ASSOCIATION DES BANQUIERS CANADIENS
CANADIAN BANKERS ASSOCIATION

Box 348, Commerce Court West
199 Bay Street, 30th Floor
Toronto, Ontario, Canada M5L 1G2
www.cba.ca

Marion G. Wrobel
Vice-President
Policy and Operations
Tel: (416) 362-6093 Ext. 277
mwrobel@cba.ca

January 31, 2014

Mr. Alan Adkins, Co-Chair, Trading Book Group
Ms. Norah Barger, Co-Chair, Trading Book Group
Mr. Ju Quan Tan, Member of Secretariat, Basel Committee on Banking Supervision

Sent by email to: alan.adkins@bankofengland.co.uk; norah.barger@frb.gov; juquan.tan@bis.org

Dear Mr. Adkins, Ms. Barger, and Mr. Tan:

**Re: CBA[1] Comments on the BCBS's Consultative Document:**
**Fundamental review of the trading book: A revised market risk framework**

The CBA is pleased to provide the Basel Committee on Banking Supervision's (BCBS) Trading Book Group (TBG) with its response to the TBG's second consultative document on the fundamental review of the trading book (FRTB). The CBA and its members support the BCBS's efforts to create a more coherent trading book framework and intend to participate constructively towards this goal.

As you are aware, the CBA has already provided the TBG with a counterproposal to the revised standardized approach. It has also shared its views on the existing FRTB timelines with the Office of the Superintendent of Financial Institutions Canada. We would like to take this opportunity to reiterate those earlier comments and also to provide comments on other components of the TBG's second consultative document.

The CBA generally supports the joint industry responses submitted by the International Swaps and Derivatives Association (ISDA), the Institute of International Finance (IIF), and the Global Financial Markets Association (GFMA). We believe that this CBA response complements these joint industry responses.

Our comments on the second consultative FRTB document are set out below, while our questions and requests for greater clarification are contained in the Annex.

[1] The Canadian Bankers Association works on behalf of 59 domestic banks, foreign bank subsidiaries and foreign bank branches operating in Canada and their 275,000 employees. The CBA advocates for effective public policies that contribute to a sound, successful banking system that benefits Canadians and Canada's economy. The Association also promotes financial literacy to help Canadians make informed financial decisions and works with banks and law enforcement to help protect customers against financial crime and promote fraud awareness. www.cba.ca

**Trading/Banking Book Boundary**

Overall, we support the "revised boundary", which evidences the BCBS's effort in considering previous comments by aligning the boundary with risk management practices and strengthening its definition. The revised boundary reduces incentives for regulatory arbitrage by establishing a more objective boundary between both books. That said, we have concerns over potential inconsistencies in the trading book definition.

The proposals state that every instrument in the trading book must be fair-valued through P&L. However, there are numerous other requirements that may conflict with the accounting guidance on what can/cannot be fair-valued through P&L. To highlight a couple of examples:

- The proposal would give the supervisor discretion to force an instrument into the trading book, which may pose a conflict with the accounting rules around those positions (e.g., repos).
- The document states that any instrument held for market-making purposes must be held in the trading book, which may not align with the accounting rules for those positions.

There are also internal inconsistencies within the definitions. As an example, the document states that unlisted equities must be held in the banking book. However, it also says that instruments managed on a trading desk and net short equity positions must be included in the trading book. Together, these restrictions may lead to certain activities becoming prohibited activities for the banking sector, which we do not believe is the intention of the rules.

In addition, the paper gives individual regulators discretion in the trading/banking book boundary decision process (i.e., exceptions to the presumptive list). We have concerns over the consistency of application across jurisdictions where members have multiple supervisors. To mitigate the consistency issue, we propose the creation of a global body/mechanism to communicate exceptions granted by individual regulators. This global body would also review the presumptive list periodically, which aligns with the spirit of "achieving a regulatory framework that can be implemented consistently by supervisors across jurisdictions".

**Factoring in Market Liquidity**

The CBA recognizes the BCBS's efforts to incorporate the risk of market illiquidity as a key consideration in banks' regulatory capital requirements for trading portfolios. However, as the document indicates, there are many challenges related to capturing this in a cohesive framework. The two main concerns are:

- the inconsistency of combining risks defined over differing liquidity horizons; and,
- the excessive value of the proposed horizons relative to trading experience, even in stressed conditions.

The features would negate the use of regulatory capital for internal capital assessment purposes such as limit monitoring or economic capital. The proposed approach generates unrealistic scenarios and inconsistent correlations between risk factors which complicates the recognition of hedges and the risk aggregation into a firm-wide expected shortfall measure.

Secondly, the CBA considers some of the prescribed liquidity horizons to be excessive. As an example, FX and interest rates have a prescribed horizon of 20 days and large cap equities have

a prescribed horizon of 10 days, which are far in excess of actual trading experiences even in very stressful environments. Additionally, the liquidity horizons proposed, coupled with the short calibration period, mean that there is no statistical significance to the results. To make this concrete, with a 20-day horizon and about 260 trading days in a year, we only have 13 independent observations[2]. It is then meaningless to infer a one in a hundred event from that data set.

Furthermore, using overlapping scenarios has the effect that all of the events in the tail are essentially identical, meaning there is essentially no difference between the percentile and the ES measures, thereby undermining a key change in the FRTB proposal. Furthermore, the homogeneity of the tail events also undermines the modelling robustness associated with having a set of economically diverse events driving the risk assessment and renders the model result overly reliant on one single historical scenario. The effect is that instead of a risk model, the capital essentially becomes a stress test.

