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EBA FINAL draft Regulatory Technical Standards

on criteria for assessing the modellability of risk factors under the Internal Model Approach (IMA) under Article 325be(3) of Regulation (EU) No 575/2013 (revised Capital Requirements Regulation – CRR2)

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1. Executive summary

The amendments to Regulation (EU) No 575/2013¹ (the 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.

The EBA proposed methodology hinges on two different criteria to assess the modellability of a risk factor:

1. identification at a minimum of 24 verifiable prices that are representative for the risk factor over the preceding 12 months, without any period of 90 days or longer with less than four verifiable prices that are representative for the risk factor;
2. identification at a minimum of 100 verifiable prices that are representative for the risk factor over the preceding 12 months.

For the purpose of this assessment, the EBA specifies in detail in the present draft regulatory technical standards (RTS) both the requirements that a price should satisfy to be verifiable and the requirements under which verifiable prices can be considered representative for risk factors. In addition, the draft RTS specify how the modellability of risk factors belonging to curves, surfaces or cubes should be assessed, as well as the bucketing approaches that are available in this context.

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.

These draft RTS have been finalised considering the comments received in response to the Consultation Paper (CP).

¹ Regulation (EU) 2019/876 of the European Parliament and of the Council of 20 May 2019 amending Regulation (EU) No 575/2013 as regards the leverage ratio, the net stable funding ratio, requirements for own funds and eligible liabilities, counterparty credit risk, market risk, exposures to central counterparties, exposures to collective investment undertakings, large exposures, reporting and disclosure requirements, and Regulation (EU) No 648/2012.

2. Background and rationale

In accordance with the amendments to Regulation (EU) No 575/2013, the EBA is mandated in Article 325be(3) to specify the criteria for assessing the modellability of risk factors and to specify the frequency of that assessment in RTS.

The assessment of modellability aims to provide assurance that the risk factors that an institution includes in its ES model are sufficiently liquid and observable to be amenable to modelling. If a risk factor fails the assessment of modellability, it is classified as a non-modellable risk factor (NMRF), excluded from the institution's ES model and included instead in the stress scenario risk measure SS_t .

2.1 Scope of the modellability assessment

Article 325be(1) of Regulation (EU) No 575/2013 states that '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'.

Under the international standards,² 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.

For illustration purposes, the following table lists some risk factors potentially in scope of the assessment of modellability using different modelling approaches that could be applied in risk models.

Table 1: Illustrative list of risk factors potentially in scope of the modellability assessment

Modelling approach in risk-measurement model	Risk factors
Interest rate (IR) curve with granularity reduction in the risk-measurement model compared with the front office	IR curve with reduced granularity, as used in the risk-measurement model
Parametric representation of an IR curve	Nelson–Siegel parameters/principal components approach

² Minimum capital requirements for market risk, January 2019 (rev. February 2019), paragraph MAR10.9.

	(Note that the assessment of modellability should be performed based on the buckets underlying the curve, as explained further below)
Equity multifactor model	Systematic and idiosyncratic factors
Stochastic alpha beta rho (SABR) model for volatility surfaces: α, β, ν, ρ (assume β is kept constant)	SABR parameters: α, ν, ρ (Note that the assessment of modellability should be performed based on the buckets underlying the surface, as explained further below)

Considering that an institution's internal risk-measurement model should be well documented, the RTS require institutions to document all risk factors in their internal risk-measurement model and their definitions. This documentation should provide a clear overview of the scope of the modellability assessment.

2.2 General methodology for the assessment of modellability

For a risk factor to be included in the ES model, a necessary condition is that it is classified as modellable following the modellability assessment specified in these draft RTS. The concept of modellability is intentionally linked, in the present context, to the concepts of liquidity and observability of market data: a risk factor can be deemed modellable if a sufficient amount of observable market data, relative to that risk factor, are available.

In line with international standards, the draft RTS specify that for a risk factor to be classified as modellable the following two criteria must be met on a quarterly basis:

1. the institution has identified at least 24 verifiable prices that are representative for the risk factor over the preceding 12-month period;
2. 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, a risk factor is classified as modellable if the institution has identified, on a quarterly basis, at least 100 verifiable prices that are representative for the risk factor over the preceding 12-month period.

To avoid double-counting of price observations, no more than one verifiable price per day shall be taken into account for the modellability assessment per risk factor. To facilitate this, institutions



should use a consistent timestamp for trades and committed quotes across all data sources (own trade data, data provided by third-party vendors, etc.), also taking into account differing time zones. This timestamp should correspond to the day of execution for trades and the day on which the quote was committed.

Suppose an instrument has been traded by an EU-based institution (via its subsidiary) in Japan. The timestamps would be as follows:

EU (CET) +0:00	Japan +8:00
15/02/2019 23:00	16/02/2019 07:00

The transaction could thus potentially be counted for the purpose of the modellability assessment as occurring on either 15 February 2019 or 16 February 2019. Given that the objective is to avoid any double-counting of observations, it is specified in the draft RTS that the observation date must be recorded based on a consistent single time zone across all data sources.

When an institution uses data for verifiable prices for a risk factor and these data are provided with a time lag (e.g. data on verifiable price observations for a particular day are made available only some weeks later), the period used for the modellability assessment for this risk factor may differ from the prescribed preceding 12-month period by at most 1 month. In this case the institution shall document which time period is used for the modellability assessment for which risk factors and follow the documented approach consistently.

2.3 Definition of a verifiable price

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, i.e. the prices used in the assessment should be proven to be correct and trustworthy. In order to comply with those goals, the EBA proposes to allow only verifiable prices in the assessment. To enforce the requirement, a definition of verifiable price is provided. 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.

For the purpose of point c), and in line with international standards³, a quote must represent the intention to conclude a transaction under the proposed conditions, i.e. the provider of the quote must buy or sell the corresponding financial instrument at that price if requested.

³ Paragraph MAR31.12 of the Basel Committee on Banking Supervision (BCBS) document 'Minimum capital requirements for market risk' states that 'A price will be considered real if it meets at least one of the following criteria: [...] (3) It is a price obtained from a committed quote made by (i) the bank itself or (ii) another party.' In addition, in



On the one hand, it could be considered that the provider of a quote must be willing to both buy and sell. On the other hand, it could be considered sufficient that the provider is willing to only buy or sell. Based on the feedback received on the Consultation Paper (CP), the EBA decided to maintain the requirement to observe, on a given date, both a bid and an offer price. However, the EBA acknowledged the need for some degree of flexibility, raised by the respondents to the CP, and, consequently, modified the provision in order to allow bid and offer quotes that do not emanate from the same party to be considered.

Furthermore, as a safeguard to ensure that only sound prices are taken into account in the modellability assessment, the RTS clarify that:

- a) internal trades between entities of the same group cannot be considered transactions delivering verifiable prices;
- b) only transactions and eligible quotes with a non-negligible volume should be allowed to deliver verifiable prices;
- c) for a quote to be considered a verifiable price, it should have a reasonably small bid–offer spread;
- d) trades should not be conducted – nor quotes provided – with the sole purpose of generating verifiable prices.

Given that institutions could not have, in particular for certain markets, sufficient in-house market data for assessing the modellability of every risk factor used in their internal risk-measurement model, the EBA considers that information on verifiable prices of transactions or quotes provided by a third-party vendor could be used in the context of the modellability assessment. In the present context, the notion of third-party vendor is intended as a third person providing services based on data-pooling schemes that can improve the availability of verifiable prices for the modellability assessment. That notion should also encompass trading platforms and exchanges.

However, in order to be allowed to consider information on verifiable prices from third-party vendors, institutions should ensure that:

- a) the transaction or quote has been processed through the vendor;
- b) the vendor or the institution has agreed to provide evidence of the transaction or quote and evidence of the verifiability of its price to competent authorities on request;
- c) the vendor communicates to the institution the dates on which the transaction or quote has been observed and the necessary set of ‘identifier’ information to enable the institution to map the verifiable price to its risk factors;

paragraph MAR31.12 FAQ 1 of the same document, a committed quote is defined as ‘a price from an arm’s length provider at which the provider of the quote must buy or sell the financial instrument’.



- d) each vendor is subject to an at least yearly independent audit regarding the validity of its price information, its governance and its processes. Audit results and reports should be made available to the institution and on request to the relevant competent authorities as a precondition for the institution to be allowed to count verifiable prices collected by the third-party vendor within its modellability assessment.

The respondents to the consultation supported the requirement for third-party vendors to be subject to an independent audit.

In cases where a third-party vendor does not deliver sufficient information for an institution to check the verifiability of the price information provided, the institution may take into account the price information provided only when the third-party vendor is contractually obliged to have checked the verifiability of the price.

2.4 Verifiable prices representative of risk factors

In order to determine which verifiable prices should be used in the modellability assessment of a risk factor, institutions should be provided with some guidance on how to map transactions or quotes to risk factor(s).

In some cases, the mapping of transactions to risk factors is straightforward, i.e. when there 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.

An institution should be allowed to identify a verifiable price for more than one risk factor. Any verifiable price may be counted as an observation for all of the risk factors for which it is representative.

To this end, the draft RTS should specify that, for a risk factor, 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. It is understood that, in extracting a risk factor from the value of a verifiable price, further inputs, such as the values of other risk factors or input parameters may be used where necessary.

This definition aims to ensure that the risk factor is a principal driver for each price taken into account in the assessment of modellability.

As part of the documentation of their internal risk-measurement model, institutions must have policies and procedures that clearly describe and define their mapping of verifiable prices to risk factors. This needs to include how the mapping changes in the event of changes in the characteristics of a position (e.g. decreased maturity) or in the event of changes in the characteristics of a risk factor (e.g. a risk factor representing a credit index that rolls regularly or a risk factor representing implied at-the-money (ATM) volatility where the ATM level changed over the preceding 12 months).



Collateral reconciliations are not considered to deliver verifiable prices, given their lack of verifiability and representativeness.

In the Basel text it is not specified exactly how the counting of verifiable prices shall work for the past 12 months, i.e. exactly which verifiable prices are representative for a risk factor.

Consider the following examples:

- A verifiable price of a 5y5y swaption traded almost 12 months ago at a 1% strike (the ATM level at that time). Today's ATM level is 2%. Possible interpretations would be that the price observation is representative for:
 - today's ATM implied volatility with a 5-year maturity; or
 - today's ATM-100bp implied volatility with a 4-year maturity.
- A risk factor representing the iTraxx. As a new iTraxx series is determined every 6 months, the risk factor is set up to always be based on the most up-to-date series. Possible interpretations would be that a verifiable price from 12 months ago for series 29:
 - can be counted as an observation for a risk factor that was based on series 29 at that time and is based on series 30 now; or
 - cannot be counted as an observation for a risk factor that was based on series 29 at that time and is based on series 30 now.

