KBC Bank / Risk IPF Markets - RME January 27, 2014

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To	:	**Secretariat of the Basel Committee on Banking Supervision, Bank for International Settlements, CH-4002 Basel, Switzerland**
Re	:	**KBC comments on Basel committee's second consultative paper on FRTB (bcbs265)**

1. Proposals of a general nature

1.1. Trading Book / Banking book boundary

KBC is opposed to tying the "Trading book / Banking book" boundary to the mere nature of an instrument's payoff (as opposed to criteria relating to the type of activity, e.g. market-making vs. long-term investment) To be specific, referring to Annex 1, paragraph 11, we are against tying "options" to one or the other side of the TB/BB boundary. Our opposition relates to both "stand-alone" options and to products with embedded options. As an example, accurately hedging a portfolio of mortgage loans originated by the bank (which belongs in the banking book) requires the use of options whenever the mortgages have material embedded optionality, so in this case, the options need to be on the banking book, just as the original mortgage loans.

2. Revised Standardized Approach (SA) proposal

2.1. General comment

The Revised SA proposal positions the concept of "discounted cash flows" as a cornerstone of the Standardized approach. KBC has no fundamental objection to the idea itself, but strongly opposes Basel's presumption that "cash flow mapping" should be specified in a pricing-model free fashion. Along with peer banks, KBC regards that presumption as unrealistic and fraught with very substantial disadvantages :

- it leads to a highly prescriptive set of rules, which relies on restrictive assumptions, and which at best allows the cash flow mapping to proceed for just the simplest instrument types. For all other instruments, Basel's approach will lead to a host of interpretation difficulties, defeating the committee's central purpose of improving comparability across banks.

- due to its use of restrictive assumptions, the proposed SA will force the banks to launch on a parallel development effort to comply with the revised SA, with no clear links to the banks' standard risk analytics and risk reporting.

- to resolve these problems, KBC concurs with the ISDA/IIF counter proposal to allow banks to let instrument pricing models play their normal role, which automatically leads to a (discounted) cash flow concept as a by-product of risk factor sensitivities. This yields a clear and generally applicable approach.

2.2. <u>Revised GIRR</u>

First of all, we refer to the general comment under 2.1. See the appendix to this note for a detailed analysis of the issue, applied to the revised GIRR proposal.

Second, KBC finds the standing proposal for inserting a 10% short-net disallowance in the GIRR calculation <u>flawed</u>. Specifically, for pairs of trades for which all cash flows match by date <u>up to a set of margin payments</u>, KBC's detailed analysis in the appendix to this document demonstrates that the standing proposal will typically yield a <u>multiple</u> of the charge attributable to the general interest rate risk of the margin payments, which are the only "open" cash flows in the case of matched pairs of trades. At the same time, we understand Basel's concern to capitalize substantial maturity mismatches between discounted cash flows maturing in the same "GIRR" bucket. To meet that concern, KBC proposes to replace the 10% short-net disallowance by an increase in the granularity of the grid of GIRR-vertices, which has the effect of progressively reducing the scope for offsetting "neighbouring" cash flows of opposite sign.

2.3. <u>CSR (Credit Spread Risk) charge</u>

The fundamental objection we made against the FRTB/CP2's approach to specifying "discounted cash flows" for GIRR applies equally to the CSR framework. Here again, we propose to recast the definition of discounted cash flows for CSR such that the bank can re-use its various pricing models for issuer-risky instruments, taking the instruments' bucketed sensitivities w.r.t. the (issuer-risky) discount curve as the starting point to derive the appropriate (delta-equivalent) discounted cash flows to be assigned to the CSR framework.

Apart from that, KBC has no fundamental objections.

2.4. <u>Options non-delta risk charge</u>

KBC's general response to the revised standardized "options non-delta risk framework" is positive. Specifically, the committee's proposal to start with a two-dimensional scenario analysis, revaluing the portfolio under discrete shifts to both implied vol and underlying, and then stripping out the delta-effect, is in our opinion a sound and generally applicable approach. Indeed this circumvents the need for analytic gammas or cross-gammas (as with e.g. the so-called delta-plus method under the existing standardized charge), which runs into numerical trouble for exotic options (e.g. if the gamma changes sign over the underlyer dimension, or becomes very large).

