Basel Committee on Banking Supervision

Consultative Document

Recalibration of shocks for interest rate risk in the banking book

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1. Introduction

In April 2016 the Basel Committee published its standard on interest rate risk in the banking book (IRRBB).[1] The IRRBB standard was subsequently incorporated into chapters SRP31 and SRP98 of the consolidated Basel Framework.[2] The standard requires banks to calculate measures of interest rate risk for their banking book exposures. These measures are based on a specified set of interest rate shocks for each currency for which the bank has material positions. The Committee noted in the IRRBB standard that it will periodically review the specified shock sizes. The review was initiated as part of the Committee's 2023–24 work programme.[3] As a result of the review, the Committee proposes in this consultative document to make a set of adjustments to the specified interest rate shocks in the IRRBB standard. It also proposes to make targeted adjustments to the current methodology used to calculate the shocks. These changes are needed to address problems with how the current methodology captures interest rate changes during periods when rates are close to zero.

Section 2 provides a brief overview of the methodology that was used to calculate the existing set of interest rate shocks in the IRRBB standard. Section 3 sets out the proposed new methodology and updated interest rate shocks. Section 4 describes planned next steps. The annex provides the edits to the Basel Framework to give effect to the proposals in Section 2.

The review of the calibration of the IRRBB interest rate risk shocks began before the March 2023 banking turmoil. The Committee report on the banking turmoil[4] notes that there were fundamental shortcomings in basic risk management of traditional banking risks, including interest rate risk. It notes that the Committee is pursuing a series of follow-up initiatives, including analytical work to assess whether specific features of the Basel Framework performed as intended during the turmoil and is assessing the need to explore policy options over the medium-term. Any policy proposals arising from this work would be subject to a separate consultation.

The Committee welcomes comments on all aspects of the proposed amendments to the IRRBB standard from stakeholders. Comments should be submitted by 28 March 2024 using the following link: https://www.bis.org/bcbs/commentupload.htm. All comments will be published on the website of the Bank for International Settlements unless a respondent specifically requests confidential treatment.

2. Current calibration and methodology

2.1 Current interest rate shocks

The IRRBB standard requires banks to apply specified interest rate shocks to risk free yield curves for each currency for which the bank has material positions. Under the standardised approach, banks must determine the impact of these yield curve shocks on their economic value of equity (EVE) and net interest income (NII).[5] The shocks that must be applied to the risk free yield curve for each currency are set out in the following table in the standard (see SRP31.90) which is derived from historical data during the 16 year

[1] See https://www.bis.org/bcbs/publ/d368.pdf

[2] See https://www.bis.org/basel_framework/

[3] See https://www.bis.org/bcbs/bcbs_work.pdf

[4] See https://www.bis.org/bcbs/publ/d555.pdf

[5] This consultative document does not propose changes to the methodology that should be used to calculate the impact of the shocks on EVE and NII. It focuses only on the methodology used to calculate the shocks.

period from January 2000 to December 2015. These shocks must also be applied by banks using their own internal management systems (IMS) to calculate the impact of IRRBB on their economic value and earnings.

Table 1: Specified size of interest rate shocks (bp)

	ARS	AUD	BRL	CAD	CHF	CNY	EUR	GBP	HKD	IDR	INR
Parallel	400	300	400	200	100	250	200	250	200	400	400
Short	500	450	500	300	150	300	250	300	250	500	500
Long	300	200	300	150	100	150	100	150	100	300	300

	JPY	KRW	MXN	RUB	SAR	SEK	SGD	TRY	USD	ZAR
Parallel	100	300	400	400	200	200	150	400	200	400
Short	100	400	500	500	300	300	200	500	300	500
Long	100	200	300	300	150	150	100	300	150	300

The methodology that the IRRBB standard used to produce the specified shocks set out in SRP31.90 combined three elements: (i) average interest rates for each currency; (ii) global shock parameters that are applied to the average rates for each currency; and (iii) application of a floor, a set of caps and rounding.

