# FRTB Charge Optimization

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# Executive summary

- In January 2016, the Basel Committee for Banking Supervision (BCBS) published its Standards for Minimum Capital Requirements for Market Risk

- Also known as the Fundamental Review of the Trading Book (FRTB), the new standards have a big impact on regulated entities in terms of both increased capital costs and difficulties of implementation

- Among the introduced changes, the following pose significant challenges for banks:

  - Approval for the Internal Model Approach (IMA) is now given on a single trading desk basis, and the approval process has intensified, with some very stringent and difficult to satisfy requirements

  - Banks can choose between two approaches for calculation of the capital charge. Both approaches have three components: a general market risk component (Sensitivities based in one approach and based on Expected Shortfall (ES) in the other); a default risk charge for instruments subject to jump to default risk; an add-on, which is based on residual risk and the exoticness of the underlying instrument in one approach and on data availability and quality in the other approach

- The fact that the IMA can be used on a single desk basis poses the question of which approach to use for each desk. A question which cannot be answered by simply looking at all the combinations, since these grow exponentially with the number of desks (for 10 desks there are already 1024 combinations)

- We therefore propose an approach based on five steps. As it will be explained later in the paper, the starting point for this optimization process will change after these steps, requiring a few repetitions of the process and making this process circular to some extent

  - **Strategy setup**. Banks set their own priorities. For example, minimizing the capital charge

  - **Definition of limitations**. The fact that there are many combinations does not mean all of them are relevant. In this phase, some limitations are set. For example, those desks for which approval of IMA is very unlikely should be eliminated a priori from the range of possible choices and be directly assigned to the Standardized Approach (SA)

  - **Charge breakdown.** Each product is analyzed for which components of the capital charge it would be subject to under each of the approaches

  - **Products' assignation**. Based on the mapping done at the previous step, products are assigned to a group with other homogeneous products, e.g., those which are subject to all three charge components under both approaches

  - **Pattern identification**. In each of the groups established, the charge is calculated under both approaches to identify patterns of "better" behavior. For example, exotic equity options might receive a lower charge in general under the IMA. These patterns will guide the choice of which products should be assigned to which desks and which approach to use for these desks

- The approach proposed is relatively quick and more statistically significant than a brute force one which tries all combinations, providing there are enough products in each category. However, it also requires a certain degree of iteration since the output (which products are assigned to which desks) is ultimately the starting point, that forms the basis of the analysis (In the phase of definitions of limitations, for example, the likeliness of obtaining IMA approval of a certain desk is a function of many variables, one of which, and a very important one, is which products are traded at this desk)

# Introduction FRTB

## History and Reasoning

As for many areas of financial institutions' risk management, the financial crisis shed light on the management of market risk intrinsic in banks' trading books. In January 2016, the Basel committee for Banking Supervision (BCBS) has therefore amended the approach to assess the capital requirement against those risks with the Fundamental Review of the Trading Book (FRTB). The new regulation has fostered heated discussions about the impacts it will have on banks and financial markets since it does not only require higher capital levels, but it also brings along a range of hurdles, that banks face when they plan for and implement it.

## Overview on total scope

Basel's updates to current regulation start with a more restricted allocation of assets to either the trading or banking book and a limitation on shifting between those books. As far as the calculation approach is concerned, banks are still free to choose between applying for the IMA or the more straightforward Standardized Approach (SA). However, both approaches are accompanied by a variety of challenges ranging from a potential increase in capital to a costly approval and implementation process.

## Standardized vs Internal Model Approach

The SA will be implemented compulsory for all banks for all desks. The capital charge calculation under this approach will have three components:

- **Sensitivities-based Method (SBM)**: aggregates three types of sensitivities (delta, vega and curvature) of the trading book to seven specified risk classes without allowing for diversification benefits across sensitivities or risk classes
- **Default Risk Charge (DRC)**: intended to capture jump-to-default risk
- **Residual Risk Add-On (RRAO)**: an additional charge for instruments which bear residual risk or with an exotic underlying

The Internal Model Approach (IMA) can be used at the bank's discretion for selected desks provided there is approval by relevant regulators.

