.**

CA-8.4.3 The calculation of the counterparty credit risk charge for collateralised OTC Shari'a compliant hedging contract transactions is the same as the rules prescribed for such transactions booked in the banking book.

CA-9.1 General Provisions

CA-9.1.1 A bank must determine its regulatory capital requirements for market risk according to the standardised approach for market risk on a daily basis.

CA-9.1.2 The standardised approach must be reported to the CBB on a quarterly basis.

CA-9.2 Structure of the Standardised Approach

Overview of the Structure of the Standardised Approach

CA-9.2.1

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 the 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 CA-9.2.2) 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 CA-9.2.8 and CA-9.2.9 for details), based on three different scenarios on the specified values for the correlation parameter ρ_{kl} (i.e. correlation between risk factors within a bucket) and γ_{bc} (i.e. 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.

CA-9.2 Structure of the Standardised Approach (continued)

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

Sensitivities-based Method: Main Definitions

CA-9.2.2 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 profit 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 CA-9.4).

(b) Risk factor: Variables (e.g. a given vertex of a given profit rate curve or an equity price) within a pricing function decomposed from trading book instruments, and which falls within the scope of the risk factor definitions in CA-9.3. 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 CA-9.4.2 to CA-9.4.26.

Sensitivities-based Method: Instruments Subject to Delta, Vega and Curvature

CA-9.2.3 **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. Additionally:**

(a) Each instrument with optionality 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 is an instrument with optionality according to Paragraph CA-9.2.3(a). Accordingly, the embedded option is subject to vega and curvature risk with respect to the profit 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 CA-9.2.12. 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.

CA-9.2 Structure of the Standardised Approach (continued)

(c) Instruments whose cash flows can be written as a linear function of underlying notional are instruments without optionality (e.g. cash flows generated by a coupon bearing sukuk can be written as a linear function) and 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.

Sensitivities-based Method: Delta and Vega

CA-9.2.4

Delta and vega risks consist of a set of prescribed risk factors and sensitivities which are defined in CA-9.3. The net sensitivities for each risk factor within a risk class is multiplied by a respective risk weight provided in CA-9.4 and CA-9.5. These weighted sensitivities are then aggregated by prescribed formulae using correlations provided in CA-9.4 and CA-9.5. CA-9.2.5 provides the aggregation 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.

CA-9.2.5

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 CA-9.3).
(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 CA-9.4 and CA-9.5.

$$WS_k = RW_k \, S_k$$

CA-9.2 Structure of the Standardised Approach (continued)

(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.

CA-9.2 Structure of the Standardised Approach (continued)

Sensitivities-based Method: Curvature

CA-9.2.6

The curvature risk charge consists of a set of stress scenarios on given risk factors which are defined in CA-9.3. Two stress scenarios must 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 CA-9.6. The purpose of CA-9.2.7 is to provide the aggregation formulae within buckets, and across buckets within a risk class.

CA-9.2.7

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 (e.g. 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:

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

where:

– *i* is an instrument subject to curvature risks associated with risk factor *k*;
– x_k is the current level of risk factor *k*;
– $V_i(x_k)$ is the price of instrument *i* depending on the current level of risk factor *k*;
– $V_i(x_k^{(RW^{(curvature)}+)})$ and $V_i(x_k^{(RW^{(curvature)}-)})$ both denote the price of instrument *i* after x_k is shifted (i.e. '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 CA-9.6.3.
  - s_{ik} is the delta sensitivity of instrument *i* with respect to the delta risk factor that corresponds to curvature risk factor *k*

CA-9.2 Structure of the Standardised Approach (continued)

under the GPRR, 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 CA-9.6.4.
- s_{ik} is the 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 ϱkl 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 Ψ (CVR , CVR_l) is a function that takes the value 0 if CVR_k and CVR_l both have negative signs. In all other cases, Ψ (CVR , CVR_l) takes the value of 1.

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 $\sum_k CVR_k$ in bucket c; and
- (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, (S_b, S_c) takes the value of 1.

CA-9.2 Structure of the Standardised Approach (continued)

Sensitivities-based Method: Correlation Scenarios and Aggregation of Risk Charges

CA-9.2.8 **In order to address the risk that correlations increase or decrease in periods of financial stress, three risk charge figures must 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 CA-9.4, CA-9.5 and CA-9.6 are uniformly multiplied by 1.25, with ρ_{kl} and γ_{bc} subject to a cap at 100 percent.

(b) Under the second scenario, 'medium correlations', the correlation parameters ρ_{kl} and γ_{bc} remain unchanged from those specified in CA-9.4, CA-9.5 and CA-9.6.

(c) Under the third scenario, 'low correlations', the corresponding prescribed correlations are the correlations given in CA-9.4, CA-9.5 and CA-9.6 uniformly multiplied by 0.75.

CA-9.2.9 **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.**

The Default Risk Charge

CA-9.2.10 The default risk charge is intended to capture jump-to-default-risk. It is described in detail in CA-9.7. The purpose of CA-9.2.11 is to provide the offsetting rules, as well as the hedging formula which can be applied within the default risk buckets.

CA-9.2.11 **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 CA-9.7, which enables the derivation of 'net jump-to-default' (net JTD) risk positions.

CA-9.2 Structure of the Standardised Approach (continued)

(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 must 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 risk, 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.

The Residual Risk Add-On

CA-9.2.12 The residual risk add-on must 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 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.

(b) 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 percent for instruments with an exotic underlying, and a risk weight of 0.1 percent for instruments bearing other residual risks.

(c) 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.

(d) 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, sukuk price, CDS price or profit rate swap; or

   (ii) Instruments which fall under the definition of the Correlation Trading Portfolio ('CTP') in Paragraph CA-9.3.3, except for those instruments which are recognised in the Market Risk Framework as eligible hedges of risks within the CTP.

