Just in Time

EU Implementation of FRTB

Regulatory Technical Standard on the Internal Model Approach

Davide Aina
Marco Gavioli
Nicola Giovanni Giancaspro

June 2020

iason
ESSENTIAL SERVICES FOR FINANCIAL INSTITUTIONS

At a Glance

01

Overview

Overview 1/3
Introduction

The purpose of this document is to identify the key points of the final draft Regulatory Technical Standards (RTS) on the new Internal Model Approach (IMA) under the Fundamental Review of the Trading Book (FRTB) released from EBA on 27 March 2020.
These technical standards conclude the first phase of the EBA roadmap finalized to ensuring the smooth implementation of the new approaches towards the implementation of the market and counterparty credit risk frameworks in the EU.

These final draft technical standards cover 11 mandates and have been grouped in three different areas:

- **Liquidity horizons for the IMA**;
- **Back-testing and profit and loss attribution (PLA) requirements**;
- **Modellability of risk factors under the IMA**.

The adoption of those RTS is expected, under the current Capital Requirements Regulation (CRR2), to trigger the three-year period after which institutions with the permission to use the FRTB internal models are required, for reporting purposes only, to calculate their own funds requirements for market risk with those internal models.

Overview 2/3

FRTB

The FRTB introduce 4 main features in the market risk framework

Pillar I Capital Charges can be computed following two main approaches

1. a **clearly defined boundary** between the **trading book** and the **banking book** to avoid regulatory arbitrage
2. a **Standardised Approach** (**FRTB-SA**) that is *risk-sensitive* and is designed and calibrated to serve as a credible *fallback* to the internal models approach
3. an **Internal Models Approach** (**FRTB-IMA**) that relies upon the use of *expected shortfall* models and sets out separate capital requirements for risk factors that are deemed *non-modellable*
4. a **simplified Standardised Approach** for use by banks that have small or non-complex trading portfolios

Overview 3/3

FRTB-IMA: Eligibility

Just in Time

Trading Desk Eligibility (IMA vs SA)

- Profit&Loss Attribution Test (**PLA Test**) + Back-testing to get the eligibility
- In case of **no-eligibility** → the model has to fall back to the **FRTB-SA for at least 1 year**, i.e. the **bank has to calculate higher capital charge** for that trading desk

Risk Factor Eligibility (ES vs NMRF)

- Within a trading desk proved to be **IMA-eligible**, the computation of the risk charges depends on the **data availability** that determines the ***"modellability"*** **of each risk factor** via the *Risk Factor Eligibility Test* or **RFET**
  - *If RFET is passed → modellable risk charge* implies modified **Expected Shortfall** (**ES**)
  - *If RFET is not passed → non-modellable risk charge* is capitalised with stress scenarios (**NMRF**) that are more conservative than ES model

NMRF implies higher capital charge for the bank

02

Risk Factor's Modellability Under IMA

New Risk Factor Eligibility Test (RFET) 1/5

Just in Time

Draft of Regulatory Technical Standards (RTS) on criteria for assessing the modellability of risk factors under the internal model approach (IMA) under Article 325be(3) of Regulation (EU) N° 575/2013 (revised Capital Requirements Regulation - CRR2) implement in EU legislation the internationally agreed Fundamental Review of the Trading Book (FRTB). A new element in this framework is the **risk factor modellability assessment**, referred to as the **risk factor eligibility test (RFET)** in the Basel standards. The modellability assessment is intended to ensure that the risk factors that institutions include in their expected shortfall (ES) model are sufficiently liquid and observable for a correct determination of regulatory capital.

For the purpose of this assessment, the EBA specifies in **Regulatory Technical Standards** (RTS) that both of the following **requirements** must be satisfied:

Price has to be **verifiable**: while a sufficient quantity of market data should be available for a risk factor to be included in the ES model, it is also of great importance that the gathered market data are of sufficient quality. In order to comply with those goals, the EBA proposes to allow only verifiable prices in the assessment.

A verifiable price means any one of the following:

a) the price of an actual transaction to which the institution was one of the parties;
b) the price of an actual transaction between other parties;
c) the price obtained from quotes made by the institution itself or another party.