2.2 Calculation of average interest rates

The average interest rates were calculated for each currency using interest rate data during the period January 2000 to December 2015. The interest rate data for each currency covered nine tenors: 3M, 6M, 1Y, 2Y, 5Y, 7Y, 10Y, 15Y, 20Y. The average rates are set out in SRP98.57 as follows:

Table 2: Average interest rates by currency (bp)

	ARS	AUD	BRL	CAD	CHF	CNY	EUR	GBP	HKD	IDR	INR
Average	3363	517	1153	341	183	373	300	375	295	1466	719

	JPY	KRW	MXN	RUB	SAR	SEK	SGD	TRY	USD	ZAR
Average	89	471	754	868	360	330	230	1494	329	867

2.3 Application of global shock parameters

The next step that was used to calculate the specified shocks set out in SRP31.90 was to multiply the average interest rates described above by the following set of global shock parameters set out in SRP98.58:

Table 3: Global interest rate shock parameters

Parallel	60%
Short rate	85%
Long rate	40%

Applying the global shock factors to the average interest rates for each currency gives the following unfloored, uncapped, unrounded interest rate shocks that are set out in SRP98.59:

Table 4: Unfloored, uncapped, unrounded interest rate shocks (bp)

	ARS	AUD	BRL	CAD	CHF	CNY	EUR	GBP	HKD	IDR	INR
Parallel	2018	310	692	204	110	224	180	225	177	880	431
Short	2858	440	980	290	155	317	255	319	251	1246	611
Long	1345	207	461	136	73	149	120	150	118	586	288

	JPY	KRW	MXN	RUB	SAR	SEK	SGD	TRY	USD	ZAR
Parallel	53	283	452	521	216	198	138	896	197	520
Short	75	401	641	738	306	280	196	1270	279	737
Long	35	188	301	347	144	132	92	597	131	347

2.4 Application of floor, caps and rounding

The IRRBB standard notes in SRP98.60 that the methodology described above can lead to unrealistically low interest rate shocks for some currencies and to unrealistically high interest rate shocks for others. To ensure a minimum level of prudence and a level playing field, a floor and a set of caps are applied. The floor is set at 100bp and the caps are set at 400bp for the parallel shock, 500bp for the short-term shock and 300bp for the long-term shock. Finally the amounts are rounded to the nearest 50bp. The application of the floor, caps and rounding produces for the specified shocks set out in SRP31.90.

2.5 Problem with methodology used to calculate global shock parameters

As set out above, the global shock parameters played a key role in the calibration of the interest rate shocks used in the current IRRBB standard. The methodology used to calculate these global shock factors is as follows:

- For each currency and for each of the nine tenors (3M, 6M, 1Y, 2Y, 5Y, 7Y, 10Y, 15Y, 20Y), the historic interest rate data series was used to calculate a series of rolling six-month percentage changes in interest rates. The changes in rates were calculated for each day in the series as: (rate in six months - current rate) / current rate, and is expressed in basis points.
- From the series of rolling six month changes in rates (for each currency and for each of the nine tenors), the 99th and 1st percentiles changes were identified and the simple average of their absolute values were calculated. This created local shock parameter for nine tenor points for each currency.
- The nine shock parameters for each currency were then used to create a short shock parameter (by averaging the 3M, 6M, 1Y shock parameters), a medium shock parameter (by averaging the 2Y, 5Y, 7Y shock parameters) and long shock parameter (by averaging the 10Y, 15Y, 20Y shock parameters). A parallel shock parameter was then created by averaging the short, medium and long shock parameters (ie all 9 tenors).
- Lastly, a weighted average of the currency specific shocks was used to calculate the global shock parameters. The weighting used was Purchasing Power Parity GDP.

The main objective of the Committee's review of the interest rate shocks in the IRRBB standard was to update the interest rate data that is used in the calibration of the shocks. The current standard uses data from the period January 2000 to December 2015 and the Committee would like to extend that period to cover the period January 2000 to December 2022. Expending the time period used, however, reveals a problem with the above methodology for calculating global shock parameter.

As noted earlier, the shock parameters are generated from the average of 99th and 1st percentiles of rolling six-month percentage changes in interest rates (ie [rate in six months - current rate] / current rate). When rates are close to zero, the rate of change can be very large. For example, when the rate went down from 0.02% to 0.001% (0.019% difference) in six-months for a certain currency, the shock parameter is 95%. In another example, however, when the rate went up from 5.5% to 5.519% (the same 0.019% difference), the shock parameter is just 0.35%. The same calculation generates huge differences depending on the original level of interest rates. Therefore, in addition to updating the data period used to calibrate the interest rate shock parameters, the Committee has agreed to propose revisions to the way the shock parameters are calculated.

3. Proposed new methodology and calibration

3.1 New methodology

The Committee proposes the following new methodology to calculate currency level shocks for each shock scenario.

