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Basel IV: Revised Standardised Approach for Market Risk

Increasing risk sensitivity through the "Sensitivities-based Method"

Overview of all requirements of the revised Standardised Approach for Market Risk.

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Contents

Preface

Starting in 2012, the Basel Committee published several consultation papers on a Fundamental Review of the Trading Book (FRTB) to adapt existing rules for the capitalization of market risk to the lessons learned and shortcomings that became evident during the financial crisis. This fundamental review covers all aspects of minimum capital requirements for market risk such as the trading book – banking book boundary, the standardized approach as well as the use of internal market risk models.

Among the proposed changes, none has more profound impacts than the revised standardized approach – the so called Sensitivities-based Method. In fact, it is less a standardized method than an internal model approach, developed by the supervisors. It leads to an enormous increase in data requirements and complexity of calculations compared to the current approaches. And it will also have a significant impact on risk weighted assets, especially with regard to positions subject to optionality or credit spread risks.

The BCBS expects the proposed changes to enter into force in 2019. They will have to be implemented by standardized approach and internal model banks alike.

This brochure will help you gain an overview over the proposed rules to prepare for the tasks ahead.

Kind regards,

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The revisions to the existing regulatory framework are focusing on determination of risk weighted assets

The Basel III framework has focused mainly on banks' own funds requirements. Currently, the Basel Committee on Banking Supervision (BCBS) is in the process of revising the standardised approaches for calculating minimum capital requirements. The industry already summarises these revisions under the term **"Basel IV"**. While the BCBS has not yet officially recognized this term the outcome is very clear: The revisions will have a fundamental impact on the calculation of **risk weighted assets and capital ratios** of all banks regardless of their size and business model.

Fig. 1 Areas of revision by the BCBS

Capital requirements		Credit risk	Securiti-sation	Counter-party credit risk	Market risk	Operational risk	CVA risk	Step-in risk
Capital floors (BCBS 306, BCBS 362)	Interest rate risk in the banking book (BCBS 368)	SA for credit risk (BCBS 347)	Revisions to the securiti-sation framework (BCBS 374)	SA counter-party credit risk (BCBS 279)	Fundamental review of the trading book (BCBS 352)	Revisions to operational risk (BCBS 355)	Review of the CVA risk framework (BCBS 325)	Step-in risk (BCBS 349)

The FRTB addresses material weaknesses of the current market risk framework exposed by the financial crisis …

Fig. 2 The fundamental review of the trading book (FRTB): An Overview

"The financial crisis exposed material weaknesses in the overall design of the framework for capitalising trading activities." (Basel Committee on Banking Supervision, October 2013)

Material weaknesses of current approaches …		… require fundamental review
Trading book – banking book boundary	Treatment of credit risk in the trading book	**1** • **Banking book/trading book boundary to be more objective** • Additional tools for supervision
Weaknesses of VaR approach	Hedging and diversification	**2** • New **standardised approach** increases risk sensitivity of RWA calculation • Marked increase of complexity
Liquidity of trading book positions	Transparency and comparability of RWA	**3** • **Internal models approach** using Expected Shortfall (ES) instead of Value-at-Risk (VaR) • Changes to model approval process • Floor based on standardised method

... and aims to replace the existing regulation and harmonizes the treatment of market risk across national jurisdictions

During the last crisis it turned out that the regulatory capital for market risk was not adequate enough to cover these risks. Therefore the Basel Committee on Banking Supervision has created with the fundamental review of the trading book (FRTB) a new framework to replace the old market risk regulation defined under “Basel II.5”. The intention is “to improve trading book capital requirements and to promote consistent implementation of the rules so that they produce comparable levels of capital across jurisdictions”.

Fig. 3 Key objectives of the FRTB

The proposals reflect BCBS’s key objectives
• To develop an effective trading book/banking book boundary condition, • to achieve a regulatory framework that captures and capitalises all market risks in the trading book, • to improve risk measurement techniques and • to achieve comparable levels of capital across internal risk models and the standardised approach.

The history of the trading book regime

1996 Basel I
First methodology laid out by the BCBS to set out capital requirements for market risks. The amendment to the Basel Capital Accord included a standardised approach and an internal models approach.

2004 Basel II
The amendment was further revised in 2005. The paper changed the trading book regime.

2009 Basel 2.5
First attempt by the BCBS to address the trading book issues revealed by the global financial crisis. Revisions to the Basel II market risk framework.

2012 FRTB
The BCBS issued the fundamental review of the trading book (FRTB) consultation paper.

2012–2015
Two more consultative papers and four quantitative impact studies.

2016 Revised standards
In January 2016 the Basel Committee on Banking Supervision (BCBS) published revised standards for minimum capital requirements for market risk.

2019
BCBS's deadline for local regulation in January 2019

End of 2019
Deadline for final implementation.