Another unintended consequence could be that historical simulation will prove unviable and that banks may be forced towards a Monte Carlo approach, where inconsistencies can be resolved more easily. This may lead to modelling variability, in contradiction to BCBS objectives.

Alternative proposal

The CBA supports the alternative approaches brought forth by the joint industry associations, in particular Variant 1. The proposed variant addresses the following issues:

- Variant 1 facilitates correct recognition of hedges and risk aggregation across a relevant time horizon into a firm-wide expected shortfall measure. This is in line with the intent of the BCBS proposal, where firm-wide diversification is captured through a "rho" parameter.
- It uses risk factor level scaling of liquidity horizons similar to the BCBS proposal. Improved integration with the desk level approach can be achieved if the add-ons are calculated separately for each desk.
- The approach utilizes a well-defined correlation horizon with efficient separation of timescales.
    - The approach uses correlations over a period over which correlations can be meaningfully defined. The 10-day horizon provides stable, well-understood correlations, covered by existing data validation. 10-day horizons would capture serial correlations and trending in returns not captured by 1-day returns.
    - The approach assumes a worst case correlation for longer horizons where correlations are fragile and idiosyncratic to the stress period. The proposed Variant 1 makes no assumptions with respect to such correlations and uses a simple conservative addition.
- The approach reduces additional development requirements and can be implemented in existing historical or Monte Carlo frameworks. It further should integrate well with most banks' internal risk assessment models.
- The alternative proposal provides easier integration with the backtesting framework:

[2] It is possible to use overlapping scenarios but they have a very high degree of correlation. Use of overlapping scenarios contains only a modicum of additional information --- about 40% by some estimates, making the ensemble statistically equivalent to about 18 independent scenarios, which is still far too few to infer anything about a remote tail.

- Backtesting could be directly aligned with the modelled 10-day predictions and performed at 97.5 and 99 percentiles as proposed. Backtesting thresholds would need to be reassessed to account for the reduced statistical significance.
- Backtesting would provide a meaningful assessment of the modelled scenarios, including a meaningful assessment of correlations and volatilities applied.

We further recommend utilizing the QIS to assess the FRTB approach for incorporating liquidity horizons against the alternative approaches, to enable an informed decision on the final proposal.

**Treatment of Credit**

The CBA welcomes the BCBS's efforts to bring trading book requirements closer to those of the banking book by separating modeling of the discrete (default risk) and continuous (spread risk) components of credit risk and replacing IRC with IDR by removing the constant level of risk assumption and migration risk; separate modeling would facilitate backtesting for market risks (including credit spread risks) at lower quantiles. The CBA supports that migration risk is incorporated into the measurement of market risk through the volatility of credit spreads.

The CBA has concerns that the prescriptive two-factor correlation model may not be sufficiently risk sensitive and equity correlations may not be representative for sovereigns; the floor of 0.03% for sovereigns issued on home currency is inconsistent with the banking book treatment. For the standalone CVA charges, clarification is needed on the liquidity horizon setting under the advanced approach: a new liquidity horizon of 60-day or above would be a significant change to the previous 10-day risk horizon.

**Revised Standardized Approach**

The CBA is supportive of the intent of introducing a standardized approach that is more risk sensitive, as well as the goal of better recognizing hedging and diversification.

We propose an alternative methodology for the standardized approach calculations for market risk regulatory capital that can easily be adopted for the forthcoming QIS[3]. The intent is to leverage risk sensitivities that are already being produced, instead of discounted cash flows, while at the same time introducing minimal changes to the existing proposal outlined in the second FRTB consultative document.

In addition, we have concerns over the relationship between internal models and the standardized approach. A floor based on the standardized approach may discourage institutions from implementing and improving internal models. Firms should be encouraged to continually develop and improve upon their internal models, and work with regulators to strengthen modeling standards.

The QIS will be very important in determining the reasonableness of the current proposal. Given the difficulties in implementing both the revised models based and cash flow based standardized approach, this will be a challenge. It will be difficult to determine other areas where there may be issues in the standardized approach without working through the QIS. For example, it will be

[3] "CBA Comments on TBG's Request for Revised Standardized Approach", January 6, 2014.

difficult to assess whether or not the standardized approach would produce unrealistic results for a large portfolio, given the floors embedded in the offsetting of the cash flows.

**Model-Independent Assessment Tool**

We echo the concerns presented in the joint industry response that the exposure measure will likely be insensitive to the actual market risk of the desk. Therefore, it would be inappropriate as a criterion for model approval. We question the need for this tool. However, if such a test is required, the exposure measure must be risk-sensitive. An appropriately calibrated stress scenario might be a viable alternative.

**Revised Models-Based Approaches**

The CBA would first and foremost point out the operational burden of implementing and supporting up to five different risk measures: the standardized approach, the model-based framework, 1-day backtesting, model-independent assessment tool and a more risk sensitive bank-internal capital measurement framework. The proposed, very prescriptive, model-based approach and the introduction of 1-day VaR solely for backtesting represent a significant departure from the use test and introduce significant overhead.

We are supportive of the overall proposal to have a desk level approach to achieve a more granular approval process. The BCBS should ensure that, under the proposed new framework outlined in the consultative document, the capital incentive for banks to use internal models-based approaches is retained. For example, recognition of hedges across trading desks with different approval status is problematic. Furthermore, imposing a floor or surcharge on the modelled approach would not provide the correct incentives; however, a supervisory review approach with potential surcharges is preferred to floors.