The capital charge under this approach will also have three components, sharing the common possibility of selecting the specific modelling choices subject to regulators' approval:

- **Global Expected Shortfall (ES)**: a sophisticated aggregation of ESs of the portfolio considering the different liquidity horizons of different risk classes
- **Default Risk Charge (DRC)**: intended to capture jump-to-default-risk as in the SA but with some degree of freedom with regards to the model used
- **Stressed Capital Add-On for Non-Modellable Risk Factors (NMRF)**: stressed calibration of ES for those products whose risk factors are deemed non-modellable. In very simplified terms, the ability to model a risk factor hinges on the quality and quantity of historical data available for that risk factor

**FIGURE 1: CONTENTS AND REQUIREMENTS OF FRTB**
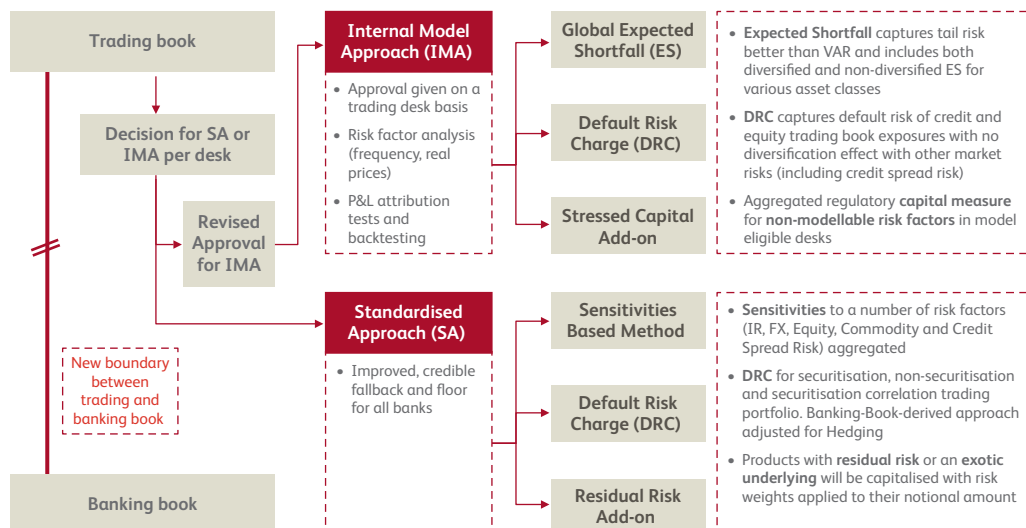


# Approval process

While regulators' approval for the use of Internal Models is not a new feature of Basel regulation (current internal models also have to be approved), one major change is that a bank must seek approval at a single desk level, where stricter rules already apply for the definition of a trading desk. This also implies that the approval can also be lost at the single desk level, which creates several challenges as explained in the following sections.

The process can be divided into three steps:

- An **overall assessment of organizational requirements** is the first hurdle for approval, both the qualitative and quantitative standards of the model

- The second step is the approval of **two separate tests** for each trading desk in scope (i.e., each trading desk that has asked for approval of the internal model). The two tests aim at:

- Showing the risk models are sophisticated enough to reflect the profit and loss of front office systems. The Profit & Loss (P&L) attribution test, in fact, looks at and compares the daily risk of theoretical and hypothetical trading P&Ls (in simple terms the P&L is calculated by risk and front office systems). The test is a failure, if the difference between the two or its variance exceeds certain thresholds over a specified period

- Verifying the adequacy of models' predictive capabilities by back testing. If a certain number of breaches occur in a certain timeframe, the approval is not received or is withdrawn

- The third step regards data. Banks need to show the risk factors used in the models have enough historical data and that the data is of a "good enough" quality. Those who pass the test are deemed modellable, the others as non-modellable risk factors (or NMRFs). While failing this third test does not prevent banks from using the internal model, the products in question will have to be capitalized under more punitive conditions. The effect of this additional step is estimated to be quite significant in the overall charge
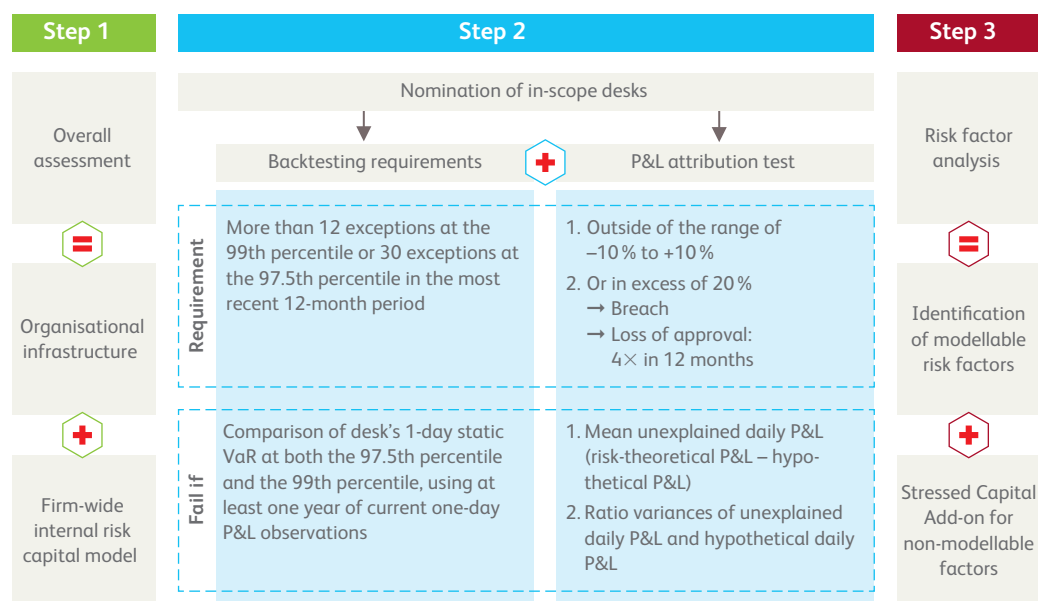
For the desks who do not reach approval, the SA will be used. This also happens when an approved desk loses approval for failing one or more of the conditions highlighted above.