CA-9.2 Structure of the Standardised Approach (continued)

(e) In cases where a transaction exactly matches with a third party transaction (i.e. a back-to-back transaction), the instruments used in both transactions must be excluded from the residual risk add-on charge. Any instrument that is listed and/or eligible for central clearing must be excluded from the residual risk add-on.

(f) A non-exhaustive list of other residual risks types and instruments that may fall within the criteria set out in Paragraphs CA-9.2.12(e) include:

(i) 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.

(ii) 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.

(iii) 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 sukuk may only be seen as possibly having behavioural risk if the right to call lies with a retail client.

(g) 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 Shari'a compliant hedging contract instrument whose underlying does not consist solely of dividend payments.

CA-9.3 Sensitivities-based Method: Risk Factor and Sensitivity Definitions

Risk Factor Definitions

CA-9.3.1

General Profit rate Risk (GPRR) risk factors:

(a) Delta GPRR: The GPRR delta risk factors are defined along two dimensions: A risk-free yield curve for each currency in which profit 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.

  (i) The risk-free yield curve per currency must be constructed using the 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 must be based on one or more market-implied swap curves used by the bank to mark positions to market. For example, inter-bank 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 sukuk curve for a given currency. In such cases, the sensitivities related to sovereign sukuks 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 GPRR and to CSR risk classes, as appropriate, with the risk factor and sensitivity definitions in the standardised approach. Applying swap curves to sukuk-derived sensitivities for GPRR will not change the requirement for basis risk to be captured between sukuk and CDS curves in the CSR risk class.

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

(b) The GPRR delta risk factors also include a flat curve of market-implied inflation rates for each currency with a 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 a simple sum.

CA-9.3 Sensitivities-based Method: Risk Factor and Sensitivity Definitions (continued)

(ii) This risk factor is only relevant for an instrument when a cash flow is functionally dependent on a measure of inflation (e.g. the notional amount or a profit payment depending on a consumer price index). GPRR 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 profit rates from the same instrument, which must be allocated, according to the GPRR framework, in the term structure of the relevant risk-free yield curve in the same currency.

(c) The GPRR delta risk factors also include one of two possible cross-currency basis risk factors for each currency (i.e. each GPRR bucket) with term structure not recognised as a risk factor (i.e. both cross-currency basis curves are flat).

(i) The two cross-currency basis risk factors are calculated as 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.

(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. GPRR 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 profit rates from the same instrument, which must be allocated, according to the GPRR framework, in the term structure of the relevant risk-free yield curve in the same currency.

(d) Vega GPRR: Within each currency, the GPRR vega risk factors are the implied volatilities of options that reference GPRR-sensitive underlyings; further defined along two dimensions:

(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.

CA-9.3 Sensitivities-based Method: Risk Factor and Sensitivity Definitions (continued)

(e) Curvature GPRR: The GPRR curvature risk factors are defined along only one dimension; The constructed risk-free yield curve (i.e. no term structure decomposition) per currency. All vertices (as defined for delta GPRR) must be shifted in parallel. There is no curvature risk charge for inflation and cross-currency basis risks.

(f) The treatment described in Paragraph CA-9.3.1(a)(ii) for delta GPRR also applies to vega GPRR and curvature GPRR risk factors.

CA-9.3.2 Credit Spread Risk (CSR) non-securitisation risk factors:

(a) Delta CSR non-securitisation: The CSR non-securitisation delta risk factors are defined along two dimensions; the relevant issuer credit spread curves (sukuk 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 non-securitisation: The vega risk factors are the implied volatilities of options that reference the relevant credit issuer names as underlyings (sukuk 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 non-securitisation: The CSR non-securitisation curvature risk factors are defined along one dimension; the relevant issuer credit spread curves (sukuk and CDS). All vertices (as defined for CSR) must be shifted in parallel.

CA-9.3 Sensitivities-based Method: Risk Factor and Sensitivity Definitions (continued)

CA-9.3.3

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 CA-9.3.5, which must be computed with respect to the names underlying the securitisation or nth-to-default instrument:

(a) The instrument is not a re-securitisation position, nor Shari'a compliant hedging contracts 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 Shari'a compliant hedging contracts, for which a liquid two-way market exists, 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 (sensitivity as defined in CA-9.3.9) must be calculated with respect to the spread of the tranche, rather than the spread of the underlying of the instruments.

CA-9.3.4

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 (sukuk 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 (sukuk and CDS). For instance, the sukuk-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 must be shifted in parallel.

CA-9.3 Sensitivities-based Method: Risk Factor and Sensitivity Definitions (continued)

CA-9.3.5 **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 (sukuk 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 (sukuk 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 (CTP): The CSR correlation trading curvature risk factors are defined along one dimension; the relevant underlying credit spread curves (sukuk and CDS). All the vertices must be shifted in parallel.

CA-9.3.6 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.

CA-9.3.7 Commodity risk factors:

(a) Delta commodity: The commodity delta risk factors are all the commodity spot prices depending on contract grade of the commodity, legal terms with respect to the delivery location 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.

CA-9.3 Sensitivities-based Method: Risk Factor and Sensitivity Definitions (continued)

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

CA-9.3.8 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.

(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.

CA-9.3 Sensitivities-based Method: Risk Factor and Sensitivity Definitions (continued)

Sensitivity Definitions

CA-9.3.9

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

Delta GPRR: 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 (Vi (.)) as a result of a 1 basis point shift in the profit 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;
- Vi (.) is the market value of the instrument i as a function of the risk-free profit rate curve and credit spread curve.

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 (Vi (.)) as a result of a 1 basis point change to credit spread cs at vertex t (cs_t), divided by 0.0001 (i.e. 0.01%). In notation form:

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

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

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 (i.e. 1 percent). 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
- Vi (.) is the market value of instrument i as a function of the price of equity k.

CA-9.3 Sensitivities-based Method: Risk Factor and Sensitivity Definitions (continued)

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 (i.e. 0.01 percent). 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.

