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To:	Ms Thérèse BLANCHET, Secretary-General of the Council of the European Union
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Subject:	COMMISSION DELEGATED REGULATION (EU) …/... of 20.10.2023 supplementing Regulation (EU) No 575/2013 of the European Parliament and of the Council with regard to regulatory technical standards on the calculation of the stress scenario risk measure

Delegations will find attached document C(2023) 6749 final.

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EUROPEAN
COMMISSION

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COMMISSION DELEGATED REGULATION (EU) …/...

of 20.10.2023

supplementing Regulation (EU) No 575/2013 of the European Parliament and of the Council with regard to regulatory technical standards on the calculation of the stress scenario risk measure

(Text with EEA relevance)

EXPLANATORY MEMORANDUM

1. CONTEXT OF THE DELEGATED ACT

Article 325bk(3) of Regulation (EU) No 575/2013 ('the Regulation') empowers the Commission to adopt, following submission of draft standards by the European Banking Authority (EBA), and in accordance with Articles 10 to 14 of Regulation No (EU) 1093/2010, delegated acts specifying how institutions are to develop extreme scenarios of future shock applicable to non-modellable risk factors and how they are to apply those extreme scenarios of future shock to those risk factors, a regulatory extreme scenario of future shock which institutions may use when they are unable to develop an extreme scenario of future shock or which competent authorities may require that institution apply when not satisfied with the extreme scenario of future shock developed by the institution, the circumstances under which institutions may calculate a stress scenario risk measure for more than one non-modellable risk factor, how institutions are to aggregate the stress scenario risk measures of all non-modellable risk factors.

In accordance with Article 10(1) of Regulation No (EU) 1093/2010 establishing the EBA, the Commission shall decide within three months of receipt of the draft standards whether to endorse the drafts submitted. The Commission may also endorse the draft standards in part only, or with amendments, where the Union's interests so require, having regard to the specific procedure laid down in those Articles.

2. CONSULTATIONS PRIOR TO THE ADOPTION OF THE ACT

In accordance with the third subparagraph of Article 10(1) of Regulation No (EU) 1093/2010, the EBA has carried out a public consultation on the draft technical standards submitted to the Commission in accordance with Article 325bk(3) of Regulation (EU) No 575/2013 ('the Regulation'). A consultation paper was published on the EBA internet site on 04 June 2020, and the consultation closed on 04 September 2020. Moreover, the EBA invited the EBA's Banking Stakeholder Group set up in accordance with Article 37 of Regulation No (EU) 1093/2010 to provide advice on them. Together with the draft technical standards, the EBA has submitted an explanation on how the outcome of these consultations has been taken into account in the development of the final draft technical standards submitted to the Commission.

Together with the draft technical standards, and in accordance with the third subparagraph of Article 10(1) of Regulation No (EU) 1093/2010, the EBA has submitted its Impact Assessment, including its analysis of the costs and benefits, related to the draft technical standards submitted to the Commission. This analysis is available at Regulatory Technical Standards (RTS) on the capitalisation of non-modellable risk factors under the FRTB | European Banking Authority (europa.eu), pages 66-90 of the Final Draft Regulatory Technical Standards package.

3. LEGAL ELEMENTS OF THE DELEGATED ACT

The RTS foresee two overarching methods to develop the extreme scenarios of future shock for non-modellable risk factors. The first - the direct method – requires institutions to develop the extreme scenario of future shock for a given non-modellable risk factor by calculating the expected shortfall measure of the losses occurring when varying that risk factor according to its historically observed levels during a stress period. Such method may be used only when the number of observations is sufficient to ensure a robust estimation of the expected shortfall

measure. The second – the stepwise method – requires institutions to obtain the extreme scenario of future shock for a given non-modellable risk factor by calculating an expected shortfall measure on the returns observed for that risk factor, and calculating the loss corresponding to the movement in the risk factor identified by that expected shortfall measure. Under such method, depending on the data availability for a given risk factor, the RTS require institutions to either estimate or approximate the expected shortfall measures. Both under the direct and stepwise method, the RTS require institutions to adjust the extreme scenario of future shock to reflect the statistical uncertainty in determining the extreme scenario of future shock by introducing an uncertainty compensation factor.

In addition, the RTS specify that the regulatory extreme scenario of future shock is the one that leads to the maximum possible loss due to a movement in the non-modellable risk factor. When such loss is infinite, the RTS specify that institutions are to use an expert based approach to identify a loss due to a change in the value taken by the non-modellable risk factor that will not be exceeded with a level of certainty equal to 99,95%.

Furthermore, the RTS set out that institutions may calculate a single stress scenario risk measure for more than one non-modellable risk factor, when those risk factors belong to the same standardised bucket and institutions used that standardised bucket when assessing the modellability of those risk factors under Article 325be of the Regulation.

Finally, the RTS require institutions to aggregate the stress scenario risk measures in accordance with the aggregation formula provided in the international standards.

COMMISSION DELEGATED REGULATION (EU) …/...

of 20.10.2023

supplementing Regulation (EU) No 575/2013 of the European Parliament and of the Council with regard to regulatory technical standards on the calculation of the stress scenario risk measure

(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 the European Parliament and of the Council of 26 June 2013 on prudential requirements for credit institutions and amending Regulation (EU) No 648/2012[1], and in particular Article 325bk(3), fourth subparagraph, thereof,

Whereas:

(1) To ensure a level playing field among institutions in the Union and to minimise regulatory arbitrage, the methodologies for developing extreme scenarios of future shock for non-modellable risk factors should be based on the international standards agreed in January 2019 by the Basel Committee on Banking Supervision (BCBS) (Basel framework), and should take into account the materiality of the own funds requirements for non-modellable risk factors. Therefore, specific and detailed methodologies for developing extreme scenarios of future shock for non-modellable risk factors should be laid down.

(2) The quality of data and the number of observations that are available to determine future shocks for non-modellable risk factors may vary significantly from one non-modellable risk factor to another. It is therefore necessary to ensure that extreme scenarios of future shock cover a wide range of cases. For that reason, it is necessary to provide for alternative sets of methodologies that institutions may use depending on the quality and the number of observations that are available for each non-modellable risk factor. Furthermore, institutions should reflect in their calculations the fact that fewer available data leads to a higher uncertainty of the estimates or values used to determine the extreme scenarios of future shock and should therefore become more conservative.

(3) Given its accuracy, one method to determine the extreme scenario of future shock for a non-modellable risk factor should consist of directly calculating the expected shortfall measure of the losses that would occur when applying a shock to that non-modellable risk factor with the historically observed levels during the relevant stress period. However, such method would provide reliable results only where the institution has a significant amount of data for that stress period, and would require many loss calculations per risk factor leading to a high computational effort. It is

[1] OJ L 176, 27.6.2013, p. 1.

therefore necessary to provide for an alternative method that requires a significant lower number of loss calculations and applies a stepwise approach. Under that alternative method, institutions should first calculate an expected shortfall measure on the returns observed for a non-modellable risk factor, and then calculate the loss that corresponds to the movement in the risk factor identified by that expected shortfall measure. Such stepwise approach should also address the specific case where the number of observations for a non-modellable risk factor in the stress period concerned is insufficient to obtain accurate and prudent estimates. Since that situation can be expected to occur only in a limited number of cases, those cases should be addressed by leveraging on methodologies that institutions have implemented for other non-modellable risk factors for which they have more observations or, where possible, on the alternative standardised approach.

