FRTB final rule

Further amendments made in the January 2019 revision to the market risk framework (BCBS 457)

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What´s new

Amendments to the IMA

Amendments to the SA

Simplified alternative to SA

Clarifications on the scope of application

Impact assessment

Foreseen entry into force

Annexes

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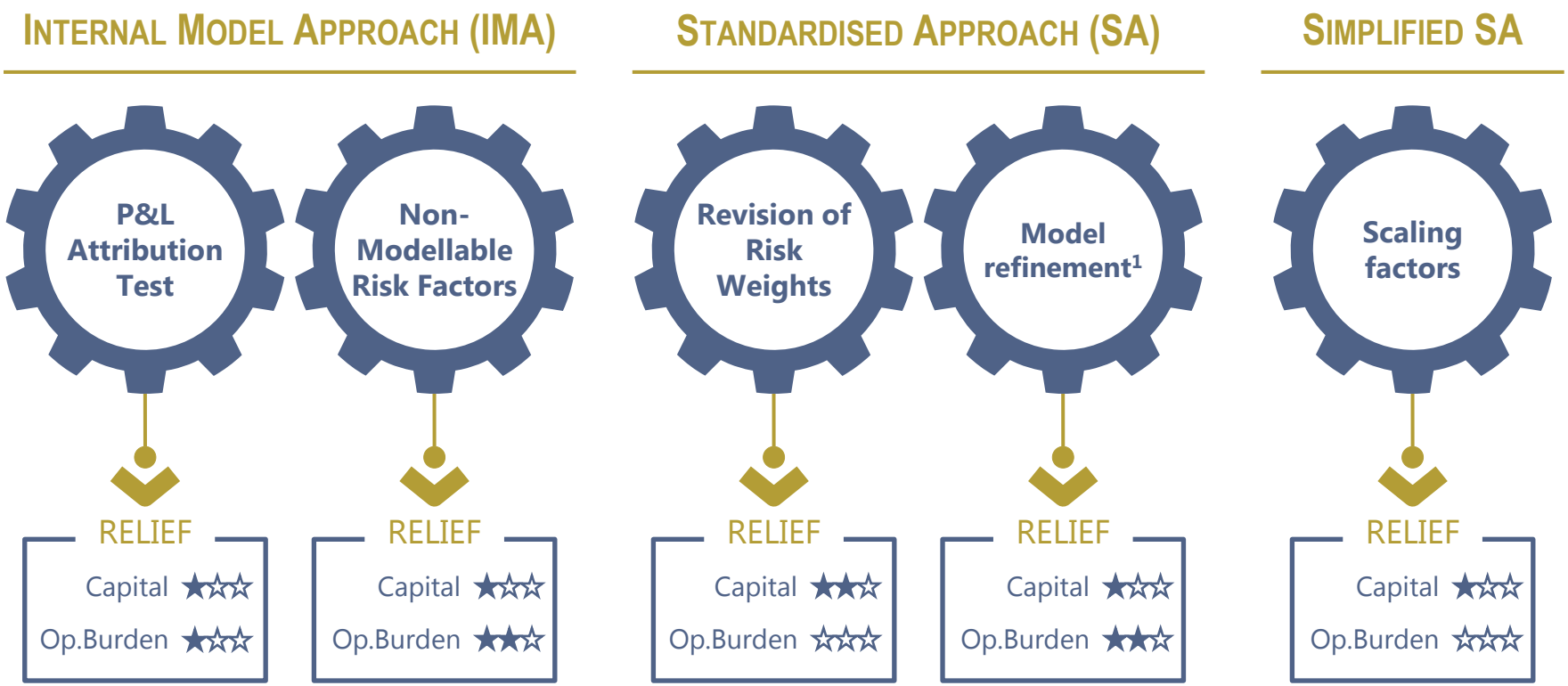
What´s new
Main Amendments

The final re-calibration of the FRTB framework brings some relief of the operational burden on the bank´s risk management and a slight reduction of the expected capital impact



Member jurisdictions to implement Pillar 1 minimum capital requirement under the FRTB framework from **1 January 2022**

1. It comprises (i) FX risk overall approach, (ii) curvature risk capital requirements, (iii) sensitivity computations, (iv) treatment of index instrument and multi-underlying options and (v) correlation scenarios.