Step 1. Generate a time series of daily interest rates $R_{k,c}$ from the year 2000 (3 January 2000) to 2022 (31 December 2022) in the time buckets k = 3m, 6m, 1Y, 2Y, 5Y, 7Y, 10Y, 15Y, and 20Y for each currency c.

Step 2. Using the time series of the interest rates levels at each tenor point k and for each currency c, a new time series of rate changes $\Delta R_{k,c}$ is calculated for a moving time window of $h = 6$ months (125 days):

$$\Delta R_{k,c}(t) = R_{k,c}(t) - R_{k,c}(t-h)$$

Step 3. For each scenario i and currency c, the average of the rate changes across the corresponding time buckets in Table 5 is taken, where N_i represents the number of time buckets.

$$\Delta R_{i,c}(t) = \frac{1}{N_i}\sum_{k_i} \Delta R_{k_i,c}(t)$$

Table 5: Average interest rate change by time bucket

Scenario	Averaged interest rate series	Time buckets
Parallel	$\Delta R_{parallel,c}(t)$	3m, 6m, 1Y, 2Y, 5Y, 7Y, 10Y, 15Y, 20Y
Short rate	$\Delta R_{short,c}(t)$	3m, 6m, 1Y
Long rate	$\Delta R_{long,c}(t)$	10Y, 15Y, 20Y

Step 4. The 99.9th percentile value of the absolute value of $\Delta R_{i,c}$ over the period from 2000 to 2022, denoted $|\Delta R_{i,c}(t)|$, is used for the interest rate shock of scenario i for currency c.

$$S_{i,c} = P_{99.9}(|\Delta R_{i,c}(t)|)$$

Step 5. In order to ensure a minimum level of prudence and a level playing field, a floor of 100 bp and variable caps (denoted as $\bar{C}_i$) are set for the scenarios concerned, those caps being 500 bp for the short-term, 400 bp for the parallel and 300 bp for the long-term interest rate shock scenario. The change in the interest rate shock for scenario i and currency c can be defined as:

$$\bar{S}_{i,c} = max\left\{100, min\{S_{i,c}, \bar{C}_i\}\right\}$$

where $\bar{C}_i$ = {400, 500,300}, for i =parallel, short and long, respectively.

Step 6. Finally, the values from step 5 are rounded to the nearest multiple of 50 bps.

3.2 Comparison of existing and new methodology

The main differences between the methodology described above and the methodology used for the calibration of the existing shock factors of the IRRBB standard set out in SRP31.90 are as follows:

- Expansion of the time series used in the calibration from December 2015 used in the IRRBB standard to December 2022 (the start date of January 2000 remains the same).
- Removal of the global shock factors calculated using rolling six-month percentage changes in interest rates. These are replaced with local shock factors calculated directly for each currency using the averages of absolute changes in interest rates calculated over a rolling six-month period.

- Move from a 99th percentile value in determining the shock factor to a 99.9th percentile value, to maintain sufficient conservatism in the proposed recalibration (discussed further below).

The other main elements of the proposal, such as the shock scenarios, time buckets, caps/floors, approach to rounding remain unchanged from the approach used in the current IRRBB standard.

3.3 Recalibration using the new methodology

Table 6 below shows the interest rate shock parameters calculated using the proposed new methodology, with the data[6] through to end-2022. The colours in the table show whether the shock sizes under the proposed new methodology result in an increase, decrease or are unchanged relative to the existing shock factors in the IRRBB standard (ie set out SRP31.90):

Table 6: Specified size of interest rate shocks (99.9th%tile, data until 2022, bp)

	ARS	AUD	BRL	CAD	CHF	CNY	EUR	GBP	HKD	IDR
Parallel	400	350	400	200	150	300	250	300	200	400
Short	500	450	500	250	250	300	350	400	350	500
Long	300	300	300	200	200	300	200	250	200	300

INR	JPY	KRW	MXN	RUB	SAR	SEK	SGD	TRY	USD	ZAR
350	100	250	400	400	300	300	150	400	200	350
450	100	350	500	500	350	400	250	500	300	500
250	100	250	200	300	250	200	200	300	250	300

Colour guide: Increase Decrease Unchanged

Table 7 below shows the estimates of the interest rate shock parameters using the proposed new methodology with the data up to end-2015, ie the same period used to calibrate the current standard. The impact of the change in methodology varies by currency and scenario. For about 50% of the values, shocks remained the same. For another third of them increased and for the remaining minority of currencies and scenarios, shocks declined despite the use of a conservative 99.9th percentile value.