In order to avoid potential ambiguities, the draft RTS set out that a verifiable price shall be considered representative of a risk factor where the institution is capable of extracting the value of the risk factor from the verifiable price as of its observation date, which implies the first option in each of the two examples above.

Where an institution uses systematic credit or equity risk factors that are designed to capture market-wide movements for a given economy, region or sector, but not the idiosyncratic risk of a specific issuer, verifiable prices of market indices or instruments of individual issuers with the same attributes as the systematic risk factor may be considered representative for the systematic risk factor.

2.5 Modellability assessment for curves, surfaces or cubes

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. The modellability of a bucket is based on the same criteria as outlined under section 2.2.2 for risk

factors. A verifiable price should be allocated to a bucket where it is representative for any possible risk factor that belongs 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 these draft RTS in line with international regulatory standards:

- i. For interest rate, foreign exchange and commodity risk factors with one maturity dimension (t – expressed in years) (excluding implied volatilities), the buckets in row i should be used.
- ii. For interest rate, foreign exchange and commodity risk factors with several maturity dimensions (t – expressed in years) (excluding implied volatilities), the buckets in row ii should be used.
- iii. For credit spread and equity risk factors with one or several maturity dimensions (t – expressed in years) (excluding implied volatilities), the buckets in row iii should be used.
- iv. For any risk factors with one or several strike/moneyness dimensions (delta – δ), the buckets in row iv should be used. For option markets where alternative definitions of moneyness are standard, institutions should convert the regulatory delta buckets to the market standard convention using their own documented and independently reviewed pricing models.
- v. For expiry and strike dimensions of implied volatility risk factors (excluding those of interest rate option instruments), the buckets in rows iii and iv should be used.
- vi. For maturity, expiry and strike dimensions of implied volatility risk factors from interest rate option instruments, the buckets in rows ii, iii and iv should be used.

Table 2: Regulatory buckets

Bucket no.	1	2	3	4	5	6	7	8	9
i	$0 \leq t < 0.75$	$0.75 \leq t < 1.5$	$1.5 \leq t < 4$	$4 \leq t < 7$	$7 \leq t < 12$	$12 \leq t < 18$	$18 \leq t < 25$	$25 \leq t < 35$	$35 \leq t$
ii	$0 \leq t < 0.75$	$0.75 \leq t < 4$	$4 \leq t < 10$	$10 \leq t < 18$	$18 \leq t < 30$	$30 \leq t$			
iii	$0 \leq t < 1.5$	$1.5 \leq t < 3.5$	$3.5 \leq t < 7.5$	$7.5 \leq t < 15$	$15 \leq t$				
iv	$0 \leq \delta < 0.05$	$0.05 \leq \delta < 0.3$	$0.3 \leq \delta < 0.7$	$0.7 \leq \delta < 0.95$	$0.95 \leq \delta \leq 1$				



Alternatively, institutions may be allowed to use their 'own bucketing approach', under which they define the buckets around their own risk factors. However, 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.

In line with international regulatory standards, the RTS include a specific provision for debt instruments to address the problem of issuances becoming non-modellable simply because they cross into a new maturity bucket even though they maintain an adequate trading volume; as debt instruments mature, verifiable prices for those products that have been identified within the previous 12 months are usually still counted in the maturity bucket to which they were initially allocated. When institutions no longer need to model a credit spread risk factor belonging to a given maturity bucket, institutions are allowed to reallocate the verifiable prices of this bucket to the adjacent (shorter) maturity bucket.

For instance, if a bond with an original maturity of 4 years had a verifiable price on its issuance date 8 months ago, institutions can opt to allocate the verifiable price to the bucket [1.5; 3.5] instead of the bucket [3.5; 7.5] to which it would normally be allocated.

Following the feedback received on the CP on whether this provision was relevant for institutions considering potential implementation issues, the EBA decided to maintain the provision in the draft RTS.

In addition, where systematic credit or equity risk factors include a maturity dimension (e.g. a credit spread curve), a bucketing approach is to be used for this maturity dimension to count verifiable prices for the modellability assessment.

2.6 Modellability assessment for parametric 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. Consider the following examples:

- Principal components derived by principal components analysis from time series for the different grid points of an interest rate curve. Here, the modellability assessment should be conducted for the interest rate buckets in accordance with row *i* in [Table](#) .
- 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). Here, the modellability assessment should be conducted for the interest rate buckets in accordance with row *i* in [Table 2](#).



- SABR parameters derived from prices of options covering different strikes. Here, the modellability assessment should be conducted for the buckets in accordance with row iv in Table 2.
- SABR parameters derived from prices of swaptions covering different maturities, tenors and strikes. Here, the modellability assessment should be conducted for the buckets in accordance with rows ii, iii and iv in Table 2.

The EBA consulted on a specific approach for the modellability assessment of function parameters. In particular, two options were specified for considering the case where some buckets are assessed as modellable and some are assessed as non-modellable. The feedback received highlighted potential implementation issues linked with both options. Consequently, the approach included in the CP has been modified and the EBA reverted to more generic wording in the draft RTS, which does not pre-empt the choices that institutions are free to make in the specification of their risk factors.

Under this wording, 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.

This rule has the advantages of being clear and easy, and it is suitable for reflecting the hierarchies that could be observed among the parameters of a model. For instance, in some models applied to volatility surfaces or parts of them, one could distinguish between a parameter measuring the overall level of implied volatility, typically observed from ATM options, and further parameters describing the shape of the curve or surface (e.g. skew and smile), typically observed from in-the-money (ITM) or out-of-the-money (OTM) options.

In general, the EBA acknowledges that 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 any case, the assessment of modellability specified in these RTS is performed based on the list of risk factors that an institution includes in its internal model approach. For each of those risk factors, the institution assesses whether it is modellable or not. It is worth clarifying that institutions are free to redefine risk factors (in case some of these risk factors do not pass the assessment of modellability), 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.

2.7 Frequency of the modellability assessment

In line with international regulatory standards, the draft RTS specify 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 referred to in section 2.2 should always terminate at the previous reporting



date. For example, consider the following reporting dates: 31 December 2019 and 31 March 2020. In order to assess the modellability of a risk factor in the period from 1 January 2020 to 31 March 2020, an institution should count verifiable prices in the period from 31 December 2018 to 31 December 2019. From 1 April 2020, the relevant 12-month period is the one starting 31 March 2019 and ending 31 March 2020.



3. Draft regulatory technical standards on criteria for assessing the modellability of risk factors under the internal model approach (IMA) under Article 325be(3) of Regulation (EU) No 575/2013 (revised Capital Requirements Regulation - CRR2)



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on supplementing Regulation (EU) No 575/2013 of the European Parliament and of the Council with regard to regulatory technical standards to further specify the criteria for assessing the modelability of risk factors under the internal model approach (IMA) under Article 325be(3)

(Text with EEA relevance)



THE EUROPEAN COMMISSION,

Having regard to the Treaty on the Functioning of the European Union,

Having regard to Regulation (EU) No 575/2013 of 26 June 2013 of the European Parliament and of the Council on prudential requirements for credit institutions and investment firms and amending Regulation (EU) No 648/2012⁴, and in particular of Article 325be(3) thereof,

Whereas:

- (1) In accordance with Article 325be(1) of Regulation (EU) No 575/2013, institutions shall assess the modellability of each and every risk factor included (or which are in the process of being included) in their internal model, i.e. under the scope of Chapter 1b, Title IV, Part Three of Regulation (EU) No 575/2013. Accordingly, modellable risk factors may be included in the expected shortfall risk measure under Article 325bb of Regulation (EU) No 575/2013, while non-modellable risk factors should be included in the stress scenario risk measure under Article 325bk of that Regulation. The criteria that should be satisfied in order for the risk factors to be assessed as modellable should be specified taking into account the relevant international framework defined by the Basel Committee on Banking Supervision (BCBS).⁵
- (2) The expected shortfall risk measure determines capital requirements for those market risk factors for which a sufficient amount of observable market data are available and hence are assessed as modellable. As a result, the assessment of the modellability of a risk factor should be based on the identification, in the 12-month observation period ending at the preceding reporting reference date, of a sufficient number of verifiable prices that are representative of that risk factor. However, in order, in particular, to account for possible delays in data availability, the period used for the assessment should be allowed to differ from that 12-month observation period. In order to ensure consistency of institutions' overall assessment of modellability and promote harmonised practices across the Union, shifted periods should not be allowed to differ by more than one month from that 12-month observation period and institutions should use those shifted periods in a consistent way across risk factors, specifying their usage via detailed documentation.
- (3) For the purposes of assessing the modellability of risk factors, institutions should also be allowed to use information based on prices collected from a third-party vendor provided that those prices are verifiable in accordance with this Regulation. The third-party vendor should be, in any case and regardless of the type of information provided to the institution, subject to an audit by a third-party undertaking regarding the validity of its information.
- (4) A key step in the assessment of modellability of risk factors consists in assessing the representativeness of identified verifiable prices for those risk factors. A verifiable price is representative of a risk factor of an institution where the institution is able to extract the value of the risk factor from the value of the verifiable price. However, a number of common extraction methodologies need additional input data in order to be able to provide the value of the risk factor. Those additional input data should be based on objective information, which should also be documented. This should prevent institutions from demonstrating representativeness on the basis of biased or unsound extraction methodologies. Due to their

⁴ OJ L 150, 7.6.2019, p. 1.

⁵ Minimum capital requirements for market risk, January 2019 (rev. February 2019).



lack of verifiability and representativeness, collateral reconciliations or valuations should not be considered eligible sources of verifiable prices, in line with international standards.