(4) The Basel framework requires that the market risk own funds requirements for non-modellable risk factors have to be calibrated to a period of stress that is the same for all non-modellable risk factors that belong to the same broad category of risk factors. To determine extreme scenarios of future shock on the basis of data observed during that identified period, institutions should collect data for non-modellable risk factors for that identified stress period.

(5) To ensure harmonisation of the calculation of the stress scenario risk measures across institutions in the Union, it is necessary to specify how institutions should identify the stress period. Those specifications should be proportionate to the purpose, and should neither require an excessive computational effort, nor the implementation of specific pricing methods. The global financial crisis of 2007-2008 has been a major stress event for the financial system. The stress period to be identified should therefore start at least from 1 January 2007. To ensure that the stress period remains relevant to an institution's trading portfolio, institutions should periodically review that stress period. However, to limit the administrative burden on institutions, it should be only required that the frequency of such review follows at least the same quarterly frequency as the corresponding supervisory reporting.

(6) The Basel framework requires that institutions determine extreme scenarios of future shock by using the pricing methods of their risk measurement model, as those methods are used in the context of the back-testing and the profit and loss attribution test. There may be scenarios of future shock for which those pricing methods cannot determine the corresponding loss for some financial instruments or commodities. Where that is the case, institutions should act in a prudentially sound manner and target only those instruments that are affected by the pricing failure. The methodologies implemented by the institution to address those cases are not to affect in any way the results of the back-testing and the profit and loss attribution requirements laid down in Commission Delegated Regulation (EU) 2022/2059[2].

(7) Article 325bk(3), second subparagraph, of Regulation (EU) No 575/2013 requires that the level of own funds requirements for market risk for a non-modellable risk factor is to be as high as the expected shortfall measure for that risk factor referred in Article 325bb of that Regulation, i.e. an expected shortfall of losses at a 97,5% confidence

[2] Commission Delegated Regulation (EU) 2022/2059 of 14 June 2022 supplementing Regulation (EU) No 575/2013 of the European Parliament and of the Council with regard to regulatory technical standards specifying the technical details of back-testing and profit and loss attribution requirements under Articles 325bf and 325bg of Regulation (EU) No 575/2013 (OJ L 276, 26.10.2022, p. 47)

level over a period of stress. The statistical estimators and the parameters for determining that expected shortfall measure should therefore be set in such a way that that confidence level is met.

(8) According to the Basel framework, the regulatory extreme scenario of future shock should be the one leading to the maximum loss that may occur due to a change in the non-modellable risk factor. It should therefore be specified what institutions should consider as maximum loss in cases where the maximum loss is not finite.

(9) To ensure consistency with the Basel framework, institutions should be able to determine the stress scenario risk measure for more than one non-modellable risk factors where those non-modellable risk factors are part of a curve or a surface, and where those risk factors belong to the same non-modellable bucket among those set out in Commission Delegated Regulation (EU) 2022/2060[3], and provided that institutions have assessed their modellability in accordance with the standardised bucketing approach referred to in that Delegated Regulation. Institutions should therefore be allowed to compute a single stress scenario risk measure for more than one non-modellable risk factor under those conditions only.

(10) To ensure the adequacy of the own funds requirements for non-modellable risk factors with the risk profile of institutions, institutions should reflect in the aggregation of the stress scenario risk measures those risks that were not yet captured when determining the extreme scenario of future shock, including the liquidity horizons of the non-modellable risk factors. To ensure a level playing field, the stress scenario risk measures should be aggregated by applying the aggregation formula agreed in the Basel framework.

(11) This Regulation is based on the draft regulatory technical standards submitted to the Commission by the European Banking Authority.

(12) The European Banking Authority 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 advice of the Banking Stakeholder Group established in accordance with Article 37 of Regulation (EU) No 1093/2010 of the European Parliament and of the Council[4],

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[3] Commission Delegated Regulation (EU) 2022/2060 of 14 June 2022 supplementing Regulation (EU) No 575/2013 of the European Parliament and of the Council with regard to regulatory technical standards specifying the criteria for assessing the modellability of risk factors under the internal model approach (IMA) and specifying the frequency of that assessment under Article 325be(3) of that Regulation (OJ L 276, 26.10.2022, p. 60).

[4] 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).

HAS ADOPTED THIS REGULATION:

CHAPTER 1
DEVELOPMENT AND APPLICATION OF THE EXTREME SCENARIOS OF FUTURE SHOCK

Article 1

Development of extreme scenarios of future shock and their application at risk factor level

Institutions shall develop the extreme scenarios of future shock for non-modellable risk factors by applying either of the following methods:

(a) the direct method set out in Article 2, provided that all of the following conditions are met:

  (i) the institutions concerned have criteria to determine whether to use the direct method referred to in point (a) or the stepwise method referred to in point (b), and those criteria are consistent over time;

  (ii) for the purposes of point (a)(i), institutions document any change from the direct method referred to in point (a) to the stepwise method referred to in point (b), and vice versa, including a justification of such change;

  (iii) institutions identify, for internal monitoring purposes, the extreme scenario of future shock in accordance with the stepwise method referred to in point (b) on a daily basis for 20 business days preceding each date for which the own funds requirements for market risk are reported;

  (iv) the number of losses in the time series of losses referred to in Article 2(1), point (a)(iii), is equal to or greater than 200.

(b) the stepwise method set out in Article 3.

Article 2

Direct method – non-modellable risk factors

1. Under the direct method, institutions shall apply the following steps in the following order:

(a) they shall determine a time series of losses as follows:

  (i) they shall determine, in accordance with Article 3, the time series of 10 business days returns for the non-modellable risk factor for the stress period determined in accordance with Article 12;

  (ii) they shall apply to the value of the non-modellable risk factor the shocks that correspond to the returns in the time series of 10 business days returns determined in accordance with point (i);

  (iii) they shall determine the time series of losses by calculating the losses which would occur if the non-modellable risk factor takes the values obtained in accordance with point (ii);

(b) they shall calculate the estimate of the right-tail expected shortfall in accordance with Article 11(2) for the time series of losses obtained in accordance with point (a);

2. At the end of the process set out in the first paragraph, a shock leading to the loss equal to the estimate referred to in paragraph 1, point (b), shall constitute the extreme scenario of future shock for the non-modellable risk factor.

Article 3

Stepwise method – non-modellable risk factors

1. Under the stepwise method, institutions shall apply the following steps in the following order:

(a) they shall, in accordance with Article 7, determine the time series of 10 business days returns for the non-modellable risk factor for the stress period determined in accordance with Article 12;

(b) they shall determine an upward and a downward calibrated shock from the time series of 10 business days returns referred to in point (a) in accordance with:

(i) the historical method set out in Article 8, where the number of returns in the time series of 10 business days returns referred to in point (a) of this paragraph is equal to or greater than 200;

(ii) the asymmetrical sigma method set out in Article 9, where the number of returns in the time series of 10 business days returns referred to in point (a) of this paragraph is lower than 200 and equal to or greater than 12;

(iii) the fallback method set out in Article 10, where the number of returns in the time series of 10 business days returns referred to in point (a) of this paragraph is lower than 12.