Table 7: Specified size of interest rate shocks (99.9th%tile, data until 2015, bp)

	ARS	AUD	BRL	CAD	CHF	CNY	EUR	GBP	HKD	IDR
Parallel	NA	350	400	200	200	300	250	250	200	400
Short	NA	450	500	250	250	300	350	450	300	500
Long	NA	300	300	150	150	300	150	150	200	300

INR	JPY	KRW	MXN	RUB	SAR	SEK	SGD	TRY	USD	ZAR
350	100	250	400	400	300	300	150	400	200	350
500	100	350	500	500	350	400	150	500	250	500
250	100	250	200	300	250	200	250	300	250	300

The Committee is of the view that the use of a 99.9th percentile value would be more appropriate than the use of a 99th percentile value, taking into account the accommodative methodological change and the recent rise in interest rates. This is illustrated by Table 8, which shows the impact of retaining the

[6] For most currencies, due to data availability and coverage during the calibration period, LIBOR or interbank interest/swaps rates (IBOR rates) were used, consistent with the data used to calibrate the existing IRRBB standard. For those currencies where IBOR rates have been discontinued, the OIS rates for the same tenor replaced the IBOR rates since the point of discontinuations. For those currencies where IBOR rates are not available, government bond rates for the relevant maturity are used. Data gaps due to holidays or absence of observations are interpolated by the using "last observation carried forward (LOCF)". Missing values from 3 January 2000 to the first observation date are treated as missing and not interpolated.

99th percentile in the application of the new methodology. It shows that this would result in a decrease in shock factors for many jurisdictions despite more recent volatility in interest rates.

Table 8: Specified size of interest rate shocks (99th%tile, data until 2022, bp)

	ARS	AUD	BRL	CAD	CHF	CNY	EUR	GBP	HKD	IDR
Parallel	400	300	400	150	150	250	200	250	200	400
Short	500	400	500	250	200	250	300	350	300	450
Long	300	200	300	150	150	300	150	150	150	300

INR	JPY	KRW	MXN	RUB	SAR	SEK	SGD	TRY	USD	ZAR
250	100	200	400	400	250	250	150	400	200	250
400	100	300	500	500	300	350	200	500	250	400
200	100	200	150	300	250	150	200	300	150	200

4. Additional issues and next steps

4.1 Caps

Many of the specified shocks in the current IRRBB standard and the proposed recalibrated version are constrained by the caps (400bp for the parallel shock, 500bp for the short-term shock and 300bp for the long-term shock). As noted earlier, these were introduced in the calibration of the current IRRBB standard to avoid unrealistically high interest rate shocks and have been maintained in the new proposed methodology.

Table 9 below shows the shock sizes that result from the proposed new methodology if the caps were removed. The following symbols are used in the table: ‡ (double dagger) means value was capped in the current standard and remains so in the recalibration; ^{1} (superscript one) means value was capped in the current standard but not after recalibration; ^{2} (superscript two) means value was not capped in the current standard but is so after recalibration; no symbol means the value was not capped in the current standard nor under the recalibration.

Table 9: Specified size of interest rate shocks (99.9th%tile, data until 2022, bp)

	ARS	AUD	BRL	CAD	CHF	CNY	EUR	GBP	HKD	IDR
Parallel	3900 ‡	350	1800 ‡	200	150	300	250	300	200	550 ‡
Short	7950 ‡	450	1000 ‡	250	250	300	350	400	350	550 ‡
Long	4600 ‡	300	2700 ‡	200	200	400 ^{2}	200	250	200	650 ‡

INR	JPY	KRW	MXN	RUB	SAR	SEK	SGD	TRY	USD	ZAR
350 ^{1}	100	250	800 ‡	2000 ‡	300	300	150	2000 ‡	200	350 ^{1}
450 ^{1}	100	350	800 ‡	2000 ‡	350	400	250	1850 ‡	300	500 ^{1}
250	100	250	200	600 ‡	250	200	200	1600 ‡	250	350 ‡

Currencies that are subject to the cap under the current and proposed new methodology will experience no change in shock factors, even if interest rates have been more volatile in the additional period used in the recalibration (ie January 2016 to December 2022). To address this issue, and to strengthen the option of local jurisdictions to apply more conservative shocks than the ones specified in the standard the Committee proposes the following amendment to SRP98.63: "*Supervisors may, applying national discretion, set a higher floor under the local interest rate shock scenarios for their home currency, or a higher cap, resulting in more conservative shocks. […]*".