Delta commodity: The sensitivity is calculated by taking the value of a 1 percentage point change in commodity spot price, divided by 0.01 (i.e. 1 percentage):

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

Where:

- k is a given equity;
- 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.

Delta FX: The sensitivity is calculated by taking the value of a 1 percentage point change in exchange rate, divided by 0.01 (i.e. 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.

CA-9.3.10 Vega risk sensitivities:

(a) The option-level vega risk sensitivity to a given risk factor is the product (i.e. multiplication) of the vega and implied volatility of the option. 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.

CA-9.3 Sensitivities-based Method: Risk Factor and Sensitivity Definitions (continued)

(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 must 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.

Treatment of Index Instruments and Multi-underlying Options

CA-9.3.11

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 calculate 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 CA-8.1.5, an equity investment in a fund in which the bank cannot look through the fund daily, must be assigned to the banking book.

CA-9.3.12

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 CA-9.2.12.

(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.

CA-9.3 Sensitivities-based Method: Risk Factor and Sensitivity Definitions (continued)

Requirements on Sensitivity Computations

CA-9.3.13 **When computing a first-order sensitivity for instruments subject to optionality, banks must assume that the implied volatility remains constant, consistent with a 'sticky delta' approach.**

CA-9.3.14 When computing a vega GPRR or CSR sensitivity, banks may use either the lognormal or normal assumptions.

CA-9.3.15 **When computing a vega equity, commodity or FX sensitivity, banks must use the log-normal assumption.**

CA-9.3.16 If, for internal risk management, a bank computes sensitivities using definitions differing from the definitions provided in the present standards, the bank may use linear transformations to deduce the sensitivities it computes should 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.

CA-9.3.17 **All sensitivities must be computed ignoring the impact of CVA.**

CA-9.4 Sensitivities-based Method: Delta Risk Weights and Correlations

CA-9.4.1 The prescribed risk weights and correlations in this section have been calibrated to the liquidity adjusted time horizon related to each risk class.

Delta GPRR

Buckets

CA-9.4.2 **Each bucket represents an individual currency exposure to GPRR.**

Risk Weights

CA-9.4.3 **The risk weights must be 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 risk weight of 2.25 percent is set for the inflation risk factor and the cross currency basis risk factors, respectively[3].

CA-9.4.4 **The delta risk correlation ρ_{kl} is set at 99.90 percent between sensitivities WS_k and WS_l within the same bucket (i.e. same currency), same assigned vertex, but different curves.**

CA-9.4.5 **The delta risk correlation ρ_{kl} between sensitivities WS_k and WS_l within the same bucket (i.e. same currency) with a different vertex and the same curve is set at:**

$$max\left[e^{\left(-\theta\cdot\frac{|T_k-T_l|}{min\{T_k;T_l\}}\right)};40\%\right]$$

Where:

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

(b) θ set at 3 percent.

CA-9.4.6 **Between two sensitivities WS_k and WS_l within the same bucket (i.e. same currency), different vertex and different curves, the correlation ρ_{kl} is equal to the correlation parameter specified in Paragraph CA-9.4.5 multiplied by 99.90 percent.**

CA-9.4.7 **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 percent.**

[3] For selected currencies (EUR, USD, GBP, AUD, JPY, SEK, CAD as well as GCC currencies), the above risk weights may at the discretion of the bank, be divided by the square root of 2.

CA-9.4 Sensitivities-based Method: Delta Risk Weights and Correlations (continued)

CA-9.4.8

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%.

CA-9.4.9

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

Delta CSR Non-securitisations

Buckets

CA-9.4.10

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

Bucket	Credit quality	Sector
1	Investment grade (IG)	Sovereigns, including central banks, multilateral development banks.
2		Local government, government-backed non-financials, education, public sector entities.
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 sukuks.
9	High yield (HY) and 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	

CA-9.4.11

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 CA-9.4.10. Risk positions from any issuer that a bank cannot assign to a sector in this fashion must be assigned to the 'other sector' (i.e. bucket 16).

CA-9.4 Sensitivities-based Method: Delta Risk Weights and Correlations (continued)

Risk Weights

CA-9.4.12

The risk weights for the buckets 1 to 16 are set out in the following table. Risk weights are the same for all vertices (i.e. 0.5 years, 1 year, 3 years, 5 years, 10 years) 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

CA-9.4.13

Between two sensitivities WS_k and WS_l within the same bucket, the correlation parameter ρ_{kl} is set as follows:

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

Where:

- ρ_{kl}^{name} is equal to 1, where the two names of sensitivities *k* and *l* are identical, and 35 percent otherwise;
- ρ_{kl}^{tenor} is equal to 1, if the two vertices of the sensitivities *k* and *l* are identical, and to 65 percent otherwise;
- ρ_{kl}^{basis} is equal to 1, if the two sensitivities are related to same curves, and 99.90 percent otherwise.

CA-9.4.14

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:

CA-9.4 Sensitivities-based Method: Delta Risk Weights and Correlations (continued)

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

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.

CA-9.4.15 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								

Delta CSR Securitisations (correlation trading portfolio)

Buckets

CA-9.4.16 Sensitivities to CSR arising from the correlation trading portfolio and its hedges must be 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.

CA-9.4 Sensitivities-based Method: Delta Risk Weights and Correlations (continued)

Risk Weights

CA-9.4.17

Risk weights are the same for all vertices (ie 0.5 years, 1 year, 3 years, 5 years, 10 years) 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

CA-9.4.18

The delta risk correlation ρ_{kl} is derived the same way as in CA-9.4.13, except that $\rho_{kl}^{(basis)}$ is now equal to 1 if the two sensitivities are related to same curves, and 99.00% otherwise.