However KBC has the following concern: the FRTB/CP2 proposal is not clear on exactly which instruments need to be subjected to the "non-delta risk charge". Clarity on this scope issue is important to guarantee comparability across banks and jurisdictions. Note that compared to 1996 (when the existing standardized charge was conceived), the range of instruments has expanded considerably with various Libor-exotics, instruments with embedded options, etc. From a risk management point of view, there is no fundamental distinction between e.g. the vega-risk of a simple CMS (say a contract to exchange 10Y IRS against 3M Euribor, over the next 5 years) and the vega of a swaption, as the value of both these instruments depends materially on implied swaption vols. This should be reflected in the new proposal, e.g. by specifying that all instruments with material vol-dependence are to be included in the "non-delta" risk framework.

As a closing remark, we return to our objections against the current approach taken by the committee to define "discounted cash flows" for the purpose of the "delta-risk" charge (mainly GIRR and CSR). By adopting the industry's counter proposal, i.e. by linking the "discounted

cash flow" squarely with the risk factor sensitivies implied by the bank's pricing models for every instrument, the committee would bring the definition of "delta-effects" as part of the "non-delta risk" framework in line with the definition of the "delta-risks" as per the GIRR- and CSR-frameworks. This consistency will be beneficial to the risk-sensitiveness of the revised standardized charge.

2.5. Revised FX risk charge

First, KBC has serious concerns over the following statement in section 3.4(ii) of FRTB/CP2: "The committee has adopted an approach that … does not depend on the reporting currency of the bank". KBC feels that such a measure of FX risk is unsound : at some point, any risk measure has to agree with the valuation side, specifically by acknowledging the P&L currency used by the bank. At the same time, to the best of our knowledge, the remainder of the FRTB/CP2 proposal (bcbs265) contains no other references to this alleged "reporting currency independence". KBC asks the Basel committee to either delete this sentence, or else to go into the rationale and feasibility as well as the details of such an approach.

Second, the proposal imposes a maturity bucket split-up of the FX risk position such that two exposures on the same currency but maturing in different buckets, are aggregated to a single currency exposure figure by applying a correlation below 1, with the correlation marked down by a further 0.05 if the exposures are of opposite sign, as per paragraph 143 of FRTB/CP2. In KBC's opinion, imposing a maturity bucket split-up for FX risk as a means to penalize maturity mismatches in FX risk exposures, amounts to a double counting of curve risk as these exposures have to be assigned to the GIRR framework anyway. Hence KBC requests to delete the "maturity bucketing" feature from the revised FX risk framework: the determination of FX risk exposures should be based on a single fixed maturity, be it "Spot" or "Sameday (=position date)" or a "1 year forward" perspective … or in fact any other **single** date. We are adamant on getting rid of this flaw: indeed, while we can live with the Revised SA approach invoking some simplifying assumptions, we are totally opposed to the idea of a standardized charge which goes against the basic principles of sound (market) risk management. The numerical example below further clarifies our position.

To fix ideas, consider the following package of deals :

- KBC buys 1 mln EUR 6M forward against USD at EUR/USD 1.34000
- KBC sells 1 mln EUR 5Y forward against USD at EUR/USD 1.31873

Using 30/360 daycount convention for simplicity, and continuously compounded rates, the EUR and USD interbank cash discount curves are assumed to be :

	EUR (Rd)	USD (Rf)
6M	0.70%	0.40%
5Y	1.75%	1.40%

These market parameters imply that both deals are concluded at the same underlying Spot FX rate. Indeed, using covered interest rate parity, the spot EUR/USD rate implied by each of the Forward rates is 1.34201:

6M Forward EUR/USD = 1.34000
=> 6M Fwd USD/EUR = F = 0.746269
=> Spot USD/EUR = S = F * exp((Rf – Rd) / 2) = 0.746269 * exp(-0.0030 / 2) = 0.74515
=> Spot EUR/USD = 1 / 0.74515 = 1.34201

5y Forward EUR/USD = 1.31873
=> 5y Fwd USD/EUR = F = 0.758305
=> Spot USD/EUR = S = F * exp(5 * (Rf – Rd)) = 0.758305 * exp(-0.0035 * 5) = 0.74515
=> Spot EUR/USD = 1 / 0.74515 = 1.34201

This yields the following PV-amounts :
6M: EUR 1.e6 * exp(-0.0035)= EUR 996,506; USD -1.34e6 * exp(-0.002)=USD -1,337,323
5Y: EUR -1.e6 * exp(-0.0875)= EUR -916,219; USD 1.34e6 * exp(-0.070)=USD 1,229,576