- (5) Where a risk factor is a point of a curve, a surface or any other higher dimensional object such as a cube, in order to count verifiable prices for the assessment of modellability, institutions should be allowed to choose, from among different bucketing approaches, the one that is more appropriate for the given curve, surface or cube. In line with international standards, given the shared characteristics of risk factors belonging to a given bucket, the verifiable prices representative of one risk factor in a bucket should also be representative for any of the risk factors in the same bucket. Hence, in order to assess the modellability of risk factors belonging to a curve, surface or cube, it should be sufficient to assess the modellability of each bucket of that curve, surface or cube, using all the verifiable prices that are allocated to that bucket. In addition, the rules on the modellability of risk factors should include rules for cases where an institution uses a parametric function to represent a curve, surface or cube and defines the function parameters as the risk factors in its risk-measurement model. In that case these rules on the modellability of risk factors should specify how the modellability assessment should be performed, taking into consideration the specificities of those parametric functions and function parameters, e.g. it should be considered that verifiable prices may not exist that are directly representative of those function parameters.
- (6) Article 325bi(1)(e) of Regulation (EU) No 575/2013 provides for documentation by institutions of their internal policies, procedures and controls of their internal risk-measurement models. In order to assist competent authorities to ensure compliance with this Regulation, it is necessary to set out further details of how that general documentation requirement should be applied in the particular case of the risk factor modellability by institutions.
- (7) This Regulation is based on the draft regulatory technical standards submitted by the European Banking Authority (EBA) to the Commission.
- (8) EBA has conducted open public consultations on the draft regulatory technical standards on which this Regulation is based, analysed the potential related costs and benefits and requested the opinion of the Banking Stakeholder Group established in accordance with Article 37 of Regulation (EU) No 1093/2010,⁶

HAS ADOPTED THIS REGULATION:

Article 1

Criteria for the modellability of risk factors

1. With the exception of the cases referred to in Articles 4 and 6, a risk factor subject to the assessment referred to in Article 325be(1) of Regulation (EU) No 575/2013 shall be considered modifiable where, over an observation period of 12 months ending at the preceding reporting

⁶ Regulation (EU) No 1093/2010 of the European Parliament and of the Council of 24 November 2010 establishing a European Supervisory Authority (European Banking Authority), amending Decision No 716/2009/EC and repealing Commission Decision 2009/78/EC (OJ L 331, 15.12.2010, p. 12).



reference date, as referred to in Article 2(1)(b) of Commission Implementing Regulation (EU) No 680/2014,⁷ an institution has identified for that risk factor either of the following:

- (a) a minimum of 24 prices which are verifiable in accordance with Article 2, with distinct observation dates, which are representative of the risk factor in accordance with Article 3 and for which there are no 90-day periods with less than four of those verifiable prices;
 - (b) a minimum of 100 prices which are verifiable in accordance with Article 2, with distinct observation dates and which are representative of the risk factor in accordance with Article 3.
2. An institution may replace the 12-month period referred to in paragraph 1 by a 12-month period that is ending no earlier than one month before the preceding reporting reference date, as referred to in Article 2(1)(b) of Commission Implementing Regulation (EU) No 680/2014, where all of the following conditions are met:
- (a) the institution applies the shifted 12-month period consistently across all risk factors of the same type as that risk factor;
 - (b) the institution applies the shifted 12-month period consistently across time;
 - (c) the institution documents the use of a 12-month period in accordance with this paragraph.

Article 2

Verifiable prices

1. A price shall be considered verifiable where any of the following conditions are met:
- (a) the price is obtained from an actual transaction to which the institution was one of the parties and which was entered into at arm's length;
 - (b) the price is obtained from an actual transaction which was entered into by third parties at arm's length;
 - (c) the institution has identified, on a given observation date, actual *bona fide* competitive bid and offer quotations provided at arm's length by the institution itself or by third parties, at which, conforming to trade custom, the institution or the third parties have committed to execute a transaction.
2. A price shall not be considered verifiable where any of the following conditions are met:
- (a) the price is obtained from a transaction or quotation between two entities of the same group;
 - (b) the price is obtained from a transaction or quotation of a negligible volume as compared to usual volume of transactions or quotes, reflective of current market conditions;

⁷ Commission Implementing Regulation (EU) No 680/2014 of 16 April 2014 laying down implementing technical standards with regard to supervisory reporting of institutions according to Regulation (EU) No 575/2013 of the European Parliament and of the Council Text with EEA relevance (OJ L 191, 28.6.2014, p. 1–1861).



- (c) the institution identified on a given observation date actual *bona fide* competitive bid and offer quotations, with a bid–offer spread deviating substantially from bid–offer spreads reflective of current market conditions;
3. Transactions shall not be conducted and quotations shall not be committed with the sole purpose of identifying a sufficient number of verifiable prices to meet the criteria specified in Article 1.
 4. The observation date of a verifiable price shall correspond to the day of execution for transactions and to the day on which the quotation was committed for quotations. The observation date of verifiable prices shall be recorded based on a consistent single time zone across all data sources.
 5. For the purpose of this Regulation, a third-party vendor shall be considered to be an undertaking that provides data on transactions or quotations to institutions for the purpose of Article 1, including data reporting service providers as defined in Article 4(1)(63) of Directive 2014/65/EU and multilateral systems as defined in Article 4(1)(19) of Directive 2014/65/EU.
 6. A transaction or a quotation shall be used for the purpose of points (b) and (c) of paragraph 1 only where all the following conditions are met:
 - (a) the transaction or quotation has been processed through, or collected by, a third-party vendor;
 - (b) the third-party vendor or the institution has agreed to provide evidence of the transaction or quotation and evidence of the verifiability of its price to the institution’s competent authorities upon request;
 - (c) the third-party vendor has provided to the institution the observation date and a minimum set of information about the transaction or quotation on the basis of which the institution is able to map the verifiable price to its risk factors for which it is representative in accordance with Article 3;
 - (d) the institution has verified that the third-party vendor is subject, at least annually, to an independent audit by a third-party undertaking, within the meaning of Article 325bi(1)(h) of Regulation (EU) No 575/2013, regarding the validity of its price information, governance and processes, and has access to audit results and reports, in case these are requested by the institution’s competent authorities.
 7. For the purpose of point (d) of paragraph 6, the independent audit by a third-party undertaking shall include, at a minimum, all of the following elements:
 - (a) that the third-party vendor possesses the information necessary to verify that a price is verifiable in accordance with paragraphs 1 and 2, as well as the information necessary to map the verifiable prices to the risk factors for which they are representative in accordance with Article 3;
 - (b) that the third-party vendor is able to demonstrate the integrity of the information referred to in subparagraph (a);
 - (c) that the third-party vendor has in place internal processes and a sufficient number of staff with a level of skills appropriate for the management of the information referred to in subparagraph (a);



- (d) that, where a third-party vendor does not provide the institution with the information to verify that a price is verifiable in accordance with paragraphs 1 and 2, the third-party vendor is contractually obliged to verify itself that the price is verifiable in accordance with paragraphs 1 and 2.
8. Where a third-party vendor does not provide the institution with the information to verify that a price is verifiable in accordance with paragraphs 1 and 2, the institution shall be able to demonstrate to its competent authority that the third-party vendor is contractually obliged to verify itself that a price is verifiable in accordance with paragraphs 1 and 2.

Article 3

Representativeness of verifiable prices for risk factors

1. A verifiable price shall be considered representative of a risk factor as of its observation date where both the following conditions are met:
 - (a) there is a close relationship between the risk factor and the verifiable price;
 - (b) the institution has specified a conceptually sound methodology to extract the value of the risk factor from the verifiable price. Any input data or risk factor used in that methodology other than that verifiable price shall be based on objective data.
2. Any verifiable price may be counted for the purpose of Article 1 for all of the risk factors for which it is representative in accordance with paragraph 1.
3. Where an institution uses a systematic credit or equity risk factor to capture market-wide movements for given attributes of a pool of issuers, such as the country, region or sector of those issuers, verifiable prices of market indices or instruments of individual issuers shall be considered representative for that systematic risk factor only where they share the same attributes as that systematic risk factor.

Article 4

Criteria for the modellability of risk factors belonging to curves, surfaces and cubes

1. Where an institution defines one or more points of a curve, a surface or a cube as the risk factors in its internal risk-measurement model, the institution shall assess the modellability of those risk factors by applying the following steps in sequence:
 - (a) for each curve, surface or cube, it shall determine relevant buckets of risk factors in accordance with Article 5;



- (b) it shall determine the modellability of the buckets determined pursuant to point (a) in accordance with paragraph 2;
 - (c) it shall consider as modellable risk factor any risk factor that belongs to a bucket that has been considered modellable pursuant to point (b).
2. A bucket shall be considered modellable where, over an observation period of 12 months ending at the preceding reporting reference date, as referred to in Article 2(1)(b) of Commission Implementing Regulation (EU) No 680/2014, the institution has identified, for that bucket, either of the following:
 - (a) a minimum of 24 prices which are verifiable in accordance with Article 2, with distinct observation dates, which are allocated to that bucket and for which there shall be no 90-day period with less than four of those verifiable prices;
 - (b) a minimum of 100 prices which are verifiable in accordance with Article 2, with distinct observation dates and which are allocated to that bucket.
 3. An institution may replace the 12-month period referred to in paragraph 2 by a 12-month period that is ending no earlier than one month before the preceding reporting reference date, as referred to in Article 2(1)(b) of Commission Implementing Regulation (EU) No 680/2014, where all of the following conditions are met:
 - (a) the institution applies the shifted 12-month period consistently across all the buckets of a curve, a surface or a cube;
 - (b) the institution applies the shifted 12-month period consistently across time;
 - (c) the institution documents the use of a 12-month period in accordance with this paragraph.
 4. A verifiable price shall be allocated to a bucket where it is representative in accordance with Article 3 for a risk factor that belongs to that bucket.
 5. For the purpose of paragraph 4, the institution may consider as a risk factor any point of the curve, surface or cube belonging to the bucket, regardless of whether such point is a risk factor included in the risk-measurement model.

Article 5

Bucketing approaches for risk factors belonging to curves, surfaces or cubes

1. In relation to each given curve, surface or cube to which a risk factor belongs, institutions shall determine the buckets of that curve, surface or cube using the standard pre-defined buckets referred to in paragraph 2, unless they meet the requirements of paragraph 3, in which case they may define those buckets themselves.
2. For the purpose of paragraph 1, the standard, pre-defined buckets shall be as follows:



- (a) the nine buckets defined in row i. of Table 1 for risk factors with one maturity dimension ‘ t ’, expressed in years, which have been assigned to the following broad risk factor categories:
 - (i) Interest rate, except those risk factors assigned to the broad risk factor subcategory Volatility;
 - (ii) Foreign Exchange, except those risk factors assigned to the broad risk factor subcategory Volatility;
 - (iii) Commodity, except those risk factors assigned to the broad risk factor subcategories Energy volatility and carbon emissions volatility, Precious metal volatility and non-ferrous metal volatility and Other commodity volatilities;
- (b) the six buckets defined in row ii. of Table 1 for each maturity dimension ‘ t ’ of risk factors with more than one maturity dimension, expressed in years, which have been assigned to the following broad risk factor categories:
 - (i) Interest rate, except those risk factors assigned to the broad risk factor subcategory Volatility;
 - (ii) Foreign Exchange, except those risk factors assigned to the broad risk factor subcategory Volatility;
 - (iii) Commodity, except those risk factors assigned to the broad risk factor subcategories Energy volatility and carbon emissions volatility, Precious metal volatility and non-ferrous metal volatility and Other commodity volatilities;
- (c) the five buckets defined in row iii. of Table 1 for each maturity dimension ‘ t ’ for risk factors with one or several maturity dimensions, expressed in years, which have been assigned to the following broad risk factor categories:
 - (i) Credit spread, except those risk factors assigned to the broad risk factor subcategory Volatility;
 - (ii) Equity, except those risk factors assigned to the broad risk factor subcategories Volatility (Large capitalisation) and Volatility (Small capitalisation);
- (d) the five buckets defined in row iv. of Table 1 for any risk factors with one or several moneyness dimensions, as expressed using the delta (δ) convention. For option markets where alternative definitions of moneyness are standard, institutions shall convert the buckets defined in row iv. of Table 1 to the market-standard convention using their own documented and independently reviewed pricing models.
- (e) the five buckets defined in row iii. and the five buckets defined in row iv. of Table 1 for risk factors assigned to the following broad risk factor categories:
 - (i) Foreign Exchange, exclusively those risk factors assigned to the broad risk factor subcategory Volatility;
 - (ii) Credit spread, exclusively those risk factors assigned to the broad risk factor subcategory Volatility;

- (iii) Equity, exclusively those risk factors assigned to the broad risk factor subcategories Volatility (Large capitalisation) and Volatility (Small capitalisation);
- (iv) Commodity, exclusively those risk factors assigned to the broad risk factor subcategories Energy volatility and carbon emissions volatility, Precious metal volatility and non-ferrous metal volatility and Other commodity volatilities;
- (f) the six buckets defined in row ii., the five buckets defined in row iii. and the five buckets defined in row iv. of Table 1 for risk factors assigned to the broad risk factor category Interest rate and to the broad risk factor subcategory Volatility with an maturity, expiry and moneyness dimension.