(c) for each shock included in the following grid, institutions shall calculate the loss that occurs when that shock is applied to the non-modellable risk factor:

$$grid = \left\{ \frac{4}{5} \cdot CS_{\text{down}}, CS_{\text{down}}, \frac{4}{5} \cdot CS_{\text{up}}, CS_{\text{up}} \right\}$$

where:

– CS_{down} is the downward calibrated shock determined in accordance with point (b);

– CS_{up} is the upward calibrated shock determined in accordance with point (b).

2. The shock which leads to the highest loss, among the shocks included in the grid referred to in paragraph 1, point (c), shall constitute the extreme scenario of future shock for the non-modellable risk factor.

Article 4

Development and application of the extreme scenarios of future shock at standardised bucket level

Where institutions calculate a stress scenario risk measure for more than one non-modellable risk factor, they shall determine the extreme scenario of future shock for the non-modellable standardised bucket to which those risk factors belong in accordance with Delegated Regulation (EU) 2022/2060 by applying either of the following methods:

(a) the direct method set out in Article 5, provided that all of the following conditions are met:

(i) institutions have defined criteria to determine whether to use the direct method referred to in Article 5 or the stepwise method referred to in Article 6, and those criteria are consistent over time;

(ii) for the purposes of point (a)(i), institutions document any change from the direct method to the stepwise method, and vice versa, including a justification of such change;

(iii) in addition to use of the direct method, institutions complementarily identify the extreme scenario of future shock in accordance with the stepwise method referred to in point (b) on a daily basis for 20 business days preceding each date for which the own funds requirements for market risk are reported;

(iv) the number of losses in the time series of losses referred to in Article 5(1), point (a)(iv), is equal to or greater than 200.

(b) the stepwise method set out in Article 6.

Article 5

Direct method – non-modellable standardised buckets

1. When applying the direct method to non-modellable risk factors belonging to non-modellable standardised buckets, institutions shall apply the following steps in the following order:

(a) they shall determine a time series of losses as follows:

(i) for each non-modellable risk factor within the non-modellable bucket, they shall, in accordance with Article 7, determine the time series of nearest to 10 business days returns for the stress period determined in accordance with Article 12;

(ii) they shall remove from each time series obtained in accordance with point (i), the values corresponding to dates for which not all those time series have a return;

(iii) for each non-modellable risk factor within the non-modellable bucket, they shall apply to the value of the non-modellable risk factor the shocks that corresponds to the returns in the corresponding time series obtained in accordance with point (ii);

(iv) they shall determine the time series of losses by calculating, for each date corresponding to a value in the time series obtained in accordance with point (iii), the loss that would occur if the non-modellable risk factors in the non-modellable bucket takes the values included in those time series for that date.

(b) they shall calculate the estimate of the right-tail expected shortfall in accordance with Article 11(2) for the time series of the losses obtained in accordance with point (a) of this paragraph.

2. The scenario of shocks leading to a loss equal to the estimate of the right-tail expected shortfall obtained in accordance with paragraph 1, point (b), shall constitute the extreme scenario of future shock for the non-modellable bucket.

Article 6

Stepwise method – non-modellable standardised buckets

1. When applying the stepwise method to non-modellable risk factors belonging to non-modellable standardised buckets, institutions shall determine the extreme scenario of future shock by applying the following steps in the following order:

(a) for each non-modellable risk factor within the non-modellable standardised bucket they shall, in accordance with Article 7, determine the time series of 10 business days returns for the stress period determined in accordance with Article 12;

(b) for each non-modellable risk factor within the non-modellable standardised bucket, they shall determine an upward and a downward calibrated shock from the corresponding time series of 10 business days returns referred to in point (a) in accordance with:

(i) the historical method set out in Article 8, where the number of returns in all the time series of 10 business days returns referred to in point (a) of this paragraph corresponding to the non-modellable risk factors in the non-modellable bucket is equal to or greater than 200;

(ii) the asymmetrical sigma method set out in Article 9, where the condition set out in point (b)(i) of this paragraph for using the historical method is not met, and the number of returns in all the time series of 10 business days returns referred to in point (a) of this paragraph corresponding to the non-modellable risk factors in the non-modellable bucket is equal to or greater than 12;

(iii) the fallback method set out in Article 10, where there is at least one non-modellable risk factor in the non-modellable bucket for which the number of returns in the time series of 10 business days returns referred to in point (a) of this paragraph is lower than 12;

(c) they shall calculate both of the following:

(i) the loss corresponding to a scenario where the corresponding upward calibrated shock determined in accordance with point (b), multiplied by a parameter β, is applied to each risk factor in the non-modellable bucket;

(ii) the loss corresponding to a scenario where the corresponding downward calibrated shock determined in accordance with point (b), multiplied by a parameter β, is applied to each risk factor in the non-modellable bucket.

For the purposes of point (c), institutions shall multiply the upward and downward calibrated shocks by the parameter β in two cases, with $\beta = 1$ and $\beta = \frac{4}{5}$.

2. The scenario of shocks leading to the highest loss among those calculated in accordance with paragraph 1, point (c), shall constitute the extreme scenario of future shock for the non-modellable standardised bucket.

Article 7

Determination of the time series of 10 business days returns

1. Institutions shall determine the time series of 10 business days returns for the stress period in relation to a given non-modellable risk factor by applying the following steps in the following order:

(a) they shall determine the time series of observations for the non-modellable risk factor for the stress period and include in that time series only one observation per business day that shall represent actual market data;

(b) they shall extend the time series referred to in point (a) by including the observations available within the period of 20 business days following the stress period; where the reference date for the calculation of the stress scenario risk measure is less than 20 business days after the end of the stress period, institutions shall include those observations that are available from the end of the stress period to the reference date;

(c) in relation to each date D_t, for which there is an observation in the time series resulting from point (a) excluding the last observation, institutions shall determine, among the dates with an observation in the extended time series referred to in point (b), the date $D_{t'}$ following D_t that minimises the following value:

$$v = \left| \frac{10 \text{ business days}}{D_{t'} - D_t} - 1 \right|$$

where:

– D_t is the date for which there is an observation in the time series referred to in point (a), excluding the last observation;

– $D_{t'}$ is a date following D_t with an observation in the extended time series referred to in point (b);

– the difference $D_{t'} - D_t$ is expressed in business days;

(d) for each date D_t, for which there is an observation in the time series resulting from point (a) excluding the last observation, they shall determine the corresponding 10 business days return by determining the return for the non-modellable risk factor over the period between the date D_t of the observation and the date $D_{t'}$ minimising the value v in accordance with point (c), and subsequently rescaling it to obtain a return over a 10 business days period by multiplying the return with $\sqrt{\frac{10 \text{ business days}}{D_{t'} - D_t}}$.

For the purposes of point (c), where there is more than one date minimising that value, the date $D_{t'}$ shall be the date among those minimising that value that occurred later in time.

2. The time series referred to in paragraph 1, point (a), shall at least include the observations that were used for calibrating the scenarios of future shocks referred to in Article 325bc of Regulation (EU) No 575/2013, where that risk factor was previously assessed to be modellable in accordance with Article 325be of that Regulation.