CA-9.4.19

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

Delta CSR Securitisations (Non-correlation Trading Portfolio)

Buckets

CA-9.4.20

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

CA-9.4 Sensitivities-based Method: Delta Risk Weights and Correlations (continued)

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 financings
6		ABS – Credit cards
7		ABS – Auto
8		CLO non-correlation trading portfolio
9	Non-Senior Investment grade (I(	RMBS – Prime
10		RMBS – Mid-prime
11		RMBS – Sub-prime
12		CMBS
13		ABS – Student financings
14		ABS – Credit cards
15		ABS – Auto
16		CLO non-correlation trading portfolio
17	High yield (HY) & non-rated (N	RMBS – Prime
18		RMBS – Mid-prime
19		RMBS – Sub-prime
20		CMBS
21		ABS – Student financings
22		ABS – Credit cards
23		ABS – Auto
24		CLO non-correlation trading portfolio
25	Other sector	

CA-9.4.21 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 CA-9.4.20. Risk positions from any tranche that a bank cannot assign to a sector in this fashion must be assigned to the 'other sector' (i.e. bucket 25).

CA-9.4 Sensitivities-based Method: Delta Risk Weights and Correlations (continued)

Risk Weights

CA-9.4.22 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%

CA-9.4.23 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 × 0.9 percent = 1.125 percent.

Equity Risk

Buckets

CA-9.4.24 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</td></tr>
</table>

CA-9.4 Sensitivities-based Method: Delta Risk Weights and Correlations (continued)

CA-9.4.25 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.

CA-9.4.26 '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.

CA-9.4.27 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.

CA-9.4.28 **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 sector buckets in the table under Paragraph CA-9.4.24 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' (i.e. 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

CA-9.4.29 **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%

CA-9.4 Sensitivities-based Method: Delta Risk Weights and Correlations (continued)

Commodity Risk

Buckets

CA-9.4.30 Eleven buckets are defined for commodity risk and set out in the next paragraph.

Risk Weights

CA-9.4.31 **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 an 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 CO_2 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 and 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	35%
9	Livestock and 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 commodities	Industrial minerals (such as potash, fertilizer and phosphate rocks), rare earths; terephthalic acid; flat glass	50%

CA-9.4 Sensitivities-based Method: Delta Risk Weights and Correlations (continued)

Correlations

CA-9.4.32 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.

CA-9.4.33 Formally, between two sensitivities WS_k and WS_l within the same bucket, the correlation parameter ρ_{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 percent 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 percent otherwise.

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

CA-9.4 Sensitivities-based Method: Delta Risk Weights and Correlations (continued)

CA-9.4.34

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

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

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

CA-9.4.35

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 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.

Foreign Exchange Risk

Risk Weights

CA-9.4.36

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

(a) Selected currency pairs 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, JPY/AUD and all GCC currency pairs.

(b) For the specified currency pairs, the above risk weight may at the discretion of the bank be divided by the square root of 2.

Correlations

CA-9.4.37

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

CA-9.5 Sensitivities-based Method: Vega Risk Weights and Correlations

The Vega Buckets

CA-9.5.1 The delta buckets are replicated in the vega context, unless specified otherwise in the preceding paragraphs within CA-9.3 and CA-9.4.

CA-9.5.2 **The bucket remains the first level of aggregation between vega risk positions within a risk class, i.e. the steps in Paragraph CA-9.2.5 must be performed.**

The Vega Risk Weights

CA-9.5.3 **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 percent;**
- **$LH_{risk\ class}$ is the regulatory liquidity horizon to be prescribed in the determination of each vega risk factor k. $LH_{risk\ class}$ is specified as follows:**

Risk class	$LH_{risk\ class}$
GPRR	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

CA-9.5.4 **With regard to vega risk sensitivities between buckets within a risk class (GPRR and non-GPRR), the same correlation parameters for γ_{bc}, as specified for delta correlations for each risk class in CA-9.4, must be used in the vega risk context (e.g. γ_{bc} = 50 percent must be used for aggregation of vega risk sensitivities across different GPRR buckets).**

CA-9.5.5 **There is no diversification or hedging benefit recognised in the standardised approach between vega and delta risk factors. Vega and delta risk charges must be aggregated by simple summation.**

CA-9.6 Sensitivities-based Method: Curvature Risk Weights and Correlations

The Curvature Buckets

CA-9.6.1 The delta buckets are replicated in the curvature context, unless specified otherwise in the preceding paragraphs within CA-9.3 and CA-9.4.

CA-9.6.2 The bucket remains the first level of aggregation between curvature risk positions within each risk class.

The Curvature Risk Weights

CA-9.6.3 For FX and equity curvature risk factors, the curvature risk weights are relative shifts ('shocks') equal to the delta risk weights.

CA-9.6.4 For GPRR, 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 GPRR, the risk weight assigned to the 0.25 year vertex (i.e. 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).

The Curvature Correlations

CA-9.6.5 **Between curvature exposures, each delta correlation parameters ρ_{kl} and γ_{bc} must be squared. For instance, between CVR_{EUR} and CVR_{USD} in the GPRR context, the correlation must be $50\%^2 = 25\%$.**

CA-9.7 The Default Risk Charge

CA-9.7.1 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).

CA-9.7.2 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.

CA-9.7.3 For the correlation trading portfolio (CTP), the capital charge includes the default risk for securitisation exposures and for non-securitisation hedges. These hedges must 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.

CA-9.7.4 While claims on sovereigns, designated public sector entities and multilateral development banks are subject to a zero default risk weight, the CBB 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.

CA-9.7.5 For traded non-securitisation credit and equity Shari'a compliant hedging contracts, JTD amounts by individual constituent issuer legal entity must be determined by applying a look-through approach.

Default Risk Charge for Non-securitisations

Gross Jump-to-default Risk Positions (gross JTD)

CA-9.7.6 As a first step, the gross JTD risk must be computed, exposure-by-exposure.

CA-9.7.7 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 Shari'a compliant hedging 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 (i.e. not bought/sold option, and not bought/sold CDS). As such, a sold put option on a sukuk is a long credit exposure, as a default results in a loss to the seller of the option.

CA-9.7 The Default Risk Charge (continued)

CA-9.7.8 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 than 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 underestimates 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.