Table 1

Bucket no.	1	2	3	4	5	6	7	8	9
i.	$0 \leq t < 0.75$	$0.75 \leq t < 1.5$	$1.5 \leq t < 4$	$4 \leq t < 7$	$7 \leq t < 12$	$12 \leq t < 18$	$18 \leq t < 25$	$25 \leq t < 35$	$35 \leq t$
ii.	$0 \leq t < 0.75$	$0.75 \leq t < 4$	$4 \leq t < 10$	$10 \leq t < 18$	$18 \leq t < 30$	$30 \leq t$			
iii.	$0 \leq t < 1.5$	$1.5 \leq t < 3.5$	$3.5 \leq t < 7.5$	$7.5 \leq t < 15$	$15 \leq t$				
iv.	$0 \leq \delta < 0.05$	$0.05 \leq \delta < 0.3$	$0.3 \leq \delta < 0.7$	$0.7 \leq \delta < 0.95$	$0.95 \leq \delta \leq 1$				

A given standard bucket may be subdivided in smaller buckets.

3. For the purposes of paragraph 1, institutions may define the buckets of a curve, surface or cube themselves only where all the following conditions are met:
 - (a) the buckets cover the whole curve, surface or cube;
 - (b) the buckets are non-overlapping;
 - (c) each bucket includes exactly one risk factor that is part of the calculation of the theoretical changes in the trading desk portfolios' values of the institution for the purposes of assessing the compliance with the profit and loss attribution requirements in accordance with Article 325bg of Regulation (EU) No 575/2013.
4. For the assessment of the modellability of risk factors of the broad risk factor category Credit spread belonging to a certain maturity bucket, an institution may reallocate the verifiable prices of a bucket to the adjacent bucket related to shorter maturities only where all the following conditions are met:
 - (a) the institution does not have exposure to any risk factor belonging to the bucket corresponding to the longer maturities and hence does not use any of these risk factors within its risk-management model;
 - (b) any verifiable price is only counted in a single maturity bucket;
 - (c) any verifiable price is only reallocated once.

Article 6

Criteria for the modellability of risk factors belonging to parametric curves, surfaces and cubes

1. Where an institution uses one or more parametric functions to represent a curve, a surface or a cube and defines the function parameters as the risk factors in its internal risk-measurement model, the institution shall assess the modellability of those function parameters used as risk factors by applying for each parametric function the following steps in sequence:
 - (a) it shall identify the set of points of the curve, surface or cube that were used to calibrate the parametric function;
 - (b) it shall apply the bucketing approach set out in Article 5(2) as if the risk factors in the risk-measurement model were the points identified pursuant to point (a);
 - (c) it shall assess, in accordance with Article 4(2) and 4(3), the modellability of the buckets resulting from the application of the bucketing approach referred to in Article 5(2), as if the risk factors in the risk-measurement model were the points identified in point (a).
2. For the purpose of assessing the modellability of a parameter of the parametric function referred to in paragraph 1, the institution shall apply the following steps in sequence:
 - (a) it shall identify the set of points of the curve, surface or cube that were used to calibrate that function parameter;
 - (b) it shall assess that function parameter as modellable, where the points identified pursuant to point (a) belong only to buckets assessed as modellable pursuant to point (c) of paragraph 1;
 - (c) it shall assess that function parameter as non-modellable, where a point identified pursuant to point (a) belongs to a bucket assessed as non-modellable pursuant to point (c) of paragraph 1.

Article 7

Documentation

1. The following shall be clearly documented in the internal policies of an institution:
 - (a) the set and definitions of risk factors in their internal risk-measurement model subject to the modellability assessment;
 - (b) the sources of verifiable price information used to assess the modellability of risk factors;



- (c) the criteria for a price to be considered verifiable in accordance with Article 2, including an outline of how the institution assesses whether the volume of a transaction or committed quote is non-negligible in accordance with Article 2(2)(b) and whether the bid–offer spread of a quote is reasonable in accordance with Article 2(2)(c);
 - (d) the mapping process and the criteria used to determine the representativeness of verifiable prices to risk factors in accordance with Article 3, including an outline of the methodology specified for the extraction of the value of the risk factor and any additional input the methodology potentially requires;
 - (e) the modellability assessment for parametric curves, surfaces or cubes in accordance with Article 6;
 - (f) the use of the bucketing approaches in accordance with Article 5, also specifying whether and how the institution applies the provision in Article 5(4);
 - (g) the use of the 12-month period in accordance with Article 1(4) or with Article 4(3).
2. For each risk factor, institutions shall keep a record of at least one year of the results of their modellability assessment, including the documentation referred to in paragraph 1. For risk factors for which one year of results is not yet available, institutions shall keep the maximum available track record of results.

Article 8
Entry into force

This Regulation shall enter into force on the twentieth day following that of its publication in the *Official Journal of the European Union*.

This Regulation shall be binding in its entirety and directly applicable in all Member States.

Done at Brussels,

For the Commission
The President

[For the Commission
On behalf of the President

[Position]

4. Accompanying documents

4.1 Draft cost–benefit analysis/impact assessment

Article 325be of CRR2 requires the EBA to develop draft RTS to specify the criteria for assessing the modellability of risk factors for positions attributed to trading desks that have been granted or are in the process of being granted permission to use internal models for calculating own funds requirements for market risk.

As per Article 10(1) of Regulation (EU) No 1093/2010 (EBA Regulation), any regulatory technical standards developed by the EBA shall be accompanied by an Impact Assessment (IA), which analyses ‘the potential related costs and benefits’.

This section presents the cost–benefit analysis of the provisions included in the RTS. The analysis provides an overview of identified problems, the proposed options to address those problems and the costs and benefits of those options.

A. Problem identification

In January 2019, the Basel Committee on Banking Supervision (BCBS) finalised the standards on ‘Minimum capital requirement for market risk’. The revised internal model approach includes three components for measuring capital requirements: (i) an ES metric, which determines capital requirements for those market risk factors (i.e. 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 are available and that therefore are deemed suitable for modelling (‘modellable’ risk factors); (ii) an NMRF requirement for market risk factors with limited observable market data that 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 revised framework recognises that there is significant uncertainty in modelling risks for which there are limited observable historical market data, and prevents institutions from modelling those risks within their ES model. Risk factors (e.g. FX rates or equity prices) that do not have sufficient observable market data are deemed to be non-modellable (i.e. NMRFs). NMRFs are excluded from the ES calculation; instead, the capital requirement for each NMRF is determined by means of a stressed scenario risk measure.

The Basel standards prescribe that a risk factor can be classified as modellable by an institution only where it passes the RFET. This test requires identification of a sufficient number of real prices that are representative of the risk factor.

CRR2, which implements the FRTB into the EU legislation, requests the EBA to specify the criteria for the modellability of risk factors. The lack of a common specification would result in inconsistent



implementation of the internal model approach for the calculation of the own funds requirements for market risk across institutions.

B. Policy objectives

The specific objective of the RTS is to establish harmonised criteria for assessing the modellability of risk factors. Generally, the RTS aim to create a level playing field, promote convergence of institutions' practices and enhance comparability of own funds requirements across the EU. Overall, the RTS are expected to promote the effective and efficient functioning of the EU banking sector.

C. Baseline scenario

The baseline scenario aims to describe the regulatory environment and regulatory developments, as well as institutions' practices.

In terms of the regulatory environment, the baseline assumes the entry into force of CRR2, which does not provide any criteria for assessing the modellability of risk factors. Institutions could rely on the RFET and principles proposed in the FRTB standards in assessing the modellability of risk factors.

In terms of institutions' practices, the baseline scenario assumes that no common criteria exist regarding the assessment of the modellability of risk factors, given that, under the current CRR framework, institutions are, subject to approval, allowed to model all risks inherent in their trading portfolio and are thus not required to distinguish between modellable and non-modellable risk factors.

D. Options considered, cost–benefit analysis and preferred options

Bid–offer spread

The FRTB frequently asked questions document defines a committed quote as a price from an arm's-length provider at which the provider of the quote must buy or sell the financial instrument. Different interpretations are considered.

Option 1a(1): For a committed quote to be considered a verifiable price, it must have either a firm bid or a firm offer price.

Option 1a(2): For a committed quote to be considered a verifiable price, it must have both a firm bid and a firm offer price emanating from the same entity.

Option 1b: For a committed quote to be considered a verifiable price, it must have both a firm bid and a firm offer price. The bid and offer quotes may not necessarily emanate from the same entity, but they must be collected on the same date.



Options 1a(1) and 1a(2) were put forward for consultation. The majority of the respondents to the CP disagreed with the condition that a committed quote, to be considered verifiable, should be required to have both a firm bid and a firm offer price.

Nevertheless, the EBA considers that the requirement of willingness to buy and sell is an additional safeguard ensuring that only sound prices are counted as verifiable prices, although this could potentially lead to a decreased number of quotes eligible to be considered in the modellability assessment.

To accommodate the respondents' concerns, Option 1b is retained, as it allows a better reflection of how prices are formed on a broader range of markets while maintaining the requirement to have an active two-sided market on the observation date.