The CBA favours the computationally simpler direct stressed VaR calculation instead of the proposed scaled up approach. We support the need for a reduced set of risk factors for determining stress periods. This would also increase the usefulness of regulatory capital for risk management purposes. Furthermore, the CBA acknowledges the BCBS's desire to move away from VaR and towards ES as a risk measure, however notes that ES has limited meaning for the proposed overlapping scenarios for long liquidity horizons, effectively selecting the worst case scenario within the stress period.

**FRTB and QIS Timelines**

It is helpful that the BCBS has proposed a QIS for this important change to market risk capital rules, and we are encouraged that it has been split into two phases. We would like to note that we are in fundamental agreement with the issues addressed in the joint industry submission to the TBG regarding the FRTB and QIS timeline. Because the changes to the new methodologies are substantial, we would advocate performing the QIS over additional phases, to ensure that participants have adequate time to synthesize requirements, build up infrastructure, and produce validated results.

It is worth highlighting difficulties which arise with the second QIS (as well as full FRTB implementation) which are not as apparent in the first QIS:

- With the simulation in the first QIS, the full trading book revaluation may require material infrastructure and feed changes; in particular, existing risk systems may not support the

infrastructure to identify at the position level which FRTB categories apply (e.g., listed/non-listed equities).

- For banks with vendor solutions, timelines are less flexible, and both the FRTB and second QIS will require extra lead time to negotiate contracts, as well as for the vendor to negotiate global solutions to the problems. This is complicated by the fact that methodologies have not yet been fully specified.
- The current proposed standardized approach will require material system enhancements to infrastructure to decompose general instruments into their cash flows, when treated at the level of the entire trading book. Implementation and validation of this item alone will likely take longer than the allotted second QIS period.

To ensure a successful QIS, the process should be iterative with clearly defined and achievable stages of development and incremental growth in complexity.

We would be pleased to discuss these comments with you further at your convenience.

Sincerely,

cc: Greg Caldwell, Office of the Superintendent of Financial Institutions
Greg.Caldwell@osfi-bsif.gc.ca

Meyer Aaron, Bank of Canada
aaro@bank-banque-canada.ca

encl: Annex

## Annex – CBA Questions and Requests for Greater Clarification

**Trading Book/Banking Book Boundary**

- *Intraday Trading*
  - There are multiple references to (active) intraday trading and associated measurement & reporting in the document. More clarity on what constitutes "active" intraday trading, the type and frequency of specific measurements and limits, would be helpful.
- *Pillar 1 capital charge for IR and CS risk in the banking book, (p 9)*
  - Can you clarify the treatment of longs and shorts?
- *"Any instrument which would lead to a net short risk position in an equity in the banking book is seen as being held for at least one of the purposes listed in paragraph 4 and therefore it must be included in the trading book.", Annex 1: Para 10 (p 48)*
  - Does this apply for retail instruments? If yes, there will be significant negative implications for retail GIC products offered by members.
  - More clarification is needed on how to identify the instrument(s) leading to a net short risk position in equity in the banking book, which is portfolio dependent. For example, if a portfolio in banking book for a desk is a net short position in equity, does that mean all instruments in that desk's banking book should switch to trading book? Will that lead to arbitrage in selecting "regulatory desk"?
- *The general presumption is that options are being held for at least one of the purposes listed in paragraph 4 and therefore are covered instrument, Annex 1: Para 11 (p 49)*
  - Does this apply to the ones hedging the bank's retail exposure, e.g. mortgage commitments or cashable GICs? Or is this just a general presumption, rather than a strict rule?
- *List of banking book items, Annex 1: Para 13 (p 49)*
  - Are these just examples of the instruments that should be in the banking book? If yes, will the BCBS send a comprehensive list at some time in the future?
- *Documentation and communication of exceptions to the presumptive list, Annex 1: Para 20a (p 51)*
  - How is it proposed for banks to specify "potential deviations" in policies & procedures?

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Toronto, Ontario, Canada M5L 1G2
www.cba.ca

Marion G. Wrobel
Vice-President
Policy and Operations
Tel: (416) 362-6093 Ext. 277
mwrobel@cba.ca

January 6, 2014

Mr. Alan Adkins, Co-Chair, Trading Book Group
Ms. Norah Barger, Co-Chair, Trading Book Group
Mr. Ju Quan Tan, Member of Secretariat, Basel Committee on Banking Supervision

Sent by email to: alan.adkins@bankofengland.co.uk; norah.barger@frb.gov; juquan.tan@bis.org

Dear Mr. Adkins, Ms. Barger, and Mr. Tan:

**Re: CBA[1] Comments on Trading Book Group's Request for a Revised Standardized Approach**

In response to the Trading Book Group's (TBG) correspondence to the Institute of International Finance and the International Swaps and Derivatives Association of December 17, 2013, the CBA welcomes the opportunity to provide the attached counterproposal to the cash flow approach, for consideration by the TBG and the Basel Committee.

We would like to express our support for the joint industry response submitted to the TBG on January 3, 2014. We believe this CBA submission is complementary by providing a detailed proposal that is aligned with this response.

We would like to note that, as with the existing Fundamental Review of the Trading Book proposal, there are a number of parameters that we would expect to be assessed in the forthcoming QIS.

We would be pleased to discuss this approach with you further at your convenience.