First, these 4 amounts are assigned to the GIRR-framework: for each currency we have a PV-amount on the 6M vertex and a slightly lower amount with opposite sign on the 5Y vertex. Economically we have a forward 6M-5Y placement in USD, funded by a forward EUR borrowing. This already indicates that the FX-risk exposure of the two deals taken together is small relative to the curve risk in the foreign and in the domestic currency. Actually, the exact amount of FX risk exposure can be easily computed, by summing the two USD-denominated PV-amounts, yielding USD -107,747. This is using a "same day" or "spot" measure; as mentioned before, one might shift the single maturity to e.g. "1 year", but that's just a matter of convention, not of substance. So our contention is that with the input data as specified, and given the assignment of both the EUR and USD PV-amounts to the GIRR framework as stated, the correct FX risk exposure for an EUR-based bank is USD -107,747.

Now consider the revised FX risk proposal. For each currency, we have PV's maturing at 6M and at 5Y, with opposite signs. As the FX risk proposal assigns them to the 1st and 3rd maturity bucket of their FX risk framework, a correlation of (merely) 0.60 applies. This yields an aggregated USD-exposure of :

USD $(1{,}337{,}323\text{^}2 + 1{,}229{,}576\text{^}2 - 2 * 0.6 * 1{,}229{,}576 * 1{,}337{,}323)^{1/2}$ = **USD 1,151,990**

On comparing Basel's proposed FX-risk exposure of USD 1,151,990 to the economically correct amount of USD -107.747, it becomes clear that the FRTB/CP2 proposal is likely to yield a grossly exaggerated FX-risk charge.

2.6. (Standardized) Default Risk charge

KBC has the following substantive comments :

- we oppose the compulsory extension of the (standardized) default risk charge to include equity positions, and this extends to the revised modelled approach (IMA) proposal. As a counter proposal, we propose to restrict the compulsory extension to cases of a clear capital arbitrage strategy (whether or not by a dedicated trading desk). For motivation we refer to section 3.1 below.

- we find the proposed default risk weights (basically 1 year PD's) of paragraph 152 inordinately high, especially for Sovereigns and higher rated corporates and banks. E.g. we perceive the fixed 1 year PD of 0.50% for all AAA issuers, with no possibility of differentiating between Sovereigns and Corporates, more as an outright deterrent to trading Sovereign bonds than as an attempt at a reasonably risk sensitive standardized charge.

3. Revised Modelled approach (IMA) proposal

3.1. Approach taken to factor in differences in liquidity

We understand that the Basel committee intends this feature to be generic, affecting both the revised SA and the revised IMA. However we focus on the IMA approach as the underlying reasoning regarding liquidity horizons is more explicit there.

KBC has fundamental reservations about the route taken by the Basel committee, in particular:

- the categorisation of the risk factor categories is extremely crude, e.g. in the FX risk domain, all currency pairs are treated as one block, which we find unacceptable.
- regarding the committee's proposal to measure risk factor shocks directly over the successively longer liquidity periods, which range from 2 weeks to 1 year, we have fundamental reservations. Not only will this severely distort correlations among risk factors, the use of overlapping returns by itself distorts (the tails of) the distribution of scenario P&L outcomes.

As a counter proposal, we generally agree with the (range of) proposals put forward by the industry associations, meaning :

- stick with measuring various risk factor shocks over a single return interval (be it 1 day or 10 days) ;
- scale up the measure obtained from the first bullet to account for differences in market liquidity (either by desk or by risk factor).

3.2. Default risk (non-securitisations)

KBC welcomes the proposal to narrow the risk factor scope down to a Default risk model, i.e. excluding migration event risk.

On the other hand, KBC opposes the following points of the proposal :

- compulsory extension of the instrument scope to equity positions;
- the proposed floor of 3 bp (per annum) on Sovereign 1 year PD's.

Below we motivate our position and provide a counter-proposal.

a) Compulsory extension of instrument scope to equity positions

First, we observe that the current proposal (bcbs265) does not provide a definition of "default risk" for equity positions. Hence we assume that the corresponding paragraph of Basel's final document on IRC (bcbs159) still applies, i.e. "*If equity securities are included in the computation of incremental risk, default is deemed to occur if the related debt defaults (as defined in paragraphs 452 and 453 of the Basel II Framework)*". We note that this definition is still pretty loose, e.g. are we referring to the issuer defaulting on its short-term or long-term debt, are we talking of senior or junior debt issues … etc.

