BCBS Consultative Document (d436) response

June 2018

Introduction

Consultative Document BCBS d436
Revisions to the minimum capital requirements for market risk

Dear Sir/Madam,

IHS Markit (Nasdaq: INFO) is a world leader in critical information, analytics and solutions for the major industries and markets that drive economies worldwide. Our company delivers next-generation information, analytics and solutions to customers in business, finance and government, improving their operational efficiency and providing deep insights that lead to well-informed decisions. We have more than 50,000 key business and government customers, including all G20 governments, 85 percent of the Fortune Global 500 and the world's leading financial institutions. Headquartered in London, IHS Markit is committed to sustainable, profitable growth.

Introductory comments

We believe the March 2018 Consultative Document (CD) is a positive step toward clarifying the requirements of the *Revisions to the minimum capital requirements for market risk* (also known as "FRTB"). The clarifications provided should allow institutions to advance in implementing and operationalising the FRTB requirements, which we take to be a welcome and positive development. We offer this consultation response in the hope that our data-driven insights will be of use in further refining the requirements and achieving the stated aims of the regulation.

IHS Markit has engaged *Oliver Wyman, a* global leader in management consulting, on FRTB modellability and data solutions and we have collaborated on the topic since October 2016, specifically in connection with the development of our FRTB Modellability Service. Oliver Wyman has contributed analysis which has informed IHS Markit's response to this consultation paper.

We have a broad insight into the market informed by frequent conversations with industry participants and re-enforced by a large and detailed pool of transaction data which we use for modellability analysis. We have included further details of our data aggregation service and illustrative examples of how it can ensure a more efficient application of FRTB in Appendix 2 of this letter. We hope that the analysis and insights provided in this response will constructively contribute towards further refinement of regulatory text.

Summary of consultation response

Our response to the CD focuses on the sections pertaining to Non-Modellable Risk Factors (NMRFs) and the Risk Factor Eligibility Test (RFET).
A number of ideas debated in the industry since the publication of the January 2016 FRTB text have been reflected in the CD, in particular the formal introduction of the concept of "buckets" for determining modellability of risk factors.

We consider this to be a positive development, for it presents a practical and workable solution to the NMRF requirements. The aims of the two Alternatives proposed in the consultation paper are clear, however having analysed a series of

case studies[1] we have identified some challenges with some of the specifics of alternatives proposed. We believe that these challenges could lead to unintended consequences if left unmitigated, which puts the original intent of Alternatives (ie: to allow practical, but prudent risk factor bucketing) at risk.

Having examined these challenges in detail, we propose in this letter a modified version of Alternative 2 (which we call "Alternative 2+"), which mitigates the challenges whilst enabling an extra degree of flexibility to allow institutions to align their risk factor buckets to the trading practices of the market.

In the following section we outline the challenges present in the two current Alternatives, and describe our enhanced proposal. A complete draft text for our enhanced proposal is given in Appendix 1 of this letter.

Risk Factor bucketing analysis

Since the publication of the January 2016 FRTB text we have been developing and advocating for a workable and practical solution to the NMRF requirements. Collectively assessing connected risk factors (RFs) for modellability, known colloquially as "bucketing", has been a particular focus of this effort.

The CD presents two bucketing alternatives within Annex B.2. Whilst the Alternatives address an important omission of the original January 2016 text by formally introducing the RF bucketing concept, our analysis indicates that both Alternatives carry with them significant challenges which could lead to undesirable and impractical outcomes, such as conflicting incentives for model complexity or lack of appropriateness across asset classes. The following sub-section reviews these challenges in detail.

The final sub-section describes a modified Alternative 2 for RF bucketing which we believe mitigates the challenges of the existing two options, whilst maintaining the spirit and intent of the NMRF rules and FRTB more broadly.