4.2 Non-parallel shocks

As described in Section 3.2, the Committee proposes to calculate the interest rate shocks under the new methodology using a 99.9th percentile in order to maintain a sufficient level of conservatism. The Committee is still discussing, however, whether there are any unintended impacts of this change. One particular area of focus is the non-parallel shocks that bank need to apply under SRB31.91. The non-parallel shocks involve short-term shocks to the term structure of the interest rates (ie short up and down scenarios) together with long-term shocks in the rotation scenarios (ie steepener and flattener scenarios). The formulas for the short (SRB31.91(2)), long (SRB31.91(3)) and rotation shocks (SRB31.91(4)) were specified during the calibration of the current IRRBB standard, and the Committee is considering whether adjustments to these formulas are warranted.

4.3 Impact assessment

As part of the consultation, the Committee intends to collect data from banks to undertake a quantitative impact assessment of the proposed new calibration of the shock factors and updated methodology. The results of the assessment will inform the finalisation of the updated standard.

Annex: Proposed edits to Basel Framework

Set out below are the edits to chapters SRP31 and SRB98 of the Basel Framework to give effect to the recalibration and adjusted methodology proposed in this consultative document.

SRP31 edits

The standardised interest rate shock scenarios

31.90 Banks should apply six prescribed interest rate shock scenarios to capture parallel and non-parallel gap risks for EVE and two prescribed interest rate shock scenarios for NII. The derivation of these shocks is explained in [SRP98.56] to [SRP98.63]. These scenarios are applied to IRRBB exposures in each currency for which the bank has material positions. In order to accommodate heterogeneous economic environments across jurisdictions, the six shock scenarios reflect currency-specific absolute shocks as specified in Table 2 below. For the purposes of capturing the local rate environment, a historical time series ranging from January 2000 to ~~2015~~ December 2022 for various maturities[7] was used to derive each scenario for a given currency. Under this approach, IRRBB is measured by means of the following six scenarios:

(1) parallel shock up;

(2) parallel shock down;

(3) steepener shock (short rates down and long rates up);

(4) flattener shock (short rates up and long rates down);

(5) short rates shock up; and

(6) short rates shock down.

Specified size of interest rate shocks, $\bar{R}_{shocktype,c}$ — Table 2

	ARS	AUD	BRL	CAD	CHF	CNY	EUR	GBP	HKD	IDR	INR
Parallel	400	~~300~~350	400	200	~~100~~150	~~250~~300	~~200~~250	~~250~~300	200	400	~~400~~350
Short	500	450	500	~~300~~250	~~150~~250	300	~~250~~350	~~300~~400	~~250~~350	500	~~500~~450
Long	300	~~200~~300	300	~~150~~200	~~100~~200	~~150~~300	~~100~~200	~~150~~250	~~100~~200	300	~~300~~250

	JPY	KRW	MXN	RUB	SAR	SEK	SGD	TRY	USD	ZAR
Parallel	100	~~300~~250	400	400	~~200~~300	~~200~~300	150	400	200	~~400~~350
Short	100	~~400~~350	500	500	~~300~~350	~~300~~400	~~200~~250	500	300	500
Long	100	~~200~~250	~~300~~200	300	~~150~~250	~~150~~200	~~100~~200	300	~~150~~250	300

Footnotes

[7] Jurisdictions may, under national discretion, recalculate the shocks in Table 2 for their domestic currencies using a time period that deviates from the ~~initial~~ 23~~16~~-year period if it better reflects their idiosyncratic circumstances.

31.91 Given Table 2, the instantaneous shocks to the risk-free rate for parallel, short and long, for each currency, the following parameterisations of the six interest rate shock scenarios should be applied:

(1) Parallel shock for currency c: a constant parallel shock up or down across all time buckets.