CA-9.7.9 **The gross JTD is a function of the LGD, notional amount (or face value) and the cumulative P&L already realised on the position:**

JTD (long) = max (LGD × notional + P&L, 0)
JTD (short) = min (LGD × notional + P&L, 0)
where *notional* is the sukuk-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:

P&L=market value – notional;

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

CA-9.7.10 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 Shari'a compliant hedging contract allow for the unwinding of the instrument with no exposure to default risk, then the JTD is equal to zero.

CA-9.7.11 **Equity instruments and non-senior debt instruments must be assigned an LGD of 100 percent. Senior debt instruments are assigned an LGD of 75 percent. Covered sukuks, as defined within Paragraph CA-9.4.10, are assigned an LGD of 25 percent. When the price of the instrument is not linked to the recovery rate of the defaulter (e.g. 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 must be no multiplication of the notional by the LGD.**

CA-9.7.12 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.

CA-9.7 The Default Risk Charge (continued)

CA-9.7.13 **To account for defaults within the 1-year capital horizon, the JTD for all exposures of maturity of less than 1 year and their hedges, are scaled by a fraction of a year. No scaling is applied to the JTD for exposures of 1 year or greater. 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 1-year maturity would have no scaling applied to the JTD.**

CA-9.7.14 **Cash equity positions (i.e. stocks) are assigned to a maturity of either more than 1 year, or 3 months, at the banks' discretion.**

CA-9.7.15 **For Shari'a compliant hedging contract exposures, the maturity of the Shari'a compliant hedging contract is considered in determining the offsetting criterion, not the maturity of the underlying instrument.**

CA-9.7.16 **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.**

Net Jump-to-Default Risk Positions (net JTD)

CA-9.7.17 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 sukuk, but a short exposure in a sukuk 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 (1 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 1 year) must be weighted by the ratio of the exposure's maturity relative to the capital horizon. For example, with the 1-year capital horizon, a 3-month short exposure would be weighted so that its benefit against long exposures of longer-than-1-year maturity would be reduced to one-quarter of the exposure size.

CA-9.7.18 **In the case of long and short offsetting exposures, where both have a maturity under 1 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 must be aggregated separately as described below.**

CA-9.7 The Default Risk Charge (continued)

Default Risk Charge for Non-securitisations

CA-9.7.19

Default risk weights are assigned to net JTD by credit quality categories (i.e. 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%

CA-9.7.20

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

CA-9.7.21

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

(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 (i.e. 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 (i.e. rating bands). The aggregated amount is used in the denominator of the expression of the *WtS* below.

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

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

CA-9.7.22

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

CA-9.7 The Default Risk Charge (continued)

CA-9.7.23 **No hedging must be 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.**

Default Risk Charge for Securitisations (Non-correlation Trading Portfolio)

Gross Jump-to-default Risk Positions (gross JTD)

CA-9.7.24 **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 (i.e. the JtD for tranche positions is their market value).**

CA-9.7.25 **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)

CA-9.7.26 For default risk (securitisations), offsetting is limited to a specific securitisation exposure (i.e. tranches with the same underlying asset pool). This means that:

(a) No offsetting is permitted between securitisation exposures with a different underlying securitised portfolio (i.e. 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.

CA-9.7 The Default Risk Charge (continued)

CA-9.7.27 Securitisation exposures that are otherwise identical except for maturity may be offset, subject to the same restriction as for positions of less than 1 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 must be determined from the perspective of long or short in relation to the underlying credit, e.g. the bank makes losses on a long securitisation exposure if there is a default on debt in the securitised portfolio.

Default Risk Charge for Securitisations (Non-CTP)

CA-9.7.28 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. 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, i.e. a maturity of 1 year is assumed. Following the corresponding treatment in the banking book, the hierarchy of approaches in determining the risk weights must 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.

CA-9.7.29 **For default risk (securitisations), the buckets must be 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 Financings/Leases, RMBS, Credit Cards, CMBS, Collateralised Loan Obligations, CDO-squared, Small and Medium Enterprises, Student Financings, Other Retail, Other Wholesale. The four regions are Asia, Europe, North America, and All other.

CA-9.7.30 **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'.**

CA-9.7 The Default Risk Charge (continued)

CA-9.7.31 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 CA-9.7.21, is applied to net short securitisation exposures in that bucket, and the capital charge is calculated as in Paragraph CA-9.7.22.

CA-9.7.32 **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.**

Default Risk Charge for Securitisations (Correlation Trading Portfolio)

Gross Jump-to-default Risk Positions (gross JTD)

CA-9.7.33 **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 CA-9.7.18.**

CA-9.7.34 **The definition of JTD for non-securitisations in the CTP (i.e. single-name and index hedges) positions is their market value.**

CA-9.7.35 **Nth-to-default products must 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)

CA-9.7.36 **Exposures that are otherwise identical,, except for maturity may be offset, but with the same specifications for exposures of less than 1 year, as described in the section on default risk (non-securitisations). Specifically, exposures longer than the capital horizon (1 year) may be fully offset, but in the case of 'longer than 1year' vs 'less than 1 year' exposures, the offset benefit of the 'less than 1 year' exposure must be reduced as described above.**

(a) For index products, for the exact same index family, series and tranche, and securitisation exposures must be offset (netted) across maturities (subject to the offsetting allowance as described above).

CA-9.7 The Default Risk Charge (continued)

- 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. 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 (e.g. 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 value of the securitisation before decomposition. In addition, such decomposition is restricted to 'vanilla' securitisations (e.g. vanilla CDOs, index tranches or bespokes); while the decomposition of 'exotic' securitisations (e.g. 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 percent tranche vs combined short securitisation exposures in 10–12 percent and 12–15 percent 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. 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.