Challenges of the two proposed bucketing Alternatives

The two Alternatives for RF bucketing are given in Annex B.2 of the consultative document, paragraph 183. The two Alternatives can be summarised as follows:

1. One bucket per IMA RF. Buckets must be non-overlapping, however exact boundaries between buckets may be specified by each institution
2. Each bucket may contain one or more IMA RFs. A prescribed set of tenor, expiry and strike boundaries is given which define the minimum requirement for the number and granularity of buckets

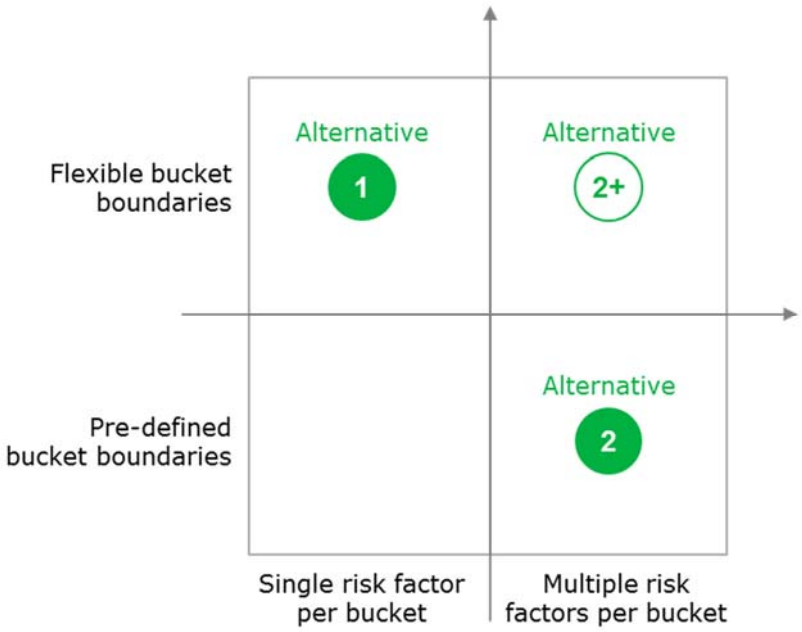
[1] Our analysis is based upon real risk factor and transaction data for Interest Rate swaptions and Equity options sourced from IHS Markit's OTCDD and MarkitSERV platforms.

There are two core features which differentiate the proposed Alternatives:

a. Whether each "bucket" can contain only one, or more than one RF
b. Whether the number and location of boundaries between buckets are pre-specified or flexible

This situation is summarised in **Figure 1** below, on which the two existing Alternatives are labelled, along with the enhanced Alternative 2+ which is described later in this document.

Figure 1: Overview of bucketing alternatives



Challenges of Alternative 1:

a. As remarked in Footnote 2 on page 22 of the consultation paper, the "single RF per bucket" restriction would create a tension between the P&L Attribution (PLA) and NMRF components of FRTB. The PLA test incentivises institutions to create risk models that closely match their Front Office pricing counterparts, a practice which enables more precise and granular risk and measurement and management than previous models.

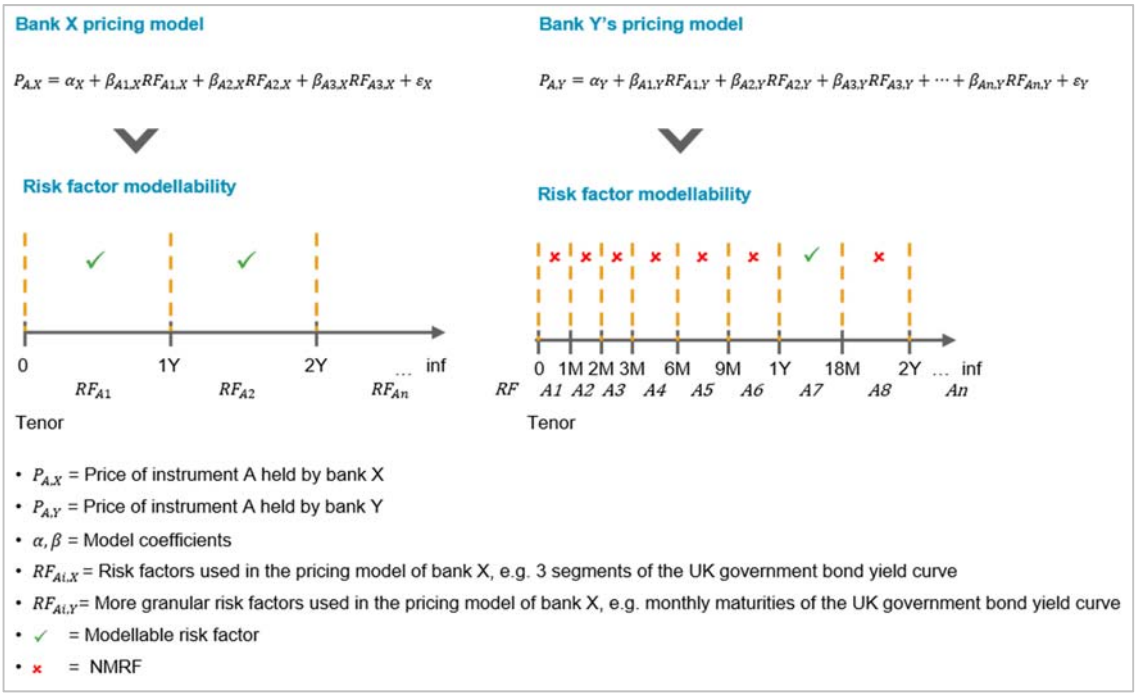
   Problematically however, Alternative 1 would directly penalise more granular RF representations. Requiring one bucket per factor causes banks with granular models to spread their fixed number of Real Price Observations (RPOs) across a larger number of observation buckets, which could result in uneconomic capital penalties vs banks with less granular representations.

