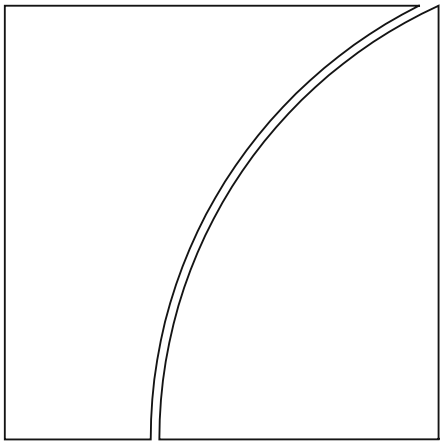
Basel Committee
on Banking Supervision



Explanatory note on the minimum capital requirements for market risk

January 2019

BANK FOR INTERNATIONAL SETTLEMENTS

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

ISBN 978-92-9259-236-3 (online)

Contents

Explanatory note on the minimum capital requirements for market risk

1. Introduction

The Basel Committee on Banking Supervision introduced the first framework for minimum capital requirements for market risk in January 1996.[1] The aim of the framework was to ensure that banks maintained a minimum level of regulatory capital to absorb losses arising from movements in market prices of instruments held in the trading book. Losses suffered by banks in the financial crisis of 2007-09 revealed that the design of the framework was not sufficient to ensure that banks could withstand such significant market distress. In response, the Committee introduced a set of revisions to the market risk framework in July 2009, often referred to as the Basel 2.5 reforms.[2] While these reforms addressed the most pressing deficiencies of the framework, the Committee acknowledged that a number of structural shortcomings that came to light during the crisis remained unaddressed. It therefore conducted a "fundamental review of the trading book" (FRTB). The objective of the project was to develop a new, more robust framework to establish minimum capital requirements for market risk, drawing on the experience of "what went wrong" in the build-up to the crisis.[3]

In January 2016, the Committee published the revised framework *Minimum capital requirements for market risk* (hereafter the "revised market risk framework").[4] The revised market risk framework:

- specified stricter criteria for the assignment of instruments to the trading book;
- overhauled the internal models approach to better address risks that were observed during the crisis;
- reinforced the supervisory approval processes for the use of internal models; and
- introduced a new, more risk-sensitive standardised approach.

In the course of monitoring the implementation and expected impact of the framework, the Committee identified a number of issues that needed to be addressed prior to its implementation. Consequently, in December 2017, the Committee's governing body, the Group of Central Bank Governors and Heads of Supervision (GHOS), announced an extension of the framework's implementation from the original 1 January 2019 date to 1 January 2022. In March 2018, the Committee published a consultative document to propose improvements to the framework to address the issues it had identified and to propose a simplified alternative to the new standardised approach for banks with

1 Basel Committee on Banking Supervision, *Amendment to the Capital Accord to incorporate market risks*, January 1996, www.bis.org/publ/bcbs24.pdf.

2 Basel Committee on Banking Supervision, *Revisions to the Basel II market risk framework (updated as of 31 December 2010)*, February 2011, www.bis.org/publ/bcbs193.pdf.

3 The Committee subsequently published three consultative documents on the trading book review prior to the January 2016 publication of the revised framework: *Fundamental review of the trading book*, May 2012, www.bis.org/publ/bcbs219.pdf; *Fundamental review of the trading book: A revised market risk framework*, October 2013, www.bis.org/publ/bcbs265.pdf; and *Fundamental review of the trading book: Outstanding issues*, December 2014, www.bis.org/bcbs/publ/d305.pdf.

4 Basel Committee on Banking Supervision, *Minimum capital requirements for market risk*, January 2016, www.bis.org/bcbs/publ/d352.pdf.

smaller-scale or simpler trading activities.[5] Having considered the responses to the consultative document, in November 2018 the Committee agreed on a set of revisions to the framework in the standard *Minimum capital requirements for market risk*, which was endorsed by the GHOS in January 2019.[6]

This explanatory note outlines the background and rationale for the FRTB project that led to the revised market risk framework published in January 2016, and the key features of the framework. The note also sets out the refinements and clarifications introduced in January 2019 and the potential capital impact of the finalised framework based on quantitative impact study data.

2. Background and rationale for revising the market risk framework

2.1 Deficiencies identified in the pre-crisis framework

The financial crisis exposed a number of shortcomings in the pre-crisis market risk framework that had been in place since 1996. The definition of the regulatory boundary between the banking book (ie exposures generally subject to credit risk capital requirements) and the trading book (ie exposures generally subject to market risk capital requirements) relied solely on the bank's intent to trade an instrument, and proved to be a key design weakness. It left open the possibility for a bank to move instruments between its trading book and its banking book in pursuit of lower capital requirements, often resulting in insufficient capital requirements relative to an instrument's risks. In addition, risk measurement methodologies to determine market risk capital requirements were insufficient. The internal models approach – which allowed banks to determine capital requirements via use of their own internal models – was not sufficiently comprehensive to incorporate all relevant risk drivers that could lead to material losses. The standardised approach (ie the framework's non-models-based approach to determining capital requirements) lacked risk sensitivity and therefore was not a credible alternative and complement to the internal models approach. When banks' internal models performed poorly, supervisors faced challenges in requiring banks to switch to use of the standardised approach in a short time frame, as the risk-insensitive design of the standardised approach could lead to a large increase in capital requirements for banks with significant trading activities.

2.2 Basel 2.5 reforms

In response to these weaknesses, the Basel 2.5 reforms, published in July 2009 (and updated in 2010), addressed the immediate need to ensure adequate capital requirements for trading activities. The reforms improved the internal model risk measure – value-at-risk (VaR) – that served as the basis for market risk capital requirements in the pre-crisis framework by introducing an additional VaR-based capital requirement calibrated to stressed market conditions. The "stressed VaR" metric takes better account of tail risk – losses that banks can suffer in a stressed period. An additional capital requirement for the credit risk associated with trading book instruments was introduced to the internal models approach via the incremental risk capital (IRC) framework. The IRC framework determined capital

[5] Basel Committee on Banking Supervision, *Revisions to the minimum capital requirements for market risk*, March 2018, www.bis.org/bcbs/publ/d436.pdf.

[6] Basel Committee on Banking Supervision, *Minimum capital requirements for market risk*, January 2019, www.bis.org/bcbs/publ/d457.pdf.

requirements both for default risk (ie the risk of losses associated with the default of the issuer of an instrument) and for ratings migration risk (ie the risk of mark-to-market losses associated with the downgrade of the credit rating of an issuer that has not defaulted). Finally, given the losses that had resulted from securitisation structures during the crisis, Basel 2.5 excluded most trading book securitisation exposures from the internal models approach.[7] Instead, the capital requirements for those exposures were aligned with those in the banking book.