~~$$VR_{parallel,c}(t_k) = \pm \bar{R}_{parallel,c}$$~~

$$VS_{parallel,c}(t_k) = \pm \bar{S}_{parallel,c}$$

(2) Short rate shock for currency c: shock up or down that is greatest at the shortest tenor midpoint. That shock, through the shaping scalar $\alpha_{short}(t_k) = (e^{\frac{-t_k}{x}})$ ~~$S_{short}(t_k) = (e^{\frac{-t_k}{x}})$~~, where x=4, diminishes towards zero at the tenor of the longest point in the term structure.[8]

~~$$VR_{short,c}(t_k) = \pm \bar{R}_{short,c} \cdot S_{short}(t_k) = \pm \bar{R}_{short,c} \cdot e^{\frac{-t_k}{x}}$$~~

$$VS_{short,c}(t_k) = \pm \bar{S}_{short,c} \cdot \alpha_{short}(t_k) = \pm \bar{S}_{short,c} \cdot e^{\frac{-t_k}{x}}$$

(3) Long rate shock for currency c (note: this is used only in the rotational shocks): Here the shock is greatest at the longest tenor midpoint and is related to the short scaling factor as: ~~$S_{long}(t_k) = 1 - S_{short}(t_k)$~~ $\alpha_{long}(t_k) = 1 - \alpha_{short}(t_k)$.

~~$$VR_{long,c}(t_k) = \pm \bar{R}_{long,c} \cdot S_{long}(t_k) = \pm \bar{R}_{long,c} \cdot \left(1 - e^{\frac{-t_k}{x}}\right)$$~~

$$VS_{long,c}(t_k) = \pm \bar{S}_{long,c} \cdot \alpha_{long}(t_k) = \pm \bar{S}_{long,c} \cdot \left(1 - e^{\frac{-t_k}{x}}\right)$$

(4) Rotation shocks for currency c: involving rotations to the term structure (ie steepeners and flatteners) of the interest rates whereby both the long and short rates are shocked and the shift in interest rates at each tenor midpoint is obtained by applying the following formulas to those shocks:

~~$$VR_{steepner,c}(t_k) = -0.65 \cdot \left|VR_{short,c}(t_k)\right| + 0.9 \cdot \left|VR_{long,c}(t_k)\right|$$~~

~~$$VR_{flattener,c}(t_k) = +0.8 \cdot \left|VR_{short,c}(t_k)\right| - 0.6 \cdot \left|VR_{long,c}(t_k)\right|$$~~

$$VS_{steepner,c}(t_k) = -0.65 \cdot \left|VS_{short,c}(t_k)\right| + 0.9 \cdot \left|VS_{long,c}(t_k)\right|$$

$$VR_{flattener,c}(t_k) = +0.8 \cdot \left|VR_{short,c}(t_k)\right| - 0.6 \cdot \left|VR_{long,c}(t_k)\right|$$

<u>*Footnotes*</u>

[8] The value of x in the denominator of the function $e^{\frac{-t_k}{x}}$ *controls the rate of decay of the shock. This should be set to the value of 4 for most currencies and the related shocks unless otherwise determined by national supervisors.* t_k *is the midpoint (in time) of the* k^{th} *bucket and* t_K *is the midpoint (in time) of the last bucket K. There are 19 buckets in the standardised framework, but the analysis may be generalised to any number of buckets.*

31.92 The following examples illustrate the scenarios in [SRP31.91](2) and [SRP31.91](4).

(1) Short rate shock: Assume that the bank uses the standardised framework with K=19 time bands and with t_K=25 years (the midpoint (in time) of the longest tenor bucket K), and where t_k is the midpoint (in time) for bucket k. In the standardised framework, if k=10 with t_k=3.5 years, the scalar adjustment for the short shock would be ~~$S_{short}(t_k) = e^{\frac{-3.5}{4}}$~~ $\alpha_{short}(t_k) = e^{\frac{-3.5}{4}}$ = 0.417. Banks would multiply this by the value of the short rate shock to obtain the amount to be added to or subtracted from the yield curve at that tenor point. If the short rate shock was +100 basis points (bp), the increase in the yield curve at t_k=3.5 years would be 41.7 bp.

(2) Steepener: Assume the same point on the yield curve as above, t_k=3.5 years. If the absolute value of the short rate shock was 100 bp and the absolute value of the long rate shock was 100 bp (as for the Japanese yen), the change in the yield curve at t_k=3.5 years would be the sum of the effect of the short rate shock plus the effect of the long rate shock in bp: −0.65 x 100bp x 0.417 + 0.9 x 100bp x (1−0.417) = +25.4bp.

(3) Flattener: The corresponding change in the yield curve for the shocks in the example above at t_k=3.5 years would be: +0.8 x 100bp x 0.417 – 0.6 x 100bp x (1−0.417) = −1.6bp.