The final capital charge will then be the sum of the separate charges of those desks using SA and those using IMA without diversification allowed between the two approaches.

Moreover, for the approved desks, the SA could potentially serve as a floor for the single-desks' IMA-based charge. Details on this floor, however, have not been published yet.

Figure 2 below summarizes the approval process.

**FIGURE 2: INTERNAL MODELS' APPROVAL PROCESS**

| Step 1 | Step 2 | | Step 3 |
|---|---|---|---|
| Overall assessment | Nomination of in-scope desks | | Risk factor analysis |
| | Backtesting requirements ✚ | P&L attribution test | |
| = | **Requirement**: More than 12 exceptions at the 99th percentile or 30 exceptions at the 97.5th percentile in the most recent 12-month period | 1. Outside of the range of −10 % to +10 %<br>2. Or in excess of 20 %<br>→ Breach<br>→ Loss of approval: 4× in 12 months | = |
| Organisational infrastructure | | | Identification of modellable risk factors |
| ✚ | **Fail if**: Comparison of desk's 1-day static VaR at both the 97.5th percentile and the 99th percentile, using at least one year of current one-day P&L observations | 1. Mean unexplained daily P&L (risk-theoretical P&L – hypothetical P&L)<br>2. Ratio variances of unexplained daily P&L and hypothetical daily P&L | ✚ |
| Firm-wide internal risk capital model | | | Stressed Capital Add-on for non-modellable factors |

# Challenges

## General Challenges

The implementation of FRTB for financial institutions is proving very challenging on several dimensions as anticipated in the previous introductory section.

The first challenge is the increase in operational complexity. This is due to the amount of additional organizational work required in the implementation and in the maintenance of a future market risk management function. Trading book and banking book are now more strictly divided and all products' movements between them need to be documented; the definition of trading desk is more stringent than before (requiring, among other things, only one trading desk per trader); approvals will have to be managed at the single desk level instead that at a global level as currently done; approvals can be lost on a desk level causing the overall charge to potentially fluctuate significantly due to the change of approach (the so-called Cliff Effect). Banks will have to restructure themselves to be able to follow all these additional or intensified activities, new governance will have to be put in place, procedures and processes will have to be setup and documented requiring a significant amount of resources.

The second challenge is the strain on resources from the increase in modelling sophistication. For all the desks in the trading book, the standardized approach will have to implemented together with and independent of the application of the IMA. This leads to a potential duplication of activities and resources. In both approaches, moreover, the amount of calculations required increases significantly. In the IMA, the calculation of a maximum of 63 expected shortfalls is required for a book covering all risk classes. In the SA, the amount of sensitivities needed for the SBM is very high and may necessitate the implementation of further, new methodologies. All of this will require a significant investment in technology and possibly new staff with a subsequent increase in costs.

The third challenge is the approval process and the preconditions for being able to pass the related tests. One feature of the approval process that will cause many problems to banks is the required alignment of data and models between front office and risk so that the bank will be able to pass the P&L attribution test. Both models and data tend to be much more complex or granular when intended for front-office use, with single desks often following individual approaches to calculate their end-of-day P&L. In contrast, the risk systems are tendentially less sophisticated. An additional challenge for aligning those processes is the use of externally provided software where ready-made models and needed data are enclosed. This alignment is technically and economically very challenging.

On the IMA usage and approval, an additional level of complexity is the punitive charge for non-model-lable risk factors. The analysis and maintenance of data for modellability will create additional activities. Banks need in fact to prove on a regular basis, and document all the related processes, that the risk factors used are modellable as required by the FRTB regulation. For risk factors deemed non-modellable, the question remains on what the optimal strategy is. A bank is faced with three possibilities if it does not want to simply accept the higher capital charge. First, it can try and source the data internally (from the front office for example) or externally (pooled data from other competitors or buy data from external providers). Second, it can also decide to change the modelling or use other risk factors, and third, it can decide to group those products in a separate desk. For these desks they can use SA and not apply for the approval of the IMA. This would eliminate the check on non-modellable risk factors.