Delays in data availability

The FRTB specifies that, when an institution uses data for real price observations from an external source, and those observations are provided with a time lag, the period used for the RFET may differ from the period used to calibrate the current ES model. The difference in periods used for the RFET and the calibration of the ES model should not be greater than 1 month.

To account for delays in data availability, the RTS allow institutions to replace the 12-month period referred to in Article 1 paragraph 1 with a 12-month period that ends no earlier than 1 month before the preceding reporting date, as referred to in Article 2(1)(b) of Commission Implementing Regulation (EU) No 680/2014. However, it has also been specified that institutions must use a consistent 12-month period across risk factor types and across time. In addition, they must set out the period used per risk factor type in their policies (**Option 2a**). Alternatively, institutions could be allowed to use a time-shift in the 1-year period that is of the same length as the time delay in data availability (**Option 2b**). Given that the latter option implies a burden that is disproportionate to the beneficial effects that it can provide, Option 2a is retained.

Mapping of verifiable prices to risk factors when the characteristics of a position or a risk factor change

The FRTB standards set out that a real price is representative for a risk factor of an institution where the institution is able to extract the value of the risk factor from the value of the real price. The institution must have policies and procedures that describe its mapping of real price observations to risk factors. However, the Basel text does not specify how exactly the counting of verifiable prices will work for the past 12 months, i.e. which verifiable prices are exactly representative for a risk factor. This leaves room for different interpretations in the event of changes in the characteristics of a position (e.g. decreased maturity) or changes in the characteristics of a risk factor (e.g. a risk factor representing a credit index that rolls regularly or a risk factor representing implied ATM volatility where the ATM level changed over the preceding 12 months).

Consider a verifiable price of a 5y5y swaption traded almost 12 months ago at a 1% strike (the ATM level at that time), with today's ATM level being 2%. Under a first interpretation (**Option 3a**), the



price observation is representative for today's ATM implied volatility with a 5-year maturity, while under an alternative interpretation (**Option 3b**) the price observation is representative for today's ATM-100bp implied volatility with a 4-year maturity.

Similarly, consider the risk factor representing the iTraxx. As a new iTraxx series is determined every 6 months, the risk factor is set up to always be based on the respective most up-to-date series. Under **Option 3a** the price observation for series 29 stemming from almost 12 months ago is representative for a risk factor that was based on series 29 at that time and is based on series 30 now. On the other hand, under **Option 3b** this price observation is not representative for a risk factor that was based on series 29 at that time and is based on series 30 now.

Option 3a is retained, i.e. a verifiable price is representative of a risk factor where the institution is capable of extracting the value of the risk factor from the verifiable price as of its observation date.

Mapping of verifiable prices to buckets for credit spread risk factors

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 may use a 'bucketing approach'. In this approach, institutions count all verifiable prices allocated to a bucket to assess whether the modellability assessment is 'passed' for any risk factors that belong to the bucket. A verifiable price must be allocated to a bucket where it is representative for any possible risk factor that belongs to the bucket. As a debt instrument matures, real price observations that have been identified within the previous 12 months are usually still counted in the maturity bucket to which they were initially allocated. This can result in an issuance becoming non-modellable, simply because it crosses into a new maturity bucket, even if it maintains an adequate trading volume. Two options are considered:

Option 4a: Allow reallocation of the verifiable price of a given maturity bucket to the adjacent (shorter) maturity bucket (given that certain conditions are met).

Option 4b: Do not allow reallocation of the verifiable price of a given maturity bucket to the adjacent (shorter) maturity bucket.

Option 4a is in line with international standards, which allow institutions that no longer need to model a credit spread risk factor belonging to a given maturity bucket to reallocate the verifiable prices of this bucket to the adjacent (shorter) maturity bucket. For example, if a bond with an original maturity of 4 years had a real price observation on its issuance date 8 months ago, institutions can opt to allocate the real price observation to the bucket associated with a maturity of between 1.5 and 3.5 years instead of to the bucket associated with a maturity of between 3.5 and 7.5 years to which it would normally be allocated. However, this can add complexity to the framework and make the outcome of the modellability test dependent on the portfolio of the institution. On the other hand, Option 4b does not allow such reallocation on the basis that institutions need to have data for the risk factors associated with the current maturity of an issuance in order to model its risk. If the current bucket of the issuance is non-modellable it means that an institution does not have these data and the bucket might be classified as non-modellable.



Option 4a is retained.

Modellability assessment of parametric curves, surfaces and 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 still has to be performed based on the buckets underlying the curve, surface or cube, as for the non-parametric case. In particular, institutions need to use the standard buckets under all the options presented below. The following options are considered:

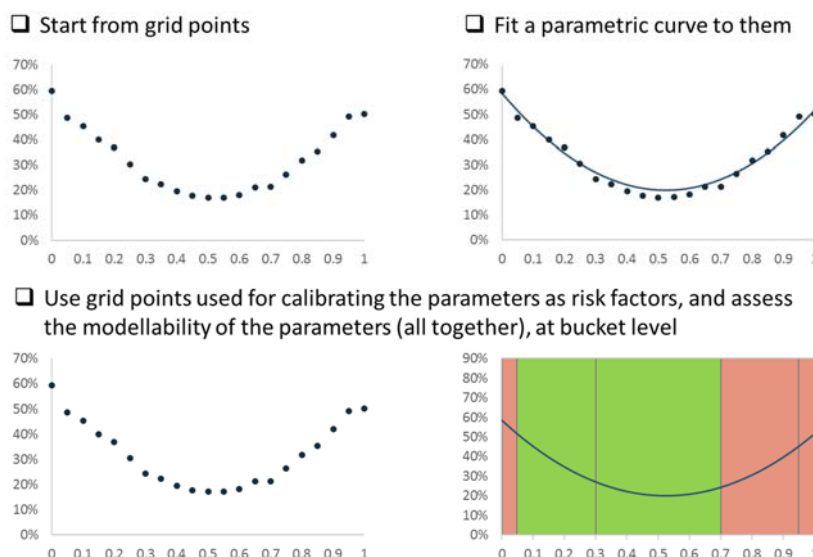
Option 5a: The function parameters will be assessed altogether as modellable only if the entire curve, surface or cube is modellable, i.e. all the buckets of the curve, surface or cube are modellable.

Option 5b: The function parameters will be assessed altogether as modellable only if the entire curve, surface or cube is modellable, but a derogation from this general rule is available, subject to conditions, in case some buckets are assessed as modellable and others are assessed as non-modellable.

Option 5c: Each function parameter will be assessed as modellable if it is solely derived from data assigned to modellable buckets.

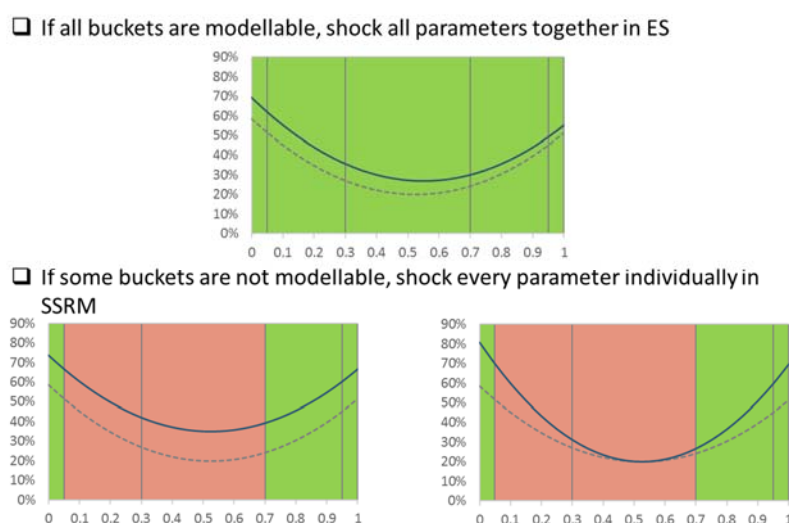
Under Option 5a, the institution, after having identified the set of points of the curve, surface or cube that were used to calibrate the function parameters, must apply the standard bucketing approach as if those points were the risk factors. The modellability assessment, performed at bucket level, determines which buckets are modellable and which are non-modellable.

Figure 1: Assessment of modellability at bucket level when institutions use function parameters as the risk factors



If all the buckets of the curve, surface or cube are modellable, the whole set of function parameters (i.e. the risk factors defined by the institution) can be included in the partial ES calculations, given that all those function parameters are deemed modellable. On the other hand, if some buckets are not modellable, institutions must deem all the function parameters non-modellable and apply as default treatment the stress scenario risk measure (SSRM) to all those parameters.

Figure 2: Consequence of the modellability assessment under Option 5a



Although Option 5a is a clear and easy rule, it may be overly punitive in many cases, as it considers all function parameters to be non-modellable even where a few buckets or just one bucket are non-modellable.



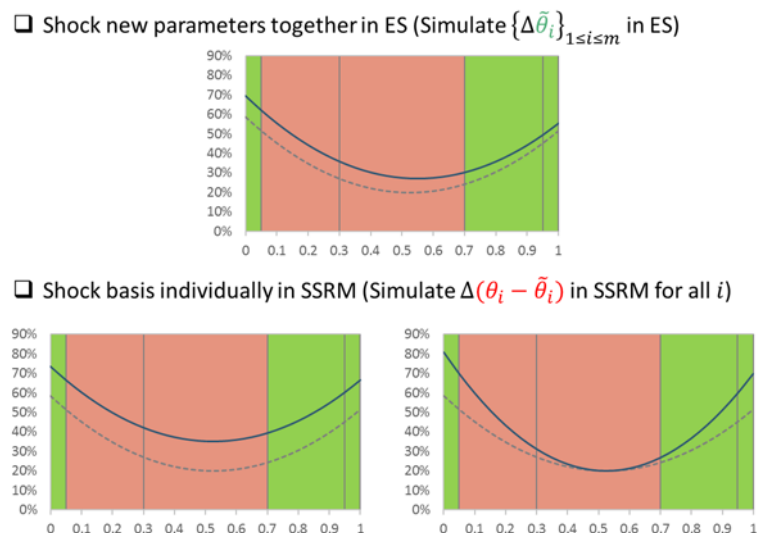
To avoid the potential overly punitive effect of Option 5a, the CP put forward two possible derogations from the general rule. These did not have the purpose of specifying what institutions should do in case some risk factors were deemed non-modellable; rather, the two derogations were proposed as an illustration of a possible way forward in a case where some buckets are non-modellable, with the view of seeking feedback from stakeholders. In particular, both options imply transformations (e.g. redefinition of risk factors) that are out of scope of these RTS:

Option 5b(1): A first set of function parameters could be determined using data from only modellable buckets. These parameters could be included in the calculation of the ES. An additional second set of parameters could be determined using data from all – modellable and non-modellable – buckets. The difference between the two parameter sets could be included in the calculation of the stress scenario risk measure.