   We believe this "penalty for granularity" outcome is undesirable and is the core challenge posed by Alternative 1.

   To illustrate this point, we present in **Figure 2** a specific example using the 3M Danish Kroner (DKK) yield curve. This curve exhibits moderate liquidity in our transaction database. Consider two example firms: "Bank X", which has fairly coarse risk factor representation of one factor per year, and "Bank Y", which has a more granular representation. Assuming both banks have

the same exposure to the DKK yield curve, under Alternative 1, they would have very different modellability results and therefore capital charges under FRTB.

Figure 2: Modellability of DKK 3M yield curve: coarse vs granular under Alternative 1

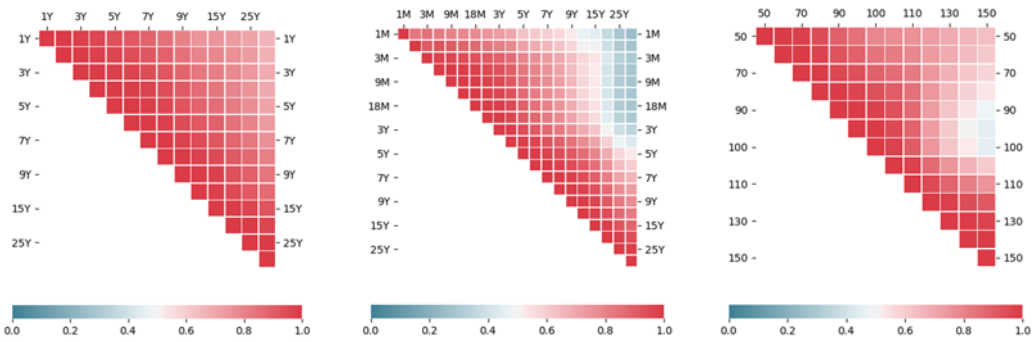


b. Adjacent/nearby risk factors on connected curves/surfaces often move in a high correlated fashion. Such is the strength of these correlations that a price observed for one RF may be considered highly representative for the RF's neighbours.

   By way of example, consider **Figure 3**, which presents correlation matrices of implied volatility risk factors of varying expiries. The correlations measured are often very high (95%+) for adjacent/nearby tenors. Accordingly, an observation of an interest rate swaption trade provides a highly representative view of both its own and neighbouring implied volatilities.

   The "one bucket per RF" rule expressed under Alternative 1 does not provide a strong reflection of this market reality and inhibits full expression of the bucketing concept (i.e. RPOs can be representative of RFs even if their parameters are not exactly aligned).

Figure 3: Implied volatility correlation heatmaps for IR Swaptions and Equity options[2]



Tenors of ATM EUR swaptions	Expiries of ATM GBP swaptions	Strikes of FTSE100 options (multiples of ATM in bps)

Deep red shading of cells directly above or to the right of each diagonal cell indicates high correlation between the adjacent risk factors

Challenges of Alternative 2:

a. There are multiple moneyness conventions used in options markets. Common representations include relative strikes ($x\%$ × ATM[3]), often used for equity instruments, and absolute deviations (ATM ± y), such as are often quoted for interest rate swaptions. These differing conventions have not been reflected in Alternative 2, which only a single specification based on relative strikes given.