CA-9.7 The Default Risk Charge (continued)

(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)

CA-9.7.37 The default risk weights for securitisations applied to tranches are based on the risk weights in the corresponding treatment for the banking book. To avoid double-counting of risks in the maturity adjustment (of the banking book approach) since migration risk in the trading book must be captured in the credit spread charge, the maturity component in the banking book securitisation framework is set to zero, i.e. a maturity of 1 year is assumed.

CA-9.7.38 For default risk (CTP), each index is regarded as a bucket of its own.

CA-9.7.39 Bespoke securitisation exposures must be allocated to the index bucket of the index that they are a bespoke tranche of.

CA-9.7.40 For the tranched products, banks must use the risk weight as per Paragraph CA-9.7.19. For the non-tranched products, banks must derive the risk weight using the banking book treatment.

CA-9.7.41 Within buckets (i.e. 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 CA-9.7.21, is applied to the 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 (i.e. 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.

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

The summation of risk weighted amounts in the equation spans all exposures relating to the index (i.e. 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.

CA-9.7.42 The bucket-level capital amounts must be then aggregated as follows:

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

CA-10.1 General Criteria

CA-10.1.1

The use of an internal model for the purposes of regulatory capital determination will be conditional upon the explicit approval of the CBB.

CA-10.1.2

At a minimum, banks must meet the following conditions on the use of the internal model approach:

(a) It is satisfied that the bank's risk management system is conceptually sound and has been implemented with integrity;
(b) The bank has 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 CBB's judgement, a proven track record of reasonable accuracy in measuring risk;
(d) The bank regularly conducts stress tests along the lines discussed in CA-10.11.1 to CA-10.11.8 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 CA-10.5.1.

CA-10.1.3

As a prerequisite, banks must wait for a period of 1 year for initial monitoring and live testing of its internal model before it is used for regulatory capital purposes.

CA-10.1.4

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

CA-10.2 Definition of Trading Desk

CA-10.2.1 For the purposes of market risk capital calculations, a trading desk is a group of traders or trading accounts that implement a well-defined business strategy, operating within a clear risk management structure.

CA-10.2.2 Trading desks are defined by the bank but subject to the regulatory approval of the CBB for capital purposes. Within this supervisory-approved desk structure, banks may further define operational sub-desks without the need for CBB approval. These sub-desks would be for internal operational purposes only and would not be used in the market risk capital framework.

CA-10.2.3 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); and
(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, P&L reports and internal and regulatory risk measurement reports.
(e) Every trading 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/specialities.
(f) 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.
(g) The desk must have a clear reporting line to bank senior management, and must have a clear and formal compensation policy clearly linked to the pre-established objectives of the desk.
(h) 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 (e.g. 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?**

CA-10.2 Definition of Trading Desk (continued)

- 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?

(i) 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.

(j) 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.
- Internal and regulatory risk measure reports, including desk VaR/ES, desk VaR/ES sensitivities to risk factors, backtesting and p-value.

(k) A 'trading desk' must be proposed by the bank but approved by the CBB.

(l) The bank must be allowed to propose the trading desk structure, as per their organisational structure, consistent with the requirements CA-8.2.3(e) to CA-8.2.3(j).

(m) The bank must prepare a policy document for each desk it defines, documenting how the desk satisfies CA-8.2.3(e) to CA-8.2.3(j).

CA-10.2.4 The bank must prepare, evaluate, and have available for the CBB, 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.

CA-10.2 Definition of Trading Desk (continued)

CA-10.2.5 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.

CA-10.3 Qualitative Standards

CA-10.3.1 A bank using the internal models must 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. The CBB will assess whether banks have met the criteria before they are permitted to use a models-based approach. These qualitative criteria include:

(a) The bank's independent risk management function, which is responsible for the design and implementation of the bank's market risk management system, must produce and analyse daily reports on the output of the bank's market 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 must report directly to the senior management of the bank.

(b) The unit must conduct regular backtesting and P&L attribution programmes, i.e. an ex-post comparison of the risk measure and the 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) The Internal Audit function of the bank must conduct the initial and ongoing validation of all internal models. Internal models must be validated on an annual basis at least.

(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. As such, the daily reports prepared by the independent market risk manager 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.

CA-10.3 Qualitative Standards (continued)

(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 must be the same. In particular, the valuation models that are embedded in both must be similar. These valuation models must be an integral part of the internal identification, measurement, management and internal reporting of price risks within the bank. In addition to this, internal risk models must, at a minimum, cover the positions covered by the regulatory models, although they may be more extensive in coverage. In the construction of their regulatory capital models, banks must start from the methodologies used in their internal models with regards 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 (e.g. 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[4] to a regulatory-approved model must be approved by the CBB prior to being implemented.**

[4] Example of significant changes are: i) significant changes to statistical methods (e.g. introduction of variance reduction methods or changes to algorithms to generate random figures); ii) introduction of additional risk factors as a result of the inclusion of new products, the risks of which cannot be captured using the current model; iii) changes in the assumptions about the joint distribution of risk factors; iv) fundamental changes in the selection or definition of risk factors, e.g. switch from zero curves to par rates or swap curves, or vice versa; v) change in the number of risk factors in a part of the risk modelling in which, for example, there was previously only one risk factor (e.g. implied volatilities); vi) changes to the mapping procedure, whether for the entire portfolio or only parts of it; vii) substantial change to the valuation method with regard both to the economic P&L, and to the clean P&L.

CA-10.3 Qualitative Standards (continued)

(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 annual review of the Market Risk Management Framework must be carried out regularly by the bank's external auditors or a qualified and eligible consultant. This review must include both the activities of the business trading units and of the Market Risk Management unit. The review must be sufficiently detailed to determine for any failings which desks are impacted. A review of the overall risk management process must take place at regular intervals (not less than once a year) and must specifically address, at a minimum:
- The organisation of the Market Risk Management 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 MIS;
- The accuracy and completeness of position data;
- The accuracy and appropriateness of volatility and correlation assumptions; and
- The accuracy of valuation and risk transformation calculations.