2.3 Remaining issues with the Basel 2.5 market risk framework

Although a material improvement, the Basel 2.5 reforms did not address key structural shortcomings in the market risk framework:

- *Issues with the scope of application were not fully addressed*. The July 2009 revisions made only minor amendments to the specification of instruments that should be excluded from, or included in, the trading book. The revisions did not change the key determinant upon which application of the credit risk framework or the market risk framework to a given instrument was based – the bank's intent to trade the instrument. This inherently subjective criterion made the boundary between the application of the credit risk and market risk frameworks difficult to enforce in a consistent manner, and allowed for the possibility of banks to engage in regulatory arbitrage between the capital requirements of the banking book and the trading book where it was determined that lower capital requirements would apply in one or the other.
- *Several weaknesses in the internal models approach remained*. The Committee identified a number of weaknesses stemming from the use of the VaR metric as the basis of capital requirements, including:

  (a) *Incentives for banks to take on tail risk*. Even though the Basel 2.5 framework better accounted for tail risk by introducing the stressed VaR requirement, the design of the VaR and stressed VaR metrics fundamentally ignored losses that had less than a 1% probability of occurring. This created perverse incentives to hold positions that featured significant tail risks but were subject to limited risk in "normal" conditions.

  (b) *Inability to capture the risk of market illiquidity*. The Basel 2.5 framework assumed that individual banks would be able to exit or hedge their trading book exposures over a 10-day period without affecting market prices. However, in times of stress, the market is likely to become illiquid rapidly when the banking system as a whole holds similar exposures. This happened at the height of the crisis as banks were unable to exit or hedge positions in a short time frame, resulting in substantial mark-to-market losses.

  (c) *Inability to capture adequately the credit risk inherent in trading positions*. The VaR and stressed VaR metrics did not adequately incorporate the credit risk to which trading book positions may be subject. The 10-day time horizon over which VaR and stressed VaR estimated potential losses was too short to account for losses incurred in the event of default or in the event of the credit rating downgrade of the issuer of an instrument. This weakness meant that, with the rapid growth in the market for traded credit in the early 2000s, banks held large, undercapitalised exposures to credit-related instruments in their trading books. The introduction of the IRC model via the Basel 2.5 reforms addressed this

[7] Basel 2.5 reforms limited the use of internal modelling for securitisations positions to correlation trading book portfolios.

as an interim measure but it caused a high variability in risk-weighted asset outcomes across banks.

(d) *Liberal recognition of the risk-reducing effects of hedging and diversification*. The Basel 2.5 internal models approach had no constraint in recognising hedging and diversification benefits across different asset classes (eg equities and FX) based on estimates of correlations derived from pre-crisis historical data. In the crisis, the diversification effects that were based on historical data disappeared.

- *The standardised approach's lack of risk sensitivity was not addressed.* The Committee focused its Basel 2.5 revisions on changes to the internal models approach. This was in recognition of the need for a rapid response to the insufficient levels of capital maintained by banks with significant trading activities that tend to use the models-based approach for determining capital requirements. The shortcomings of the standardised approach were left unaddressed. Its design therefore continued to be overly risk-insensitive, meaning that capital requirements were not aligned with risk drivers. Furthermore, its calibration remained unchanged from its introduction in 1996.

3. Key elements of the revised market risk framework

This section sets out the key elements introduced in the January 2016 standard *Minimum capital requirements for market risk*. The revisions introduced in the amended framework are also summarised below.

3.1 Scope of application under the January 2016 market risk framework

The January 2016 market risk framework's specification of the scope of application for market risk capital requirements (commonly referred to as the "boundary" between the trading book and the banking book) is designed to improve consistency of implementation and to reduce arbitrage opportunities between the capital requirements for market risk and credit risk. Under the revised market risk framework, the basis for the boundary is still trading intent, but the framework has been bolstered by additional specifications and enhancements, including:

- *Additional specification on the appropriate contents of the trading book*. Recognising that the market risk and credit risk capital requirements address different types of risk, the revised boundary sets out a list of instruments that must be allocated to the trading book and a list of instruments that must be allocated to the banking book – banks are not permitted to deviate from these lists. Additionally, the definition of the trading book is supplemented with a list of instruments "presumed" to be in the trading book. A bank must receive supervisory approval for any deviations from these presumptions.
- *Enhanced supervisory oversight*. Banks must make available to supervisors reports that describe the rationale for including instruments in the trading book and compliance with the framework's scope of application.
- *Restrictions on the ability to arbitrage the boundary*. The framework establishes a strict limit on the movement of instruments between the banking book and the trading book. If the capital requirement for an instrument is reduced as a result of moving the instrument from one book to the other, the difference in the capital requirement as measured at the time of the move is imposed as a fixed, additional Pillar 1 minimum capital requirement.

- *Clearer treatment of risk transfers across the boundary*. Banks may choose to hedge some of the risks in the banking book via instruments held in the trading book. The Basel 2.5 framework's boundary specified the treatment of such internal risk transfers of credit risk but was silent with respect to other risk classes, such as equity risk and interest rate risk. To promote consistency and comparability in regulatory practices across jurisdictions, the framework specifies the treatment of internal risk transfers of equity risk and interest rate risk from the banking book to the trading book.

Further amendments made in the January 2019 revision to the scope of application

In the course of monitoring banks' implementation of the framework's revised scope of application, the Committee identified areas where the clarity of the requirements warranted improvement. It also recognised that the treatment of specific instruments necessitated amendment in order to reduce implementation burden. The January 2019 revision includes refinements and clarifications in three main areas:

- *Clarifications regarding to which regulatory book instruments are to be assigned*. The Committee identified that, in some cases, a financial instrument could be included both in the list of instruments that must be in a particular book, and in the list of instruments that are expected to be in the other book. In these cases, it was not clear which requirement would take precedence. The amended framework clarifies the approach in these situations.
- *Treatment of investments in funds (eg investment funds or similar types of managed funds)*. The January 2016 framework lacked clarity with regard to necessary criteria for investment funds to be allocated to the trading book, when a bank cannot look through the fund to its underlying assets. The amended framework permits equity investments in funds to be allocated to the trading book if the bank is able to "look through" to the fund's underlying assets (ie determine capital requirements based on the underlying positions held by the fund), or where the bank has access both to daily price quotes and to the information contained in the mandate of the fund.
- *Treatment of structural foreign currency positions*. As was the case under the Basel 2.5 framework, the January 2016 framework permitted banks to exclude certain foreign currency risk positions from foreign exchange (FX) capital requirements, if those positions were entered into or maintained with the intent to completely or partially hedge adverse effects of exchange rate movements on the bank's risk-based capital ratio. The amount of the exclusion was limited to the amount of the bank's investments in subsidiaries. To better align with banks' risk management practices, the amended framework revises the limit to the amount that serves to neutralise fluctuation of the bank's risk-based capital ratio due to FX movements.

3.2 Internal models approach under the January 2016 market risk framework

The internal models approach under the January 2016 market risk framework features an enhanced, more granular model approval process to ensure that internal models are used only where they estimate risk appropriately. The approach is also designed to better capture credit and tail risks and to incorporate the risk of market illiquidity. It replaced the Basel 2.5 internal models approach's heavy reliance on VaR, and includes three components for measuring capital requirements which are described in more detail below: (i) an expected shortfall (ES) metric, which determines capital requirements for those market risk factors (ie market variables such as interest rates or equity prices that affect the value of financial instruments) for which a sufficient amount of observable market data is available and therefore are deemed suitable for modelling ("modellable" risk factors); (ii) a non-modellable risk factor (NMRF) requirement for market risk factors with limited observable market data which are deemed not suitable for modelling; and (iii) a default risk capital (DRC) requirement, to determine the capital

requirements associated with default risk for credit and equity positions. The overall internal models approach capital requirement is calculated as the simple sum of the capital requirement for each of the three components.