What this shows is that "default risk" on equity positions constitutes an "indirect" risk. The only exception is the case where the equity is held as part of a capital arbitrage strategy. Since the first consultative papers on IRC (published in 2007), KBC has consistently taken the position that inclusion of equity in the scope of IDR (or IRC) is warranted only if the portfolio is driven by a capital arbitrage strategy. In all other cases, the link between the equity position and default event risk is so tenuous and indirect that compulsory inclusion of equity positions is overkill.

By way of counterproposal, we propose to stick with the “optionality” of inclusion of equity in the IRC / IDR model as in Basel 2.5, with the exception of cases of a clear capital arbitrage strategy (in line with our counter proposal for the standardized default risk charge). To cover the indirect risk that default events may pose to equity positions, we propose to supplement the existing VAR (or future ES) model with stress tests to quantify the effects of large (downward) jumps in the underlying stock prices.

b) proposed 3 bp floor on Sovereign 1 year PD’s

Our assessment is that imposing a 3 bp floor poses severe risks. Specifically this tends to obfuscate the differences in creditworthiness between the very best and the slightly less creditworthy sovereigns, which goes against the idea of a risk-sensitive standardized charge.

Appendix : KBC proposal to bring the "discounted cash flow" approach of FRTB/CP2's revised GIRR-charge in line with existing Risk management systems, at the same time removing an anomalous charge for opposite cash flows maturing on the same date

1. Summary

1.1. KBC asks the Basel committee to revise its perception of "discounted cash flow mapping" as an approach parallel to the banks re-using the risk factor sensitivities which follow from the pricing models for various instruments

FRTB/CP2 positions the Revised Standardised approach as a "partial risk factor" type of approach. From FRTB/CP2's section 3, the Basel committee equates this to a "pricing-model free" approach. That is, the Basel Committee regards it as feasible to come up with a reasonably accurate (discounted) cash flow map across the whole range of instruments without clear reference to pricing models. While we are not opposed to the idea of cash flow mapping per se, we contend that it is unfortunate to regard the use of pricing-models and cash flow mapping as parallel routes. This is unfortunate for 3 reasons:

- in this way the Basel committee sends the message to banks that they are to implement the revised standardised approach (for GIRR) as a completely separate / parallel system with no clear links to their existing risk management reporting. Such an approach seems to be in no one's interest: it will be much harder to perform sanity / consistency checks with a parallel implementation, plus the costs of a parallel implementation will be higher.
- various banks have a range of non-vanilla instruments on their books, including but not limited to interest rate options (think of various Libor-exotics, various strands of CMS …). The GIRR-guidance given in CP2 is extremely vague on such instruments, which is likely to cause a host of interpretation difficulties, which may ultimately defeat the Basel committee's central aim of comparability. In our view, the only sound approach is to squarely link the concept of a discounted cash flow map to first-order sensitivities by maturity vertex ;
- as an added complexity, over the last 5-10 years, changing market conditions have forced banks to introduce (forward rate) "estimation curves" on top of discount curves, viz. to distinguish discount curves for collateralised deals from cash discount curves etc… All of these changes contribute to make the concept of a cash flow map progressively less straightforward and intuitive to implement, again unless we squarely link this idea to existing risk management systems, particularly to existing sensitivity analytics. At the same time, FRTB/CP2 seems to require us to "roll back" these methodological changes for the purpose of calculating the GIRR-charge, see the requirement to assign "fixed cash flows" only to the GIRR framework. As it is clear that KBC needs to keep its risk measures in line with market conditions and with its valuation methodologies, this shows once again that the revised Standardized approach will necessitate a parallel system effort, which needs to be maintained subsequently. Indeed, a preliminary analysis by KBC's risk management system experts concluded that the size of such a separate development effort is probably in the order of man-years.

For all these reasons we urge the committee to revise its basic perception of the task of implementing "discounted cash flow mapping". Indeed, in all practically relevant cases, the pricing model, and the sensitivities which follow from it, are essential to arrive at a cash flow map which is clearly defined across instrument types. This can be achieved by explicitly allowing cash flow maps to be driven by existing pricing models using the (combined) sensitivities by vertex w.r.t. estimation and discount curves[1], as explained in more detail in

[1] Estimation Curve refers to the floating rate index, say Euribor 3M or Euribor 6M.

section 2. On top of providing conceptual clarity, this also allows banks to re-use large parts of their existing risk management systems.