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What´s new

Amendments to the IMA

1. **P&L Attribution test**
2. **Non-Modellable Risk Factors**

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Foreseen entry into force

Annexes

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Amendments to the Internal Model Approach

P&L Attribution test

The outcome of the long-discussed revision of the PLA test[1] is still a hard-to-pass hurdle

PLA test intends to measure the **materiality of simplifications in the banks´ internal models driven by missing risk factors** and **differences in the way positions are valued** compared with their FO systems

	2016	FINAL RULE (2019)
Frequency	**Monthly**	**Quarterly**
Observation window	Number of breaches over the **previous 12 one-month periods**	**Most recent 250 trading days**
Data input alignment	**Not envisaged**	Allowance to **align RTPL[2] input data** for its risk factors **with data used in HPL[3]**
Test metrics	**1) MV** - Mean of unexplained P&L (daily RTPL minus daily HPL) over std. deviation of HPL **2) VV** - Variance of unexplained P&L over the variance of HPL	**1) Spearman correlation metric** **2) Kolmogorov-Smirnov (KS) test metric** (Distributional test[4])
Failure consequences	**Cliff effect** (binary pass or fail)  Test failed (desk ineligible) ⇨ SA Test passed ⇨ IMA	**Smoother transition to SA**  Test failed (desk out-of-scope) ⇨ SA Near-miss ⇨ IMA but capital surcharge Test passed ⇨ IMA
Backstop (unchanged)	**10% criterion to remain eligible** (bank-wide level)	**10% criterion to remain eligible** (bank-wide level)

1. Please see Annex 1 for further details
2. RTPL stands for Risk Theoretical P&L
3. HPL stands for Hypothetical P&L
4. Chi-Squared test metric has been dismissed (proposal to revamp the PLA test introduced in BCBS CD March 2018)

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Amendments to the Internal Model Approach
NMRF

The BCBS has finally addressed the industry complaints about the NMRF framework

Each non-modellable risk factor (NMRF) is to be capitalised using a stress scenario that is calibrated to be at least as prudent as the Expected Shortfall (ES) calibration used for modelled risks

	2016	FINAL RULE (2019)
RFET[1] – Frequency	**Monthly**	**Quarterly**
RFET – Eligibility criteria	At least **24 real price observation per year** (over the period to calibrate the current ES model) **with no more than 30-day gap**	Must meet **EITHER** (1) at least **24 real price observation per year** (over the period to calibrate the current ES model) **AND no 90-day period** with **fewer than 4 real price observations over the previous 12 months** (2) at least **100 "real" price observations** over the previous 12 months
RFET – Bucketing	**Not contemplated**	**Own/ regulatory bucketing approach for counting real price observations** (points on curves/ surfaces)
SES[4] – Stress Period	**Separated** for each NMRF	**Common** across all NMRFs in the **same risk class**
SES – LH[2] of the Stress Scenario	The **greater of the largest time interval between two consecutive price observations** over the prior year and the **LH assigned to the risk factor category** for the ES measurement	**LH specified for the ES measure with a floor of 20 days**
SES – Aggregation	**No diversification benefit** among NMRFs **other than** for those arising from **idiosyncratic credit risk**	**Additional but limited diversification benefits[3]**

1. RFET stands for Risk Factors Eligibility Test
2. LH stands for Liquidity Horizon
3. Please see Annex 2 for further details
4. SES stands for Stress Scenario capital requirement for NMRF

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Amendments to the Internal Model Approach

NMRF (cont.)

The BCBS has finally addressed the industry complaints about the NMRF framework

Each non-modellable risk factor (NMRF) is to be capitalised using a stress scenario that is calibrated to be at least as prudent as the Expected Shortfall (ES) calibration used for modelled risks