(i) Enhanced model approval process

Under the revised framework, model approval is granted at the level of banks' trading desks. This is in contrast to the Basel 2.5 framework, which determined supervisory approval/removal of internal models at the bank-wide level. The revised framework's granular, desk-level approach makes it easier for supervisors to disallow the use of internal models for particular trading desks for which risks are not adequately captured by a bank's internal model, without causing a sudden change or cliff effect in overall capital requirements.

The validation tests that banks' models must pass on an ongoing basis have also been enhanced. To use internal models to determine capital requirements, a trading desk's internal model must pass two tests:

- *Profit and loss attribution*. A test to determine whether the internal model comprehensively measures the risks that drive the daily profits and losses (P&L) of the trading desk.
- *Backtesting*. A test to determine if the risk estimated by the internal model is sufficiently conservative to cover observed trading losses.

Trading desks with internal models that fail these tests must use the standardised approach.

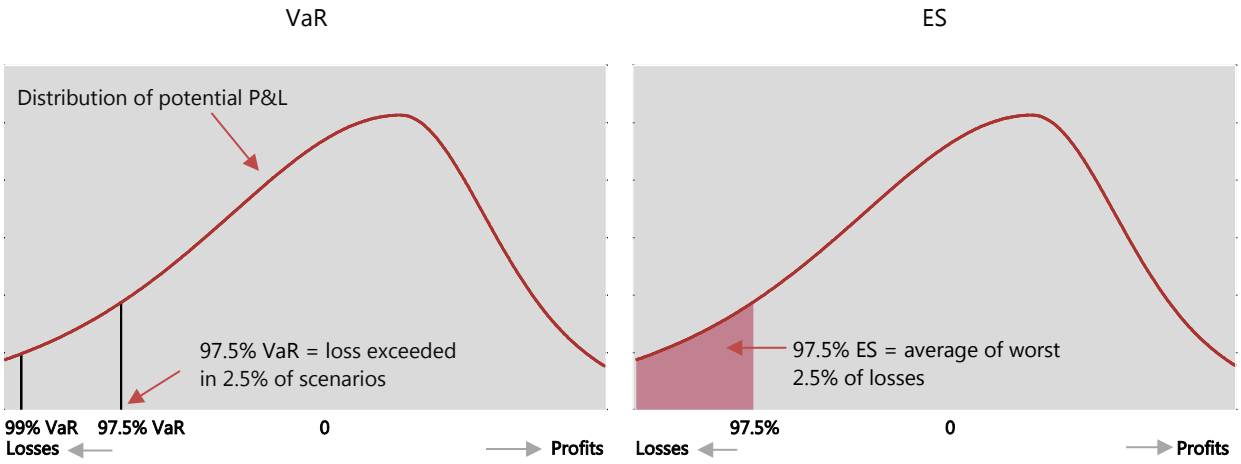
(ii) New type of internal model to capture tail risk and market illiquidity: expected shortfall

The revised internal models approach replaces VaR and stressed VaR with a single ES metric that is calibrated to a period of significant market stress. Two features of this new metric address deficiencies in the Basel 2.5 framework:

- ES captures the tail risks that are not accounted for in the existing VaR measures. While VaR calculates the maximum potential loss at a certain confidence level (eg a 97.5% VaR measures a loss that is expected to be exceeded only 2.5% of the time), ES calculates the average loss above a certain confidence level (eg a 97.5% ES measures the average of the worst 2.5% of losses).[8]

[8] In other words, whereas VaR calculates the losses at a single cut-off point in the distribution (eg 97.5%), ES looks at the average of any loss that exceeds the cut-off point in the distribution. Therefore, if the same cut-off point is used for VaR and for ES, the value of ES will be higher than the value of VaR. The difference between ES and VaR outcomes increases in cases of fat-tailed distributions. In the revised market risk framework, the 97.5th percentile ES is roughly equivalent to the 99th percentile VaR used in Basel 2.5.

Graph 1: Expected shortfall compared to value-at-risk



- To recognise the risk of market illiquidity, the ES measure prescribes different liquidity horizons for different risk factors. In this context, "liquidity horizon" is defined as the time required to exit a position or to hedge a risk factor without materially affecting market prices under stressed market conditions. The ES measure calculates the loss that a bank might suffer over the specified liquidity horizon in a period of market stress – the measure will thus tend to calculate higher capital requirements for less liquid risk factors.

Finally, the revised internal models approach limits the amount of diversification benefit assumed in determining capital requirements. The total ES capital requirement is calculated as the average of: (i) an "unconstrained" ES calculation, with diversification benefits recognised across all risk classes (eg across interest rate, equity, FX, commodity and credit spread risks); and (ii) a simple sum of separate ES calculations for each risk class, in which no diversification benefit across risk classes can be recognised.

(iii) Limits on the modelling of illiquid and unobservable risk factors

The Basel 2.5 internal models approach allowed banks to model all risks inherent in their trading portfolio. The revised framework recognises that there is significant uncertainty in modelling risks for which there are limited observable historical market data, and prevents banks from modelling those risks. Risk factors (eg FX rates or equity prices) that do not have sufficient observable market data are deemed to be non-modellable (ie NMRFs). NMRFs are excluded from the ES calculation; instead, the capital requirement for each NMRF is determined by means of a stress test.

(iv) Revised treatment of default risk

The Basel 2.5 IRC model for default and migration risk is replaced by a DRC model that focuses exclusively on default risk. The longer liquidity horizons used in the ES measure allow it to incorporate migration risk, but default risk requires separate measurement. To address one of the main observations from the Committee's review of variability of market risk-weighted assets – that IRC models were a material source of unwarranted variation due to the flexibility banks were afforded in the way they

calibrated the model[9] – under the revised framework, the DRC model requirement limits the choices banks can make when building the model, and requires all equity positions to be included in its scope.[10]

Further amendments made in the January 2019 revision for the internal models approach

The Committee's monitoring following the January 2016 publication identified aspects of the internal models approach that posed significant implementation challenges – in particular, the design of the profit and loss attribution test. In addition, as banks began to investigate the range of risk factors deemed non-modellable under the framework, some risk factors that appeared amenable to modelling failed the conditions, and the impact of the NMRF framework was significantly greater than had originally been estimated. The January 2019 revisions do not change the overall structure of the internal models framework, but introduce targeted changes to address these issues.

- *Revised P&L attribution (PLA) test metric and failure consequence*. The revisions introduce new PLA test metrics to better differentiate well performing models from poorly performing models. To reduce potential cliff effects in capital requirements, the consequence of failing the test has also been revised from the previous binary pass or fail outcome to a "traffic light" approach with an intermediate "amber zone". Trading desks in the "amber zone" may continue to use the internal models approach but will be subject to a capital surcharge. Trading desks that materially fail the test are determined to be in the "red zone" and must use the standardised approach.
- *Revised NMRF conditions and capitalisation approach*. A number of revisions have been made to reduce the conservatism and operational burden of this element of the framework.