1.2. As FRTB/CP2's proposed 10% disallowance between gross long / short discounted cash flows by vertex leads to anomalous GIRR-charge for "matched" pairs of trades, KBC proposes to capitalise substantial maturity mismatches instead by making the grid of vertices substantially more fine-grained than in CP2's GIRR proposal

First, note that the 10% disallowance yields a GIRR charge lacking continuity. Consider e.g. two opposite cash flows within the 1st maturity bucket 0-0.25Y: the same 10% disallowance applies whether they are just a single day or nearly 3 months apart.

Second, and even more important, the 10% disallowance gives rise to an anomalous GIRR-charge for cash flow matched pairs of trades. Our worked example for a pair of IRS contracts which match exactly except for a fixed rate margin, yields a substantial GIRR charge above and beyond the charge attributable to the true cash flow mismatches . Hence this feature of the GIRR proposal will yield a substantial "general interest rate risk" capital requirement with no economic justification: being a market risk charge, and given opposite cash flows which match by date, the GIRR charge for the package made up of the original IRS and its hedge, should entirely reflect the margin payment mismatches. An additional argument comes from comparing the revised GIRR with the "old" GIRR charge: under the "old" GIRR charge, a bank has the option to start out from zero-yield curve sensitivities w.r.t. a regulatory vertex grid, translating them into (delta-equivalent) PV's by vertex; no separate "disallowance" on long / short cash flows maturing in the same regulatory bucket applies.

The Basel committee's central aim of capitalising opposite discounted cash flows with (substantially) different maturities can be achieved without the 10% disallowance, specifically by making the proposed grid of vertices substantially more fine-grained.

It seems wise to take the standing proposal as a starting point, as it correctly acknowledges that riskwise, a maturity mismatch between say 5Y and 5Y 1M is smaller than a mismatch between 1M and 2M, and to refine it via "progressive halving". As an example, the following 32-point grid would go a long way to adequately capitalising maturity mismatches without the need for a separate 10% disallowance on long / short discounted cash flows by vertex.

Table 1 : proposal for a 32 vertex grid as a refinement of the standing 10-vertex proposal

1W	2W	1M	2M	3M	4M	5M	6M	7M	8M	9M	10M	11M	12M	15M	18M
2Y	3Y	4Y	5Y	6Y	7Y	8Y	9Y	10Y	12Y	15Y	20Y	25Y	30Y	40Y	50Y

We leave it to the Basel committee to judge whether additional detail is needed to meet the aim of capitalising substantial maturity mismatches.

Note that the case for suppressing the 10% disallowance becomes even stronger if the Basel-committee agrees to allow banks to re-use their existing pricing models and sensitivities w.r.t. the relevant estimation and discount curves, as argued in point a). Indeed, to circumvent the anomalous GIRR-charge on cash flow matched pairs of trades in the presence of the 10% disallowance, a bank would have to keep track of sensitivities on an intermediate vertex grid by working day, to allow it to apply a pre-netting of (discounted) cash flows maturing on the same date, before aggregating them to gross long and gross short discounted cash flows by GIRR vertex. It is clear that such an intermediate grid by working day would render the calculation of the GIRR-charge extremely onerous and unwieldy system-wise.

2. A detailed look at the issues using a worked example

To start out with a good idea of what constitutes a reasonable cash flow map, we pick a very simple example: consider a 10 Y fixed rate payer EUR IRS (annual fixed rate payments) against 6M Euribor, as seen by a bank using a typical "2013-vintage" risk management system. The example is realistic, except that we simplified the daycount conventions, assuming 30/360 throughout. We assume that the first 6M Euribor period is not yet fixed at the time we price the deal and calculate its sensitivities.

We focus on the case where the original IRS deal is hedged by an identical IRS on the same date, with the hedging IRS matching the original IRS exactly, except for a 5 bp per annum margin on the fixed rate.

Before going into the numerical example, we first review the pricing model, and re-derive the sensitivities by vertex w.r.t. estimation- and discount-curve. The latter are useful in their own right, as they allow to check our intuition on the "correct" cash flow map. Note that in real life, these sensitivities would typically be calculated by "brute force", i.e. by running the pricing model a number of times, each time administering a discrete shock to the next vertex of the relevant (zero-coupon) yield curve.