1

Verifiable prices must be considered **representative** for risk factors. In some cases, the mapping of transactions to risk factors is a one-to-one relationship. In other cases, the price of a transaction or quote is a function of that risk factor and potentially other risk factors.

A verifiable price is representative only if there is a close relationship between the risk factor and the verifiable price and if the institution is capable of extracting the value of the risk factor from the value of the verifiable price.

2

New Risk Factor Eligibility Test (RFET) 2/5

RF in Scope and Frequency

Under the international standards, risk factors are defined as variables that are drivers of the change in value of an instrument. Risk factors are used for the quantification of market risk in the risk-measurement model.

Article 325be(1) - Regulation (EU) No 575/2013

Institutions shall assess the modellability of all the risk factors of the positions assigned to the trading desks for which they have been granted permission as referred to in Article 325az(2) or are in the process of being granted such permission.

In line with international regulatory standards, RTS specifies that the modellability assessment should be applied by institutions on a quarterly basis. In addition, in order to ensure consistency with the other parts of the FRTB framework included in CRR2, it has been specified that the 12-month period should always terminate at the previous reporting date. A generic example of modellability assessment time period is reported in the following figure:

- ***Institutions should provide a documentation with a clear overview of the scope of the modellability assessment.***
- ***Institutions must also have policies and procedures that clearly describe and define their mapping of verifiable prices to risk factors.***

New Risk Factor Eligibility Test (RFET) 3/5

Methodology

The methodology of the modellability assessment is in line with the work that the Basel Committee has conducted in the past years on the requirements for the identification of risk factors that are eligible for inclusion in the ES model. New RTS maintain the same criteria of the current RTS released on June 2019.

Risk Factors Assessment criteria

On quarterly basis :

- the institution has identified at least **24 verifiable prices** that are representative for the risk factor over the preceding 12-month period;
- there must be **no 90-day period with less than four verifiable prices** that are representative for the risk factor over the preceding 12-month period.

Alternatively

- at least **100 verifiable prices** that are representative for the risk factor over the preceding 12- month period.

- ***No more than one verifiable price per day shall be taken into account for the modellability assessment per RF*** → to avoid double counting

- ***Institutions should use a consistent timestamp (taking into account differing time zones) for trades and committed quotes across all data sources*** → Timestamp should correspond to day of execution for trades and the day on which the quote was committed.

New Risk Factor Eligibility Test (RFET) 4/5

RF Type 1/2

About how continuous risk factor objects have to be treated an institution should consider that different choices of bucketing approaches will have a big impact on modellability results and consequently on capital. FRTB text does not explain what appropriate bucketing of "representative transactions" means, but it only defines the boundaries within which an institution must operate.

Modellability assessment for curves, surfaces or cubes

The modellability of a bucket is based on the same criteria. Where a risk factor is a grid point of a curve or a surface, in order to count verifiable prices for the modellability assessment, institutions should use the so-called 'bucketing approach'. In this case, institutions should count all verifiable prices allocated to a bucket to assess whether the bucket 'passes' the modellability assessment for any risk factors that belong to the bucket. To this end, institutions should apply a 'regulatory bucketing approach'. Under this approach, institutions use, at a minimum, a set of standard buckets pre-defined by RTS in line with international regulatory standards:

Bucket i	For interest rate, foreign exchange and commodity risk factors with one maturity dimension (t – expressed in years) (excluding implied volatilities)	**Alternatively** Institutions may be allowed to use their 'own bucketing approach', under which they define the buckets around their own risk factors. This approach should be allowed only where each of those buckets includes exactly one risk factor and the buckets are a partition of the curve, surface or cube.
Bucket ii	For interest rate, foreign exchange and commodity risk factors with several maturity dimensions (t – expressed in years) (excluding implied volatilities)	
Bucket iii	For credit spread and equity risk factors with one or several maturity dimensions (t – expressed in years) (excluding implied volatilities)	
Bucket iv	For any risk factors with one or several strike/moneyness dimensions (delta – δ)	