The allocation of assets to desks is then crucial for the permission to use IMA, whereby both smaller and larger desks are associated with benefits and downsides. A small desk that fails the approval process will not have a detrimental effect on the total charge. However, the costs for going through the process and implementation in general are costlier for a large number of small desks.

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These challenges (among others which are out of the scope of this article), show that the result in the capital charge depends on a number of separate factors (which nonetheless also show a certain degree of interdependence). The results can have a strong impact on the profitability of certain products. This leads us to analyze this topic in more detail in the following sections and to recommend an approach to make an optimal choice.

## The challenge of the increase in capital charge and costs

We have introduced the general requirements of FRTB and the challenges that derive from it for banks which must comply under constraints in time and budget. These challenges are rooted in part in the current structure of banks, that they operate based on different regulations, and that changing these operations is always very costly due also to older legacy systems and procedures. These general costs must be summed to the increase in the capital charge itself and can put a strain on the profitability of certain products.

It is in fact estimated that the increase in the capital charge will be significant in both approaches. Numbers obtained in several industry and Basel Committee studies have shown increments of a factor of 2.4 (relative to the current RWA) for SA and 1.5 for IMA. However, these figures represent an average, and the variability across banks was tremendous, ranging from close to zero (or even negative in some specific cases) to an increase of over six.

The question then is how banks can decrease or at least mitigate this increase in RWA. The obvious answer would be to stop trading those products that seem to have fallen out of the regulators' favor. However, this has practical implications both for the financial markets, which would then be less complete, and for the banks themselves, which would see the relationship with those clients who currently trade these products affected. Also, the business model of some financial institutions will then be affected, as some of them are known in the market and position themselves as specialists, leaving this option outside the spectrum of possible solutions. While it is not the objective of this paper to challenge and reshape banks' strategy, we will try to tackle this problem in the following sections without a change in the product mix (i.e., by leaving the number and type of products traded the same).

While banks must implement the SA for all desks, they can choose on a desk basis if additionally adopting the IMA. Evidence shows this provides in general a lower charge but requires increased operational efforts. Moreover, features like NMRFs still have the potential to largely increase the IMA-based charge. And if IMA approval is not obtained for all desks, there is a high number of possible configurations to mix the two approaches. Each configuration is associated with a certain capital charge which is difficult to predict. In a mixed approach, there is the risk of a higher-than-optimal charge. So which approach should a bank use to calculate capital charges between SA and IMA considering costs and benefit? And which mixed configuration is the best, i.e., allows for a lower charge than when SA is applied to the total portfolio? This question is partly due to the lack of diversification between the two approaches, as shown in Figure 3 below.