CA-10.4 Quantitative Standards

CA-10.4.1 **Banks will have flexibility in devising the precise nature of their models, but the following minimum standards must apply for the purpose of calculating their capital charge.**

(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 must be used;

(c) In calculating the expected shortfall, the liquidity horizons described in paragraph CA-10.4.1(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:

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

Where:

- ES is the regulatory liquidity-adjusted expected shortfall;
- T is the length of the base horizon, i.e. 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 CA-10.4.1(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

CA-10.4 Quantitative Standards (continued)

- LH_j is the liquidity horizon j, with lengths in the following table:

j	LHj
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 must 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 CBB approval and must meet the data quality requirements for a modellable risk factor, as outlined in Paragraph CA-10.6.1(c). The identified reduced set of risk factors must be able to explain a minimum of 75 percent of the variation of the full ES model (i.e. the ES of the reduced set of risk factors must be at least equal to 75 percent 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:

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

CA-10.4 Quantitative Standards (continued)

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 CBB may also require a bank to calculate its expected shortfall using a shorter observation period if, in its judgement; this is justified by a significant upsurge in price volatility. However, in this case, the period must 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, the CBB 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 (profit 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 aggregation requirements, as described in CA-10.10.3, and must be calculated and used in a manner consistent with the applicable liquidity horizons, clearly documented and able to be explained to the CBB on request.

CA-10.4 Quantitative Standards (continued)

(i) A banks' models must accurately capture the unique risks associated with *options* within each of the broad risk categories. The following criteria applies to the measurement of options risk:

- A 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, i.e. 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 (i.e. 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 CA-10.10.1 to CA-10.10.8 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 CA-10.4.1(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 the CBB; 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 (i.e. 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 CBB approval. Furthermore, liquidity horizons must be capped at the maturity of the related instrument:

CA-10.4 Quantitative Standards (continued)

Risk factor category	*n*	Risk factor category	*n*
Profit rate: Specified currencies - EUR, USD, GBP, AUD, JPY, SEK, CAD and domestic currency of a bank	10	Equity price (small cap): Volatility	60
Profit rate: – unspecified currencies	20	Equity: Other types	60
Profit rate: Volatility	60	FX rate: Specified currency pairs	10
Profit 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 pr	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		

CA-10.5 Model Validation Standards

CA-10.5.1

Banks must have processes in place to ensure that their internal models have been adequately validated by both internal and external auditors, 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 annually re-validated and 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 where end-of-day positions remain unchanged. It, therefore, excludes fees, commissions, bid-ask spreads and intraday trading. Moreover, additional tests are required which may include, for instance:

- Testing carried out for longer periods than required for the regular backtesting programme (e.g. 3 years); 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 CBB, the following information for each desk for each business day over the previous 3 years, with no more than a 60-day lag:

  (i) Two daily VaRs 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 percent level.

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CA-10.5 Model Validation Standards (continued)

(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 CA-10.4.1 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 must 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.

External Validation

CA-10.5.2 The validation of models' accuracy by external auditors and/or the CBB must, at a minimum, include the following steps:

(a) Verifying that the *internal validation processes* described in CA-10.5.1 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 internal audit;
(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 (i.e. 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. Accordingly banks must make the results, as well as the underlying inputs to their expected shortfall calculations and details of the P&L attribution exercise, available to the CBB 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 the CBB are in a position to have easy access, whenever they judge it necessary and under appropriate procedures, to the models' specifications and parameters.

CA-10.6 Determining the Eligibility of Trading Activities

CA-10.6.1 The process for determining the eligibility of trading activities for the internal models-based approach is based on a three-stage approach.

Assessment of Firm-wide Internal Risk Capital Model

(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.

Backtesting

(b.i) The second step breaks the model approval process into smaller, more discrete, elements – the regulatory trading desks, as defined in Paragraphs CA-10.2.1 to CA-10.2.5. 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 1 year.

(b.ii) 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.

(b.iii) 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 1-day P&L. 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. Positions must continue to be capitalised using the standardised method until the desk no longer exceeds the above thresholds over the prior 12 months.

CA-10.6 Determining the Eligibility of Trading Activities (continued)

(b.iv) P&L attribution requirements are based on two metrics - mean unexplained daily P&L (i.e. 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 percent to +10 percent or if the second ratio were in excess of 20 percent, 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.

(b.v) 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).

(b.vi) For a bank to remain eligible for capitalisation under the internal models approach, a minimum of 10 percent 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.

CA-10.6 Determining the Eligibility of Trading Activities (continued)

Risk Factor Analysis

(c.i) 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 bank has conducted a transaction; 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 the CBB 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.

(c.ii) 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 1 month between two consecutive observations. The above criteria must be assessed on a monthly basis. Any 'real' price that is observed for a transaction must be counted as an observation for all of the risk factors concerned (i.e. 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).

(c.iii) 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.

(c.iv) Once a risk factor is deemed modellable, the bank must 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.

(c.v) 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 CBB.

CA-10.6 Determining the Eligibility of Trading Activities (continued)

(c.vi) With the CBB's 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.

CA-10.7 Interaction with the Standardised Approach Methodology

CA-10.7.1 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 CA-10.2 and CA-10.3.
(b) Monitor, over time, the relative calibration of standardised and modelled approaches, facilitating adjustments as needed.
(c) Provide macro-prudential insight in an ex-ante consistent format.

CA-10.8 Specification of Market Risk Factors

CA-10.8.1

An important part of a bank's internal market risk measurement system, is the specification of an appropriate set of market risk factors, i.e. the market rates and prices that affect the value of the bank's trading positions. The risk factors contained in a market risk measurement system 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 must 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 the CBB. 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 CA-9, or prove to the CBB 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 (e.g. mortgage-backed securities), as well as correlation risk and relevant basis risks (e.g. between credit default swaps and sukuks). Moreover, the CBB has to be satisfied that proxies are used which show a good track record for the actual position held (i.e. an equity index for a position in an individual stock).