Option 5b(2): Institutions could define as risk factors (instead of the function parameters) points of the curve, surface or cube represented by the function parameters and assess the modellability of this new set of risk factors by applying the regulatory bucketing approach. For each given point, institutions would use as data inputs for calibrating the shocks applicable to that point (i.e. the time series comprising the value of that point in the relevant period) the value taken by that point as the output of the parametric function.

Under Option 5b(1), in the case one or more buckets are non-modellable, institutions could either calibrate the function parameters using all buckets and hence consider them as NMRFs (θ_i) or decompose the initial function parameters θ_i (calibrated on all buckets, modellable and non-modellable) into new function parameters $\tilde{\theta}_i$ (calibrated on modellable buckets only) plus the difference (basis; $\theta_i - \tilde{\theta}_i$) between the old and the new parameters, i.e. $\theta_i = \tilde{\theta}_i + (\theta_i - \tilde{\theta}_i)$. The set of new parameters $\tilde{\theta}_i$ would be modellable, while the basis between initial and new parameters would be non-modellable. Figure 3 summarises the envisaged treatment in terms of the inclusion of the two parameter sets in the ES or in the SSRM.

Figure 3: Possible consequence of the modellability assessment under Option 5b(1)



While this option would allow institutions to include the function parameters in the ES in more cases, it has the drawback that the function parameters would be based only on the reduced set of modellable buckets instead of on all data available. Furthermore, it would force institutions to rebuild the whole data history of the function parameters every quarter based on the currently modellable/non-modellable buckets, which can be especially problematic and burdensome in case of unstable modellability results for the buckets.

Under Option 5b(2), institutions could either calibrate the function parameters using all buckets and hence consider them as NMRFs (θ_i) or (1) define new risk factors corresponding to points of the curve/surface/cube represented by the parametric function and (2) assess the modellability of those risk factors based on the regulatory buckets, as for the non-parametric case. Institutions would consider the newly defined risk factors modellable when they belong to a modellable regulatory bucket or non-modellable when they belong to a non-modellable regulatory bucket.

In addition, as the new risk factors would be the points on the curve/surface/cube, those points would have to be shocked in the context of the ES or the SSRM. The scenarios of future shock to be applied to the newly defined risk factors would be inferred from the scenarios described by the function parameters. In other words, those shocks would have to be determined as follows:

- 1) institutions would determine the value taken by the function parameters in the stress period (or last 12-month period);
- 2) institutions would determine the value taken by the points (i.e. the new set of risk factors) in the stress period (or the last 12-month period) as the output of the parametric function;
- 3) the time series comprising the values obtained in accordance with point 2 would be used as the time series of data inputs from which the future shocks are derived.



Option 5b(2) may allow institutions to consider modellable the part of the curve, surface or cube that is relevant for them, and classify as non-modellable the part that may not be relevant (e.g. at the far end of the curve). However, it would force institutions to model the curve, surface or cube based on grid points instead of function parameters.

Most respondents criticised Option 5b given that both the derogations put forward for consultation (i.e. Options 5b(1) and 5b(2)) are impractical or even impossible to be implemented. Many respondents argued that the rules should reflect the fact that there are typically hierarchies among the parameters of a model. In particular, in most models one could distinguish an eminent parameter measuring the overall (or ATM) level of implied volatility from further parameters describing the shape (e.g. skew and smile). The respondents argued that, in this situation, the assessment of modellability of the ATM parameters should be independent of the assessment of the other parameters. Several of the respondents proposed that ATM parameters should be considered modellable whenever there are sufficient verifiable prices for the ATM bucket of implied volatility. Several participants suggested including a dedicated methodology for the most common situation in which an implied volatility surface or cube is parametrised in the strike dimension but not in the expiry or tenor dimension. In this case, the parametrisation of the surface or cube is effectively made up of independent smile parametrisations attached to a grid of expiries (and tenors).

Overall, the EBA considers that Options 5b(1) and 5b(2) could have the drawback of excessively constraining institutions' modelling choices. A more general approach therefore seems desirable.

Option 5c allows for some parameters to be modellable, even if not all buckets of a curve, surface or cube are modellable. In particular, each function parameter is modellable if it is solely derived from data assigned to modellable buckets. This option allows institutions to recognise some benefits in the case in which some buckets are modellable and seems to address some of the concerns raised by the respondents around Option 5b. It allows simpler treatment than in Option 5b(1), providing, in addition, a more practical solution for institutions.

Option 5c is retained.

4.2 Feedback on the public consultation

The EBA publicly consulted on the draft proposal contained in this paper.

The consultation period began on 27 June 2019 and ended on 4 October 2019. Fifteen responses were received, of which eleven were published on the EBA website.

This paper presents a summary of the key points and other comments arising from the consultation, the analysis and discussion triggered by these comments and the actions taken to address them if deemed necessary.

In a number of cases several industry bodies made similar comments or the same body repeated its comments in response to different questions. In such cases, the comments and the EBA analysis are included in the section of this paper where the EBA considers them most appropriate.

Changes to the draft RTS have been incorporated as a result of the responses received during the public consultation.

Summary of key issues and the EBA's response

As highlighted in the background section, the EBA decided to make changes to the draft RTS to reflect the feedback provided by respondents. In the feedback table that follows, the EBA has summarised the comments received and explains which responses have and have not led to changes and the reasons for this.

Several respondents expressed their concerns over the proposed treatment of parametric functions in the modellability assessment. The default approach, envisaging as the only alternative a curve/surface/cube that is either completely modellable or completely non-modellable, has been considered overly punitive by respondents. In addition, the two derogations, included in the CP by the EBA in order to enhance the risk sensitivity of the treatment, were considered impractical in their application, given that they would entail major changes in institutions' procedures and systems and thus generate excessive implementation costs. Consequently, the EBA decided to amend the treatment of parametric functions, taking into account the feedback and suggestions provided.

In terms of the sources of verifiable prices, the EBA, after reviewing the feedback received, decided to maintain the requirement to observe, on a given date, both a bid and an offer price. However, the EBA acknowledged the need for some degree of flexibility raised by the respondents to the CP and, consequently, modified the provision in order to allow bid and offer quotes to be considered that do not emanate from the same party. In addition, taking into account the feedback and suggestions provided, the 'legal obligation' to buy and sell, associated with quotes, was rephrased to better reflect the criteria that quotes have to meet to be eligible as verifiable prices.



Finally, the EBA gathered further feedback on a number of other points, including the potential impact of the benchmark rate reform on the RFET and integration between the RFET and the model calibration process.



Summary of responses to the consultation and the EBA's analysis

Comments	Summary of responses received	EBA analysis	Amendments to the proposals
General comments			
	<p>Many respondents point out that the definition of 'legally obliged' in Article 2 of the CP RTS is a strict requirement that would reduce the use of quotes for a considerable number of instruments. They suggest removing it and considering a price to be committed simply when it is a market-consistent (competitive) price.</p> <p>On this aspect (the 'legally obliged' requirement), one respondent proposes the following redrafting of point (c) of Article 2: 'For the purposes of point (c), a quote shall be considered committed only where the provider of the quote is obligated, by market convention, to buy and sell the corresponding financial instrument at that price requested.'</p> <p>Finally, some respondents provide alternatives and/or adjustments to the framework. One respondent states that single-side quotes should be considered 'committed' if they are sourced from an institutional platform and provided by an active participant.</p>	<p>The EBA recognises that the 'legally obliged' requirement could be difficult to meet in practice. The requirement was therefore amended, with a view to ensuring that not any kind of quote is eligible to be considered a verifiable price.</p>	<p>The 'legally obliged' requirement has been amended.</p>
	<p>Regarding the modellability assessment for parameters of parametric models for curves, surfaces or cubes, respondents generally consider both the options presented in Article 5 of the CP RTS to be impractical (see Question 9). Some respondents stress that the baseline 'all-or-nothing' requirement in Article 5(3)(a) and (b) of the CP RTS is a lot more restrictive than the provision included in the FRTB. Therefore, they call for a suitable</p>	<p>The EBA acknowledges that the general 'all-or-nothing' approach might be too punitive, as it could push whole curves/surfaces/cubes into the NMRF space when just a few buckets are not modellable.</p>	<p>The approach in Article 5 was amended in the new Article 6 to account for the diversity in modelling choices.</p>



Comments	Summary of responses received	EBA analysis	Amendments to the proposals
	derogation in order to avoid entire curves or surfaces being considered NMRFs.	The EBA does not support a mixed bucketing approach.	No amendments are needed.
	One respondent asks for the possibility of combining regulatory and own buckets along different axes of surfaces or cubes. It is argued that this would allow institutions to better reflect conventions in certain markets (e.g. the strike dimension in FX markets).	In the FRTB it is left to institutions to either use the prescribed regulatory buckets (with the benefit of defining as many risk factors as preferred) or use their own buckets (with the limitation of defining only one risk factor per bucket). The EBA considers that no method could combine the two alternatives in a consistent mixed approach.	
Responses to questions in Consultation Paper EBA/CP/2019/07			
Question 1. Do you agree that a committed quote, to be considered verifiable, should be required to have both a firm bid and offer price? If you think that solely a bid or offer price should be sufficient please provide a convincing rationale.	<p>The majority of the respondents disagree on the condition that a committed quote, to be considered verifiable, should be required to have both a firm bid and a firm offer price.</p> <p>Several respondents say that the EBA approach is not in line with the Basel framework. This could jeopardize the level playing field, as other jurisdictions are likely to implement the Basel framework as it is.</p> <p>Many respondents state that considering only the two-way quotes as verifiable prices would not take into account market conventions, in which – for example in over-the-counter (OTC) markets and dealer-to-customer (D2C) bond markets – it is usual for an institution/dealer to quote either a bid or an offer side only. In addition, it has been argued that major exchanges support single-sided quotes in instruments such as the index option on EUREX.</p>	<p>The EBA considers that having both bid and offer prices is an additional safeguard, ensuring that only sound prices are counted as verifiable prices.</p> <p>Nevertheless, the EBA recognises the argument that the respondents made on the availability of two-sided quotes.</p> <p>Consequently, the EBA decides to take into consideration the suggestions made by the respondents and to allow the use of bid and offer quotes that do not necessary emanate from the same party for the purpose of the modellability assessment, provided that they are collected on the same date and all the other requirements set out in these RTS are satisfied.</p>	Amendments to Article 2 were provided.



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Some respondents also point out that some regulations (e.g. MiFID – Markets in Financial Instruments Directive) do not envisage any obligation for two-sided quotes to be published, while other regulations prevent, under certain circumstances, an institution from providing a specific quote (either bid or ask, or both)

Some respondents state that the requirements envisaged by the EBA may result in an entry barrier for the implementation of an internal model, especially for smaller institutions.