Article 8

Downward and upward calibrated shock with the historical method

1. Under the historical method, institutions shall determine the downward calibrated shock from a time series of 10 business days returns for a non-modellable risk factor in accordance with the following formula:

$$downward\ calibrated\ shock = \widehat{\mathrm{ES}}_{\mathrm{Left}}(Ret) \cdot \left(0{,}95 + \frac{1}{\sqrt{N - 1{,}5}}\right)$$

where:

– *Ret* denotes the time series of 10 business days returns of the non-modellable risk factor;

– $\widehat{\mathrm{ES}}_{\mathrm{Left}}(Ret)$ is the estimate of the left-tail expected shortfall for the time series *Ret* calculated in accordance with Article 11(1);

– *N* is the number of returns in the time series *Ret*.

2. Institutions shall determine the upward calibrated shock from a time series of 10 business days returns for a non-modellable risk factor with the historical method in accordance with the following formula:

$$upward\ calibrated\ shock = \widehat{\mathrm{ES}}_{\mathrm{Right}}(Ret) \cdot \left(0{,}95 + \frac{1}{\sqrt{N - 1{,}5}}\right)$$

where:

– *Ret* denotes the time series of 10 business days returns of the non-modellable risk factor;

– $\widehat{\mathrm{ES}}_{\mathrm{Right}}(Ret)$ is the estimate of the right-tail expected shortfall for the time series *Ret* calculated in accordance with Article 11(2);

– *N* is the number of returns in the time series *Ret.*

Article 9

Downward and upward calibrated shock with the asymmetrical sigma method

Under the asymmetrical sigma method, institutions shall determine the downward and upward calibrated shock from a time series of 10 business days returns for a non-modellable risk factor by applying the following steps in the following order:

(a) they shall determine the median of the returns within the time series, and split the 10 business days returns comprised in that time series into the following two subsets:

(i) the subset of 10 business days returns the value of which is equal to or lower than the median;

(ii) the subset of 10 business days returns the value of which is greater than the median;

(b) for each subset referred in point (a), they shall compute the mean of the 10 business days returns in the subset;

(c) they shall determine the downward calibrated shock in accordance with the following formula:

$$downward\ calibrated\ shock$$

$$= \left(-\hat{\mu}_{Ret \leq m} + C_{ES} \cdot \sqrt{\frac{1}{N_{\text{down}} - 1{,}5} \cdot \sum_{\substack{i=1, \\ Ret_i \leq m}}^{N} (Ret_i - \hat{\mu}_{Ret \leq m})^2} \right) \cdot \left(0{,}95 + \frac{1}{\sqrt{N_{\text{down}} - 1{,}5}} \right)$$

where:

– *Ret* denotes the time series of 10 business days returns of the non-modellable risk factor;

– Ret_i is the i-th return in the 10 business days returns time series *Ret*;

– *m* is the median of the 10 business days returns time series *Ret*;

– $\hat{\mu}_{Ret \leq m}$ denotes the mean of the 10 business days returns computed in accordance with point (b) on the subset identified in accordance with point (a)(i);

– N_{down} is the number of 10 business days returns in the subset determined in accordance with point (a)(i);

– *N* is the number of returns in the 10 business days returns time series *Ret*;

– $C_{ES} = 3$;

(d) they shall determine the upward calibrated shock in accordance with the following formula:

$$upward\ calibrated\ shock$$

$$= \left(\hat{\mu}_{Ret > m} + C_{ES} \cdot \sqrt{\frac{1}{N_{\text{up}} - 1{,}5} \cdot \sum_{\substack{i=1, \\ Ret_i > m}}^{N} (Ret_i - \hat{\mu}_{Ret > m})^2} \right) \cdot \left(0{,}95 + \frac{1}{\sqrt{N_{\text{up}} - 1{,}5}} \right)$$

where:

– *Ret* denotes the time series of 10 business days returns of the non-modellable risk factor;

– Ret_i is the i-th return in the 10 business days returns time series *Ret*;

– *m* is the median of the 10 business days returns time series *Ret*;

– $\hat{\mu}_{Ret > m}$ denotes the mean of the 10 business days returns computed in accordance with point (b) on the subset determined in accordance with point (a)(ii);

– N_{up} is the number of returns in the subset determined in accordance with point (a)(ii);

– *N* is the number of returns in the 10 business days returns time series *Ret*;

– $C_{ES} = 3$.

Article 10

Downward and upward calibrated shock with the fallback method

1. Under the fallback method, institutions shall determine the downward and upward calibrated shock from the time series of 10 business days returns for a non-modellable risk factor by applying one of the methodologies set out in this Article.

2. Where the non-modellable risk factor is equal to one of the risk factors defined in Part Three, Title IV, Chapter 1a, Section 3, Subsection 1, of Regulation (EU) No 575/2013, institutions shall determine the downward and upward calibrated shock by applying the following steps in the following order:

   (a) they shall identify the risk-weight assigned to that risk factor in accordance with Part Three, Title IV, Chapter 1a, of Regulation (EU) No 575/2013;

   (b) they shall multiply that risk-weight by $1{,}15 \cdot \sqrt{\frac{10}{LH}}$

   where:

   – *LH* is the liquidity horizon of the non-modellable risk factor referred to in Article 325bd of Regulation (EU) No 575/2013;

   (c) the downward and upward calibrated shock shall be the result of point (b).

3. Where the non-modellable risk factor is a point of a curve or a surface and it differs from other risk factors as defined in Part Three, Title IV, Chapter 1a, Section 3, Subsection 1, of Regulation (EU) No 575/2013 only in relation to the maturity dimension, institutions shall determine the downward and upward calibrated shocks by applying the following steps in the following order:

   (a) from those risk factors defined in Part Three, Title IV, Chapter 1a, Section 3, Subsection 1, of Regulation (EU) No 575/2013 differing from the non-modellable risk factor only in the maturity dimension, they shall identify the risk factor that is the closest in the maturity dimension to the non-modellable risk factor;

   (b) they shall identify the risk-weight assigned in accordance with Part Three, Title IV, Chapter 1a, of Regulation (EU) No 575/2013 to the risk factor identified in accordance with point (a);

   (c) they shall multiply that risk-weight by $1{,}15 \cdot \sqrt{\frac{10}{LH}}$

   where:

   – *LH* is the liquidity horizon of the non-modellable risk factor referred to in Article 325bd of Regulation (EU) No 575/2013;

   (d) the downward and upward calibrated shock shall be the result of point (c).

4. Where the non-modellable risk factor does not meet the conditions set out in paragraphs 2 and 3, institutions shall determine the corresponding downward and upward calibrated shocks by selecting a risk factor that meets the conditions set out in paragraph 5 and apply the method set out in paragraph 6 to that selected risk factor.

5. The risk factor to be selected in accordance with paragraph 4 shall meet all of the following conditions:

(a) it belongs to the same broad risk factor category and broad sub-category of risk factors referred to in Article 325bd of Regulation (EU) No 575/2013 of the non-modellable risk factor;

(b) it is of the same nature as the non-modellable risk factor;

(c) it differs from the non-modellable risk factor for features that do not lead to an underestimation of the volatility of the non-modellable risk factor, including under stress conditions;

(d) its time series of 10 business days returns referred to in paragraph 6, point (a), contains at least 12 returns.