2.1. Pricing model and sensitivities by vertex

Given the IRS deal with its bi-annual floating and annual fixed interest payment schedule, it makes sense to consider the vertex grid made up of these bi-annual payment dates as an intermediate step : it is easy to see that we need to specifiy a grid which contains all of the contractual payment dates to stand a chance of reproducing the exact cash flows as specified in the IRS contract(s).

a) Notation

j : indexes the floating rate payments, $j = 1, \ldots, n$
δ_j : year-fraction for the floating rate period between $(j-1)^{th}$ and j^{th} payment date
i : indexes the fixed rate payments, $i = 1, \ldots, m = n/2$
Δ_i : year-fraction for the fixed rate time interval between $(i-1)^{th}$ and i^{th} payment date
R : IRS fixed rate
z_i : cont. compounded zero yield for i-th vertex corresponding to the discount curve
z'_I : cont. compounded zero yield for i-th vertex corresponding to the estimation curve curve
W = PV of the IRS at calculation date (=pricing date)

B_i = discount factor for maturity τ_i implied by z_i : $B_i = \exp(-\tau_i z_i)$
B'_i = analogous discount factor for z'_i

6M Forward rates F'_j, $j=1,\ldots,n$ are implied from the Estimation curve as :

$$1 + F'_j \delta_j = B'_{j-1} / B'_j \quad \Rightarrow \quad F'_j = (B'_{j-1} / B'_j - 1) / \delta_j$$

b) Pricing model

$$W = -R \Sigma_i \Delta_i B_i + \Sigma_j \delta_j B_j F'_j \qquad (1)$$

Expression (1) can be solved for the "fair" IRS Swap rate R by setting W=0.

c) Sensitivities

We start by deriving expressions for the sensitivities by vertex w.r.t. the two sets of zero-coupon yields : estimation curve (column 2 of table 2 on the last page) viz. discount curve (column 3 of the same table).

From FRTB/CP2's guidance on the appropriate cash flow map for the GIRR-charge, we infer that the Basel committee's GIRR proposal simplifies things by ignoring any estimation-versus discount curve basis risk, meaning that e.g. for single currency OTC derivatives a single interbank curve drives both the discounting of cash flows and the forward rates over different tenors. This corresponds to considering the set of total sensitivities by vertex (shifting both estimation and discount curve), as per column 4 of table 2.

From these "total sensitivities" by vertex, a set of delta-equivalent cash flows by vertex follows by a simple application of the chain rule of derivative calculus. In symbols, the total sensitivities correspond to $\partial W / \partial B_j$, with the understanding that B now stands for both the Estimation Curve and Discount Curve "discount factor". By definition, the delta-equivalent cash flows are :

$$DeqCF_j = \partial W / \partial B_j = (\partial W / \partial z_j) / (\partial B_j / \partial z_j) = (\partial W / \partial z_j) / (- \tau_j B_j) \qquad (2.a)$$

Delta-equivalent present values ("discounted cash flows") by vertex (not shown in table 2) then follow simply by multiplying each Delta-equivalent cash flow $DeqCF_j$ by its discount factor B_j.

Indeed we have : $DeqPV_j = \partial W / \partial \ln(B_j) = B_j * DeqCF_j = (\partial W / \partial z_j) / (- \tau_j)$ (2.b)

This reveals that the DeqPV simply equals the ZC yield sensitivity divided by maturity, at the same time reversing the sign. Given this very simple relationship, it is obvious that it is highly advisable (if not downright necessary) to take a sensitivities-based approach to cash flow mapping. As stated in section 1, the case for a sensitivities-based approach becomes all the more forceful for portfolios containing various option instruments and LIBOR-exotics.

The last column of table 2 shows the expression for the Delta-equivalent CF in the special case (envisaged by Basel Committee) where estimation and discount curves coïncide, i.e. if $B_j = B'_j$ for j=1, …, n. Under this restrictive assumption, we find that the cash flow map of a (short) fixed rate bond position reproduces the IRS-deal GIRR-wise. Indeed, in this special case, the same cash flow map is valid irrespective of market conditions, i.e. we no longer need to add the "delta-equivalent" qualification.

This raises an important implementation question. Under a "literal" reading of FRTB/CP2, it seems that the Basel committee expects the (short) fixed rate bond cash flow map as the "correct" cash flow mapping for the IRS deal, i.e. as per the last column of table 2. However, we have just shown that this "nice" cash flow map only emerges from a bank's typical "2013-vintage" risk management system if the bank first enforces equality between discount and estimation curve(s) for the given currency. We strongly urge the Basel committee not to impose such restrictive assumptions. First, from a pragmatic point of view, the numerical differences between the two variants are typically minor (the results for our numerical example show this). Second, imposing that restriction would (once again) force the banks into setting up a parallel machinery to conform to the Basel committee's "very special" assumptions. Instead, we advocate using the Total sensitivities obtained from the bank's normal sensitivities reporting, and to translate these into Delta equivalent cash flows as per the penultimate column of table 2.