  (a) The quantitative conditions for a risk factor to be eligible for modelling have been amended to include risk factors that have sufficient liquidity but may experience extended periods during which there is limited trading (eg agricultural commodities). For example the requirement of no more than a 30-day gap between real price observations has been replaced by a requirement of a minimum of four real price observations in a 90-day period. Where a risk factor fails this risk factor eligibility test, it may still be considered eligible for modelling if there are a minimum of 100 real price observations in the previous 12 months. In both cases banks are permitted to count only one real price observation per day.

  (b) The calculation of the stressed loss for each NMRF has been simplified to reduce operational burden. The January 2016 framework required banks to identify a separate stress period for each NMRF for the calculation of stressed loss. The amended framework allows banks to use a common stress period for all risk factors relevant to a particular risk class (eg all interest rate risk factors). The period over which the loss should be calculated has been amended to be the same as the liquidity horizon specified for the ES measure, with a floor of 20 days.

  (c) The aggregation approach to calculating the overall NMRF capital requirement incorporates additional, but limited, diversification benefits. No diversification benefit was recognised among NMRFs under the January 2016 framework other than for particular types of credit risk factors – this led to an overly conservative level of NMRF capital requirements.

[9] Basel Committee on Banking Supervision, *Regulatory consistency assessment programme (RCAP) – Analysis of risk-weighted assets for market risk*, January 2013, www.bis.org/publ/bcbs240.pdf.

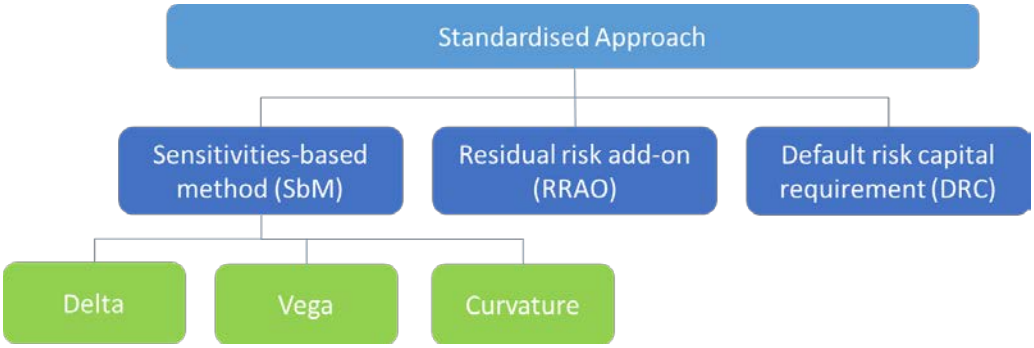
[10] Under IRC, banks had the option (subject to supervisory approval) to include equity positions.

(d) The amended framework clarifies the qualitative conditions for eligible risk factors to be considered modellable, introducing a set of principles that banks must apply to the data used to model risk factors that have passed the risk factor eligibility test.

3.3 Standardised approach under the January 2016 market risk framework

The revised standardised approach is designed to be more risk-sensitive than the Basel 2.5 framework (in which the standardised approach was largely unchanged from the version introduced in 1996). It has three components (shown in Graph 2), the sum of which determines the overall capital requirement: (i) sensitivities-based method; (ii) standardised default risk capital requirement; and (iii) residual risk add-on.

Graph 2: Structure of the revised market risk framework standardised approach



The Annex sets out a number of worked examples to illustrate the mechanics of key elements of the revised standardised approach.

(i) Sensitivities-based method

The core component of the revised standardised approach is the sensitivities-based method. Conceptually, the method is similar to a stress test – the capital requirement is based on the loss a bank estimates it would suffer under a defined stress scenario. It relies on "sensitivities" as the main input to the calculation. A "sensitivity" is the change in the value of an instrument given a small movement in a risk factor that affects the instrument's value. For example, banks are required to calculate the change in value of their financial instruments if there was a 1 basis point move in interest rates.

The framework specifies:

- A set of risk factors which are considered to be the main market variables that affect the value of banks' trading portfolios. Similar risk factors are grouped together into "buckets" (eg for equities, buckets are defined by industrial sector). Banks calculate the sensitivity of their trading book portfolio to movements in the value of each of the risk factors.
- Risk weights to be applied to those risk factors. Risk weights have been calibrated to stressed market conditions to ensure a calibration aligned with the internal models approach. Banks must scale up their "sensitivities" to each risk factor based on the prescribed risk weight to estimate how much value the portfolio would lose if a shock was to happen to the risk factor.
- A methodology for aggregating the losses calculated for each risk factor shock to determine the loss for the scenario at the portfolio level. In order to ensure a level of risk sensitivity, the aggregation method recognises a degree of diversification benefit between risk factor-level losses (applying different levels of assumed correlation between shocks applied to risk factors in the same buckets and those in different buckets).

The above steps are applied separately for three different types of risk and added as a simple sum to calculate the sensitivities-based method capital requirement:

- Delta risk – the potential loss due to a small change in price of an equity or commodity, or a small change in an interest rate, credit spread, or FX rate.
- Vega risk – the potential loss due to a change in the implied volatility of an option (for instruments that feature optionality).
- Curvature risk – the potential incremental loss beyond delta risk when large movements occur in risk factors of instruments that feature optionality.

To address the risk that correlations in the movement of risk factors can fluctuate in periods of financial stress, sensitivities are aggregated three times, assuming high, medium and low correlations between risk factor shocks. Capital requirements are calculated separately for each of the seven regulatory risk classes[11] under each correlation scenario and the risk class-level capital requirements are aggregated as a simple sum. The total capital requirement is the largest of the capital requirements across the three correlation scenarios.

(ii) Standardised default risk capital requirement

The standardised default risk capital requirement ("standardised DRC") allocates all credit and equity positions to default risk bucket categories (eg categories for non-securitisation exposures include corporates, sovereigns and local governments/municipalities). Within each default risk bucket, the DRC requirement is calculated based on the default risk weight (based on credit rating) and the estimated loss that each position would experience in the event of a default.

(iii) Residual risk add-on

The final component of the revised standardised approach is the residual risk add-on. This provides a simple, conservative capital requirement for any other risks not addressed by the main risk factors included in the sensitivities-based method or standardised DRC requirement. The residual risk add-on is the simple sum of gross notional amounts of instruments with residual risks, multiplied by a risk weight of 1.0% for instruments with an exotic underlying (eg weather derivatives) or 0.1% for instruments with other residual risks (eg complex derivatives such as barrier options).

Further amendments made in the January 2019 revision to the standardised approach

The Committee's monitoring of the implementation and impact of the revised standardised approach highlighted areas where the approach to measuring risk factor losses, and their aggregation, was too high in relation to the actual risk. In addition, the Committee identified a number of areas where the approach could be simplified to reduce its operational burden. The January 2019 revisions include the following changes to the sensitivities-based method:

- Under the FX risk class, the scope of currency pairs that are considered liquid, and are therefore subject to lower risk weights, has been broadened. The overall approach to FX risk has also been amended so that banks, subject to supervisory approval, may calculate FX risk with respect to the currency in which they manage their trading business (their "base currency")

[11] Risk classes are interest rate risk, equity risk, FX risk, commodity risk, credit spread risk (non-securitisations), credit spread risk (securitisations – non correlation trading portfolio) and credit spread risk (securitisations – correlation trading portfolio).

rather than with respect to their reporting currency. A worked example of this approach is included in the Annex.