**FIGURE 3: TRADING DESK AND APPROACH SELECTION EFFECT ON OVERALL CHARGE**
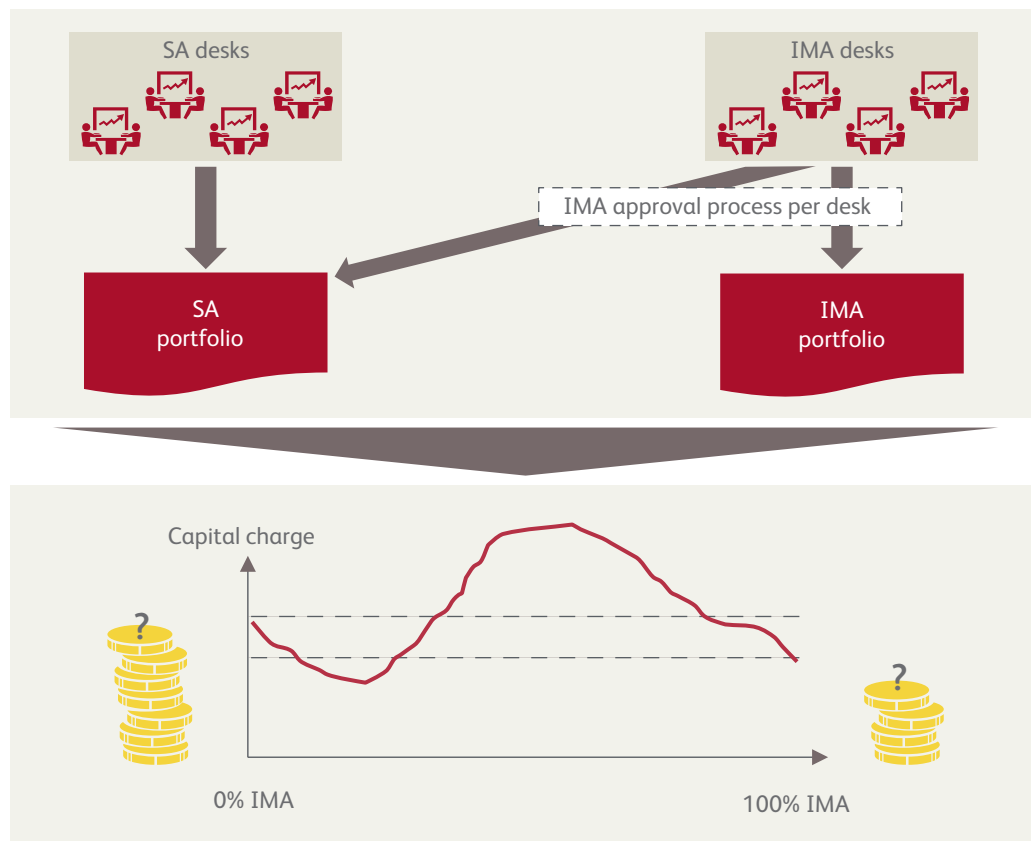


Finally, when investigating the optimal desk structure and allocation to either IMA or SA, implementation costs must be considered as well. An institution needs to adopt a strategy for preparation and implementation of the revised requirements, which defines its priorities on dimensions such as the duration of implementation, the level of confidence to qualify for IMA, or the expenses for IT implementation and preparatory quantitative and qualitative analyses. The next section will present our approach for finding an optimal desk configuration.
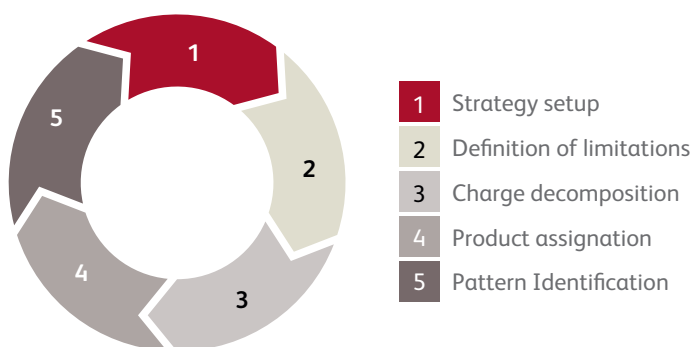
# Charge optimization

## General Approach

As the number of possible combinations between SA and IMA increases exponentially with the number of desks (with 10 desks there would be already over 1000 combinations), trying out all of them is not feasible. At the same time, without considering all the possibilities, we cannot exclude that some extreme cases could unexpectedly happen. Our proposal is therefore to implement an optimization process. The objective of this process is to identify patterns in the trading book on which products perform better under either approach. This directs the assignment of products and desks to IMA or SA and increases both feasibility and probability of selecting the optimal mix.

Since the current desk set up serves as a starting point for this process and is used to limit degrees of freedom (as explained in the following sections), a certain degree of circular optimization is required to reach a mix that is optimal under different conditions.

The approach proposed comprises five phases:

- Strategy setup
- Definition of limitations
- Charge breakdown
- Product assignation
- Pattern identification

**FIGURE 4: CIRCULAR APPROACH TO CHARGE OPTIMIZATION**



| | |
|---|---|
| 1 | Strategy setup |
| 2 | Definition of limitations |
| 3 | Charge decomposition |
| 4 | Product assignation |
| 5 | Pattern Identification |

## 1. Strategy Setup

Before embarking on a journey for optimizing the desk configurations, a bank needs to decide on its priorities. There exists a trade-off between the minimization of the charge and the costs to implement these actions. A possible strategy, for example, might be the identification of that combination which delivers the lowest possible capital charge. However, it needs to be confronted with the costs and time frame for its implementation.

Based on these considerations, a starting point for the analysis is decided on and will function as a base/reference case for the optimization.
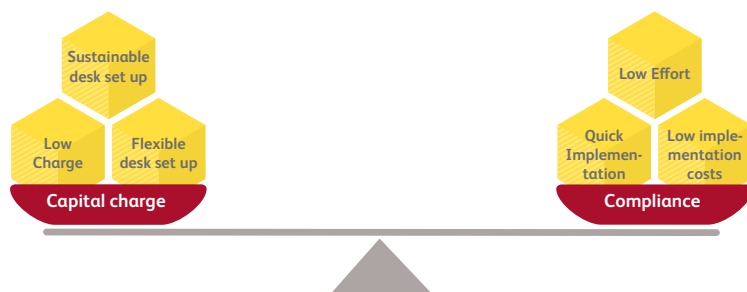
# 2. Definition of limitations

The degrees of freedom in the optimization process are the number of combinations for allocating desks to SA or IMA. Even if all combinations are possible in theory, some limitations should be set at the beginning of the optimization process. Those will be defined based on the institutions' priorities.

Such limitations will include, but are not limited to, the exclusion of those desks for which the IMA approval is unlikely at inception or which carry a high risk of losing an already obtained approval. Also, those desks which are providing the highest diversification benefit might be excluded from this optimization processes.