	2016	FINAL RULE (2019)
3rd party vendor criteria	**Not indicated**	(1) Vendor communicates number of real price observations and dates. (2) Vendor provides info. to map observations to risk factors (3) Vendor subject to an audit on its pricing info.
Mapping real price vs RF	**Not indicated**	Must have **Policies & Procedures in place** to describe the mapping.
Qualitative conditions for eligible RF to be considered modellable	• Risk factors derived from a combination of modellable risk factors are modellable. • For modellable risk factors not available during the stress window, proxy data can be used	Must demonstrate **data** used to calibrate ES model are **appropriate based on the following principles**: ***(1)*** *Combination of modellable RF produce modellable RF;* ***(2)*** *pick up idiosyncratic and general market risk;* ***(3)*** *reflect volatility and correlation of risk positions;* ***(4)*** *data used must be reflective of prices observed/quoted in the market;* ***(5)*** *data updated at a sufficient frequency;* ***(6)*** *data used to determined SES must be reflective of market prices observed/quoted in the period of stress;* ***(7)*** *proxies must have sufficient similarity to the transaction they represent and their use must be limited.*

1. RFET stands for Risk Factors Eligibility Test

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What´s new

Amendments to the IMA

Amendments to the SA

1. **FX risk: overall approach**
2. **Curvature Risk Capital requirements**
3. **Sensitivity Computations**
4. **Treatment of index instrument and multi-underlying options**
5. **Correlation scenarios**
6. **Revisions to Risk Weights**

Simplified alternative to SA

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Amendments to the Standardised Approach

FX risk: overall approach

The SA approach specifies over which currency the bank may calculate FX Risk and the scope of currency pairs that are considered liquid

The final rule **increases the number of liquid pairs** which benefit from lower capital requirements and allows banks to **compute the FX risk with respect to the currency in which they manage their trading business**

	2016	FINAL RULE (2019)
FX liquid pairs	It is not possible to combine two liquid currency pairs to create a new triangulated pair that would also be liquid. Thus, some liquid FX currency pairs may be subject to capital requirements that are not commensurate with their risk.	[21.88] Allow banks to combine two currency pairs in the current list of liquid pairs and treat the resulting new FX pair (first-order cross of the specified currency pairs) as liquid in order to benefit from lower associated capital requirements.
FX risk factors	All the exchange rates between the currency in which an instrument is denominated and the reporting currency.	[21.14 (1)] All the exchange rates between the currencies of the pair and the reporting currency, even if the reporting currency is not contained in the pair. Alternatively FX risk may be calculated relative to a base currency. FX risk factors are all the exchange rates against the base currency and between the reporting currency and the base currency (translation risk).

1. Example: For example, EUR/AUD is not among the selected currency pairs specified by the BCBS , but is a first-order cross of USD/EUR and USD/AUD.

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Amendments to the Standardised Approach

Curvature Risk Capital requirements

The curvature risk capital requirements[1] are computed by calculating the maximum loss of two scenarios of shocks, upward shock and downward shock.

The BCBS has **modified the calculation of curvature risk capital requirements for options**: consistent shocks to similar risk factors, cliff effects and potential double-counting.

	2016	FINAL RULE (2019)
Approach to apply shock scenarios	Upward and downward shocks are applied separately to each risk factor.	[21.5] Consistent scenarios are applied to risk factors that are in the same "bucket" for the credit spread risk, equity and commodity risk classes.
Cliff effects when computing capital requirements	The formulae used to calculate the aggregate curvature risk capital requirement can cause cliff effects when the curvature risk positions are negative	[21.5] To avoid an abrupt increase in capital requirements, a floor is applied to the part of the formula causing a cliff effect
Potential double-counting	SA requires banks to define FX exposures relative to their reporting currency, which can lead to a double-counting when a bank holds a FX options where neither of the underlying currencies is the bank´s reporting currency	[21.98] For options that do not reference a bank's reporting currency or base currency, net curvature risk charges may be divided by a scalar of 1.5.

1. 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.
2. Please see Annex 3 for further details

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Amendments to the Standardised Approach

Sensitivity Computations

The final rule allows different approaches in sensitivity computations to keep consistency with pricing models.

The final rule **allows to use both sticky delta and sticky strike approach**

Requirements on sensitivity computations

2016	Final Rule (2019)
When computing a first-order sensitivity for instruments subject to optionality, banks should assume that the implied volatility remains constant, consistent with a sticky delta approach.	[21.27] When computing a first-order sensitivity for instruments subject to optionality, banks should assume that the implied volatility either: (1) remains constant, consistent with a "sticky strike" approach; or (2) follows a "sticky delta" approach, such that implied volatility does not vary with respect to a given level of delta.