- The equity risk and the credit spread risk classes have been enhanced, with new "index" buckets for equity and credit spread risks introduced to provide a simple approach that does not require the identification of each underlying position in an index to calculate the capital requirements for equity and credit indices.
- The calculation of curvature risk capital requirements for options has been modified to (i) apply consistent shocks to similar risk factors; (ii) address double-counting of FX risk for certain instruments; and (iii) remove a potential cliff effect in the aggregation formula for capital requirements. The scope of the curvature risk calculation has been broadened to allow banks to include bonds and other instruments without optionality when curvature risk is managed holistically across options and other instruments.
- With regard to the aggregation of risk sensitivities, the "low correlations" scenario has been modified to ensure it does not produce unrealistically low correlations for risk factors that are considered to be highly correlated in stressed market conditions.

Finally, to ensure that the overall level of capital requirements resulting from the revised standardised approach remains broadly consistent with the Committee's original expectation, the Committee has reduced the risk weights for general interest rate risk (by 30%) and FX risk (by 50%). Adjustments have also been made to risk weights for the credit spread risk of high-yield sovereign bonds and covered bonds.

3.4 Simplified alternative to the standardised approach

The standardised approach included in the January 2016 framework was developed to provide a risk-sensitive approach for banks that do not require a modelled treatment for market risk, to serve as a credible fallback to the internal models approach (IMA) and to facilitate transparent, consistent and comparable reporting of market risk across banks and jurisdictions.

However, the Committee recognises that the sophistication of the revised standardised approach's sensitivities-based method may pose implementation challenges for some banks that have relatively small or non-complex trading portfolios.

For those banks, the current Basel 2.5 standardised approach will be retained as a simplified alternative to the revised standardised approach, subject to the application of specified scalars to ensure a sufficiently conservative calibration of capital requirements for these banks. The scalars per risk class are set at: 1.3 for interest rate risk; 3.5 for equity risk; 1.9 for commodity risk; and 1.2 for FX risk. As the scalars are multiplied by the capital requirement calculated under the Basel 2.5 framework, the scalar of 1.3 for the interest rate risk means a 30% increase in capital requirements relative to Basel 2.5.

4. Impact assessment

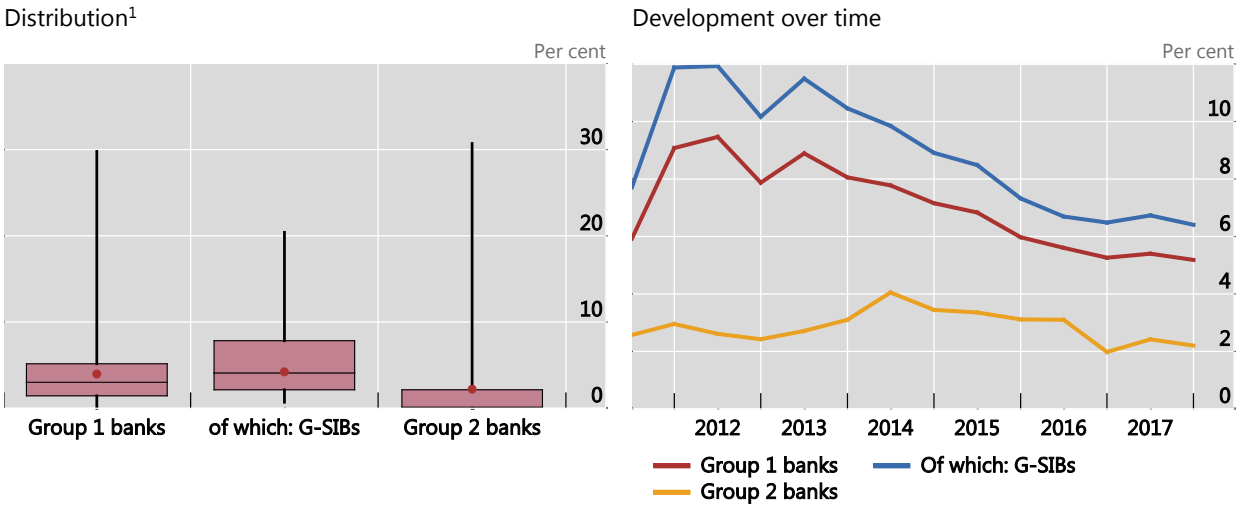
The overall calibration of the framework is based on a limited set of data provided by banks, due to the challenges banks face in establishing systems to assess all aspects of the revised framework prior to its implementation.

The data used for the analysis below on the impact of the amended market risk framework[12] were adjusted to the extent possible to account for the amendments to the framework that are described in Section 3 of this note. However, they are subject to the following limitations. For the standardised approach, the amendments associated with the double-counting of FX curvature risk and the "base currency" approaches have not been captured in this impact analysis given that data of sufficient granularity to measure their impact have not been collected by the Committee. For both amendments, the Committee expects that their impact will result in reductions to FX risk capital requirements relative to the impact analyses set out below. For the internal models approach, the analysis assumes that the scope of model permissions remains unchanged, which means that it ignores (i) the potential for banks to change the scope of trading desks that use models and (ii) the potential consequences of trading desk-level backtesting and the PLA test results. To reflect the potential impact of amendments to the NMRF capital requirement, the analysis replaces the amount of NMRF capital requirement as reported by each bank with the median value reported within the sample of banks. This amount has then been reduced by 60% to reflect the expected amount by which NMRF capital requirements will change owing to amendments to the framework.

To put the impact analyses in context, based on Basel III monitoring quantitative impact study (QIS) data provided by banks as of end-December 2017, market risk weighted assets (RWAs) account for 4.0% of total RWAs for Group 1 banks and 2.2% for Group 2 banks. The average share for Group 1 banks and G-SIBs is at a similar level as it was at end-June 2011. However, as can be seen in the right panel of Graph 3, Group 1 banks (and, in particular, the G-SIBs among them) experienced a significant peak in market RWAs as a share of total RWAs at the end of 2011 as a result of financial market stress; the share of market RWAs has gradually decreased between the end of 2011 and the end of 2017.

[12] As noted in the Committee's report on the end-December 2017 Basel III monitoring exercise, QIS data for market risk represent best efforts and are less robust than in other areas of the Committee's Basel III monitoring exercise owing to the large number of trading positions at individual banks that require, and will require, numerous manual adjustments until systems reflecting the revised minimum capital requirements for market risk are available. See Basel Committee on Banking Supervision, *Basel III Monitoring Report*, October 2018, www.bis.org/bcbs/publ/d449.pdf.

Share of market risk RWAs in total RWAs under the current rules Graph 3



[1] The median value is represented by a horizontal line, with 50% of the values falling in the 25th to 75th percentile range shown by the box. The upper and lower end points of the vertical lines generally show the range of the entire sample. The dots represent weighted averages.

Sample for distribution includes 93 Group 1 banks, 30 G-SIBs, 85 Group 2 banks, and the consistent sample of banks for the development over time includes 36 Group 1 banks, 14 G-SIBs, 20 Group 2 banks.