Some respondents envisage that, if the EBA persists in requiring both bid and offer committed quotes, some flexibility should be introduced in the framework: (i) the bid and offer quotes should not necessarily emanate from the same party; (ii) a time delay (in terms of the number of days) could be considered between the quotation of a bid price and the quotation of an offer price.

One respondent reports some analysis by comparing one-way quotes with two-sided quotes. The main findings are:

- there is a significantly higher volume of one-way quotes than two-sided quotes – by a magnitude of five in the corporate credit markets;
- on the other hand, there are markets (e.g. for credit default swaps) where over 98% of the available data are two-sided;
- in the markets analysed by the data provider, 19% of all two-sided quotes were consummated with a transaction on that day whereas only 3% of the one-way quotes resulted in a transaction;
- when the data are aggregated on a monthly basis, the results are quite different: 61% (out of 22,000 unique ISINs) of two-sided quotes resulted in a transaction in



Comments	Summary of responses received	EBA analysis	Amendments to the proposals
<p>Question 2. Please provide an estimation of the impact of requiring solely a firm bid or offer price compared to requiring both. Please provide this impact, e.g. in terms of number of non-modellable risk factors, stress scenario risk measure charge or number of eligible committed quotes for different risk factors/risk factor categories.</p>	<p>the month versus 26% of one-way quotes (out of 19,000 unique ISINs).</p> <p>The majority of the respondents are not able to provide an estimate of the impact. Only one respondent specifies that requiring both prices (bid and offer) or requiring only one does not significantly change the number of NMRFs given the portfolio structure of the bank.</p> <p>Some respondents provide an estimate of the data reduction stemming from the two-sided quotes requirement. One respondent estimates that for many bond and derivative markets this requirement could lead to a near 100% reduction in the quantity of quote data available for the modellability assessment. Another respondent provides an estimate of the impact divided by market (Government, Supranational, Agency and Corporate (GSAC) bond and municipal (MUNI) bond markets). For the GSAC bond market, over 90% of D2C quotes are one-sided. For the MUNI bond market, the reliance on quotes is larger than for the general bond market, with less than 25% of the quotes (per unique instrument ID) turning into an actual trade within the week following the initial quote. Furthermore, the skew towards a one-sided quote is even larger because these are mostly retail based, with very few dealer-to-dealer quotes (these also tend to be one-sided).</p>	<p>The majority of respondents were not able to provide a concrete estimation of the potential impact.</p> <p>Some feedback was given by data providers.</p>	<p>No amendments are needed.</p>
<p>Question 3. How would you define and check for a “non-negligible volume of a transaction or quote, as compared to usual</p>	<p>The majority of the industry representatives deem that setting a ‘one-size-fits-all’ approach or fixed thresholds to assess the volume of transactions or quotes would not be appropriate given the variety of asset classes and market structures and, therefore, that the EBA RTS should remain</p>	<p>As previously mentioned, the inclusion of a provision based on the filtering of quotes and transactions of small/irrelevant size is motivated by the intention of</p>	<p>The principle-based approach has been maintained, with rewording provided.</p>



Comments	Summary of responses received	EBA analysis	Amendments to the proposals
<p>transaction sizes for the bank, reflective of normal market conditions” for the purpose of assessing the validity of a price observation?</p>	<p>principle based. Many also point out that an explicit volume-based approach would be difficult to implement, especially for smaller banks that do not have the data infrastructure for monitoring.</p> <p>One respondent suggests as an alternative to the absolute threshold the setting of a relative threshold as a specific percentage of the bank’s total amount of committed quotes for similar risk factor.</p> <p>One respondent believes that giving each institution the flexibility to set its own volume threshold would result in unintended consequences. It provides two examples: (i) a smaller entity that has a lower negligible volume threshold could more easily have certain modellable risk factors than a large institution; (ii) in a retail-driven market (e.g. US municipal debt), the small average sizes will probably be considered negligible for a large bank. The respondent suggests creating an industry-standardised threshold as a function of existing MiFID/MiFIR (Markets in Financial Instruments Regulation) requirements. Specifically, it proposes leveraging the MiFID/MiFIR rules and defining as retail any transaction whose size is below EUR 100 000.</p> <p>Some respondents suggest some ‘rules of thumb’ for classifying a quote/trade as being of non-negligible volume. Specifically, two respondents recommend that all committed quotes and trades centrally cleared or conducted over regulated trading venues should be classified as being of non-negligible volume.</p>	<p>the EBA not to consider quotes from products sold on retail markets eligible as verifiable prices.</p> <p>The feedback from the responses indicate that no fixed absolute value should be set. In addition, even a relative value has various downsides.</p> <p>The EBA maintains a principle-based approach.</p>	



Comments	Summary of responses received	EBA analysis	Amendments to the proposals
	<p>One respondent suggests that it should be possible to use all quotes, provided that they reflect normal market conditions.</p>		
<p>Question 4. How would you define and check for an “unreasonably large bid–offer spread as compared to usual bid–offer spreads, reflective of normal market conditions”, for the purpose of assessing the validity of a price observation obtained from a committed quote? In your response, please provide a detailed reasoning.</p>	<p>Similarly to Question 3, many respondents deem that setting a one-size-fits-all approach or fixed thresholds would not be appropriate where the bid–ask spread largely depends on the liquidity of the market and/or it would not be available for one-sided quotes. Some respondents suggest a principle-based approach.</p> <p>One respondent suggests that it should be possible to use all quotes, provided that they reflect normal market conditions.</p>	<p>The feedback indicates that no fixed absolute value should be set.</p> <p>The EBA maintains a principle-based approach.</p>	<p>The principle-based approach has been maintained, with rewording provided.</p>
<p>Question 5. Do you see any problems with requiring that institutions are allowed to use data from external data providers as input to the modellability assessment only where the external data providers are regularly subject to an independent audit</p>	<p>Several respondents support the requirement for data providers to be subject to an independent audit. Some of them specify the need to agree on such a requirement at the international level, in order to create a level playing field and/or to avoid multiple/duplicative audits.</p> <p>One respondent points out that a significant deviation from the BCBS standard could introduce additional costs and risk for both institutions and vendors, and may negatively impact the availability of third-party data.</p> <p>Some respondents see potential problems: it must be ensured that the requirements can be fulfilled with reasonable efforts made by the data providers, otherwise</p>	<p>Broad support was expressed for the requirement for third-party vendors to be subject to an independent audit.</p>	<p>No amendments are needed.</p>



Comments	Summary of responses received	EBA analysis	Amendments to the proposals
(independent of whether the price is shared with the institution or not)? If so, please describe them thoroughly (i.e. for which data providers and the reasons for it).	the information needed for the model would not be available or could come at a significant cost.		
Question 6. Do you have any proposals on additional specifications that could be included in the legal text in order to ensure that verifiable prices provided by third-party vendors meet the requirements of this Regulation?	One respondent suggested that the implementation approach should be 'pragmatic', both for the requirements on third-party vendors and for the alignment between the definition of committed quotes and market convention (mandating committed quotes to be a legal obligation to buy and sell the corresponding financial instrument at that price if requested is not fully consistent with convention in many OTC markets). The respondent also suggests limiting the scope and granularity of the annual independent audit.	No specific proposals were provided by the respondents to the consultation (except by one). The EBA included general qualitative requirements to be met by third-party vendors in Article 2.	Qualitative requirements on the scope of the annual independent audit were included in Article 2(7).
Question 7. How relevant are the provisions outlined above for your institution? How many and which curves, surfaces or cubes are (planned to be) represented by a mathematical function with function parameters chosen as risk factors in	One respondent conducted a survey with 11 participating institutions regarding the current use of parametric functions in their regulatory value-at-risk (VaR) models. The results show that parametric functions are almost exclusively used for modelling implied volatility. Among the broad risk factor categories, parametric functions are used by a majority of the survey participants for interest rates and by about half of the survey respondents for FX and equities. Few survey participants use them for commodities while none use them for credit spreads.	From the results of a survey provided as feedback to the consultation, it emerged that parametric models are currently used by several institutions, mainly for interest rates, FX and equity implied volatilities. The most relevant case is where an implied volatility surface or cube is parametrised in the strike dimension but not in the expiry or tenor dimension. Several participants in the survey expressed their intention to extend the use of parametric models in the future. It has been noted that the FRTB might encourage institutions towards parametric models, in	No amendments are needed.



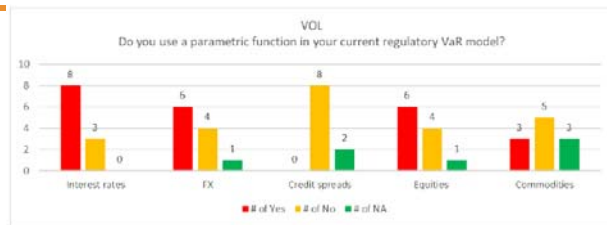
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your (future) internal model?



their attempt to use less redundant, more orthogonal risk factors.

Some respondents stated that they are not currently using any parametric function parameters as risk factors.

In addition, the survey showed that the SABR model is the model most used by institutions, with more than half of the participants declaring that they are currently using it. The survey shows that many institutions use parametric functions to parametrise volatility surfaces or cubes in the strike dimension exclusively. In most cases, normal tenor-by-tenor bucketing is used in the expiry dimension (or in the expiry and maturity dimensions for interest rate volatility cubes) and the ‘smile’ is defined using a separate set of parameters for each tenor bucket.

Two respondents report the intention to extend the use of parametric models in the future. Two respondents consider parametric functions as a practical tool to represent the joint dynamic of a whole set of market data, and remark that some parts of the FRTB framework (e.g. PLA and capitalisation rules) could encourage institutions to use less redundant, more orthogonal risk factors.

Several respondents report that they currently make almost no use of parametric functions in their regulatory VaR models.