6. Under the method referred to in paragraph 4, institutions shall apply the following steps in the following order:

(a) for the selected risk factor, institutions shall, in accordance with Article 7, determine the time series of 10 business days returns for the stress period determined in accordance with Article 12;

(b) institutions shall determine the downward and upward calibrated shocks for the selected risk factor with:

(i) the historical method set out in Article 8, where the number of returns in the time series of 10 business days returns for the selected risk factor referred to in point (a) of this paragraph is equal to or greater than 200;

(ii) the asymmetrical sigma method set out in Article 9, where the number of returns in the time series of 10 business days returns for the selected risk factor referred to in point (a) of this paragraph is lower than 200;

(c) institutions shall determine the downward calibrated shock for the non-modellable risk factor by multiplying the downward shock for the selected risk factor determined in accordance with point (b) by $1{,}35 / \left(0{,}95 + \frac{1}{\sqrt{N_{\text{other}}^{\text{down}} - 1{,}5}} \right)$

where:

– $N_{\text{other}}^{\text{down}}$ is one of the following, depending on which method has been used to determine the downward calibrated shock for the selected risk factor in accordance with point (b):

(i) the number of returns in the time series of 10 business days returns for the selected risk factor referred to in point (a), where the institution used the historical method for determining the downward calibrated shock for the selected risk factor;

(ii) the number of returns in the subset determined in accordance with Article 9(1), point (a)(i), where the institution used the asymmetrical sigma method for determining the downward calibrated shock for the selected risk factor;

(d) institutions shall determine the upward calibrated shock for the non-modellable risk factor by multiplying the upward shock for the selected risk factor determined in accordance with point (b) by $1{,}35 / \left(0{,}95 + \frac{1}{\sqrt{N_{\text{other}}^{\text{up}} - 1{,}5}} \right)$

where:

– $N_{\text{other}}^{\text{up}}$ is one of the following, depending on which method has been used to determine the upward calibrated shock for the selected risk factor in accordance with point (b):

(i) the number of returns in the time series of 10 business days returns for the selected risk factor referred to in point (a), where the institution used the historical method for determining the upward calibrated shock for the selected risk factor;

(ii) the number of returns in the subset determined in accordance with Article 9(1), point (a)(ii), where the institution used the asymmetrical sigma method for determining the upward calibrated shock for the selected risk factor.

7. By way of derogation from paragraph 6, points (b)(i) and (b)(ii), where institutions apply the method referred to in paragraph 4 to all non-modellable risk factors in a non-modellable standardised bucket, they shall determine the upward and downward shocks for all the corresponding selected risk factors in accordance with either of the following:

(a) the historical method set out in Article 8, where the number of returns in the time series of 10 business days returns referred to in paragraph 6, point (a), is equal to or greater than 200 for all the selected risk factors;

(b) the asymmetrical sigma method set out in Article 9, where the condition referred to in point (a) of this paragraph for applying the historical method is not met.

Article 11

Estimators of the expected shortfall

1. Institutions shall calculate the estimate of the left-tail expected shortfall of a time series X in accordance with the following formula:

$$\widehat{\mathrm{ES}}_{\mathrm{Left}}(X) = \frac{-1}{\alpha \cdot N} \times \left\{ \sum_{i=1}^{[\alpha \cdot N]} X_{(\mathrm{i})} + (\alpha \cdot N - [\alpha \cdot N]) \cdot X_{([\alpha \cdot N]+1)} \right\}$$

where:

– N is the number of observations in the time series;

– α = 2,5 %;

– $[\alpha \cdot N]$ denotes the integer part of the product $\alpha \cdot N$;

– $X_{(\mathrm{i})}$ denotes the i-th smallest observation in the time series X.

2. Institutions shall calculate the estimate of the right-tail expected shortfall of a time series X in accordance with the following formula:

$$\widehat{\mathrm{ES}}_{\mathrm{Right}}(X) = \widehat{\mathrm{ES}}_{\mathrm{Left}}(-X)$$

where:

– $\widehat{\mathrm{ES}}_{\mathrm{Left}}(-X)$ is the estimate of left-tail expected shortfall for the time series $-X$ calculated in accordance with paragraph 1.

Article 12

Determination of the stress period

1. Institutions shall determine the stress period for the non-modellable risk factors in a broad category of risk factors by identifying the 12-months observation period maximising the value obtained in accordance with following formula:

$$\sum_{j \in i} RSS^j$$

where:

– i denotes the broad risk factor category;

– j is the index denoting the non-modellable risk factors or the non-modellable standardised buckets for which the institution calculates the stress scenario risk measure belonging to the broad risk factor category i;

– RSS^j is the rescaled stress scenario risk measure for the non-modellable risk factor or the non-modellable standardised bucket j calculated in accordance with Article 16.

2. By way of derogation from paragraph 1, institutions may determine the stress period for the non-modellable risk factors in a broad risk factor category by identifying the 12-months observation period maximising the partial expected shortfall measure $PES^{\mathrm{RS,i}}$ referred to in Article 325bb(1) of Regulation (EU) No 575/2013. Where institutions apply this derogation, they shall provide evidence that the stress period identified represents a period of financial stress for its non-modellable risk factors. Institutions shall take into account how their portfolio is exposed to the non-modellable risk factors in the broad category of risk factors.

3. When determining the stress period, institutions shall use an observation period starting at least from 1 January 2007, to the satisfaction of the competent authorities.

4. Institutions shall review the stress period identified at least with a quarterly frequency.

Article 13

Computation of the losses

1. Institutions shall calculate the loss corresponding to a scenario of future shock applied to one or more non-modellable risk factors by calculating the loss on the portfolio of positions for which they calculate the own funds requirements for market risk in accordance with the alternative internal model approach set out in Part Three, Title IV, Chapter 1b, of Regulation (EU) No 575/2013, and that occurs if that scenario of future shock is applied to that non-modellable risk factor or those non-modellable risk factors in a standardised bucket, and all other risk factors remain unchanged.

2. Institutions shall calculate the loss corresponding to a scenario of future shock applied to one or more non-modellable risk factors by using the pricing methods used in the risk measurement model.

3. By way of derogation from paragraph 2, where institutions cannot calculate the loss for some financial instruments or commodities included in the portfolio referred to in paragraph 1, corresponding to a scenario of future shock applied to one or several

non-modellable risk factors by using their pricing methods, they shall apply the following steps in the following order:

(a) they shall identify those financial instruments or commodities and the cause of the failure of the pricing calculation;

(b) they shall use sensitivity-based pricing methods, including at least the material first order and material second order terms of Taylor series approximations, to reflect the change in the price of those financial instruments or commodities due to changes in the non-modellable risk factors in this scenario of future shock.

4. By way of derogation from paragraph 2, institutions may, only for the purpose of determining the stress period in accordance with Article 12(1), calculate the loss corresponding to a scenario of future shock applied to one or more non-modellable risk factors using sensitivity-based pricing methods. Institutions shall demonstrate that the price changes that are not captured by the sensitivity-based pricing methods would not modify the stress period identified by the institution.