Source: Basel Committee on Banking Supervision.

For the sample of banks included in the impact analyses below, Table 1 shows the share of market RWAs as a proportion of total RWAs based upon the Basel 2.5 framework, the January 2016 framework excluding the January 2019 amendments (2016 FRTB), and the amended framework (2019 FRTB). Overall, as of end-December 2017, based on the 2019 amended framework, market RWAs would account for 5.3% of total RWAs on average,[13] compared with 4.4% under the Basel 2.5 framework and 7.2% under the original January 2016 framework.

Share of market risk-weighted assets as a percentage of total Basel III risk-weighted assets based on end-December 2017 data

All banks, in percent Table 1

	Basel 2.5 framework	2016 FRTB	2019 FRTB	No. of banks
Total	4.4	7.2	5.3	37

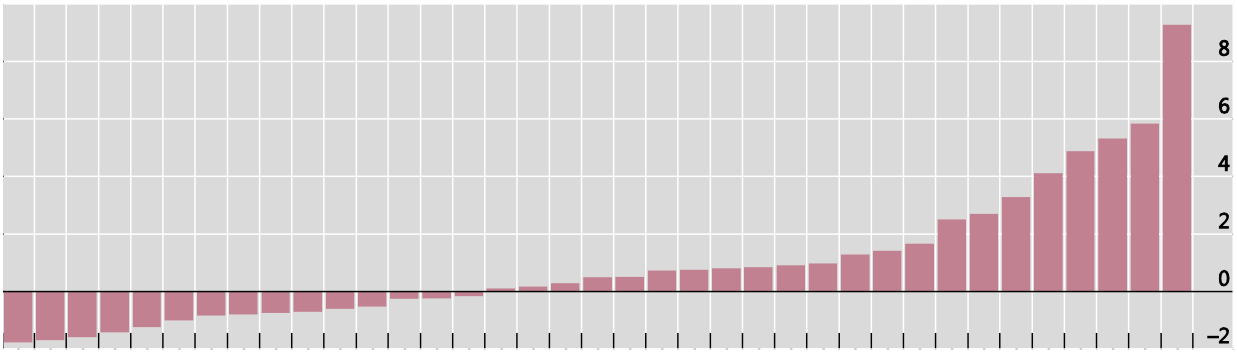
Source: Basel Committee on Banking Supervision.

The distribution of impact on the share of market risk capital requirements across the sample of banks is illustrated in Graph 4.

[13] The difference in the share of market risk capital requirement under the January 2016 framework between the Basel III Monitoring Report (October 2018) and this note stems from the smaller size of the sample used for this analysis – banks that did not contribute granular data to assess the impact of amended framework are not included.

Estimated change in share of total market risk-weighted assets as a percentage of total Basel III risk-weighted assets based on December 2017 data

All banks, in percentage point — Graph 4



Sample (horizontal axis) = 37 banks; weighted average = 0.9%p.

Source: Basel Committee on Banking Supervision.

Compared with the Basel 2.5 framework, the amended framework is estimated to result in a median increase of 16%, and a weighted average increase of 22% in market risk capital requirements (Table 2). The expected impact on banks that exclusively use the standardised approach is a 40% increase for the median bank and a 30% increase on a weighted average basis, while the expected impact on banks that use the internal models approach is a 5% increase for the median bank and a 20% increase on a weighted average basis.

Estimated changes in market risk capital requirement under the amended framework compared with the Basel 2.5 framework

All banks, in percent — Table 2

	25th percentile	Median	75th percentile	Weighted average	No of banks
Total	–19.3	16.4	58.1	21.7	40

Source: Basel Committee on Banking Supervision.

Table 3 sets out the ratio of market risk capital requirements under the revised standardised approach relative to capital requirements under the revised internal models approach. In practice, the ratio for the FX risk class is expected to be lower given that these estimates, as noted above, do not account for all amendments to the standard.

Estimated capital requirements under the amended standardised approach relative to capital requirements under the amended internal models approach (non-securitisation exposures)

IMA banks, breakdown by risk class — Table 3

	Median	Sample size
General interest rate risk	1.5	31
Credit spread risk: non-securitisations	1.1	24
Equity risk	1.8	24
Commodity risk	1.6	22
Foreign exchange risk	2.2	31

Source: Basel Committee on Banking Supervision.

Table 4 shows the distribution of capital impacts for banks that could use the simplified alternative to the standardised approach. Based on a sample of 13 banks that currently use only the standardised approach to determine market risk capital requirements, the market risk capital requirement would be expected to increase 43% for the median bank (57% on a weighted average basis). The Committee notes, however, that the banks included in this sample may not be representative of those banks that ultimately would be permitted by their supervisors to use the simplified alternative. As noted above, the simplified alternative is intended to be used only by banks with smaller and less complex trading book positions. Banks of this nature may not be well represented in the sample of banks from which QIS data are collected.

Estimated capital impact of simplified standardised approach relative to Basel 2.5 standardised approach

SA-only banks, in per cent — Table 4

	25th percentile	Median	75th percentile	Weighted average	No of banks
Total	34.7	42.5	96.2	57.4	13

Source: Basel Committee on Banking Supervision.

Annex: Examples of the application of the standardised approach

This Annex provides worked examples of the key elements of the standardised approach. Worked examples 1 and 2 illustrate the core calculation mechanics of the sensitivities-based method and of the default risk capital requirement. Worked example 3 illustrates the application of a newly introduced feature of the standardised approach – the base currency approach.

Worked example 1 – Sensitivities-based method for delta risk and the default risk capital requirement

This example demonstrates the calculation of capital requirements for a portfolio of equities. A bank uses USD as its reporting currency and has a portfolio containing the three equities described in Table A1.1. The portfolio does not contain any options, so the elements of the standardised approach that must be calculated are the sensitivities-based method delta risk capital requirement and the standardised default risk capital (DRC) requirement.

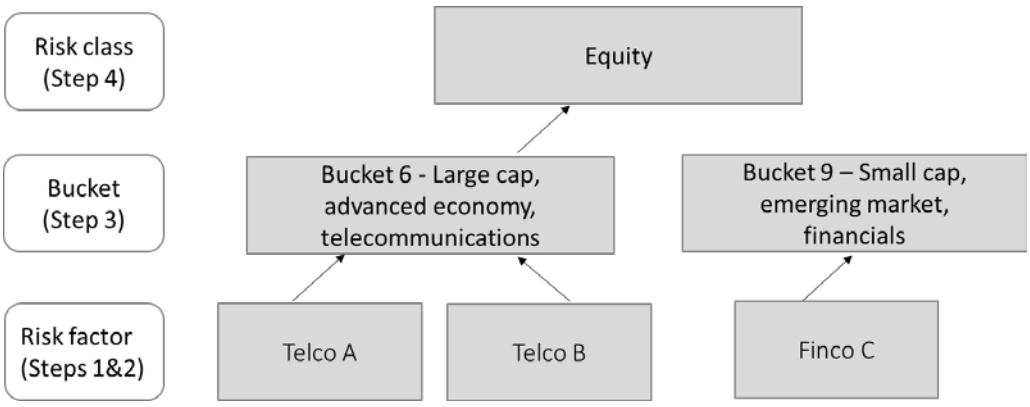
Equities portfolio — Table A1.1

Issuer	Sector	Market value	Sensitivity **(a)**	Risk weight **(b)**	Weighted sensitivity **(a) x (b)**
Telco A	Telecommunications (equity risk class bucket 6)	USD 200m	USD 200m	35%	USD 70m
Telco B	Telecommunications (equity risk class bucket 6)	USD –100m	USD –100m	35%	USD –35m
Finco C	Financials (equity risk class bucket 9)	USD 100m	USD 100m	70%	USD 70m

1. Delta risk capital requirement

The Graph A1 below provides an overview of the calculation steps for the delta risk capital requirement.