The assumptions that are used for the calculation of the delta, should also be used for calculating the shifted price of the instrument in curvature computations.

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Amendments to the Standardised Approach

Treatment of index instrument and multi-underlying options

The final rule provides a simple approach that does not require the identification of each underlying position in an index for equity and credit indices.

The final rule allows banks to opt for **not applying a look-through approach under given circumstances**

	2016	Final Rule (2019)
Look -through approach	For index instruments and multi-underlying options where all idx constituents/option underlyings have delta risk sensitivities of the same sign, a look-through approach must be used.	[21.31] In the delta and curvature risk context: for idx instruments and multi-underlying options, a look-through approach should be used. However, a bank may opt not to apply the look-through approach for instruments referencing any listed and widely recognised and accepted equity or credit idx, where: (1) it is possible to look-through the idx. (2) the idx contains at least 20 constituents; (3) No single constituent contained within the idx represents more than 25% of the total idx; (4) the largest 10% of constituents represents less than 60% of the total idx; and (5) the total market capitalisation of all the constituents of the idx is no less than USD 40 billion.

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Amendments to the Standardised Approach

Correlation scenarios

The BCBS has modified the "low correlations" scenario to avoid correlations that are more conservative than what the empirical data would support, resulting in an overly conservative outcome.

The final rule **limits the reduction in correlations in the case of "low correlations"**

	2016	FINAL RULE (2019)
Between risk factors within a bucket	$\rho_{kl}^{low} = 75\% \times \rho_{kl}$	[21.6] $\rho_{kl}^{low} = \max(2 \times \rho_{kl} - 100\%; 75\% \times \rho_{kl})$
Across buckets within a class	$\gamma_{bc}^{low} = 75\% \times \gamma_{bc}$	$\gamma_{bc}^{low} = \max(2 \times \gamma_{bc} - 100\%; 75\% \times \gamma_{bc})$

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Amendments to the Standardised Approach

Revisions to Risk Weights (1/3)

The BCBS has identified that reductions in RWs in the January 2016 SA were necessary to bring market risk capital requirements closer to that original intended level.

The BCBS has **reduced the risk weights for GIRR, FX and CSR and added new buckets** to incorporate index buckets for equity and credit spread risks

GIRR

		2016	Final Rule (2019)
		RW	**RW**[1]
Vertex (years)	**0.25**	2.40%	1.70%
	0.5	2.40%	1.70%
	1	2.25%	1.60%
	2	1.88%	1.30%
	3	1.73%	1.20%
	5	1.50%	1.10%
	10	1.50%	1.10%
	15	1.50%	1.10%
	20	1.50%	1.10%
	30	1.50%	1.10%
Inflation		2.25%	1.60%
X-ccy Basis		2.25%	1.60%

FX

	RW	**RW**[2]
	30.00%	15.00%

1. Specified currencies (EUR, USD, GBP, AUD, JPY, SEK, CAD and the domestic reporting currency) may be divided by $\sqrt{2}$
2. Specified currencies pairs (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) and ccy pairs forming first-order crosses across the specified ccy pairs may be divided by $\sqrt{2}$

Amendments to the Standardised Approach

Revisions to Risk Weights (1/3)

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CSR

		2016	Final Rule (2019)
		RW	RW
Bucket Number	1	0.5%	0.5%
	2	1.0%	1.0%
	3	5.0%	5.0%
	4	3.0%	3.0%
	5	3.0%	3.0%
	6	2.0%	2.0%
	7	1.5%	1.5%
	8	4.0%	2.5%[1]
	9	3.0%	2.0%
	10	4.0%	4.0%
	11	12.0%	12.0%
	12	7.0%	7.0%
	13	8.5%	8.5%
	14	5.5%	5.5%
	15	5.0%	5.0%
	16	12.0%	12.0%
	17[2]	-	1.5%
	18[3]	-	5.0%

1. For covered bonds that are rated AA- or higher, the applicable risk weight may at the discretion of the bank be 1.5%.
2. Bucket 17: IG indices
3. Bucket 18: HY indices

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Revisions to Risk Weights (1/3)

The BCBS has identified that reductions in RWs in the January 2016 SA were necessary to bring market risk capital requirements closer to that original intended level.