New Risk Factor Eligibility Test (RFET) 5/5

Just in Time

RF Type 2/2

Modellability assessment for parametrical curves, surfaces or cubes

Where an institution uses a mathematical function to represent a curve, surface or cube and defines the function parameters as the risk factors in its risk-measurement model, the assessment of modellability should still be performed based on the buckets underlying the curve, surface or cube. In order to select the appropriate buckets, institutions should be first required to identify the points on the curve, surface or cube that are used to calibrate the mathematical function. The same standard bucket table used for non parametrical curves, surface and cubes is use for parametrical ones:

Bucket i	• Principal components derived by principal components analysis from time series for the different grid points of an interest rate curve. • The parameters of an interest rate curve fitted to a point cloud of rate versus maturity observations through some optimisation algorithm (e.g. Nelson–Siegel approach).
Bucket iv	SABR parameters derived from prices of options covering different strikes
Bucket ii – iii - iv	SABR parameters derived from prices of swaptions covering different maturities, tenors and strikes.

A function parameter should be assessed as modellable only if all the data points of the curve, surface or cube used for calibrating it are included in modellable buckets. In any other case the function parameter is considered non-modellable.

➢ ***Institutions are free to define the risk factors to be included in their internal model approach, as long as those risk factors lead to compliance with profit and loss attribution requirements and back-testing requirements, as referred to in Article 325bg of the CRR2.***

In case some of these risk factors don't pass the assessment of modellability, institutions are free to redefine risk factors by decomposing the NMRFs into a modellable risk factor and a non-modellable spread, provided that the new risk factors (i.e. the modellable part and the non-modellable spread) are used in the context of the profit and loss attribution test.

03

Back-testing Requirements and P&L Attribution Requirements

Back-testing & PLA test 1/3

Overview

- In January 2019, BCBS (d457) finalised and published standards on minimum capital requirements for market risk, replacing previous standards implemented in EU thanks to Regulation (EU) no 575/2013 (**CRR**)
- Revised requirements have been implemented in EU via amendments to the CRR (**CRR2**)
- EU Commission should submit a legislative proposal by 30 June 2020 for **fully implementing the FRTB framework** in the Union
- A key requirements for an institution to obtain approval to use internal model approach (**IMA**) to calculate own funds requirements for market risk, is that the IMA produces reliable capital requirements relative to the profit and loss (**P&L**) of the institution
- One way of assessing whether or not a model produces reliable capital requirements is the **regulatory back-testing programme**
- Another way of assessing whether or not a model produces reliable capital requirements is the P&L attribution test (**PLA test**)

REGULATORY BACKTESTING PROGRAMME

It compares the model generated risk metric at a given confindence level with the subsequent business day's realised trading actual and hypothetical P&Ls

→ APL vs HPL

1

PLA TEST

It ensures that theoretical changes in a trading desk portfolio's value, based on the institution's risk measurement model and risk factors in the risk measurements model, are sufficiently close to the hypothetical changes in the end-of-day valuation process and including all the risk factors included in such pricing methods

→ RTPL vs HPL

2

Meeting the PLA requirement is not yet a full condition for computing own funds requirements for market risk with the IMA for positions within a trading desk. It will be such when FRTB framework will be fully implemented in EU.

Back-testing & PLA test 2/3

Definition of APL and HPL

The basic principles for the definition of actual and hypothetical P&Ls for regulatory back-testing purposes are set out in CRR2.

Back-testing should be performed for two different purposes, at two different levels:

1. *Each trading desk in the scope of the IMA approval must, on an ongoing basis, meet back-testing requirements for being eligible to be capitalised under the IMA (**trading desk level**). The test is performed separately for each desk;*

2. *All desks capitalised under the IMA are subject to a regulatory back-testing on a portfolio of all positions attributed to these trading desks. Back-testing in this case is performed at a **top-of-the-house (ToH) level**, with the objective of defining an addend (on the multiplication factor) aimed at also ensuring adequate capital requirements for institutions with low performing risk models.*

To ensure that the technical implementation does not undermine the usefulness of back-testing and PLA test and to ensure consistent implementation across EU institutions, specific definitions of HPL, APL and RTPL for the purpose of back-testing and PLA test are provided in the RTS. In line with international regulatory standards, the EBA sets out the same definition for HPL in the two contexts. Accordingly, the criteria for inclusion/exclusion if technical elements in/from the HPL apply in the context of both back-testing and the PLA test.