Sincerely,

[1] The Canadian Bankers Association works on behalf of 57 domestic banks, foreign bank subsidiaries and foreign bank branches operating in Canada and their 275,000 employees. The CBA advocates for effective public policies that contribute to a sound, successful banking system that benefits Canadians and Canada's economy. The Association also promotes financial literacy to help Canadians make informed financial decisions and works with banks and law enforcement to help protect customers against financial crime and promote fraud awareness. www.cba.ca

Attachment – FRTB – Sensitivity based Standardized Approach (SSA)

cc: Greg Caldwell, Office of the Superintendent of Financial Institutions
Greg.Caldwell@osfi-bsif.gc.ca

Meyer Aaron, Bank of Canada
aaro@bank-banque-canada.ca

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# FRTB – Sensitivity based Standardized Approach (SSA)

This document proposes an alternative methodology for the standardized approach calculations for market risk regulatory capital that can easily be adopted for the forthcoming QIS. The intent is to leverage risk sensitivities that are already being produced, while at the same time introducing minimal changes to the existing proposal outlined in the second consultative paper on the Fundamental Review of the Trading Book. Longer term, it would be desirable to align the standardized approach with existing regulatory reporting requirements such the Federal Reserve's FR-Y14[1].

In fact, many of the calculations required to produce the Standardized Approach capital requirement are identical to what is presented in the consultative paper - the proposed changes are primarily on the starting point of the calculation, as well as the explicit capture of basis risk. Note, the proposal only focuses on the GIRR and CSR framework.

Features of the new proposal include:

- Same level of model reliance
  Most banks currently build discount and forecasting curves using market quoted rates. Therefore, the SSA has the same level of model reliance as that of the cash flow based standardized approach (CFSA), as CFSA requires discount curves.

- Limited changes to the overall approach
  Most procedures stay the same, except discounted cash flows are replaced by risk factor sensitivities. For the example of GIRR and CSR, steps of recognizing hedging and diversification within each currency / bucket and across currencies / buckets are virtually identical to what is in the FRTB proposal.

- Capture basis risk explicitly
  By using the sensitivities to various basis curves, we are able to capture basis explicitly, rather than indirectly using 90 percent floor in the current FRTB proposal. Therefore, the new proposal is more risk sensitive and simpler.

- Independent validation and control on risk sensitivity
  Pricing model approval requires independent validation of risks produced by the model. The validated risk sensitivities are then extensively used by risk management practice, including risk limit monitoring, P&L decomposition, scenario analysis, etc. Banks already impose a substantial amount of discipline and controls on their calculation, testing and validation of risk sensitivities.

Overall, the new proposal achieves the goal of being more accurate with respect to basis, easier to implement and more intuitive, with minimum revision to the current FRTB proposal.

[1] Please see details of FR-Y14 in the following link
http://federalreserve.gov/apps/reportforms/reportdetail.aspx?sOoYJ+5BzDZGWnsSjRJKDwRxOb5Kb1hL

# Generic Interest Rate Risk (GIRR)

The basic idea is to get interest rate (IR) risk per currency (in a way that reflects both various trade basis within each currency, as well as across tenors as per FRTB proposal), and aggregate across currencies again as per FRTB proposal. This achieves measures that are very similar to FRTB proposal (since new methodology could be calibrated to the proposal in the FRTB paper), but is simpler to implement and provides a more accurate measure on large portfolios.

Step 1: *Calculate sensitivity (i.e., partial PV01) at each vertex per risk factor within each currency*

Underlying risk factors are interest rate curves, such as bond or swap curve. Partial PV01 is defined as mark-to-market change due to 1 basis point increase at a given vertex on a curve. For the example of USD currency, Table 1 illustrates risk factors (curves) along vertex tenors, and includes an explicit capture of the various traded basis curves. All cash based instruments would have their interest rate risk bucketed under the "Governments' curves. Any remaining credit spread risk for these would be captured in the CSR framework. Note, all risk sensitivities are represented as outright risks – for example, the underlying risk to the LIBOR 1M curve is based on shifting the outright curve rather than the 1M vs 3M basis quotes. Note this is similar to the risk sensitivities that are requested as part of the FR-Y14 template, with the main difference being on the granularity of the tenor buckets.

**Table 1: Risk Factor Vertex Example**

| Partial PV01 | 0.25y | 0.5y | 1y | 2y | 3y | 5y | 10y | 15y | 20y | 30y |
|---|---|---|---|---|---|---|---|---|---|---|
| Governments | | | | | | | | | | |
| OIS | | | | | | | | | | |
| Libor 1m | | | | | | | | | | |
| Libor 3m | | | | | | | | | | |
| Libor 6m | | | | | | | | | | |
| Libor 12m | | | | | | | | | | |

Most of these sensitivities are already calculated by banks for risk management purpose and regulatory reporting requirement.

Step2: *Aggregate sensitivities (i.e., partial PV01) at each vertex across risk factors within each currency*

$$AS = sign\left(\sum_i S_i\right) \times \sqrt{\sum_i S_i^2 + \sum_i \sum_{k \neq i} \theta_{i,k} S_i S_k}$$

where $S_i$ is the sensitivity (i.e., partial PV01) for $i$ th risk factor (curve) at a given vertex within each currency. Here, $\theta_{i,k}$ is the correlation between risk factor $i$ and $k$ . $\theta$ is equal to 0.9 (it can be adjusted as per QIS results).

Here, *AS* is effectively adjusted to capture basis through less than perfect offset of a long versus short position in the various curves. The first term on right hand side (RHS) represents the outright position (whether long or short) to IR at a particular vertex, therefore taking the sign of

aggregated PV01 across risk factors (curves). The second term on RHS calculates the aggregated amount while explicitly capturing traded basis (e.g., Libor 1m vs. Libor 3m) via correlation.