The BCBS has **reduced the risk weights for GIRR, FX and CSR and added new buckets** to incorporate index buckets for equity and credit spread risks

EQUITY

		2016		FINAL RULE (2019)	
		RW Equity spot price	RW Equity repo rate	RW Equity spot price	RW Equity repo rate
Bucket Number	1	55.0%	0.55%	55.0%	0.55%
	2	60.0%	0.60%	60.0%	0.60%
	3	45.0%	0.45%	45.0%	0.45%
	4	55.0%	0.55%	55.0%	0.55%
	5	30.0%	0.30%	30.0%	0.30%
	6	35.0%	0.35%	35.0%	0.35%
	7	40.0%	0.40%	40.0%	0.40%
	8	50.0%	0.50%	50.0%	0.50%
	9	70.0%	0.70%	70.0%	0.70%
	10	50.0%	0.50%	50.0%	0.50%
	11	70.0%	0.70%	70.0%	0.70%
	12[1]	-	-	15.0%	0.15%
	13[2]	-	-	25.0%	0.25%

1. Bucket 12: Large market cap, advanced economy equity indices (non-sector specific)
2. Bucket 13: Other equity indices (non-sector specific)

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Impact assessment

Foreseen entry into force

Annexes

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Simplified alternative to the Standardised Approach

Scaling up Basel 2.5 SA

The BCBS comes up with a reduction of the scalars for IR risk and FX risk

The **current Basel 2.5 SA will be retained as a simplified alternative to the revised SA**, subject to the application of **specified scalars** to ensure a sufficiently conservative calibration

Indicative eligibility criteria

(a) smaller or simpler trading books (supervisor can mandate that banks with relatively complex or sizable risks apply the full SA)
(b) non-G-SIB bank
(c) not using IMA for any of its trading desks
(d) not holding any correlation trading positions

Supervisory competences

- **subject to supervisory approval and oversight**
- **supervisor can mandate** that banks with relatively complex or sizable risks **apply the full SA**, even if those banks meet the indicative eligibility criteria

Capital Requirements

Capital requirements calculated under **Basel 2.5 SA multiplied by the following scalars**

$$Capital\ requirement = CR_{IRR} * SF_{IRR} + CR_{EQ} * SF_{EQ} + CR_{FX} * SF_{FX} + CR_{COMM} * SF_{COMM}$$

	Scaling Factors (SF)	
	CD (March 2018)	**Final Rule (2019)**
General and specific IR risk	1.50 - 2.00	1.30 ▼
General and specific EQ Risk	3.00 - 3.50	3.50
Commodity	1.50 - 2.50	1.90
FX	1.25 - 1.50	1.20 ▼

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Amendments to the IMA

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Impact assessment

Foreseen entry into force

Annexes

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Clarifications on the scope of application

Treatment of specific positions

The BCBS identified areas where the clarity of the requirements warranted improvement

The BCBS has included **clarifications** regarding the **treatment of structural FX positions** and **equity investments in funds**

	2016	FINAL RULE (2019)
Exclusion of structural FX positions[1]	**Limited to the maximum of:** ▪ the **amount of investments in affiliated** but not consolidated entities denominated in foreign ccys; and/or ▪ the **amount of investments in consolidated subsidiaries** denominated in foreign ccys.	**Limited to the amount of the risk position that neutralises the sensitivity of the capital ratio** to movement in exchange rates
Equity investments in funds – TB allocation criteria	Where the bank **can look through the fund daily <u>OR</u> obtain daily real prices** for its equity investment in the fund	**Meets at least one** of the following conditions: (a) the bank is able to **look through the fund to its individual components** and there is **sufficient and frequent info., verified by an independent third party**, provided to the bank regarding the fund's composition; **<u>OR</u>** (b) the bank **obtains daily price quotes for the fund** and it has **access to** the info. contained in the **fund's mandate** or in the national regulations governing such investment funds
Equity investments in funds – Capital treatment	Not expressly set out in the standards	**Specific treatments under the SA**

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

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Amendments to the IMA

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Clarifications on the scope of application

Impact assessment

Foreseen entry into force

Annexes

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Impact assessment
Slightly less bad