   The result of this single approach would be that for some cases the given buckets would be "too narrow" for the spread of transactions in the market, and in others they would be "too wide". Furthermore in some cases where the ATM value is negative value, the given buckets would result in a reversed order of the buckets.

   Figure 4 presents the transaction distribution for 1Y1Y USD swaptions. In this case the given bucket boundaries appear to suitably divide up the trade population. Contrastingly, **Figure 5** presents the comparable case for 1Y1Y EUR swaptions, where the small and negative ATM value results in a tight and reversed set of bucket boundaries which leave many transactions in the most extreme buckets. We believe this consequence may not be desirable.

[2] Over the period Jan 2016 to Dec 2017 for IR swaptions and Oct 2016 to May 2018 for Equity options. Absolute non-overlapping 30-day returns used for IR implied volatility to account for the fact that IR smile information is updated monthly in the underlying timeseries dataset. 10-day overlapping returns used for EQ implied volatility.

[3] For simplicity, "ATM" here represents both the "At The Money" and "At The Money Forward", depending on instrument type

Figure 4: USD 1Y1Y Swaptions, overlaid with the bucket boundaries given by Alternative 2

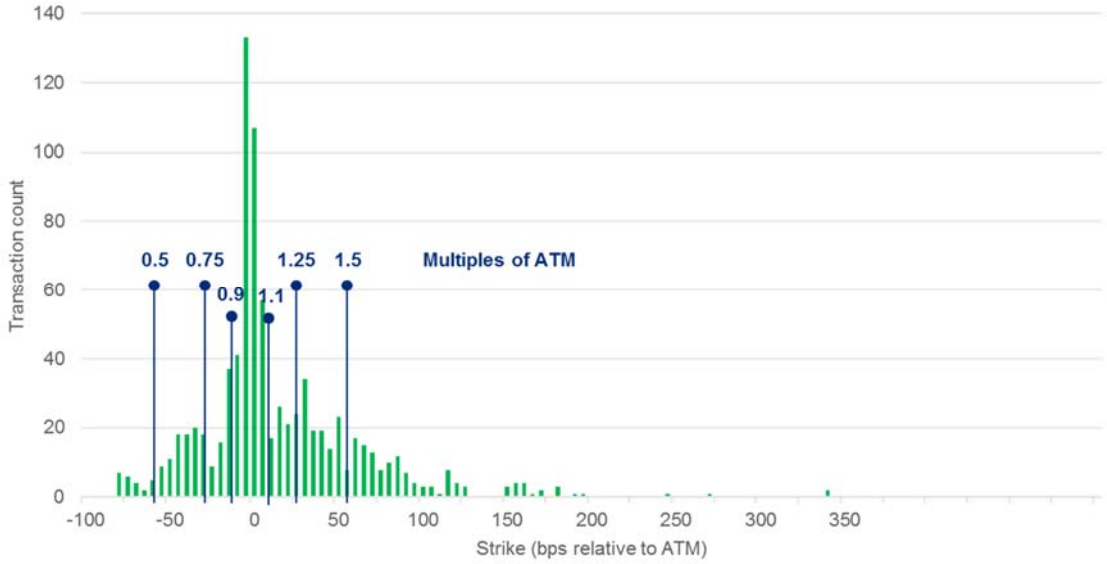
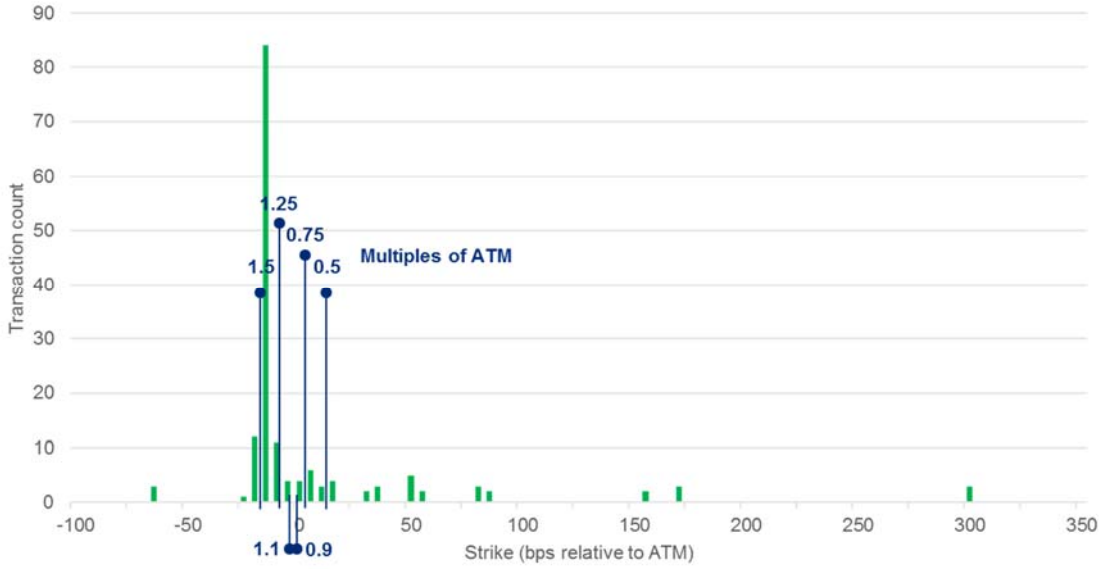