**FIGURE 6: EXEMPLARY DEFINITION OF LIMITATIONS THAT DELIVER A LOWER NUMBER OF APPROACH COMBINATIONS**
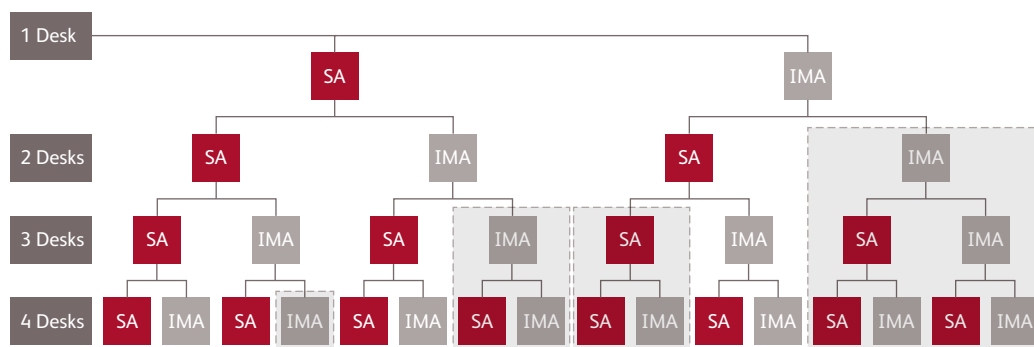


The allowance of correlation is already limited under SA, where delta, vega and curvature sensitivity are calculated and summed separately, even though they might have compensating effect to some extent. There is additionally an unwanted effect based on the segregation of the charge under the two approaches. Under both approaches, all desks are combined to determine the capital charge of each approach. These two charges are then summed up. This means that products which compensate each other (in terms of sensitivity or ES) will be having a lower capital charge if all within the same approach

Thus, when moving desks from one approach to the other, the overall portfolio might lose or gain diversification effects. The reason for this is simple, albeit counterintuitive. Under SA, products are subject to the same scenarios, for example, a bump up of 1bp in interest rates. Products which are negatively correlated will then be compensating each other to a certain degree. In IMA, however, we look at the tail of the loss distribution. It might then be that the scenarios where the loss is the highest are others than the 1bp bump up. When separating products in two different approaches, we get the worst of both worlds, eliminating the possibility of compensation. This is because we look at different scenarios at the same time.

When defining limitations to the optimization process, the desks with the highest diversification benefit should not be moved initially or only when their diversification benefit is higher under the alternative approach (e.g., in the case of many other desks being moved as well).

# 3. Charge breakdown

The following step in the approach for those desks and products that are in the scope of the optimization process, is breakdown the charge of each type of product and analyzing its components. As an example, under the SA, there will be products that will be capitalized under the calculation of sensitivities only. Some other products will also receive a DRC charge component as they are subject to jump to default risk (equity instruments, for example). Lastly, there will be products that will be relevant for all three components, including the RRAO. The intuition behind our approach is that some products like exotics might result in a lower charge when allocated to an IMA desk (if not relevant for NMRF). Going one step further brings another example: non-modellable risk factors are forced to be capitalized by an expected shortfall calibrated to a period of extreme stress and thus lead to a significantly higher capital charge. Under the IMA there exists the possibility to minimize the list of non-modellable risk factors through data provided by a third-party vendor or sources of trade data that cover many parties' transactions, whereas under the SA the RRAO is a feature which is embedded in the products themselves and will not change with time (i.e. an exotic product will be always such, while data availability can change in time). A similar logic in the breakdown can be applied under the IMA.

The final objective of this phase is to have a clear mapping for each product of which charge components they will receive under which approach. This will form the base for the analysis carried out in the next phase.

**FIGURE 7: CAPITAL CHARGE DIVISION INTO ITS DIFFERENT COMPONENTS PER PRODUCT UNDER BOTH APPROACHES**

| Prod. | Standardised Approach | | | Internal Model Approach | | |
|---|---|---|---|---|---|---|
| | Sens. | DRC | RRAO | ES | DRC | NMRF |
| 1 | ✓ | – | – | ✓ | – | ✓ |
| 2 | ✓ | – | – | ✓ | – | ✓ |
| 3 | ✓ | – | – | ✓ | – | – |
| 4 | – | – | – | ✓ | – | – |
| 5 | ✓ | ✓ | – | – | ✓ | – |
| 6 | – | ✓ | – | – | ✓ | – |
| 7 | ✓ | – | ✓ | ✓ | – | – |
| 8 | ✓ | – | ✓ | ✓ | – | ✓ |
| ... | ... | ... | ... | ... | ... | ... |

# 4. Product assignation

Defining categories to group the products in scope will form the basis for pattern identification. In the previous step, the three components of SA or IMA are depicted. For each product, there are similarities and differences between the SA and IMA components that need to be identified. For example, some products are subject to DRC under both approaches (i.e., equity and debt instruments subject to jump to default risk), but some others might require a residual risk add-on under the SA but not necessarily NMRF in IMA. In a second step, more detailed categories will be defined based on, for example, the sub-categories of the DRC or the different liquidity horizons to be applied under the IMA.