The figures disclosed by the BCBS look promising…

Share of market RWA as a percentage of total Basel III RWA

in percent

	Basel 2.5	2016 FRTB	2019 FRTB
MR-RWA Share	4.4%	7.2%	5.3% ▼

Source: Basel Committee on Banking Supervision

Estimated capital requirements under the amended SA relative to capital requirements under the amended IMA[1]

IMA banks, breakdown by risk class

	2016 FRTB*	2019 FRTB**
GIRR	3.7	1.5
CSR: non-securitisation	1.6	1.1
Equity risk	3.8	1.8
Commodity risk	3.3	1.6
FX risk	5.3	2.2

Source: * ISDA/GFMA/IIF Publish Industry FRTB QIS Analysis (July 2017) / **SBA relative to ES**
** Basel Committee on Banking Supervision (January 2019)

… but not for all

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

in percent

	IMA-banks	SA-only banks	All banks
Median increase	5%	40%	16%
WA increase	20%	30%	22%

Source: Basel Committee on Banking Supervision

Estimated capital impact of simplified SA relative to Basel 2.5 SA

SA-only banks, in per cent

	Total
Median increase	42.5%
WA increase	57.4%

Source: Basel Committee on Banking Supervision

1. Restricted to non-securitisation exposures

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Amendments to the SA

Simplified alternative to SA

Clarifications on the scope of application

Impact assessment

Foreseen entry into force

Annexes

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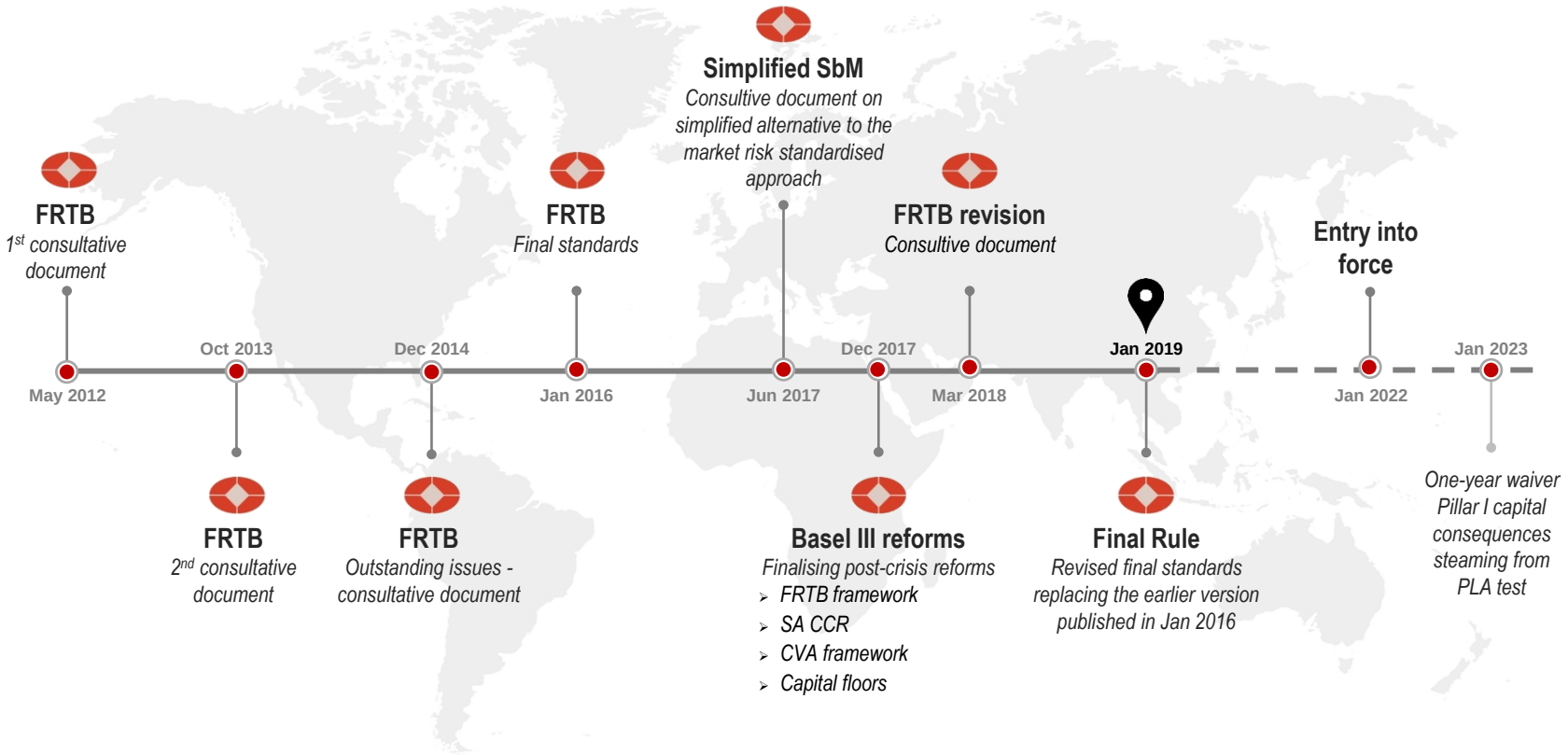
Foreseen entry into force