Figure 5: EUR 1Y1Y Swaptions, overlaid with the buckets boundaries given by Alternative 2



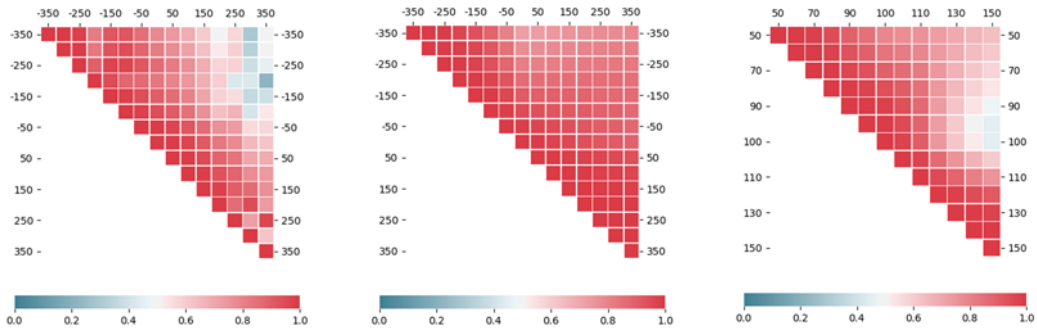
b. The ATM region is often the most liquid area on an implied volatility surface, with trades at or immediately either side of the ATM point carrying very similar prices. From the perspective of reflecting underlying RF behavior, we believe there is a strong case to bucket these trades together for the purposes of counting RPOs for the RFET.

   By contrast, the bucket set proposed in Alternative 2 give the central buckets as [0.9×ATM, ATM) and [ATM, 1.1×ATM), which artificially divides this region of strongly connected behavior into two sections.

c. The specified minimum number of buckets under Alternative 2 will be suitable for some risk factors, but less suitable for others. Analysis of historical correlations across credit spread curves reveals extremely high levels of correlation between tenor points; in these cases, requiring six tenor buckets could prove to be excessively granular.

   Similarly for volatility surfaces, our analysis indicates that the minimum of nine moneyness buckets is excessively granular in some cases, given the high correlation between volatility RFs of adjacent strike (see **Figure 6**).

Figure 6: Examples of high correlation between adjacent strikes for IR swaptions and Equity options[4]



Strikes of GBP swaptions (bps relative to ATM)	Strikes of EUR swaptions (bps relative to ATM)	Strikes of FTSE100 options (multiples of ATM in bps)

Alternative 2+: an enhanced approach to Risk Factor bucketing

As a constructive proposal into the consultation process, we describe in this section an enhanced bucketing approach which maintains the spirit of the consultation paper and the FRTB text more broadly, whilst also aiming to address the shortcomings we have identified in our analysis of Alternatives 1 and 2. We call this revised proposal "Alternative 2+", since it most closely resembles the existing Alternative 2.

[4] Over the period Jan 2016 to Dec 2017 for IR swaptions and Oct 2016 to May 2018 for Equity options. Absolute non-overlapping 30-day returns used for IR implied volatility to account for the fact that IR smile information is updated monthly in the underlying timeseries dataset. 10-day overlapping returns used for EQ implied volatility.