Graph A1: Steps for delta risk capital requirement

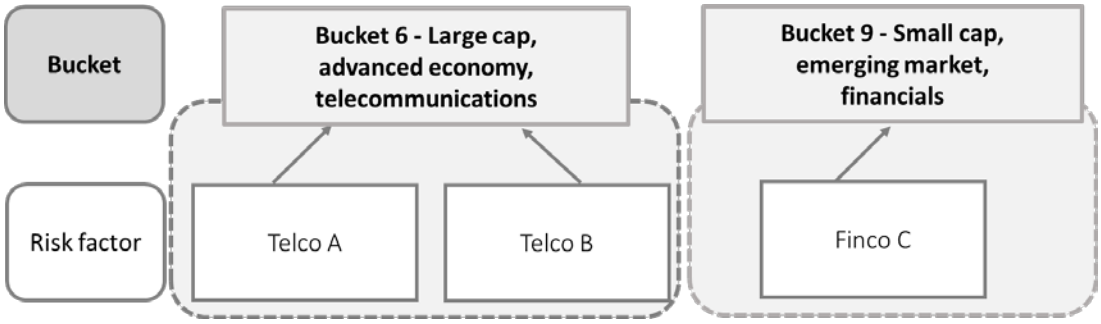


Step 1 is to identify the risk factors that are relevant to the portfolio and to calculate risk factor sensitivities and assign them to the buckets defined in the framework. The approach defines each equity issuer as a separate risk factor; in this example, the Telco A and Telco B equities are mapped to the same bucket given that they are associated with the same industry sector. The sensitivity for each equity position is its current price (column (a) of Table A1.1).

Step 2 is to calculate net sensitivities to the same risk factor (eg offset long and short positions in the same equity) and multiply the net sensitivities by the risk weights specified for each bucket. As the equities represent three separate risk factors, there is no netting in this example. Sensitivities (calculated in Step 1) are multiplied by the risk weight prescribed for the bucket to which they have been assigned (with the resultant weighted sensitivities shown in the right-most column of Table A1).

Step 3 is to aggregate risk-weighted sensitivities using prescribed correlations and a specified formula, first within each bucket and then across buckets.

Graph A2: Step 3 – Aggregation of risk-weighted sensitivities within buckets

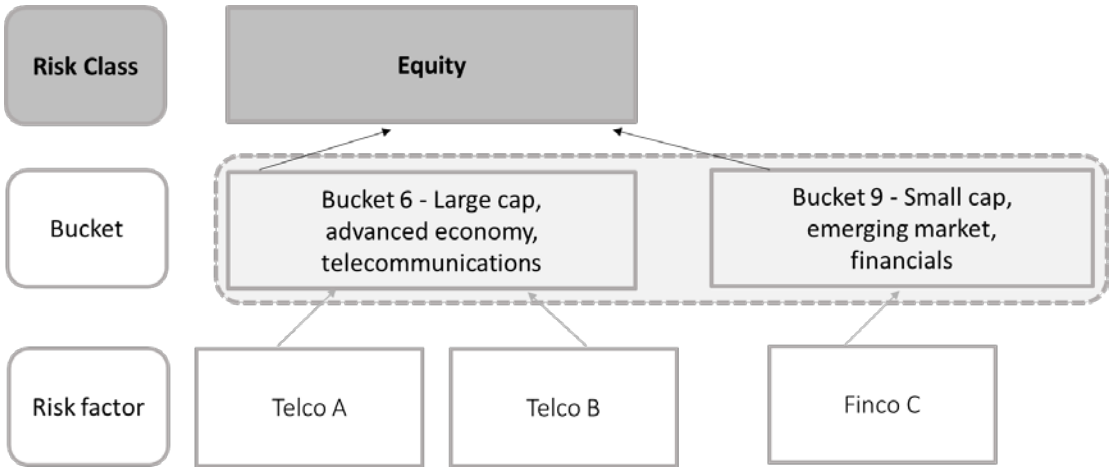


The bucket-level capital requirement for the bucket of Telco A and Telco B (bucket 6) is based on a prescribed correlation parameter of 25%:

$$\sqrt{(\mathbf{70})^2 + (\mathbf{-35})^2 + (2 \times \mathbf{25\%} \times \mathbf{70} \times (\mathbf{-35}))} = USD\ 70m$$

The bucket-level capital requirement for Finco C (bucket 9) is its weighted sensitivity (ie $USD\ 70m$) since it is the only risk factor in this bucket.

Graph A3: Step 3 – Aggregation of risk-weighted sensitivities across buckets



The bucket-level capital requirements are then aggregated using a prescribed cross-bucket correlation parameter to produce the overall capital requirement for the equity risk class. For this example, the prescribed correlation is 15%. The resultant equity risk class-level capital requirement is:

$$\sqrt{(\mathbf{70})^2 + (\mathbf{70})^2 + (2 \times \mathbf{15\%} \times \mathbf{70} \times \mathbf{35})} = USD\ 102.6m$$

Step 4 is to calculate the overall delta risk capital requirement. To take account of the risk that correlations can change in stress periods, Step 3 is performed two additional times to consider two alternative correlation scenarios: a "high correlations" scenario (whereby correlations are scaled up by 25% but capped at 1) and a "low correlations" scenario (whereby correlations are reduced by 25% with a sliding scale so that the size of the reduction becomes smaller when the prescribed correlation is high). In this example, the results are as follows:

Capital requirement under correlations scenarios

Table A1.2

Scenario	Total (USD millions)
High correlations	102.0
Medium correlations	102.6
Low correlations	103.2

The capital requirement is the largest value of the low, medium and high correlations scenarios. In this example, the low correlation scenario produces the largest outcome, resulting in an overall delta risk capital requirement of USD 103.2 million for the portfolio.

2. Default risk capital requirement

In addition to the delta risk capital requirement, banks must calculate default risk capital requirements for equities. The approach specifies (i) how banks should measure exposure at default (ie the jump-to-default, or JTD, position) for instruments subject to default risk (ie the loss that would be incurred in the event of a default on the part of the issuer) and (ii) risk weights. These two components are simply multiplied together, with some offsetting benefit permitted between long and short positions.