In particular, actual and hypothetical changes in the relevant portfolio's value should be computed with techniques used in the end-of-day valuation process. Fee and commissions should be excluded and actual changes should reflect any changes in the portfolio's value, following the independent price verification (IPV) process. The institution should also capture the passage of time (i.e. the theta effect) in APL and HPL. With RTPL, we refer to the P&L (ignoring intra-day trading) calculated using the risk factors and valuation engines in the risk management model.

Back-testing & PLA test 3/3

Treatment of the Adjustments in APL & HPL

For our purposes, "adjustments" is a generic term that includes, for example, fair value adjustments, xVAs, reserves and model risk valuation adjustments

Treatment of the adjustments in APL & HPL	• No CVA and adjustments deducted from CET1 • **HPL**: adjustments sensitive to market risk factors and updated daily, included in the risk measurement model. **APL**: adjustments sensitive to market risk factors, regardless of the calculation frequency • **No smoothing** between two reference dates
Treatment of the adjustments in APL & HPL (trading desk level)	• Adjustments are computed, at the trading desk level, on a **stand-alone basis:** no diversification effect between trading desks • However, institutions can exclude, at this level, adjustments on set of positions assigned to multiple trading desks due to the nature of the adjustments
Treatment of the adjustments in APL & HPL (ToH level)	• **ToH back-testing:** only adjustments on positions assigned to desks under IMA, meeting back-testing requirements (no diversification effect with desks under SA) • Exceptions for adjustments calculated, on a permanent basis, on **all** positions subject to market risk own funds requirements

Institutions are required to fulfil several documentation requirements and to maintain a comprehensive list of adjustments computed for fair valuing the relevant portfolio.

Test Metrics for the P&L Attribution 1/2

P&L Attribution Test Metrics and Allocation

Test metrics to be applied to ensure that theoretical changes are sufficiently close to hypothetical changes. These metrics are not particularly sensitive to outliers and are based on the most recent 250 observations of the RTPL and HPL of the trading desk. Additional differences may arise as the result of misalignments in input data used for determining the values of HPL and RTPL. To avoid issues resulting from such differences, institutions are allowed to align the data used in the RTPL with those used in the HPL as long as specific conditions are met.

Spearman Correlation Metric

- It assesses the correlation between the RTPL and the HPL
- A well modelled trading desk would be expected to exhibit a high dependence between its HPL and its RTPL

Kolmogorov-Smirnov (KS) Test Metric

- It assesses the similarity of the distribution of the RTPL and the HPL
- Well modelled trading desks would be expected to feature smaller differences between the distributions

Based on the outcome of the metrics, a trading desk can be allocated to a “red zone”, “green zone”, “orange zone” or “yellow zone”

In accordance to Basel standards, orange and red desks should be capitalised under the standardised approach (SA), while yellow desks should be subject to a capital surcharge. However, this will be the case in EU only after the full implementation of FRTB

Test Metrics for the P&L Attribution 2/2

Consequences Following a Poor Performance in the P&L Attribution Test

In accordance with Basel standards:
▪ If a trading desk is in the PLA "**red zone**" or "**orange zone**", then it is considered to **not meet** the PLA requirements and should be capitalised under SA
▪ Institutions with **yellow desks** (having hence a relatively poor performance in the PLA test) are required to compute a **capital surcharge**
▪ If a trading desk is in the "**green zone**" than the institution is **not subject to any consequence** with respect to the positions held in the desk

Right now, EU institutions are required to calculate a capital surcharge for positions in yellow, orange and red zone, meeting all conditions in Article 325az(2)

With full implementation of FRTB framework, the PLA requirement will be a necessary condition for using IMA. Only yellow desks will be subject to capital surcharge. It is worth remarking that, for trading desks, meeting PLA requirements will be a full necessary condition for computing capital requirements only under the IMA: desks should always be compliant with back-testing requirements at the trading desk level. Institutions must also flag the trading desks not meeting the PLA requirements in accordance with Basel standards and perform the PLA test on a quarterly basis for all trading desks.