With the identification of similarities and differences within the categories, groups of products become known that possess the potential to lower the charge in a specific approach. Analyzing these groups helps in identifying patterns and the subsequent allocation of instruments to a specific approach. This means analyzing those products subject only to Sensitivities in SA and only to Expected Shortfall in IMA. Another group could be those products which get RRAO and NMRF and so on.

**FIGURE 8: PRODUCTS ARE ASSIGNED TO GROUPS IN TERMS OF HOMOGENEITY OF CHARGE COMPONENTS**

| Group | Prod. | Standardised Approach | | | Internal Model Approach | | | Other categories | |
|---|---|---|---|---|---|---|---|---|---|
| | | Sens. | DRC | RRAO | ES | DRC | NMRF | C1 | C2 |
| SA = Sens / IMA = ES + NMRF | 1 | ✓ | – | – | ✓ | – | ✓ | | |
| | 2 | ✓ | – | – | ✓ | – | ✓ | | |
| SA = Sens / IMA = ES | 3 | ✓ | – | – | ✓ | – | – | i | – |
| | 4 | – | – | – | ✓ | – | – | j | ✓ |
| SA = DRC / IMA = DR | 5 | ✓ | ✓ | – | – | ✓ | – | Specific subcategories to decide | |
| | 6 | – | ✓ | – | – | ✓ | – | | |
| SA = Sens + RRAO / IMA = ES | 7 | ✓ | – | ✓ | ✓ | – | – | | |
| SA = Sens + RRAO / IMA = ES + NMRF | 8 | ✓ | – | ✓ | ✓ | – | ✓ | | |
| | ... | ... | ... | ... | ... | ... | ... | ... | ... |

# 5. Pattern identification

The objective of this step is to identify patterns for products under either approach in terms of capital charge. After assigning products to homogenous groups, several partial simulations of the charge can be done to understand what products charge more benefit under which approach. The results of this analysis might be the discovery that products which normally are subject to RRAO under SA, deliver a lower charge under IMA even if they receive an NMRF add-on. These patterns can be used to assign products and desks to one of the two approaches so that the final results will be optimal.

It is important to note, however, that the allocation of products to a favorable desk will obviously have to consider existing limitations and configurations, such as the organizational setup on the trading floor. A reallocation of instruments to desks requires either a change to the responsibilities of single traders or teams, or to split or merge desks. Whereby there are not only operational consequences need to be considered, but also the likelihood of failing approval for the internal approach for a desk. A smaller desk might for instance have bigger chances to continuously survive P&L attribution test as well as back testing.

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In case those limitations prevent the shifting of instruments between desks, the identified patterns can also be used to decide not on an approach or at the product level, but at the desk-level for the most favorable approach to reduce capital costs.

**FIGURE 9: OPTIMAL PATTERN IDENTIFICATION DRIVES THE ASSIGNMENT OF PRODUCTS AND DESKS TO OPTIMAL APPROACHES GIVEN THE EXISTING LIMITATIONS**
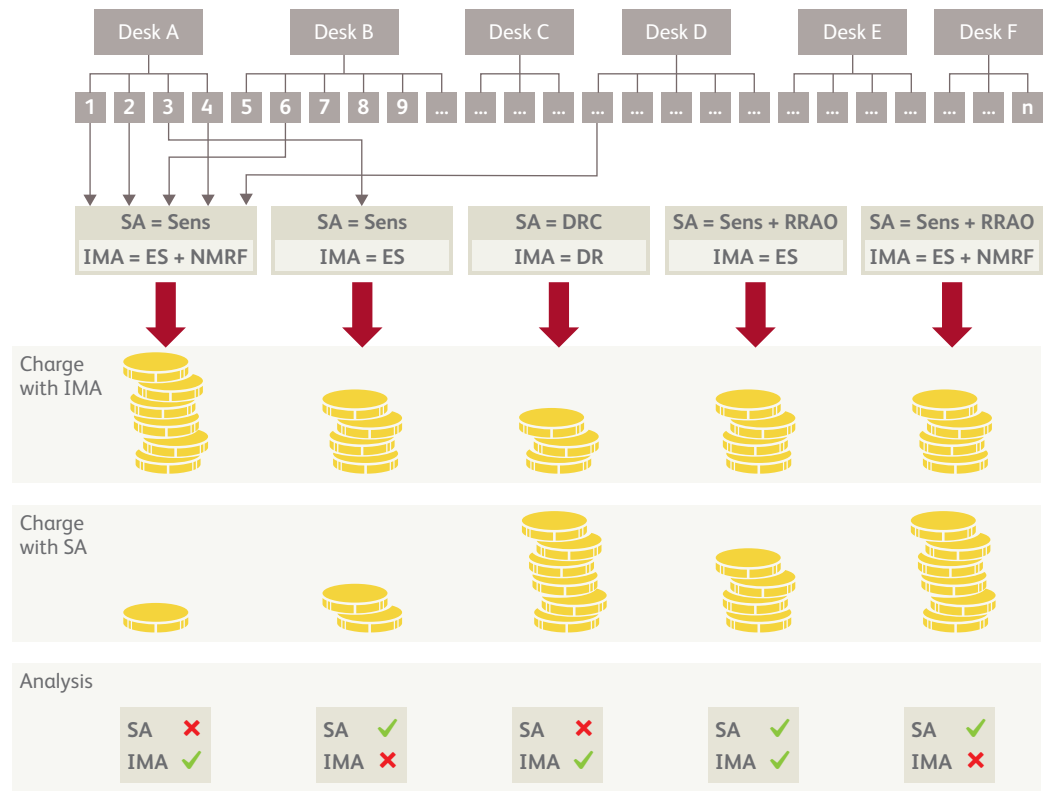