Step3: *Apply weights across vertices within each currency*

$$WAS_j = W_j \times AS_j$$

where $W_j$ is the weight at vertex $j$, as shown in the Table 2 below. For the purpose of simplicity, we choose a constant weight, i.e., $W_j = 100$. This represents effective shocks (e.g., 100 basis points) among risk factors, which calibrates well to those put forth in the FRTB proposal and can be further adjusted as per QIS results.

This is similar to the current FRTB proposal, where weights are applied against discounted cash flows.

**Table 2: GIRR Weight**

| | **0.25y** | **0.5y** | **1y** | **2y** | **3y** | **5y** | **10y** | **15y** | **20y** | **30y** |
|---|---|---|---|---|---|---|---|---|---|---|
| *W* | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |

Step 4: *Apply the formula that recognizes hedging and diversification within each currency*

**This is the same as current FRTB proposal**. The sensitivities at each vertex are then put into the following formula, which recognises offsetting between sensitivities at different vertices in the same currency:

$$K_b = \sqrt{\sum_i WAS_i^2 + \sum_i \sum_{j \neq i} \rho_{i,j} \times WAS_i \times WAS_j}$$

where $\rho$ is specified by regulators for same or different signs. The first correlation matrix below should be used for correlation if the net sensitivity at vertices $i$ and $j$ have the same sign (long/long or short/short). The second correlation matrix below should be used if the net sensitivity at vertices $i$ and $j$ have the different signs (long/short)

**Table 3: GIRR Correlation Matrix under Single Currency**

Correlations for Positions with the Same Sign

| | 0.25yr | 0.5yr | 1yr | 2yr | 3yr | 5yr | 10yr | 15yr | 20yr | 30yr |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.25yr | | | | | | | | | | |
| 0.5yr | 95% | | | | | | | | | |
| 1yr | 85% | 90% | | | | | | | | |
| 2yr | 75% | 75% | 90% | | | | | | | |
| 3yr | 65% | 70% | 85% | 95% | | | | | | |
| 5yr | 55% | 65% | 75% | 90% | 95% | | | | | |
| 10yr | 45% | 50% | 60% | 75% | 80% | 90% | | | | |
| 15yr | 40% | 45% | 50% | 65% | 75% | 85% | 95% | | | |
| 20yr | 40% | 45% | 50% | 60% | 70% | 75% | 90% | 100% | | |
| 30yr | 35% | 40% | 50% | 60% | 65% | 70% | 85% | 100% | 100% | |

Correlations for Positions with Different Signs

| | 0.25yr | 0.5yr | 1yr | 2yr | 3yr | 5yr | 10yr | 15yr | 20yr | 30yr |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.25yr | | | | | | | | | | |
| 0.5yr | 90% | | | | | | | | | |
| 1yr | 70% | 85% | | | | | | | | |
| 2yr | 55% | 70% | 80% | | | | | | | |
| 3yr | 50% | 60% | 75% | 90% | | | | | | |
| 5yr | 40% | 45% | 60% | 75% | 85% | | | | | |
| 10yr | 25% | 35% | 45% | 55% | 60% | 75% | | | | |
| 15yr | 20% | 25% | 35% | 40% | 50% | 60% | 85% | | | |
| 20yr | 15% | 20% | 30% | 40% | 50% | 60% | 75% | 85% | | |
| 30yr | 15% | 15% | 20% | 40% | 45% | 50% | 65% | 70% | 70% | |

Step 5: *Apply the formula that recognizes hedging and diversification across currencies*.

**This is the same as current FRTB proposal**. The capital requirements for each of the individual currencies are then aggregated to obtain the overall capital requirement for GIRR. The following formula should be used to aggregate the individual currency capital requirements, recognizing diversification across currencies.

$$GIRR \quad Capital = \sqrt{\sum_b K_b^2 + \sum_b \sum_{c \neq b} \gamma_{bc} K_b K_c}$$

where $K_b^2$ is the capital requirement arising from currency b and $\gamma_{bc}$ is equal to 0.5.

## GIRR Example #1

Portfolio

- 5y USD receiver swap with $100M notional, i.e., receiving 1% fixed rate and paying Libor3M.
- 5y USD payer swap with $100M notional, i.e., paying 1% fixed rate and receiving Libor6M.

Step 1: *Calculate sensitivity (i.e., partial PV01) at each vertex per risk factor within each currency*

| Partial PV01 | 0.25y | 0.5y | 1y | 2y | 3y | 5y | 10y | 15y | 20y | 30y |
|---|---|---|---|---|---|---|---|---|---|---|
| Governments | | | | | | | | | | |
| OIS | | | | | | | | | | |
| Libor 1m | | | | | | | | | | |
| Libor 3m | | | | | | (48,150) | | | | |
| Libor 6m | | | | | | 48,200 | | | | |
| Libor 12m | | | | | | | | | | |

Step2: *Aggregate sensitivities (i.e., partial PV01) across risk factors at each vertex within each currency*

Trade basis (e.g., Libor 3m vs. Libor 6m) is explicitly captured through correlation structure.

$$AS_{5y} = sign(-48150 + 48200) \times \sqrt{(-48150)^2 + (48200)^2 + 2 \times 0.9 \times (-48150) \times 48200} = 21{,}544.75$$

| | 0.25y | 0.5y | 1y | 2y | 3y | 5y | 10y | 15y | 20y | 30y |
|---|---|---|---|---|---|---|---|---|---|---|
| Aggregated Sensitivity (AS) | 0 | 0 | 0 | 0 | 0 | 21,545 | 0 | 0 | 0 | 0 |