2.2. Results of the numerical example

The two relevant input curves (estimation and discount curves) are given in table 3 below. Inputting these into the pricing model (1), and solving for R, we find R = 2.002% in the "normal" case, and R = 1.999% under the assumption that the discount curve equals the estimation curve.

The first thing to note from table 3 is that the Delta-equivalent discounted cash flows using a "2013-market-conform" IRS pricing and sensitivities calculation are really close to those using the restrictive assumption that estimation and discount curves coïncide. Hence the GIRR charge will not be materially different. In what follows, we indeed assume the "market-conform" pricing model and sensitivities are used.

We assume that following the original fixed rate payer IRS, a fixed rate receiver IRS is struck by the bank, with the bank receiving 2.002% + 5 bp p.a. as fixed rate on this hedging deal. The margin causes the DeqPV of the two contracts to diverge slightly, as per table 4 below.

Under a literal reading of FRTB/CP2, we obtain (delta-equivalent) discounted cash flows for the first IRS viz. for the hedging IRS as per columns 2 and 3 of table 4. For each GIRR-vertex, we have a long / short pair of PV's, which yields the the net PV's in column 4 including the 10% disallowance, e.g. for 10 Year: 8,755.34 – 0.9*8,742.42 = 887.16. On risk weighting these amounts, and on applying the quadratic expression of par. 98 of FRTB/CP2 using the correlation parameters given in par. 99, we find a GIRR charge of EUR 93.90 for a notional EUR 10,000, as per column 5 of table 4.

Now, as we argued in section 1, we regard this GIRR charge as anomalous. To make our point in numerical terms:

- consider the (delta-equivalent) discounted cash flows on the detailed grid of vertices corresponding to the exact payment dates of the original IRS viz. of the hedging IRS ; given that the two IRS deals share the exact same payment dates, on netting by cash flow date, on each of the payment dates we are left with either zero or a long discounted cash flow, as a result of the positive 5 bp margin on the fixed rate receiver IRS.
- allocate these net PV amounts to the GIRR-vertices, as per par. 94 of FRTB/CP2. As all the individual cash flows are of the same sign, GIRR's 10% disallowance does not play in this case.

This yields the Net DeqPV in the 6th column of table 4, e.g. the EUR 7.36 on the 3 year GIRR vertex corresponds to the 5 EUR fixed rate margin at 3Y, plus half of the 5 EUR fixed rate margin at 4Y. Again applying the GIRR riskweights, and using the quadratic expression of par. 98, we find a new GIRR-charge of EUR 2.44. We regard this as the "true" GIRR charge for this case, as it reflects the 5 bp fixed rate margin payments, the only true mismatch.

The root of the anomaly is the current CP2 proposal's idea of inserting a 10% disallowance **after** grouping the PV's by cash flow date to the reduced set of GIRR-vertices, which makes the GIRR charge "forget" that there is a fundamental distinction between two opposite cash flows which match by date versus two opposite cash flows which do not match by date. As explained in section 1, KBC proposes to suppress the 10% disallowance, compensating simply by increasing the detail of the maturity grid used for the GIRR charge.

Table 4: DeqPV by vertex: IRS & matching opposite IRS with 5 bp p.a. margin (EUR 10,000 Notional)

Maturity	**Original IRS Deq PV**	**Hedging IRS DeQ PV**	**Net Deq PV with 10% disallowance, no pre-netting**	**GIRR Charge with 10% disallowance**	**Net Deq PV on pre-netting matched cashflows**	**GIRR charge on pre-netting matched cashflows**
0.25	0.00	0.00	0.00	0.00	0.00	0.00
0.5	7.47	-7.47	0.75	0.01	-0.04	0.00
1	-189.88	194.87	23.98	0.36	4.99	0.07
2	-186.30	191.26	23.60	0.59	4.97	0.12
3	-275.28	282.63	34.88	1.22	7.36	0.26
5	-616.10	632.36	77.87	3.89	16.26	0.81
10	-8,742.42	8,755.34	887.16	88.72	12.91	1.29
Total GIRR charge (√ Sum of Squares)				**93.90**		**2.44**

Table 2 : estimation viz. discount curve sensitivities of a fixed-to-float IRS ; delta-equivalent cash flows