CHAPTER 2
REGULATORY EXTREME SCENARIO OF FUTURE SHOCK

Article 14

Determination of the regulatory extreme scenario of future shock

1. The regulatory extreme scenario of future shock referred to in Article 325bk(3), point (b), of Regulation (EU) No 575/2013 shall be a shock leading to the maximum loss that may occur due to a change in the non-modellable risk factor where such maximum loss is finite.

2. Where the maximum loss referred to in paragraph 1 is not finite, institutions shall determine the regulatory extreme scenario of future shock by applying the following steps in the following order:

(a) they shall use an expert-based approach using qualitative and quantitative information available to identify a loss due to a change in the value taken by the non-modellable risk factor that will not be exceeded with a level of certainty equal to 99,95 % on a 10 business day horizon in a future period of financial stress equivalent to the stress period identified for the non-modellable risk factor. When doing so, institutions shall take into account the skewness and the excess kurtosis that may characterise the returns of the non-modellable risk factor in a period of financial stress and shall justify any distributional or statistical assumptions taken for identifying that loss;

(b) they shall multiply the loss obtained in accordance with point (a) by $\sqrt{\frac{LH_{\text{adj}}}{10}}$;

where:

– $LH_{adj} = \max(20, LH)$, and where LH is the liquidity horizon for the non-modellable risk factor or for the risk factors within the non-modellable standardised bucket referred to in Article 325bd of Regulation (EU) No 575/2013;

(c) they shall identify the regulatory extreme scenario of future shock as the shock leading to the loss resulting from points (a) and (b).

3. Where institutions calculate a stress scenario risk measure for more than one non-modellable risk factor as referred to in Article 325bk(3), point (c), of Regulation (EU) No 575/2013, the regulatory extreme scenario of future shock referred to in Article 325bk(3), point (b), of that Regulation shall be a scenario leading to the maximum loss that may occur due to a change in the values taken by those non-modellable risk factors.

4. By way of derogation of paragraph 3, where institutions calculate a stress scenario risk measure for more than one non-modellable risk factor as referred to in Article 325bk(3), point (c), of Regulation (EU) No 575/2013 and the maximum loss referred to in paragraph 3 of this Article is not finite, institutions shall determine the regulatory extreme scenario of future shock by applying the following steps in the following order:

   (a) they shall use an expert-based approach using qualitative and quantitative information available to identify a loss due to a change in the values taken by the non-modellable risk factors that will not be exceeded with a level of certainty equal to 99,95 % on a 10 business day horizon in a future period of financial stress equivalent to the stress period for the non-modellable risk factors. When doing so, institutions shall take into account the skewness and the excess kurtosis that may characterise the returns of the non-modellable risk factors in a period of financial stress and shall justify any distributional or statistical assumptions taken for identifying that loss;

   (b) they shall multiply the loss obtained in accordance with point (a) by $\sqrt{\frac{LH_{\text{adj}}}{10}}$;

   where:

   – $LH_{\text{adj}} = \max(20, LH)$, and where LH is the liquidity horizon for the non-modellable risk factors referred to in Article 325bd of Regulation (EU) No 575/2013;

   (c) they shall identify the regulatory extreme scenario of future shock as the scenario leading to the loss resulting from points (a) and (b).

CHAPTER 3
CIRCUMSTANCES UNDER WHICH INSTITUTIONS MAY CALCULATE A STRESS SCENARIO RISK MEASURE FOR MORE THAN ONE NON-MODELLABLE RISK FACTOR

Article 15

Circumstances for the calculation of a stress scenario risk measure for more than one non-modellable risk factor

The circumstances under which institutions may calculate a stress scenario risk measure for more than one non-modellable risk factor as referred to in Article 325bk(3), point (c), of Regulation (EU) No 575/2013 shall be the following:

   (a) the risk factors belong to the same standardised bucket as referred to in Article 5(2) of Delegated Regulation (EU) 2022/2060;

   (b) institutions assessed the modellability of those risk factors, by determining the modellability of the standardised bucket to which they belong in accordance with Article 4(1) of Delegated Regulation (EU) 2022/2060;

CHAPTER 4
AGGREGATION OF THE STRESS SCENARIO RISK MEASURES

Article 16

Aggregation of the stress scenario risk measures

1. For the purposes of aggregating the stress scenario risk measures as referred to in Article 325bk(3), point (d), of Regulation (EU) No 575/2013, institutions shall, for each stress scenario risk measure they have computed, determine the corresponding rescaled stress scenario risk measure as follows:

   (a) where institutions determined the extreme scenario of future shock for a single risk factor in accordance with the stepwise method set out to in Article 3, the corresponding rescaled stress scenario risk measure shall be calculated in accordance with the following formula:

$$RSS = \max\left(0; \sqrt{\frac{LH_{\text{adj}}}{10}} \cdot SS \cdot \kappa\right)$$

where:

– RSS is the rescaled stress scenario risk measure for the non-modellable risk factor;

– SS is the stress scenario risk measure for the non-modellable risk factor;

– $LH_{\text{adj}} = \max(20, LH)$, and where LH is the liquidity horizon referred to in Article 325bd(1) of Regulation (EU) No 575/2013 for the non-modellable risk factor;

– κ is the non-linearity coefficient for the non-modellable risk factor calculated in accordance with Article 17;

   (b) where institutions determined a stress scenario risk measure for more than one risk factor by determining an extreme scenario of future shock in accordance with the stepwise method set out in Article 6 for a non-modellable standardised bucket comprising those risk factors, the corresponding rescaled stress scenario risk measure shall be calculated in accordance with the following formula:

$$RSS = \max\left(0; \sqrt{\frac{LH_{\text{adj}}}{10}} \cdot SS \cdot \kappa\right)$$

where:

– RSS is the rescaled stress scenario risk measure for the non-modellable standardised bucket;

– SS is the stress scenario risk measure for the non-modellable standardised bucket;

– $LH_{\text{adj}} = \max(20, LH)$, and where LH is the liquidity horizon referred to in Article 325bd(1) of Regulation (EU) No 575/2013 for the risk factors within the non-modellable standardised bucket;

– κ is the non-linearity coefficient for the non-modellable standardised bucket calculated in accordance with Article 18;

(c) where institutions determined the extreme scenario of future shock for a single risk factor in accordance with the direct method set out in Article 2, the corresponding rescaled stress scenario risk measure shall be calculated with the following formula:

$$RSS = \max\left(0; \sqrt{\frac{LH_{\text{adj}}}{10}} \cdot SS \cdot UCF\right)$$

where:

– RSS is the rescaled stress scenario risk measure for the non-modellable risk factor;

– SS is the stress scenario risk measure for the non-modellable risk factor;

– $LH_{\text{adj}} = \max(20, LH)$, and where LH is the liquidity horizon referred to in Article 325bd(1) of Regulation (EU) No 575/2013 for the non-modellable risk factor;

– UCF is the uncertainty compensation factor to be calculated in accordance with Article 20.