Step3: *Apply weights across vertices within each currency*

Simply multiply 100 weight with AS to obtain weighted aggregated sensitivity (WAS).

$$WAS_{5y} = 21{,}544.75 \times 100 = 2{,}154{,}475$$

| | 0.25y | 0.5y | 1y | 2y | 3y | 5y | 10y | 15y | 20y | 30y |
|---|---|---|---|---|---|---|---|---|---|---|
| Weight | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| AS | 0 | 0 | 0 | 0 | 0 | 21,545 | 0 | 0 | 0 | 0 |
| Weighted AS (WAS) | 0 | 0 | 0 | 0 | 0 | 2,154,475 | 0 | 0 | 0 | 0 |

Step 4: *Apply the formula that recognizes hedging and diversification within each currency*

$$K_b = \sqrt{\sum_i WAS_i^2 + \sum_i \sum_{j \neq i} \rho_{i,j} \times WAS_i \times WAS_j} = 2{,}154{,}475$$

Step 5: *Apply the formula that recognizes hedging and diversification across currencies.*

$$GIRR \quad Capital = \sqrt{\sum_b K_b^2 + \sum_b \sum_{c \neq b} \gamma_{bc} K_b K_c} = 2{,}154{,}475$$

**GIRR Example #2**

Portfolio

- Long a 3y USD Government Bond, with $100M notional, and 1% fixed coupon.
- Long a 5y USD Government Bond, with $100M notional, and 1% fixed coupon.
- Long a 10y USD Government Bond, with $100M notional, and 1% fixed coupon.
- Enter into a 5y USD payer swap with $300M notional, i.e., paying 1% fixed rate and receiving Libor3M.

Step 1: *Calculate sensitivity (i.e., partial PV01) at each vertex per risk factor within each currency*

| Partial PV01 | 0.25y | 0.5y | 1y | 2y | 3y | 5y | 10y | 15y | 20y | 30y |
|---|---|---|---|---|---|---|---|---|---|---|
| Governments | | | | | (29,773) | (48,150) | (87,489) | | | |
| OIS | | | | | | | | | | |
| Libor 1m | | | | | | | | | | |
| Libor 3m | | | | | | 144,451 | | | | |
| Libor 6m | | | | | | | | | | |
| Libor 12m | | | | | | | | | | |

Step2: *Aggregate sensitivities (i.e., partial PV01) across risk factors at each vertex within each currency*

$$AS_{3y} = -29{,}773.10$$

$$AS_{5y} = sign(-48150+144451)\times\sqrt{(-48150)^2+(144451)^2+2\times 0.9\times(-48150)\times 144451} = 103{,}270.91$$

$$AS_{10y} = -87{,}489.40$$

Again, the basis between the swap and government interest rate curve is explicitly captured through the correlation assumption.

| | 0.25y | 0.5y | 1y | 2y | 3y | 5y | 10y | 15y | 20y | 30y |
|---|---|---|---|---|---|---|---|---|---|---|
| Aggregated Sensitivity (AS) | 0 | 0 | 0 | 0 | (29,773) | 103,271 | (87,489) | 0 | 0 | 0 |

Step3: *Apply weights across vertices within each currency*

Apply 100 weight from Table 2 to AS, and obtain weighted aggregated sensitivity (WAS) across vertices within USD.

$$WAS_{3y} = -29{,}773.10\times 100 = -2{,}977{,}310$$

$$WAS_{5y} = 103{,}270.91\times 100 = 10{,}327{,}091$$

$$WAS_{10y} = -87{,}489.40\times 100 = -8{,}748{,}940$$

| | 0.25y | 0.5y | 1y | 2y | 3y | 5y | 10y | 15y | 20y | 30y |
|---|---|---|---|---|---|---|---|---|---|---|
| Weight | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| AS | 0 | 0 | 0 | 0 | (29,773) | 103,271 | (87,489) | 0 | 0 | 0 |
| Weighted AS (WAS) | 0 | 0 | 0 | 0 | (2,977,310) | 10,327,091 | (8,748,940) | 0 | 0 | 0 |

Step 4: *Apply the formula that recognizes hedging and diversification within each currency*

$$K_b = \sqrt{\sum_i WAS_i^2 + \sum_i \sum_{j\neq i} \rho_{i,j}\times WAS_i \times WAS_j}$$

$$= \sqrt{\begin{matrix}(-2{,}997{,}310)^2+(10{,}327{,}091)^2+(-8{,}748{,}940)^2 \\ +2\times 0.85\times(-2{,}997{,}310)\times 10{,}327{,}091 \\ +2\times 0.80\times(-2{,}997{,}310)\times(-8{,}748{,}940) \\ +2\times 0.75\times 10{,}327{,}091\times(-8{,}748{,}940)\end{matrix}} = 6{,}777{,}755$$

where correlation are due to Table 3.

Step 5: *Apply the formula that recognizes hedging and diversification across currencies*.

$$GIRR \quad Capital = \sqrt{\sum_b K_b^2 + \sum_b \sum_{c\neq b} \gamma_{bc} K_b K_c} = 6{,}777{,}755$$

# Credit Spread Risk (CSR)

The basic idea for CSR is to calculate credit spread (CS) risk and apply bucket weights. The proposal first aggregates at single name level across bonds and CDS at each vertex tenor, next aggregates across tenors and names within the bucket, and finally aggregates across buckets. The last two steps are virtually identical to the current FRTB proposal.