04

Liquidity Horizons for the IMA

Regulatory Context

In December 2018, the BCBS published the *Standards on minimum capital requirements for market risk* which replaces the previous ones, which are implemented in the EU through **Regulation (EU) No. 575/2013 (CRR)**. One of the improvements to the new market risk standards is the **incorporation of the market illiquidity risk**. In particular, the requirements for reporting different liquidity horizons have been introduced both in the standardized approach (SA) and in the internal model approach (IMA) with the aim of mitigating the risk of a sudden and serious loss in the asset markets.

Article 325bd CRR2

Institutions must map each risk factor of positions, attributed to trading desks for which they have been granted the permission to use the IMA or are in the process of getting that permission, to one of the broad risk factor categories and one of the broad risk factor subcategories listed in Table 2 of the same article.

Mapping risk factors to risk factor categories and subcategories is a key step in the assignment of a liquidity horizon to each risk factor for the ***purpose of scaling the calculated capital requirements based on the risk of illiquidity of the given risk factor of a position***.

Article 325bd of CRR 2 mandates the EBA to develop RTS:

1. **how institutions must map risk factors to risk factors categories and subcategories**;
2. **the currencies that constitute the most liquid currencies for interest rate risk;**
3. **the currency pairs that constitute the most liquid pairs for FX risk;**
4. **the definition of small and large capitalization for equities.**

Mapping of Risk Factors

General and *ad hoc* Mapping Methodology

1. Institutions shall map risk factors in accordance to:
    a) the most **appropriate broad risk factor category**;
    b) the most **appropriate broad risk factor subcategory** under the broad risk factor category identified in accordance with point (a).
2. If the risk factor does not correspond to any broad risk factor category, they shall map that risk factor to the broad risk factor category **'commodity'** and to the broad risk factor subcategory **'other types'** under the '**commodity'** broad risk factor category with a liquidity horizon of 120 days.
3. In order to clarify the uncertainty around the categorization of some risk factors, the RTS specifies that:
    a) The liquidity horizon for **equity large capitalization repo** and **dividend risk factors** is **20 days**. All o**ther equity repo** and **dividend risk factors** are subject to a liquidity horizon of **60 days**;
    b) For **mono-currency** and **cross-currency basis risk**, liquidity horizons of **10 days** and **20 days** for **interest rate most liquid currencies** and **other currencies**, respectively, are applied;
    c) The liquidity horizon for **inflation risk factors** should be consistent with the liquidity horizons for **interest rate risk factors for a given currency**.

Moreover institutions may determine the liquidity horizon of a risk factor **modelling an index** by first performing a **weighted average of the liquidity horizons of the index's components** and then choosing the liquidity horizon (out of 10, 20, 40, 60 or 120 days) that is greater or equal to the computed weighted average. Alternatively, institutions can use the general mapping methodology to map the risk factor modelling the index to the relevant category.

Definitions

Relevant Definitions in Risk Factor Mapping Process

MOST LIQUID CURRENCY FOR INTEREST RATE RISK

- the most liquid currencies correspond to those **underlying net OTC interest rate derivative contracts** with a **sufficient average daily turnover** (of more than **USD 30 billion**).
- The statistics, considered for the assessment of the average daily turnover, are those contained in the BIS report of statistics on OTC interest rate derivatives.

MOST LIQUID CURRENCY PAIRS FOR FX RISK

- The most liquid currency pairs are those **underlying net OTC FX derivative contracts** with a **sufficient average daily turnover** (of more than **USD 45 billion**).
- The most liquid currency pairs attracting a **10-day liquidity horizon** would be made of:

  a) the currency pairs in the list provided in the RTS;

  b) the currency pairs that are composed of the euro and a currency other than the euro of an EU Member State participating in the second stage of the economic and monetary union.

LARGE CAPITALISATION FOR EQUITY RISK

- A market capitalization equal to or greater than **EUR 1.75 billion** is considered large market capitalization.
- Equities in indices listed in the **ESMA ITS**, the components of which are all quoted in the EU, are considered large market capitalization.

Company Profile

Iason is an international firm that consults Financial Institutions on Risk Management. Iason integrates deep industry knowledge with specialised expertise in Market, Liquidity, Funding, Credit and Counterparty Risk, in Organisational Set-Up and in Strategic Planning

Davide Aina
Business Analyst

Marco Gavioli
Business Analyst

Nicola Giovanni Giancaspro
Business Analyst

www.iasonltd.com