(b) For *profit rates*, there must be a set of risk factors corresponding to profit rates in each currency in which the bank has profit 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 profit rate movements in the major currencies and markets, banks must model the yield curve using a minimum of six risk factors.

CA-10.8 Specification of Market Risk Factors (continued)

However, the number of risk factors used must 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 profit rate risk accurately. For *credit,* the risk measurement system must incorporate separate risk factors to capture spread risk (e.g. between sukuks 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 profit 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. As such, 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 (e.g. 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 must correspond to the bank's exposure to the overall market, as well as its concentration in individual equity issues in that market.

CA-10.8 Specification of Market Risk Factors (continued)

(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' between Shari's compliant hedging contract 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.

CA-10.9 Default Risk

CA-10.9.1 Banks must have a separate internal model to measure the default risk of trading book positions. The general criteria in Paragraphs CA-10.1.1 to CA-10.1.4 and the qualitative standards in Paragraph CA-10.3.1 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 includes a period of stress as defined in Paragraph CA-10.4.1(d), and based on a 1-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 1-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 CA-10.9.1(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 1-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.
    - PDs are subject to a floor of 0.03 percent.
(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 (e.g. differences in seniority).

CA-10.9 Default Risk (continued)

(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 CA-10.9.1(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 CA-10.8.1(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 1 year.
- These correlations must be calibrated over a period of at least 10 years.
- Banks 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 1-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 1 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.

CA-10.9 Default Risk (continued)

(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 Shari'a compliant hedging contract 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 CBB approval).

(o) The 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) Due to the high confidence standard and long capital horizon of the DRC, robust direct validation of the DRC model through standard backtesting methods at the 99.9 percent/1-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 the CBB and banks jointly determine the exact set of validation procedures to be employed.

(q) Banks must 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.

CA-10.10 Capitalisation of Risk Factors

CA-10.10.1

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)*).

CA-10.10.2

The bank must calculate a series of partial expected shortfall charges (i.e. all other risk factors must be held constant) for the range of broad regulatory risk classes (profit 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.

CA-10.10.3

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

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

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

The stress period used in the risk class-level $ES_{R,S,i}$ must 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 to 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.

CA-10.10 Capitalisation of Risk Factors (continued)

The multiplication factor *mc* will be 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 *(VaRFC)*. If the backtesting results are satisfactory and the bank meets all of the qualitative standards set out in CA-10.3.1, the plus factor could be zero. Banks must develop the capability to perform backtests using both hypothetical (i.e. using changes in portfolio value that would occur were end-of-day positions to remain unchanged) and actual trading (excluding fees and commissions) outcomes. The multiplication factor will be based upon the maximum of the exceptions generated by the two backtesting results.

CA-10.10.4

Each non-modellable risk factor must be capitalised using a stress scenario that is calibrated to be at least as prudent as the expected shortfall calibration used for modelled risks (i.e. a loss calibrated to a 97.5 percent 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 CA-10.4.1. 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 the CBB that this is appropriate. No correlation or diversification effect between other non-modellable risk factors is permitted. In the event that a bank cannot provide a stress scenario which is acceptable for the CBB, 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.

CA-10.10 Capitalisation of Risk Factors (continued)

CA-10.10.5 The additional regulatory capital charge for modellable risk positions subject to default risk is DRC as described in Paragraph CA-10.8.1 above.

CA-10.10.6 The aggregate capital charge for those desks eligible for the internal models approach is equal to the aggregate capital charge for modellable risk factors (CA,M) plus the sum of the individual capital requirements for non-modellable risk factors (CA,U) plus the charge for default risk charge model (DRC).

CA-10.10.7 The regulatory capital charge associated with risks from model-ineligible (i.e. unapproved) desks (Cu) must be calculated by aggregating all such risks and applying the standardised charge.

CA-10.10.8 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.

$$ACC = C_A + DRC + C_U$$

CA-10.11 Stress Testing

CA-10.11.1

Banks that use the internal models approach for meeting market risk capital requirements must have a rigorous and comprehensive stress testing program in place, 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.

CA-10.11.2

A bank's stress scenarios must 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 (i.e. options and instruments that have option-like characteristics).

CA-10.11.3

A bank's stress tests must be both of a quantitative and qualitative nature, incorporating both the market risk and liquidity aspects of market disturbances. Quantitative criteria must identify plausible stress scenarios to which banks could be exposed. Qualitative criteria must 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 must be routinely communicated to senior management and, periodically, to the bank's Board of Directors.

CA-10.11.4

Banks must combine the use of supervisory stress scenarios with stress tests developed by the banks themselves to reflect their specific risk characteristics. Specifically, CBB 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

CA-10.11.5

Banks must have information on the largest losses experienced during the reporting period and must make this available for CBB review upon request. This loss information could be compared to the level of capital that results from a bank's internal measurement system.

CA-10.11 Stress Testing (continued)

Scenarios Requiring a Simulation by the Bank

CA-10.11.6

Banks must subject their portfolios to a series of simulated stress scenarios and provide the CBB with the results. These scenarios could include testing the current portfolio against past periods of significant disturbance. 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 must be given to the sharp variation that, at times, has occurred in a matter of days in periods of significant market disturbance.

Scenarios Developed by the Bank Itself to Capture the Specific Characteristics of its Portfolio

CA-10.11.7

In addition to the scenarios prescribed by CBB under CA-10.11.5 and CA-10.11.6, a bank must also develop its own stress tests which it identifies as most adverse based on the characteristics of its portfolio (e.g. problems in a key region of the world, combined with a sharp move in oil prices). Banks must provide the CBB 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 on a yearly basis.

CA-10.11.8

The results must be reviewed periodically by senior management and the relevant policies and limits must be adjusted accordingly. Furthermore, if the testing reveals particular vulnerability to a given set of circumstances, the CBB would expect the bank to take prompt steps to manage those risks appropriately (e.g. by hedging against that outcome or reducing the size of its exposures).