31.93 The Committee acknowledges that shock sizes of different currencies should reflect local conditions in a timely manner. For this reason, the Committee will review the calibration of the interest rate shock sizes (eg every five years). National supervisors may, at their discretion, set floors for the post-shock interest rates under the six interest rate shock scenarios, provided the floors are not greater than zero.

SRP98 edits

Derivation of the interest rate shocks

98.56 [SRP31] describes six prescribed interest rate shock scenarios that banks should apply to parallel and non-parallel gap risks for EVE and two prescribed interest rate shock scenarios for NII. In order to derive these shocks, the following general steps are taken.

~~98.57 Step 1: generate a 16-year time series of daily average interest rates for each currency c. The average daily interest rates from the year 2000 (3 January 2000) to 2015 (31 December 2015) are contained in Table 1. The average local percentile of the rate series is determined by calculating the average rate across all daily rates in time buckets 3m, 6m, 1Y, 2Y, 5Y, 7Y, 10Y, 15Y and 20Y.~~

~~Average interest rates by currency~~ ~~Table 1~~

	~~ARS~~	~~AUD~~	~~BRL~~	~~CAD~~	~~CHF~~	~~CNY~~	~~EUR~~	~~GBP~~	~~HKD~~	~~IDR~~	~~INR~~
~~Average~~	~~3363~~	~~517~~	~~1153~~	~~341~~	~~183~~	~~373~~	~~300~~	~~375~~	~~295~~	~~1466~~	~~719~~

	~~JPY~~	~~KRW~~	~~MXN~~	~~RUB~~	~~SAR~~	~~SEK~~	~~SGD~~	~~TRY~~	~~USD~~	~~ZAR~~
~~Average~~	~~89~~	~~471~~	~~754~~	~~868~~	~~360~~	~~330~~	~~230~~	~~1494~~	~~329~~	~~867~~

~~98.58 Step 2: the global shock parameter is prescribed based on the weighted average of the currency-specific shock parameters, $\bar{\alpha}_i$. The shock parameter for scenario i is a weighted average of the $\alpha_{i,c,h}$ across all currencies and defined as α_i. The following baseline global parameters are obtained:~~

~~Baseline global interest rate shock parameters~~ ~~Table 2~~

~~Parallel~~	~~$\bar{\alpha}_{parallel}$~~	~~60%~~
~~Short rate~~	~~$\bar{\alpha}_{short}$~~	~~85%~~
~~Long rate~~	~~$\bar{\alpha}_{long}$~~	~~40%~~

~~98.59 Applying the α_i from Table 2 to the average long-term rates from Table 1 results in the revised interest rate shocks by currency for parallel, short and long segments of the yield curve in Table 3.~~

~~Revised interest rate shocks, $\Delta\bar{R}_{shocktype,c}$~~ ~~Table 3~~

	~~ARS~~	~~AUD~~	~~BRL~~	~~CAD~~	~~CHF~~	~~CNY~~	~~EUR~~	~~GBP~~	~~HKD~~	~~IDR~~	~~INR~~
~~Parallel~~	~~2018~~	~~310~~	~~692~~	~~204~~	~~110~~	~~224~~	~~180~~	~~225~~	~~177~~	~~880~~	~~431~~
~~Short~~	~~2858~~	~~440~~	~~980~~	~~290~~	~~155~~	~~317~~	~~255~~	~~319~~	~~251~~	~~1246~~	~~611~~
~~Long~~	~~1345~~	~~207~~	~~461~~	~~136~~	~~73~~	~~149~~	~~120~~	~~150~~	~~118~~	~~586~~	~~288~~

	~~JPY~~	~~KRW~~	~~MXN~~	~~RUB~~	~~SAR~~	~~SEK~~	~~SGD~~	~~TRY~~	~~USD~~	~~ZAR~~
~~Parallel~~	~~53~~	~~283~~	~~452~~	~~521~~	~~216~~	~~198~~	~~138~~	~~896~~	~~197~~	~~520~~
~~Short~~	~~75~~	~~401~~	~~641~~	~~738~~	~~306~~	~~280~~	~~196~~	~~1270~~	~~279~~	~~737~~
~~Long~~	~~35~~	~~188~~	~~301~~	~~347~~	~~144~~	~~132~~	~~92~~	~~597~~	~~131~~	~~347~~