Period	**Sens. wrt. z'_j**	**Sens. wrt. z_j**	**Total Sensitivity**	**DeqCF**	**DeqCF if $B_j=B'_j$**
j =1,3,…,n-1	$\tau_j (B_j B'_{j-1} / B'_j - B_{j+1} B'_j / B'_{j+1})$	$- \tau_j B_j F'_j \delta_j$	$\tau_j (B_j - B_{j+1} B'_j/B'_{j+1})$	$(B_{j+1}/B_j) (B'_j /B'_{j+1})-1$	0
j =2,4,…,n-2	$\tau_j (B_j B'_{j-1} / B'_j - B_{j+1} B'_j / B'_{j+1})$	$\tau_j B_j (\Delta_{j/2} R - \delta_j F'_j)$	$\tau_j (B_j - B_{j+1} B'_j/B'_{j+1}+ B_j \Delta_{j/2} R)$	$(B_{j+1}/B_j) (B'_j /B'_{j+1})-1-\Delta_{j/2} R$	$-\Delta_{j/2} R$
j = n	$\tau_n B_n B'_{n-1} / B'_n$	$\tau_n B_n (\Delta_{n/2} R - \delta_n F'_n)$	$\tau_n B_n (1 + \Delta_{n/2} R)$	$-1 - \Delta_{n/2} R$	$-1-\Delta_{n/2} R$

Table 3: Curve data used for the numerical example, sensitivities and Delta-equivalent cash flows of the 10 year IRS (Not Amt=10,000) 2.002% fixed

Maturity in year	Continuously Comp. Zero-yields		**Normal Sensitivities + DeqPV**				**Sens + DeqPV forcing Discount = Estim curve**			
	Estim.Curve	Discount Curve	Estim.Curve	Disc Curv	Total	DeqPV	Estim.Curve	Disc Curv	Total	DeqPV
0.50	0.319%	0.270%	4.22	-7.98	-3.74	7.47	7.98	-7.98	0.00	0.00
1.00	0.349%	0.250%	12.80	180.75	193.54	-193.54	18.92	180.29	199.21	-199.21
1.50	0.389%	0.282%	24.06	-35.06	-11.00	7.33	35.01	-35.01	0.00	0.00
2.00	0.449%	0.331%	50.63	335.26	385.89	-192.94	62.36	333.87	396.23	-198.12
2.50	0.529%	0.411%	90.12	-105.02	-14.90	5.96	104.71	-104.71	0.00	0.00
3.00	0.608%	0.490%	129.63	442.80	572.44	-190.81	148.53	440.34	588.87	-196.29
3.50	0.719%	0.599%	214.76	-237.91	-23.15	6.61	236.91	-236.91	0.00	0.00
4.00	0.830%	0.707%	287.03	465.37	752.40	-188.10	311.58	461.93	773.52	-193.38
4.50	0.954%	0.831%	394.86	-424.51	-29.64	6.59	422.16	-422.16	0.00	0.00
5.00	1.078%	0.953%	495.73	428.04	923.77	-184.75	523.11	423.95	947.06	-189.41
5.50	1.195%	1.070%	582.41	-615.93	-33.53	6.10	611.71	-611.71	0.00	0.00
6.00	1.311%	1.186%	696.46	389.49	1,085.94	-180.99	723.78	384.89	1,108.66	-184.78
6.50	1.415%	1.290%	764.92	-799.63	-34.70	5.34	793.17	-793.17	0.00	0.00
7.00	1.518%	1.394%	895.49	355.55	1,251.03	-178.72	907.66	350.56	1,258.22	-179.75
7.50	1.613%	1.493%	975.59	-994.13	-18.54	2.47	985.22	-985.22	0.00	0.00
8.00	1.708%	1.592%	1,086.08	298.45	1,384.53	-173.07	1,101.36	293.58	1,394.94	-174.37
8.50	1.795%	1.682%	1,158.47	-1,183.35	-24.88	2.93	1,171.98	-1,171.98	0.00	0.00
9.00	1.882%	1.771%	1,293.66	236.54	1,530.20	-170.02	1,286.89	231.89	1,518.78	-168.75
9.50	1.962%	1.856%	1,363.51	-1,365.97	-2.46	0.26	1,352.29	-1,352.29	0.00	0.00
10.00	2.042%	1.941%	83,836.24	169.84	84,006.07	-8,400.61	82,994.01	165.66	83,159.67	-8,315.97