Comments	Summary of responses received	EBA analysis	Amendments to the proposals
	<p>Two respondents point out that parametric models are frequently used in pricing, even if they might not be used in risk management.</p> <p>One respondent argues that the modellability assessment should generally not take place at parameter level because in this case the assessment outcome could depend on the choice of pricing models, thereby potentially leading to market distortions.</p>		
<p>Question 8. Do you have a preference for any of the options outlined above? For which reasons? Please motivate your response.</p>	<p>Neither of the two options receive substantial support from respondents. In fact, many respondents consider both options impractical; see Question 9 for details.</p> <p>Moderate support is expressed for Option 1. It is remarked that, of the two alternatives, Option 1 is the best. One respondent considers it a valid and, for some risk factors, elegant approach that tends to avoid arbitrage situations. Nevertheless, given its operational intensity, Option 1 may not be suitable for all risk factors.</p> <p>One respondent remarks that Option 1 does not constitute a derogation, as the approach is already covered by the general provisions on derived risk factors and the possibility of representing NMRFs as the sum of a modellable risk factor and a non-modellable basis (see footnote [3] in MAR 31.13(2)).</p> <p>Respondents express problems with understanding Option 2.</p> <p>One respondent states a preference for Option 2, under the assumption that the stressed scenario risk measure for</p>	<p>The EBA acknowledges the issues raised by the respondents to the CP in relation to both options.</p> <p>The EBA would like to highlight the fact that both options were mainly proposed with a view to seeking feedback from stakeholders on a possible way forward. In particular, both options imply transformations (e.g. redefinition of risk factors) that are outside the scope of these RTS.</p> <p>The EBA acknowledges that 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 any case, the assessment of modellability specified in these RTS is performed based on the list of risk factors that an institution includes in its internal model approach. For each of those risk factors, the institution assesses whether it is modellable or not. It is worth clarifying that institutions are free to redefine risk factors (in case some of those risk factors do not pass the</p>	<p>No amendments are needed.</p>



Comments	Summary of responses received	EBA analysis	Amendments to the proposals
	<p>non-modellable buckets may also be calculated using shocks to the parameters.</p>	<p>assessment of modellability), 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 PLA test.</p> <p>Therefore, the EBA acknowledges that a more general approach is desirable that does not excessively constrain institutions' modelling choices.</p>	
<p>Question 9. Do you consider any of the options outlined above as impossible or impractical? For which reasons? Please motivate your response.</p>	<p>A large number of respondents criticise both options as impractical.</p> <p>Many participants point out that Option 1 would potentially require maintaining a large number of alternative model calibration histories to cater for changing modellability assessments. Some of the respondents conclude that Option 1 is feasible only for models that allow 'on-the-fly' calibration, for which a complete input data history is available and for which human intervention in the calibration process can be substituted by algorithmic intelligence. One of the respondents remarks that for some risk factors it is common practice to store historical data in the form of parameters, rather than input data (e.g. SABR parameters). Two respondents consider the required historical recalibrations outright impossible. One respondent remarks that Option 1 entails a loss of information, as not all available data are taken into account. Another respondent points out that the exclusion of buckets could lead to underdetermined calibrations (e.g. three parameters calibrated to only two data points).</p>	<p>The EBA acknowledges the issues raised in relation to both options, which the respondents to the CP seem to consider impractical.</p> <p>In particular, Option 1 is seen as requiring the maintenance of a potentially large number of versions of alternative calibrations, while Option 2 is seen as requiring new pricing functions to be built based on data points on the curve/surface/cube.</p> <p>The EBA acknowledges that a more general approach is desirable that does not excessively constrain institutions' modelling choices.</p>	<p>Amendments were made to the new Article 6 to account for the diversity in modelling choices.</p>



Comments	Summary of responses received	EBA analysis	Amendments to the proposals
	<p>Option 2 is dismissed by most respondents as substantially impractical because it requires redefining risk factors and building new pricing functions. It is claimed that this would render parametric approaches almost useless. Moreover, two respondents argue that using different risk factors in internal and regulatory risk measurement would violate the qualitative requirements in Article 325bi (1)(f) of CRR2.</p>		
<p>Question 10. Do you have alternative proposals to define the consequence for the modellability of the parameters where some buckets of a curve, surface or cube are modellable whilst others are non-modellable?</p>	<p>General remarks as well as concrete proposals were received for this question.</p> <p>Two respondents argue that including a principle-based derogation could ensure a more meaningful mapping of verifiable prices to risk factors. Institutions should be able to choose from several options to adequately account for parameters and internal model approach implementation specificities.</p> <p>Many respondents argue that the rules should reflect the hierarchies that typically are observed among the parameters of a model. In particular, in most models one could distinguish a parameter measuring the overall (or ATM) level of implied volatility from further parameters describing the shape of the curve or surface (e.g. skew and smile). The participants argue that in this situation the assessment of modellability of the ATM parameter should be independent of the assessment of the other parameters. Several of the respondents propose that the ATM parameter should be considered modellable whenever there are sufficient verifiable prices for the ATM bucket of implied volatility.</p>	<p>The EBA takes note that the dominant use case seems to be where an implied volatility surface or cube is parametrised in the strike dimension but not in the maturity or tenor dimension.</p> <p>The EBA acknowledges that a more general approach is desirable that does not excessively constrain institutions' modelling choices.</p>	<p>Amendments were made to the new Article 6 to account for the diversity in modelling choices.</p>



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Several respondents suggest including a dedicated methodology for the most common situation where an implied volatility surface or cube is parametrised in the strike dimension but not in the expiry or tenor dimension. In this case, the parametrisation of the surface or cube is effectively made up of independent smile parametrisations attached to a grid of expiries (and tenors).

One respondent provides a concrete suggestion for amending Article 5 in the CP:

'3(d): By way of derogation from point (b), where the parametric function for an implied volatility curve, surface, or cube belongs to the following general class:

- i. the strike dimension is parameterised independently from the time dimension(s); and*
- ii. the institution has demonstrated that one parameter in the strike dimension measures the overall level of implied volatility (ATM) with other distinct parameters measuring the shape of the volatility (smile, skew);*

an institution may assess modellability of the level and shape parameters separately, in accordance with paragraph 2, so that

- i. modellability of parameters shall be assessed at bucket (expiry)/Grid (expiry × maturity) level rather than the entire surface;*
- ii. if there is a sufficient number of observations, as per paragraph 3 of Article 4, in the ATM strike*



Comments	Summary of responses received	EBA analysis	Amendments to the proposals
	<p><i>bucket, then the corresponding model parameter is deemed modellable;</i></p> <p><i>iii. if in addition, there is a sufficient number of observations, as per paragraph 3 of Article 4, in either the ITM or OTM strike bucket, then the model parameter measuring volatility skew is also deemed modellable;</i></p> <p><i>iv. if there is a sufficient number of observations, as per paragraph 3 of Article 4, in both the ITM and OTM strike buckets, then the model parameters measuring volatility skew and smile are deemed modellable.</i></p>		
	<p><i>The ATM, ITM and OTM buckets can be defined either using the standard, pre-defined set, as per paragraph 3 of Article 6, in which case Bucket 3 in Table 1 will be used for assessing modellability of the parameters describing ATM/level of implied volatility; or own bucketing approach, in which case the institution will define the strike range corresponding to each of the parameters of the model, measuring ATM, skew and smile.'</i></p>		
	<p>Two other respondents in their proposal provide a clear indication of how ATM, ITM and OTM buckets could be defined. They suggest that the ATM bucket should be the bucket around ATM volatility, while the OTM bucket would comprise all strikes lower than, and the ITM bucket all strikes higher than, the ATM bucket. In the case of supervisory buckets, bucket 3 would be the ATM bucket, while the unions of buckets 1 and 2, or 4 and 5, would constitute the OTM and ITM buckets, respectively.</p>		



Comments	Summary of responses received	EBA analysis	Amendments to the proposals
<p>Question 11. Do you intend to apply paragraph 4? If so, for which risk factors will it be relevant? Do you expect any implementation issues related to it? Please explain expected issues thoroughly.</p>	<p>As of now, no respondent is able to give a reliable indication of whether or not they will make use of the provision in the future. One respondent states it cannot rule it out and another respondent assesses it will be very useful in practice, although it will make the outcome of the modellability assessment dependent on the institution's portfolio.</p> <p>One respondent suggests removing requirement (a) regarding the zero exposure of the institution to the longer maturities, which it deems punitive.</p> <p>Two respondents remark that the provision appears operationally very complex. Two other participants raise the concern that the option might not be available for banks that rely on third-party vendors for their modellability assessments. However, they are still supportive of the provision because they welcome every regulatory measure that bolsters demand for bonds with a short remaining maturity.</p> <p>Finally, one respondent suggests extending the derogation to other risk factor categories where applicable, in particular to rates. One relevant example is inflation bonds, where liquidity is concentrated at the longer end of the curve.</p>	<p>The EBA takes note of the comments received and maintains the provision.</p>	<p>No amendments are needed.</p>
<p>Question 12. Do you agree with the outlined methodology for the assessment of modellability of risk</p>	<p>One respondent agrees with the methodology proposed. One respondent deems that the condition set out in Article 3(b) (on the extraction of the value of the risk factor from a verifiable price) is too strict for certain types of products, such as exotic derivatives.</p>	<p>The EBA does not consider that amendments to Article 3 (on representativeness) are needed based on the specific feedback received.</p>	<p>No amendments are needed.</p>



Comments	Summary of responses received	EBA analysis	Amendments to the proposals
factors? If not, please explain why.	<p>Two respondents state that, as soon as a liquid new market reference rate is established, no additional problems are expected, while one respondent recognises that it is necessary to ensure the equivalence of the new benchmark.</p> <p>Many respondents point out that the benchmark rate transition would pose problems because of the lack of liquidity, and they ask for a migration agreement (such as grandfathering of the risk factor associated with the old reference rate). One respondent recognises that it is too early to assess and explore the full impact of the reform.</p>	<p>The EBA takes note of the fact that the benchmark transition may pose some problems (especially because of the lack of liquidity of the new benchmark rate) and of the requests that were expressed for some derogations relative to benchmark rates (e.g. grandfathering of instruments referencing the old rates, counting verifiable prices referencing old rates for the new rates and vice versa).</p>	No amendments are needed.
<p>Question 14. How do you intend to integrate the risk factor modellability assessment (i.e. RFET) into the processes of your institution? Do you expect those data to be used for the purpose of the RFET only or do you think those data would increase the data availability used e.g. for the calibration of your internal model (under para. 31.26 of 2019 Basel rules)? What percentage</p>	<p>All respondents agree that data used for the modellability assessment will play no big role or no role at all in model calibration.</p> <p>Some respondents state that they do not expect to integrate RFET data into the calibration of their internal models. Other respondents declare that they see no direct link between the data used for the modellability assessment and the historical dataset for model calibration. One respondent explains that it will be difficult to leverage data used for the modellability assessment for model calibration, as verifiable price data will typically not meet the requirements of regular frequency (e.g. daily) and consistent cut-off times.</p> <p>Two respondents believe that the modellability assessment will be a stand-alone test, independent of the</p>	<p>The EBA takes note of the fact that data used in the modellability assessment will typically not be used by institutions for calibrating their internal models.</p>	No amendments are needed.



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**Amendments to
the proposals**

of data used for the RFET do you think will be used also for the calibration of your internal model?	internal model processes. Another considers the modellability assessment to be an added regulatory requirement that requires the development of new dedicated processes.
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