~~98.60 However, the proposed interest rate shock calibration can lead to unrealistically low interest rate shocks for some currencies and to unrealistically high interest rate shocks for others. In order to ensure a minimum level of prudence and a level playing field, a floor of 100 basis points and variable caps (denoted as $\Delta\bar{R}_j$) are set for the scenarios concerned, those caps being 500 basis points for the short-term, 400 basis points for the parallel and 300 basis points for the long-term interest rate shock scenario.~~

~~98.61 The change in the risk-free interest rate for shock scenario j and currency c can be defined as follows, where $\Delta\bar{R}_j$ is 400, 500 or 300 when j is parallel, short or long respectively.[11]~~

$$\bar{R}_{j,c} = \max\left(100, \min(\Delta\bar{R}_{j,c}, \Delta\bar{R}_j)\right)$$

~~*Footnotes*~~

~~*[11] In the case of the rotation scenarios, $\Delta\bar{R}_{j,c}$ cannot exceed 500 basis points and $\Delta\bar{R}_{j,c}(t_k)$ cannot exceed 300 basis points.*~~

~~98.62 Applying the caps and floors to the shocks described in Table 3 results in the final set of interest rate shocks by currency that is shown in [SRP31.90].~~

98.57 Step 1: Generate a time series of daily interest rates $R_{k,c}$ from the year 2000 (3 January 2000) to 2022 (31 December 2022) in the time buckets k = 3m, 6m, 1Y, 2Y, 5Y, 7Y, 10Y, 15Y, and 20Y for each currency c.

98.58 Step 2: Using the time series of the interest rates levels at each tenor point k and for each currency c, a new time series of rate changes $\Delta R_{k,c}$ is calculated for a moving time window of h = 6 months (125 days):

$$\Delta R_{k,c}(t) = R_{k,c}(t) - R_{k,c}(t-h)$$

98.59 Step 3: For each scenario i and currency c, the average of the rate changes across the corresponding time buckets k_i in Table 1 is taken, where N_i represents the number of time buckets.

$$\Delta R_{i,c}(t) = \frac{1}{N_i}\sum_{k} \Delta R_{k,c}(t)$$

Table 1: Average interest rate change by time bucket

Scenario	Averaged interest rate series	Time buckets
Parallel	$\Delta R_{parallel,c}(t)$	3m, 6m, 1Y, 2Y, 5Y, 7Y, 10Y, 15Y, 20Y
Short rate	$\Delta R_{short,c}(t)$	3m, 6m, 1Y
Long rate	$\Delta R_{long,c}(t)$	10Y, 15Y, 20Y

98.60 Step 4. The 99.9th percentile value of the absolute value of $\Delta R_{i,c}$ over the period from 2000 to 2022, denoted $|\Delta R_{i,c}(t)|$, is used for the interest rate shock of scenario i for currency c.

$$S_{i,c} = P_{99.9}(|\Delta R_{i,c}(t)|)$$

98.61 Step 5. In order to ensure a minimum level of prudence and a level playing field, a floor of 100 bp and variable caps (denoted as $\bar{C}_i$) are set for the scenarios concerned, those caps being 500 bp for the short-term, 400 bp for the parallel and 300 bp for the long-term interest rate shock scenario. The change in the interest rate shock for scenario i and currency c can be defined as:

$$\bar{S}_{i,c} = max\left\{100, min\{S_{i,c}, \bar{C}_i\}\right\}$$

where $\bar{C}_i$ = {400, 500,300}, for i =parallel, short and long, respectively.

98.62 Step 6. Finally, the values from step 5 are rounded to the nearest multiple of 50 bps. This methodology results in the specified interest rate shocks set out in [SRP31.90].

98.63 Supervisors may, applying national discretion, set a higher floor under the local interest rate shock scenarios for their home currency, or a higher cap, resulting in more conservative shocks. Supervisors may also, applying national discretion, set a zero or negative lower bound for the post-shock interest rates $\bar{R}_{j,c}$, where j represents the six interest rate shock scenarios set out in [SRP31.91]:

~~$$\bar{R}_{j,c}(t_k) = \max\left(\bar{R}_{0,c}(t_k) + \Delta\bar{R}_{j,c}(t_k), (\textit{zero or negative lower bound set})\right)$$~~

$$\bar{R}_{j,c}(t_k) = \max\left(\bar{R}_{0,c}(t_k) + \Delta\bar{S}_{j,c}(t_k), (\textit{zero or negative lower bound set})\right)$$