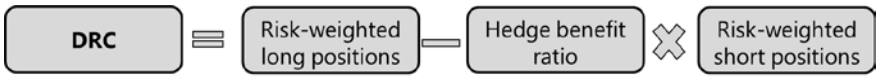
For equities, the market price is the basis of the gross JTD positions. Thus the JTD positions for the three equities are: $JTD_{Telco\ A} = \text{USD}\ 200m, JTD_{Telco\ B} = \text{USD} - 100m, JTD_{Finco\ C} = \text{USD}\ 100m.$

To recognise the hedging relationship between long and short positions, a fraction of the short positions can be offset against the long positions. This fraction (the "hedge benefit ratio") is calculated as the ratio of long JTD positions to the summed absolute values of long and short JTD positions:

$$Hedge\ benefit\ ratio = \frac{200m + 100m}{200m + |-100m| + 100m} = \frac{300m}{400m} = 0.75$$

Each position is risk-weighted, with risk weights determined by the credit rating of the equity issuer. In this example, Telco A is rated BBB, so receives a risk weight of 6%. Telco B and Finco C are both rated B, so receive a risk weight of 30%.

The default risk capital requirement is: (i) the sum of risk-weighted long positions minus (ii) the sum of risk-weighted short positions multiplied by hedge benefit ratio.



For this example:

$$DRC = RW_{Telco\ A} \times JTD_{Telco\ A} + RW_{Finco\ C} \times JTD_{Finco\ C} - \text{Hedge benefit ratio} \times RW_{Telco\ B} \times |JTD_{Telco}|$$
$$= 6\% * 200m + 30\% * 100m - 0.75 * 30\% * 100m = USD\ 19.5m$$

The total capital requirement for the portfolio is the sum of the delta risk and DRC requirements: USD 122.7 million.

Worked example 2 – Sensitivities-based method for vega risk and curvature risk

This worked example illustrates the implementation of the standardised approach vega and curvature risk capital requirements for options (the approach for delta risk is described in worked example 1, so is not addressed here). The example is from the perspective of a CAD reporting bank that holds a put option on Telco D as described in Table A2.

Table A2.1

Instrument	Currency	Maturity	Industry	Exercise type	Market value (CAD)
Telco D put option	EUR	Two years	Telecoms	European	–0.38

1. Vega risk capital requirement

The vega risk calculation process is the same as that used for the delta risk capital requirement, but based on a different type of sensitivity – the sensitivity of the value of the options to a 1 basis point change of the implied volatility of the underlying equity.

Step 1 is to calculate the sensitivity of the value of the option to movements in implied volatility at specified tenor points. For the Telco D option, the relevant tenor points are: 0.5 years, 1 year and 3 years.

Table A2.2

Vega sensitivity in CAD	Equity risk bucket	Tenor point (years)		
		0.5	1	3
Telco D put option	6	0.00	–0.63	–0.60

Step 2 is to multiply the sensitivities by a specified risk weight. In this case, the risk weight is 77.8%.

The risk-weighted net sensitivities (CAD) are:

Table A2.3

Vega sensitivity in CAD	Equity risk bucket	Tenor point (years)		
		0.5	1	3
Telco D put option	6	0.00	–0.49	–0.47

Step 3 is to aggregate risk-weighted sensitivities using a specified formula (the same formula as for delta risk) and correlation assumption. The resulting vega capital requirement is CAD 0.95.

2. Curvature risk capital requirement

For curvature risk, the sensitivity is the difference between the actual change in value of the option and the change in value estimated based on the option's delta when equity prices move significantly. As such, the curvature risk measurement captures the additional risk not captured by delta risk. Curvature risk is based on two scenarios: one upward shock and one downward shock to the equity price. Applying the prescribed shock (in this case 35%), the curvature risk sensitivity is:

Table A2.4

Curvature risk in CAD	Bucket	Upward shock	Downward shock
Telco D	6	1.75	0.90

The sensitivities are then aggregated separately for (i) the upward shock scenario and (ii) the downward shock scenario, with a prescribed correlation using a similar formula to the one used for delta and vega risk. The maximum of the two is the resulting capital requirement. In this case, as there is only one instrument, no aggregation is required and the curvature capital requirement is simply the maximum of the upward and downward shock figures above: CAD 1.75. The vega and curvature capital requirements are added to those for delta risk as a simple sum.

Worked example 3 – Sensitivities-based method "base currency" approach

The January 2019 revisions introduce the "base currency" approach as an additional method to determine FX risk. This worked example illustrates the mechanics of applying the approach.

The example is based on a CAD reporting bank with the net open FX positions set out in Table A3.1. If the bank did not use the "base currency" approach, it would calculate one sensitivity for each exposure; but under the "base currency" approach, the exposures would have two sensitivities (illustrated in Steps 2 and 3 below).

Table A3.1

Positions in CAD	CAD	CHF	EUR	JPY	SGD	USD
Net open FX position	30	–50	–20	60	30	–50

Under the "base currency" approach, assuming that USD is the bank's chosen "base currency", the bank can transform the value of its FX positions into USD, measure the FX risk relative to USD, and then translate the capital requirement back to CAD for reporting purposes.

Step 1 is to convert the value of all FX exposures to USD by applying the current CAD/USD spot FX rate as shown in Table A3.2 below (the rate applied in the example is 1.2534).

Table A3.2

Positions in USD	CAD	CHF	EUR	JPY	SGD	USD
Net open FX position	23.9	–39.9	–16.0	47.9	23.9	–39.9

Step 2 is to measure the sensitivity of the USD-denominated exposures to a change in each exchange rate relative to USD. For example, the CAD exposure's sensitivity is calculated by shocking USD/CAD. The sensitivities are then risk-weighted using the prescribed risk weight of 21.1%. The resulting risk-weighted sensitivities are shown in the shaded columns in Table A3.3.

Step 3 is to measure the sensitivity of each position to movements in the CAD/USD rate. This captures the translation risk between the "base currency" and the reporting currency; no risk is ignored by changing the currency in which capital requirements are calculated. The sensitivities are risk-weighted using the prescribed risk weight of 21.1%. The resulting risk-weighted sensitivities are shown in the unshaded columns in Table A3.3.

Step 4 is the same as for the non-base currency approach, whereby banks net the sensitivities within buckets. For FX risk, each currency is assigned to a separate bucket (identified in the second row in Table A3.3 for each exposure). In this example, all CAD weighted sensitivities calculated in Steps 2 and 3 are then summed. The CAD net weighted sensitivity is USD 5.1 (the final column of the table).

Step 5 is to aggregate the net weighted sensitivities (shown in bold in Table A3.3) across buckets using the prescribed correlation parameter of 60%. The resulting FX risk capital requirement is USD 11.75.

The capital requirement expressed in USD is then converted back to CAD using the spot rate (the same rate as used in Step 1). In this case, the ultimate FX risk capital requirement is CAD 14.73.

Table A3.3

Positions in	CAD		CHF		EUR		JPY		SGD		USD	Total
FX risk bucket	CAD	CAD	CHF	CAD	EUR	CAD	JPY	CAD	SGD	CAD	CAD	CAD
S_k *(in USD)*	23.9	–23.7	–39.9	39.5	–16.0	15.8	47.9	–47.4	23.9	–23.7	39.5	23.9
WS_k *(in USD)*	5.1	–5.0	**–8.5**	8.4	**–3.4**	3.4	**10.2**	–10.1	**5.1**	–5.0	**8.4**	**5.1**

Delta FX risk (in USD)	11.75	**Delta FX risk** (in CAD)	**14.73**	Note: Converted at CAD/USD spot rate