Step 1: *Calculate sensitivity (i.e., partial CS01) at each vertex per risk factor per single name within each sector/rating bucket.*

The buckets are shown in Table 4, assuming no change to the FRTB definition.

**Table 4: CSR Bucket List**

| Bucket Number | Credit Quality | Sector |
|---|---|---|
| 1 | Investment Grade (IG) | Sovereigns |
| 2 | | Financial (includes national banks) |
| 3 | | Basic Materials, Energy, Industrials |
| 4 | | Consumer |
| 5 | | Technology, Telecommunications |
| 6 | | Health care, Utilities, Local government, Government-backed corporates (non-financial) |
| 7 | High Yield (HY) Non-rated (NR) | Sovereigns |
| 8 | | Financial (includes national banks) |
| 9 | | Basic Materials, Energy, Industrials |
| 10 | | Consumer |
| 11 | | Technology, Telecommunications |
| 12 | | Health care, Utilities, Local government, Government-backed corporates (non-financial) |

Risk factor is a credit curve, such as bond credit spread curve, or credit default swap (CDS) curve. Partial CS01 is defined as mark-to-market change due to 1 basis point increase at a given vertex on a credit curve.

Single name refers to either issuer name for bond or underlying reference name for CDS.

The vertex tenors in CSR are the same as those used in GIRR.

Step2: *Aggregate sensitivities (i.e., partial CS01) at each tenor vertex across risk factors per single name within each sector/rating bucket*

$$AS = sign\left(\sum_i S_i\right) \times \sqrt{\sum_i S_i^2 + \sum_i \sum_{k \neq i} \theta_{i,k} S_i S_k}$$

where $S_i$ is the sensitivity (i.e., partial CS01) for $i$ th risk factor (curve) at a given vertex within each bucket. Here, $\theta_{i,k}$ is the correlation between risk factor $i$ and $k$. $\theta$ is equal to 0.9 (it can be adjusted as per QIS results).

Here, *AS* is effectively adjusted to capture basis between bond and CDS spreads. The first term on right hand side (RHS) represents the outright position (whether long or short) to CS at a particular vertex, therefore taking the sign of aggregated CS01 across risk factors (curves) per single name. The second term on RHS calculates the aggregated amount while explicitly capturing the bond/CDS basis via correlation.

Step3: *Apply weights across vertices per single name within each sector/rating bucket*

$$WAS_j = W_j \times AS_j$$

where $W_j$ is the weight at vertex $j$ within a bucket. For the purpose of simplicity, we choose a constant weight per bucket, see Table 5 below. Intuitively speaking, this represents effective shocks (e.g., 200 basis points shocks for financial IG bucket), which calibrates well to those put forth in the FRTB proposal and can be further adjusted as per QIS results.

This is similar to the current FRTB proposal, where weights are applied against discounted cash flows.

**Table 5: CSR Bucket Sector/Rating Weights**

| Bucket Number | Weight |
|---|---|
| **1** | 50 |
| **2** | 200 |
| **3** | 150 |
| **4** | 100 |
| **5** | 100 |
| **6** | 100 |
| **7** | 100 |
| **8** | 400 |
| **9** | 300 |
| **10** | 350 |
| **11** | 350 |
| **12** | 250 |
| **Residual** | 400 |

Step 4: *Apply the formula that recognizes hedging and diversification across tenor vertices and names within each sector/rating bucket*

**This is the same as current FRTB proposal**. The sensitivities at each vertex are then put into the following formula, which recognises offsetting between sensitivities at different vertices in the same bucket:

$$K_b = \sqrt{\sum_i WAS_i^2 + \sum_i \sum_{j \neq i} \rho_{i,j} \times WAS_i \times WAS_j}$$

where $\rho$ is the correlation parameter between sensitivity $i$ and $j$.

The value of $\rho$ for a pair of sensitivities will depend on the characteristics of the risk factors. The correlations that should be used are set out in the following table

**Table 6: CSR Correlation Matrix within Sector/Rating Bucket**

| | Same name and maturity difference less than or equal to 5 years | Same name and maturity difference over 5 years | Different name |
|---|---|---|---|
| Sensitivities have the same sign | 95% | 90% | 40% |
| Sensitivities have different signs | 75% | 60% | 10% |
| Residual bucket - sensitivities have the same sign | 100% | | |
| Residual bucket - sensitivities have different signs | 0% | | |

Step 5: *Apply the formula that recognizes hedging and diversification across sector/rating buckets.*

**This is the same as current FRTB proposal**. The risk exposures for each of the individual risk buckets must be aggregated to obtain the capital requirement for CSR. The following formula is used to aggregate the individual bucket risk exposures, recognizing hedging and diversification across buckets

$$CSR \quad Capital = \sqrt{\sum_b K_b^2 + \sum_b \sum_{c \neq b} \gamma_{bc} X_b X_c} + K_{residual}$$

Where $K_{residual}$ is the capital requirement that arises due to the residual bucket, the parameter $X_b = \sum_{i \in b} WAS_i$ and $\gamma_{bc}$ is the correlation parameter between sector/rating buckets b and c, which are outlined in the following correlation matrix:

**Table 7: CSR Correlation Matrix across Sector/Rating Buckets**

| Bucket | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | | | |
| 2 | 10% | | | | | | | | | | | |
| 3 | 20% | 5% | | | | | | | | | | |
| 4 | 25% | 15% | 20% | | | | | | | | | |
| 5 | 20% | 20% | 25% | 25% | | | | | | | | |
| 6 | 15% | 5% | 5% | 5% | 5% | | | | | | | |
| 7 | 20% | 10% | 10% | 10% | 15% | 10% | | | | | | |
| 8 | 15% | 15% | 15% | 15% | 20% | 15% | 25% | | | | | |
| 9 | 20% | 5% | 0% | 0% | 10% | 5% | 15% | 20% | | | | |
| 10 | 20% | 15% | 25% | 25% | 20% | 20% | 20% | 20% | 25% | | | |
| 11 | 20% | 0% | 0% | 5% | 20% | 10% | 15% | 20% | 15% | 15% | | |
| 12 | 15% | 30% | 40% | 40% | 15% | 30% | 20% | 15% | 15% | 20% | 15% | |

## CSR Example

Portfolio

- Long a 10y JPM IG Bond, with $100M notional, and 2% fixed coupon.
- Buy a 5y CDS protection on JPM, with $200M notional, i.e., paying 2% premium.
- Long a 3y IBM IG bond, with $100M notional, and 1% fixed coupon
- Buy a 3y CDS protection on IBM, with $100M notional, receiving 1% premium

Step 1: *Calculate sensitivity (i.e., partial CS01) at each vertex per risk factor per single name within each sector/rating bucket*

| Partial CS01 | 0.25y | 0.5y | 1y | 2y | 3y | 5y | 10y | 15y | 20y | 30y |
|---|---|---|---|---|---|---|---|---|---|---|
| JPM Bond Curve (Bucket #2) | | | | | | | (98,050) | | | |
| JPM CDS Curve (Bucket #2) | | | | | | 98,000 | | | | |
| IBM Bond Curve (Bucket #5) | | | | | (29,750) | | | | | |
| IBM CDS Curve (Bucket #5) | | | | | 29,700 | | | | | |

According to Table 4, JPM is a financial company, which belongs to bucket #2. IBM is a technology company that belongs to bucket #5.

Step2: *Aggregate sensitivities (i.e., partial CS01) at each vertex across risk factors per single name within each sector/rating bucket*

| | 0.25y | 0.5y | 1y | 2y | 3y | 5y | 10y | 15y | 20y | 30y |
|---|---|---|---|---|---|---|---|---|---|---|
| JPM AS (Bucket #2) | 0 | 0 | 0 | 0 | 0 | 98,000 | (98,050) | 0 | 0 | 0 |
| IBM AS (Bucket #5) | 0 | 0 | 0 | 0 | (13,294) | 0 | 0 | 0 | 0 | 0 |

$$AS_{3y}^{IBM} = sign(-29750+29700)\times\sqrt{(-29750)^2+(29700)^2+2\times 0.9\times(-29750)\times 29700} = -13{,}293.51$$

$$AS_{5y}^{JPM} = 98{,}000$$

$$AS_{10y}^{JPM} = -98{,}050$$

where $AS_{3y}^{IBM}$ explicitly captures and aggregates bond-CDS basis risk through correlation $\theta = 0.9$.

Step3: *Apply weights across vertices per single name within each bucket*
To obtain weighted and aggregated sensitivities (WAS), multiply aggregated sensitivity in step (2) with bucket weight from Table 5.

$$WAS_{3y}^{IBM} = -13{,}293.51\times 100 = -1{,}329{,}351$$

$$WAS_{5y}^{JPM} = 98{,}000\times 200 = 19{,}600{,}000$$

$$WAS_{10y}^{JPM} = -98{,}050\times 200 = -19{,}610{,}000$$

| | 0.25y | 0.5y | 1y | 2y | 3y | 5y | 10y | 15y | 20y | 30y |
|---|---|---|---|---|---|---|---|---|---|---|
| Weight (Bucket #2) | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 |
| Weight (Bucket #5) | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| JPM WAS (Bucket #2) | 0 | 0 | 0 | 0 | 0 | 19,600,000 | (19,610,000) | 0 | 0 | 0 |
| IBM WAS (Bucket #5) | 0 | 0 | 0 | 0 | (1,329,351) | 0 | 0 | 0 | 0 | 0 |

Step 4: *Apply the formula that recognizes hedging and diversification within each sector/rating bucket*

$$K_2 = \sqrt{(19{,}600{,}000)^2 + (-19{,}610{,}000)^2 + 2 \times 0.75 \times 19{,}600{,}000 \times (-19{,}610{,}000)} = 13{,}862{,}832$$

$$K_5 = \sqrt{(-1{,}329{,}351)^2} = 1{,}329{,}351$$

where 0.75 is the correlation for same name with maturity equal to 5 years that have different sign sensitivities, according to Table 6. In this way, tenor basis are captured through correlation structure.

Step 5: *Apply the formula that recognizes hedging and diversification across sector/rating buckets.*

$$\begin{aligned} \textit{CSR Capital} &= \sqrt{\sum_b K_b^2 + \sum_b \sum_{c \neq b} \gamma_{bc} X_b X_c} + K_{residual} \\ &= \sqrt{(13{,}862{,}832)^2 + (1{,}329{,}351)^2 + 2 \times 0.2 \times (-19{,}610{,}000 + 19{,}600{,}000) \times (-1{,}329{,}351)} \\ &= 13{,}926{,}615 \end{aligned}$$

where 0.2 is the correlation between bucket #2 and bucket #5 due to Table 7.