Outline of Alternative 2+:

Alternative 2+ has the following features:

- 1 or more RFs within each bucket
- Institutions may choose a strike representation that best suits the risk factors under consideration
- Institutions may choose the number of buckets on each axis, subject to prescribed minima
- Institutions may choose the location of bucket boundaries based on the results of independently-verified analysis of RF behavior. Where no such analysis is possible, a set of "standard fallback" buckets should be used

We believe this combination of flexibility, asset-class sensitivity and a conservative fallback should allow banks to implement practical and nuanced bucketing logic into their NMRF systems. Whilst these additional nuances in the rules may increase the effort required to validate models, we believe this is additional work is worth the outcome in terms of more precise and appropriate bucketing.

A summary comparison of the three Alternatives is given in **Table 1** below.

A proposed draft of the formal text for Alternative 2+ may be found in Appendix 1 of this letter.

Table 1: Summary comparison of the three bucketing Alternatives

	Alternative 1	Alternative 2	Alternative 2+
Brief description	*"One bucket per RF"*	*"Pre-defined buckets"*	*"Flexible, but constrained buckets"*
RFs per bucket	1	1+	1+
Flexibility to choose bucket boundaries?	Yes	No	Yes, constrained by analytical evidence
Variable by asset class?	Yes	No	Yes
Fallback buckets included?	No	Yes	Yes

Conclusion

In this letter, we discuss the two Alternatives put forward by BCBS for bucketing risk factors in the NMRF assessment. Using analysis of IHS Markit's derivative transaction dataset, we examine the challenges posed by the two Alternatives and use these insights to inform and enhanced "Alternative 2+".

We hope this letter will constructively contribute towards further refinement of the regulatory text of the *Revisions to the minimum capital requirements for market risk*.

Appendix 1: Alternative 2+ proposed text

To apply the bucketing approach, banks must define a set of buckets for each risk factor curve/surface which comply with the following standards:

a. A minimum of **[five]** buckets for each expiry and tenor dimension, including an "indefinite" bucket at the unbounded end of the dimension

b. A minimum of **[five]** buckets for each moneyness/strike dimension, including an "indefinite" bucket at each unbounded end of the dimension

c. The chosen number of buckets and the placement of boundaries should be justified using data and/or analysis which examines the underlying behavior of the risk factors in each case. The analysis used should be repeatable and validated by a team that is independent from trading activity

d. Where no suitable justification / analysis can be produced for a bucket set, the "standard fallback" buckets should be used

e. Indefinite buckets are always non-modellable

Standard fallback buckets

- Eleven buckets for the maturity dimension of interest rate, foreign exchange and commodity risk factors, excluding implied volatilities (for a given underlying): 0 year up to 0.25 years; longer than 0.25 years up to 0.5 years; longer than 0.5 years up to 1 year; longer than 1 year up to 2 years; longer than 2 years up to 3 years; longer than 3 years up to 5 years; longer than 5 years up to 10 years; longer than 10 years up to 15 years; longer than 15 years up to 20 years; longer than 20 years up to 30 years; longer than 30 years.
- Six buckets for the maturity dimension of credit spread and equity risk factors, excluding implied volatilities (for a given underlying): 0 year up to 0.5 years; longer than 0.5 years up to 1 year; longer than 1 year up to 3 years; longer than 3 years up to 5 years; longer than 5 years up to 10 years; longer than 10 years.
- 6 x 9 buckets for expiry and strike dimensions of interest rate, foreign exchange, commodity, equity and credit spread implied volatility risk factors (for a given underlying):
  - Expiry buckets: 0 year up to 0.5 years; longer than 0.5 years up to 1 year; longer than 1 year up to 3 years; longer 3 years up to 5 years; longer than 5 years up to 10 years; longer than 10 years.
  - Strike buckets chosen depending on the underlying asset class of the risk factors under consideration. Strikes may be represented relative to either the "at-the-money" or "at-the-money-forward" value, depending on asset class. Hereunder both shall be signified with the abbreviation "ATM". Strikes may either be defined in terms multiplies of ATM, absolute deviations from ATM or delta.
- In the case of multiples of ATM, the buckets are defined as:
  [0, 0.5ATM), [0.5ATM, 0.75ATM), [0.75ATM, 0.9ATM), [0.9ATM, 1.1ATM), [1.1ATM, 1.25ATM), [1.25ATM, 1.5ATM), [1.5ATM, ∞)
- In the case of absolute deviations from ATM in basis points, the buckets are defined as:

(-∞, ATM-300bps), [ATM-300bps, ATM-200bps), [ATM-200bps, ATM-100bps), [ATM-100bps, ATM-50bps), [ATM-50bps, ATM+50bps), [ATM+50bps, ATM+100bps), [ATM+100bps, ATM+200bps), [ATM+200bps, ATM+300bps), [ATM+300bps, ∞)

- In the case of delta, the buckets are defined as:
  [0, 0.1), [0.1, 0.2), [0.2, 0.3), [0.3, 0.45), [0.45, 0.55), [0.55, 0.7), [0.7, 0.8), [0.8, 0.9), [0.9, 1.0]

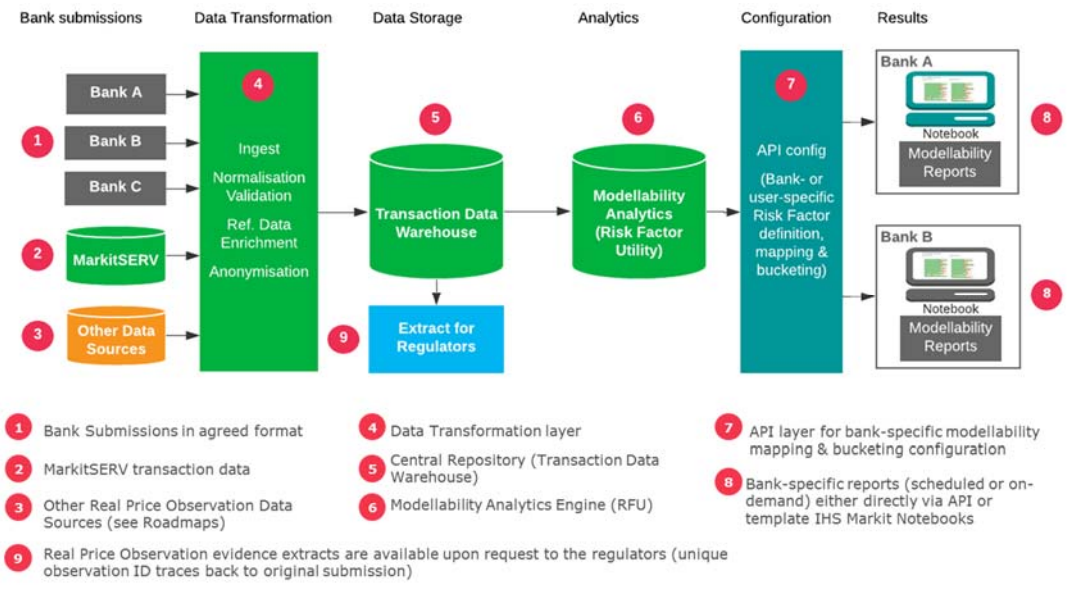
Appendix 2: FRTB Modellability Service

In this appendix we present a brief overview of the IHS Markit Modellability Service, and some selected outputs from the Proof of Concept work we have conducted with banks preparing for FRTB.

The Modellability Service is underpinned by a pool of "Real Price Observation" data, fed by IHS Markit's MarkitSERV platform and other data sources. The system harmonises and anonymizes the data such that it may be reliably used for determining modellability status under FRTB.

Risk factor modellability outcomes are then mapped and computed in the Risk Factor Utility, which is accessible both through a flexible front-end GUI and as a programmatic API. This overview is depicted in **Figure 7** below.

Figure 7: FRTB Modellability Data Service workflow



The Modellability Service is live and has been used in 20+ Proof of Concept with banks around the globe in their preparations for FRTB. In the following figures, we present a selection of the modellability results from the Service. In Figures **8, 9 and 10** the modellability status of common risk factors is shown for a typical Tier 1 bank in isolation vs the complete pool. In each **Figure**, Green RFs are modellable; Amber RFs are non-modellable with the gap between trades >1 month; Red RFs are non-modellable with both a >1month gap and fewer than 24 transactions in a year.

Figure 8: Yield Curve modellability, "Typical Tier 1 bank" vs pooled data

Figure 9: EUR Swaption modellability, "Typical Tier 1 bank" vs pooled data

Figure 10: CDS (Financial Sector) modellability, "Typical Tier 1 bank" vs pooled data