Still an uncertain path

The BCBS publishes the long-awaited FRTB Final Rule after nearly 7 years of consultations and re-calibrations, but its implementation by the major jurisdictions worldwide(*) is still uncertain



** The EU Commission is running out of time to present a new legislative proposal before the upcoming EU Parliament elections (May 2019), so the odds are fairly high that the FRTB will be implemented initially as a reporting requirement only*

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Amendments to the IMA

Amendments to the SA

Simplified alternative to SA

Clarifications on the scope of application

Impact assessment

Foreseen entry into force

Annexes

1. **Revised PLA test metrics and failure consequence**
2. **Non-Modellable Risk Factors – Capitalisation**
3. **Curvature Risk Capital requirements**

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Annex 1: Amendments to the Internal Model Approach

Revised PLA test metrics and failure consequence

How to run the revamped PLA test?

1 Test metrics computation

PLA test compares **daily RTPL with the daily HPL for each trading desk**. Two test metrics:

(1) Spearman correlation metric

$$r_S = \frac{cov(R_{HPL}, R_{RTPL})}{\sigma_{R_{HPL}} \cdot \sigma_{R_{RTPL}}}$$

where R_{HPL} and R_{RTPL} are the corresponding time series of ranks based on the size of the P&L

(2) KS test metric

largest absolute difference observed **between the empirical cumulative distribution functions of RTPL and HPL** at any P&L value

2 Zone allocation

Traffic light approach based on the comparison against **regulator-set thresholds**

Zone	Spearman		KS
🟢	> 0.80	AND	< 0.09
🟡	[0.70-0.80]	OR	[0.09-0.12]
🔴	< 0.70	OR	> 0.12

3 Test failure consequences

🟢 Trading desks that **PASS the PLA test** are **eligible to be capitalised using IMA**

🟡 **Near-miss trading desks** face a **capital surcharge that is** calculated as the **difference** between the **aggregate standardised capital charges** ($SA_{G,A}$) and the **aggregated internal models-based capital charges** ($IMA_{G,A} = C_A + DRC$)

$$k \cdot \max\{0; SA_{G,A} - IMA_{G,A}\}$$

$$\text{where } k = 0.5 \cdot \frac{\sum_{i \epsilon A} SA_i}{\sum_{i \epsilon G,A} SA_i}$$

🔴 Trading desks that **FAIL the PLA test** become **ineligible to use IMA,** and thereby be subject to **capital requirements based on SA**

4 Return to green zone

The trading desk **cannot return to the PLA test green zone** (either remaining out-of-scope to use the IMA or subject to the capital surcharge) **UNTIL**:

1) produces **outcomes in the PLA test green zone, AND**
2) has **satisfied its back-testing exception requirements** over the prior 12 months (i.e., <12 exceptions at 99th AND <30 exceptions at 97.5th)

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Annex 2: Amendments to the Internal Model Approach

Non-Modellable Risk Factors – Capitalisation

The higher-than-expected capital impact of the NMRF framework has led the BCBS to allow the recognition of the correlation or diversification effects among the NMRFs arising from the idiosyncratic equity risks and non-idiosyncratic risks