As anticipated at the beginning, the result obtained with this optimization delivers a new starting point. And this has consequences, not least of which is the ability to pass P&L attribution tests. If a desk before had a good chance of passing this test, after some products are maybe reassigned to a different desk, and some new products enter under its responsibility, the likelihood of receiving approval might become quite lower, inhibiting in principle the possibility to apply the IMA. Therefore, some iterations of the approach presented, are necessary to find an optimal mix.

# Pros and cons of the approach

## Many pros

The approach presented, far from being perfect, helps financial institutions untangle the problem of how to best choose which approach to adopt for each desk.

We believe this approach delivers the results with the following additional benefits:

- It saves significant time compared to the brute force approach, which would potentially try all combinations. This is, because it first decreases the complexity of the problem by excluding some cases which are not relevant and then it identifies patterns instead of trying several combinations
- No additional data is needed other than what is already needed for the implementation of FRTB
- It is not computationally intensive, since it only requires one simulation per approach (but divided by the different charge categories)
- It is statically sounder than trying all the combinations. While the brute force approach is impractical for most institutions given the high number of combinations, there might be cases where it is possible, albeit time consuming. One bank might decide to invest time and resources to try all possible combinations. However, we would argue that this approach is less optimal. This is because the results would be based on the specific composition in terms of products of each desk. When this composition changes, because some products expire and some different ones are being traded, the results will be different. Our proposed approach, because it looks at trends, is valid for future product mixes as long as the initial base used for the analysis is big enough. If, for example, our approach finds that equities receive a lower DRC charge under the internal model approach, this will be tendentially always valid if we have a wide enough sample. Nevertheless, when we establish that a certain combination of SA vs IMA is optimal given the current products and desks, this will change when a desk stops trading some products and some new ones are added
- Finally, this approach provides several additional quick wins:
  – An analysis of the impact of non-modellable risk factors is part of the approach. Independent of what the final choice will be, the financial institutions adopting this approach will have a clear view of which products will be receiving this additional charge and what the impact can be
  – An initial estimate of compliance with the requirements of IMA will be done to limit the scope of products, and this will be an activity which is required, if the institution is to adopt the IMA for some desks

## Some things to consider

The approach is not free of limitations, which needs to be kept in mind when applying it.

- The approach presented assumes that the strategy of the bank is to minimize the charge. If the objective is to reach compliance as soon as possible and minimizing investment in doing so, the approach is not the best one suited
- The approach requires a certain degree of circularity since the conditions directly follow from the selected starting point (e.g., which desks have a higher or lower probability of being approved for IMA is a direct consequence of which products are traded at the desk. And this is the exact output of our approach)
- Considering trading desks and products can change over time, this analysis might have to be repeated from time to time to see if assignments still reflect the identified patterns

# Conclusions

We have presented an approach on how to decide which desks and products should be capitalized under which of the two approaches proposed by FRTB. As highlighted at the beginning, this is only one of the challenges posed by the new regulation. It is very important to keep this in mind when deciding on which approach to select. Other considerations, like the profitability impact, the overall strategy of the institutions, etc., have to be taken into consideration when looking at the challenges of FRTB implementation. However, at some point the decision of which approach to use will have to be done, and the difference between the potential choices is quite significant.

We believe, our approach is a cost-effective and relatively quick way of tackling the problem. The final results will have to be assessed, based on specific circumstances of the different financial institutions.

# Contacts



Thomas Steiner
Partner
thomas.steiner@bearingpoint.com



Giovanni Sonnino
Senior Manager
giovanni.sonnino@bearingpoint.com

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