(d) where institutions determined a stress scenario risk measure for more than one risk factor by determining an extreme scenario of future shock in accordance with the direct method set out in Article 5 for the non-modellable bucket comprising those risk factors, the corresponding rescaled stress scenario risk measure shall be calculated in accordance with the following formula:

$$RSS = \max\left(0; \sqrt{\frac{LH_{\text{adj}}}{10}} \cdot SS \cdot UCF\right)$$

where:

– RSS is the rescaled stress scenario risk measure for the non-modellable standardised bucket;

– SS is the stress scenario risk measure for the non-modellable standardised bucket;

– $LH_{\text{adj}} = \max(20, LH)$, and where LH is the liquidity horizon referred to in Article 325bd(1) of Regulation (EU) No 575/2013 for the risk factors within the non-modellable bucket;

– UCF is the uncertainty compensation factor to be calculated in accordance with Article 20.

(e) where institutions determined a stress scenario risk measure by determining a regulatory extreme scenario of future shock in accordance with Article 14, the corresponding rescaled stress scenario risk measure shall be calculated in accordance with the following formula:

$$RSS = \max(0; SS)$$

where:

– RSS is the rescaled stress scenario risk measure;

– SS is the stress scenario risk measure.

2. Institutions shall aggregate the stress scenario risk measures in accordance with the following formula:

$$\sqrt{\sum_{k \in \text{ICSR}} (RSS^k)^2} + \sqrt{\sum_{l \in EIR} (RSS^l)^2} + \sqrt{\left(\rho \cdot \sum_{j \in OR} RSS^j\right)^2 + (1-\rho^2) \cdot \sum_{j \in OR} (RSS^j)^2}$$

where:

– $ICSR$ denotes the set of non-modellable risk factors or non-modellable standardised buckets for which institutions determined a stress scenario risk measure that was classified as reflecting idiosyncratic credit spread risk only, in accordance with paragraph 3;

– k is an index denoting the non-modellable risk factors or non-modellable standardised buckets belonging to $ICSR$;

– EIR denotes the set of non-modellable risk factors or non-modellable standardised buckets for which institutions determine a stress scenario risk measure that was classified as reflecting idiosyncratic equity risk only, in accordance with paragraph 4;

– l is an index denoting the non-modellable risk factors or non-modellable standardised buckets belonging to EIR;

– OR denotes a non-modellable risk factor or non-modellable standardised bucket for which institutions determine a stress scenario risk measure that was neither classified as reflecting idiosyncratic credit spread risk only, in accordance with paragraph 3, nor idiosyncratic equity risk only, in accordance with paragraph 4;

– j is an index denoting the non-modellable risk factors or non-modellable standardised buckets belonging to OR;

– RSS^k, RSS^l, RSS^j are respectively the rescaled stress scenario risk measures for the non-modellable risk factors or the non-modellable standardised buckets k, l, j calculated in accordance with paragraph 1;

– $\rho = 0{,}6$.

3. The non-modellable risk factors that institutions classify as reflecting idiosyncratic credit spread risk only shall meet all of the following conditions:

(a) the nature of the risk factor is such that it reflects idiosyncratic credit spread risk only;

(b) the value taken by the risk factor is not driven by systematic risk components;

(c) the correlation among risk factors is negligible;

(d) institutions perform and document the statistical tests used to verify the condition set out in point (c).

4. The non-modellable risk factors that institutions classify as reflecting idiosyncratic equity risk only shall meet all of the following conditions:

(a) the nature of the risk factor is such that it reflects idiosyncratic equity risk only;

(b) the value taken by the risk factor is not driven by systematic risk components;

(c) the correlation among risk factors is negligible;

(d) institutions perform and document the statistical tests used to verify the condition set out in point (c).

Article 17

Non-linearity coefficient for a single risk factor

Where the stress scenario risk measure for which institutions are determining the non-linearity coefficient has been determined for a single risk factor, such non-linearity coefficient shall be determined as follows:

(a) where the extreme scenario of future shock for the non-modellable risk factor does not coincide with either the downward calibrated shock or the upward calibrated shock determined in accordance with Article 3(1), point (b), institutions shall set $\kappa = 1$ for that non-modellable risk factor;

(b) where the extreme scenario of future shock for the non-modellable risk factor coincides with the downward calibrated shock determined in accordance with Article 3(1), point (b), institutions shall calculate the non-linearity coefficient in accordance with the following formula:

$$\kappa = \min\left(\max\left[\kappa_{\min};\ 1 + \frac{\text{loss}_{-1} - 2 \cdot \text{loss}_0 + \text{loss}_{+1}}{2 \cdot \text{loss}_0} \cdot (\phi - 1) \cdot 25\right];\ \kappa_{\max}\right)$$

where:

– $\kappa_{\min} = 0{,}9$;

– $\kappa_{\max} = 5$;

– ϕ is the estimate of the tail parameter for the non-modellable risk factor calculated in accordance with Article 19;

– loss_0 is the loss that occurs when the downward shock CS_{down} determined in accordance with Article 3(1), point (b) is applied to the non-modellable risk factor;

– loss_{-1} is the loss that occurs when a downward shock equal to $\frac{4}{5} \cdot CS_{\text{down}}$ is applied to the non-modellable risk factor, where CS_{down} is the downward shock determined in accordance with Article 3(1), point (b);

– loss_{+1} is the loss that occurs when a downward shock equal to $\frac{6}{5} \cdot CS_{\text{down}}$ is applied to the non-modellable risk factor, where CS_{down} is the downward shock determined in accordance with Article 3(1), point (b);

(c) where the extreme scenario of future shock for the non-modellable risk factor coincides with the upward calibrated shock determined in accordance with Article 3(1), point (b), institutions shall calculate the non-linearity coefficient in accordance with the following formula:

$$\kappa = \min\left(\max\left[\kappa_{\min};\ 1 + \frac{\text{loss}_{-1} - 2 \cdot \text{loss}_0 + \text{loss}_{+1}}{2 \cdot \text{loss}_0} \cdot (\phi - 1) \cdot 25\right];\ \kappa_{\max}\right)$$

where:

– $\kappa_{\min} = 0{,}9$;

– $\kappa_{\text{max}} = 5$;

– ϕ is the estimate of the tail parameter for the non-modellable risk factor calculated in accordance with Article 19;

– loss_0 is the loss that occurs when the the upward shock CS_{up} determined in accordance with Article 3(1), point (b) is applied to the non-modellable risk factor;

– loss_{-1} is the loss that occurs when an upward shock equal to $\frac{4}{5} \cdot CS_{\text{up}}$ is applied to the non-modellable risk factor, where CS_{up} is the upward shock determined in accordance with Article 3(1), point (b);

– loss_{+1} is the loss that occurs when an upward shock equal to $\frac{6}{5} \cdot CS_{\text{up}}$ is applied to the non-modellable risk factor, where CS_{up} is the upward shock determined in accordance with Article 3(1), point (b).