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

$$\sqrt{\sum_{j=1}^{J} ISES_{NM,j}^2} + \sqrt{\left(\rho \cdot \sum_{k=1}^{K} SES_{NM,k}\right)^2 + (1-\rho^2) \cdot \sum_{k=1}^{K} ISES_{NM,k}^2}$$

idiosyncratic equity risks

(aggregated with zero correlation)

non-idiosyncratic risks

weighted by Rho (ρ) =0.6

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Annex 3: Amendments to the Standardised Approach

Curvature Risk Capital requirements

The BCBS has modified the calculation of curvature risk capital requirements for options: consistent shocks to similar risk factors, cliff effects and potential double-counting

1. Approach to apply shock scenarios (1/2)

2016

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

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

- 53.(d) The curvature risk exposure must be aggregated within each bucket using the corresponding prescribed correlation ρkl as set out in the following formula:

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

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

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Annex 3: Amendments to the Standardised Approach

Curvature Risk Capital requirements

The BCBS has modified the calculation of curvature risk capital requirements for options: consistent shocks to similar risk factors, cliff effects and potential double-counting

1. Approach to apply shock scenarios (2/2)

Final Rule (2019)

- [21.5.(2)] The net curvature risk capital requirement is calculated by the formula below:

$$CVR_k^+ = -\left(\sum_i V_i\left(x_k^{RW\,(Curvature)^+}\right) - V_i(x_k) - RW_k^{Curvature} \cdot s_{ik}\right)$$
$$CVR_k^- = -\left(\sum_i V_i\left(x_k^{RW\,(Curvature)^-}\right) - V_i(x_k) - RW_k^{Curvature} \cdot s_{ik}\right)$$

- [21.5.(3)] The curvature risk exposure must be aggregated within each bucket using the corresponding prescribed correlation ρkl as set out in the following formula for CSR, equity and commodity risk classes:

$$K_b = max(K_b^+, K_b^-), \text{ where}$$

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

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

Where $K_b = K_b^+$, this shall be termed the "upward scenario" and $K_b = K_b^-$ "downward scenario". In the specific case where $K_b^+ = K_b^- = 0$, if $\sum_k CVR_k^+ > \sum_k CVR_k^-$, the upward scenario is selected; otherwise, the downward scenario is selected.

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Annex 3: Amendments to the Standardised Approach

Curvature Risk Capital requirements

The BCBS has modified the calculation of curvature risk capital requirements for options: consistent shocks to similar risk factors, cliff effects and potential double-counting

2. Cliff effects when computing capital requirements

2016

The BCBS has observed that the formulae used to calculate the aggregate curvature risk capital requirement can cause cliff effects when curvature risk positions are negative, i.e. when applying the alternative specification:

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

If these values for S_b and S_c produce a negative number for the overall sum of $\sum_b K_b^2 + \sum_b \sum_{c \neq b} \gamma_{bc} S_b S_c \psi(S_b, S_c))$; the bank is to calculate the curvature risk charge using and alternative specification whereby $S_b = \max[\min(\sum_k CVR_k, K_b), -K_b]$ for all risk factors in bucket b and $S_c = \max[\min(\sum_k CVR_k, K_c), -K_c]$ for all risk factors in bucket c.

Final Rule (2019)

To avoid an abrupt increase in capital requirements, the BCBS proposes to apply a floor to the part of the formula causing a cliff effect:

[21.5.(4)] $$\boldsymbol{Curvature\ risk} = \sqrt{\boldsymbol{max}(0, \sum_b \boldsymbol{K_b^2} + \sum_b \sum_{b \neq c} \boldsymbol{\gamma_{bc} S_b S_c \psi(S_b S_c)})}$$

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3. Potential double-counting

Final Rule (2019)

[21.98] For calculating the net curvature risk capital requirement CVR_k for risk factor k for FX and equity risk classes, the curvature risk weight, which is the size of a shock to the given risk factor, is a relative shift equal to the respective delta risk weight. For FX curvature, for options that do not reference a bank's reporting currency (or base currency as set out in [MAR21.14](b)) as an underlying, net curvature risk charges (CVR_k^+ and CVR_k^-) may be divided by a scalar of 1.5. Alternatively, and subject to supervisory approval, a bank may apply the scalar of 1.5 consistently to all FX instruments provided curvature sensitivities are calculated for all currencies, including sensitivities determined by shocking the reporting currency (or base currency where used) relative to all other currencies.

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