Article 18

Non-linearity coefficient for a bucket

Where the stress scenario risk measure for which institutions are determining the non-linearity coefficient has been determined for a non-modellable standardised bucket, the non-linearity coefficient shall be determined as follows:

(a) where the extreme scenario of future shock does not correspond to a scenario identified in accordance with Article 6(1), point (b), where the value of the parameter β referred to in Article 6(1), point (c), it set equal to 1, institutions shall set the non-linearity coefficient $\kappa = 1$ for that non-modellable bucket;

(b) where the extreme scenario of future shock is a scenario where the corresponding downward shock determined in accordance with Article 6(1), point (b) is applied to each risk factor in the non-modellable bucket, institutions shall calculate the non-linearity coefficient in accordance with the following formula:

$$\kappa = \min\left(\max\left[\kappa_{\text{min}};\ 1 + \frac{\text{loss}_{-1} - 2 \cdot \text{loss}_0 + \text{loss}_{+1}}{2 \cdot \text{loss}_0} \cdot (\phi_{\text{median}} - 1) \cdot 25\right];\ \kappa_{\text{max}}\right)$$

where:

– $\kappa_{\text{min}} = 0{,}9$;

– $\kappa_{\text{max}} = 5$;

– ϕ_{median} is the median of the estimates of the tail parameters calculated in accordance with Article 19 for each of the risk factors within the bucket;

– loss_0 is the loss occurring when the corresponding downward shock determined in accordance with Article 6(1), point (b), is applied to each risk factor in the non-modellable bucket;

– loss_{-1} is the loss occurring when the corresponding downward shock determined in accordance with Article 6(1), point (b), multiplied by $\frac{4}{5}$ is applied to each risk factor in the non-modellable bucket;

– loss_{+1} is the loss occurring when the corresponding downward shock determined in accordance with Article 6(1), point (b), multiplied by $\frac{6}{5}$ is applied to each risk factor in the non-modellable bucket;

(c) where the extreme scenario of future shock is a scenario where the corresponding upward shock determined in accordance with Article 6(1), point (b), is applied to each risk factor in the non-modellable bucket, institutions shall calculate the non-linearity coefficient in accordance with the following formula:

$$\kappa = \min\left(\max\left[\kappa_{\text{min}};\ 1 + \frac{\text{loss}_{-1} - 2 \cdot \text{loss}_0 + \text{loss}_{+1}}{2 \cdot \text{loss}_0} \cdot (\phi_{\text{median}} - 1) \cdot 25\right];\ \kappa_{\text{max}}\right)$$

where:

– $\kappa_{\text{min}} = 0{,}9$;

– $\kappa_{\text{max}} = 5$;

– ϕ_{median} is the median of the estimates of the tail parameters calculated in accordance with Article 19 for each of the risk factors within the bucket;

– loss_0 is the loss occurring when the corresponding upward shock determined in accordance with Article 6(1), point (b), is applied to each risk factor in the non-modellable bucket;

– loss_{-1} is the loss occurring when the corresponding upward shock determined in accordance with Article 6(1), point (b), multiplied by $\frac{4}{5}$ is applied to each risk factor in the non-modellable bucket;

– loss_{+1} is the loss occurring when the corresponding upward shock determined in accordance with Article 6(1), point (b), multiplied by $\frac{6}{5}$ is applied to each risk factor in the non-modellable bucket.

Article 19

Calculation of the estimate of the tail parameter

Institutions shall calculate the estimate of the tail parameter for a given non-modellable risk factor as follows:

(a) where institutions used the historical method set out in Article 8 for determining the downward and upward calibrated shock of that non-modellable risk factor and the extreme scenario of future shock is the downward calibrated shock, they shall calculate the estimate of the tail parameter in accordance with the following formula:

$$\phi = \frac{\frac{1}{\alpha \cdot N} \times \left\{\sum_{i=1}^{[\alpha \cdot N]} Ret_{(\text{i})}{}^2 + (\alpha \cdot N - [\alpha \cdot N]) \cdot Ret_{([\alpha \cdot N]+1)}{}^2\right\}}{\left\{\widehat{\text{ES}}_{\text{Left}}(Ret)\right\}^2}$$

where:

– $\alpha = 2{,}5\%$;

– Ret is the time series of 10 business days returns for the non-modellable risk factor used in the historical method set out in Article 8;

– $Ret_{(i)}$ represents the i-th smallest return in the time series Ret;

– $[\alpha \cdot N]$ denotes the integer part of $\alpha \cdot N$;

– $\widehat{\mathrm{ES}}_{\mathrm{Left}}(Ret)$ is the estimate of the left-tail expected shortfall for the time series Ret calculated in accordance with Article 11(1).

(b) where institutions used the historical method set out in Article 8 for determining the downward and upward calibrated shock of that non-modellable risk factor and the extreme scenario of future shock is the upward calibrated shock, they shall calculate the estimate of the tail parameter in accordance with the following formula:

$$\phi = \frac{\frac{1}{\alpha \cdot N} \times \left\{ \sum_{i=1}^{[\alpha \cdot N]} (-Ret)_{(i)}{}^2 + (\alpha \cdot N - [\alpha \cdot N])(-Ret)_{([\alpha \cdot N]+1)}{}^2 \right\}}{\left\{ \widehat{\mathrm{ES}}_{\mathrm{Right}}(Ret) \right\}^2}$$

where:

– $\alpha = 2{,}5\%$;

– Ret is the time series of 10 business days returns for the non-modellable risk factor used in the historical method set out in Article 8;

– $-Ret_{(i)}$ represents the i-th smallest return in the time series $-Ret$;

– $[\alpha \cdot N]$ denotes the integer part of $\alpha \cdot N$;

– $\widehat{\mathrm{ES}}_{\mathrm{Right}}(Ret)$ is the estimate of the right-tail expected shortfall for the time series Ret calculated in accordance with Article 11(2);

(c) in all other cases institutions shall set the estimate of the tail parameter $\phi = 1{,}04$.

Article 20

Calculation of the uncertainty compensation factor

1. Where the stress scenario risk measure for which the institutions are determining the uncertainty compensation factor (UCF) has been determined for a single risk factor, the uncertainty compensation factor shall be equal to:

$$UCF = 0{,}95 + \frac{1}{\sqrt{N - 1{,}5}}$$

where:

– N is the number of losses in the time series referred to in Article 2(1), point (a)(iii), from which the extreme scenario of future shock has been determined for the non-modellable risk factor in accordance with that Article.

2. Where the stress scenario risk measure for which the institutions are determining the uncertainty compensation factor has been determined for a non-modellable standardised bucket, the uncertainty compensation factor shall be equal to:

$$UCF = 0{,}95 + \frac{1}{\sqrt{N - 1{,}5}}$$

where:

– N is the number of losses in the time series referred to in Article 5(1), point (a)(iv), from which the extreme scenario of future shock has been determined for the non-modellable bucket in accordance with that Article.

CHAPTER 5
QUALITATIVE REQUIREMENTS

Article 21
Documentation of the criteria and methods

For the purposes of developing extreme scenarios of future shock, determining the regulatory extreme scenario of future shock, and aggregating the stress scenario risk measures, the set of internal policies referred to in Article 325bi(1), point (e), of Regulation (EU) No 575/2013, shall include documentation of any information necessary to demonstrate that the applicable criteria and methods laid down in this Regulation are complied with, in particular in relation to criteria on the application of choices, assumptions made, conditions, required steps for applying the derogations, and justifications, where applicable.

CHAPTER 6
FINAL PROVISIONS

Article 22
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, 20.10.2023

For the Commission
The President
Ursula VON DER LEYEN