The FRTB introduces several enhancements to the existing framework

Fig. 4 Overview of the enhancements to the existing market risk framework

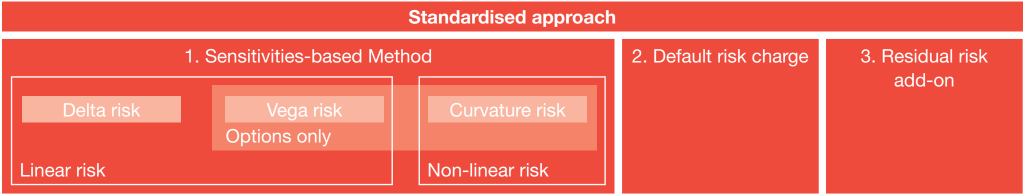
Regulatory boundary between trading and banking book	• New defined list of instruments presumed to be included in the trading book or banking book. Deviation requires explicit approval from supervisor. • Strict limits on the movement of instruments between the books after initial designation. Should a re-designation be approved a capital benefit will not be allowed.
From VaR to ES	• The new risk measure for market risk according to FRTB is the Expected Shortfall (ES). • ES is a coherent risk measure, whereas Value-at-Risk (VaR) is not due to the missing sub-additivity feature. • Banks must calibrate the ES to periods of significant market stress. • This new metric will help to capture the tail risk and so maintain adequate capital during periods of significant market stress.
Revised standardised approach	• Significant changes with introduction of Sensitivities-based methodology. • The revised standardised approach will act as a floor to the internal models approach.
Inclusion of market illiquidity	• Varying liquidity horizons included in the internal models approach. • Replaces the static 10 day liquidity horizon currently assumed in the VaR framework.
Revised approach to approval for internal models	• Supervisors will review the use of internal models at desk level. • More rigorous model approval process using both qualitative and quantitative criteria.

FRTB Framework
Sensitivities-based Method

The revisions to the standardised approach (Sensitivities-based Method) aim to increase risk sensitivity

The standardised approach mimimum capital requirement is the **sum of three components**: *Sensitivities-based Method* and *default risk charge* provide the main risk factors which are supported by *residual risk add-on* to sufficiently cover market risks.

Fig. 5 Overview of the revised standardised approach



Delta: A risk measure based on sensitivities of a bank's trading book positions to regulatory delta risk factors.
Vega: A risk measure that is also based on sensitivities to regulatory vega risk factors to be used as inputs to a similar aggregation formula as for delta risks.

A risk measure which captures the **incremental risk** not captured by the delta risk of price changes in the value of an option.

A risk measure that captures the **jump-to-default risk** in three independent capital charge computations.

A risk measure to capture **residual risk**, i.e. risk which is not covered by the components 1. or 2.

- Calculation of three risk charge figures based on **three different scenarios** on the specified values for the correlation parameter.
- The bank must determine each delta and vega sensitivity based upon regulatory pre-defined shifts for the corresponding risk factors.
- Two stress scenarios per risk factor have to be calculated and the worst scenario loss is aggregated in order to determine curvature risk.

Sensitivities-based Method
Definitions that cover the main concepts

The main concepts of the Sensitivities-based Method are given by the supervisor.

Especially the relevant risk classes differ in parts from the risk classes used in the current approach.

Fig. 6 Overview of the definitions that cover the main concepts

Risk class	Definition of seven risk classes for the Sensitivities-based Method: GIRR; Equity; Commodity; FX; CSR (non-SEC); CSR (SEC); CSR (CTP)
Risk factor	• Variables (e.g. a given vertex of a given interest rate curve or an equity price) within a pricing function decomposed from trading book instruments • Risk factors are mapped to a risk class
Risk position	• Main input that enters the risk charge computation • Delta and vega risks: sensitivity to a risk factor • Curvature risk: worst loss of two stress scenarios
Bucket	Set of risk positions which are grouped together by common characteristics
Risk charge	• Amount of capital that a bank should hold as a consequence of the risks it takes • Computed as an aggregation of risk positions first at the bucket level, and then across buckets within a risk class defined for the Sensitivities-based Method

FRTB framework uses seven risk classes (1/2)

GIRR, Equity, Commodity & FX

Fig. 7 Overview of risk classes and corresponding risk buckets, risk weights and correlations (1/2)

	Risk buckets
GIRR (General interest rate risk)	Each bucket represents an individual currency exposure to GIRR
Equity	• Buckets are depending on market capitalisation, economy (emerging or advanced) and sector • Total of 11 buckets (e.g. consumer goods and telecommunication)
Commodity	Eleven buckets are defined for commodity (e.g. energy, freight, metals, grains & oilseed, livestock and other agriculturals)
Foreign Exchange (FX)	No specific FX buckets

Risk weights	Correlations
• Risk weights (RW) depending on vertices ranging from 0.25 years to 30 years • Risk weights are ranging from 1.5% to 2.4%	Correlations between two sensitivities are depending on equality of buckets, vertices and curves
• Differentiation between risk weights to equity spot price and equity repo rate • Risk weights for equity spot price ranges from 55% to 70%	Correlations between two sensitivities for the same bucket (but related to different equity issuer names) are depending on market cap and economy and are ranging between 7.5% and 25%
• The risk weights depend on the commodity buckets (which group individual commodities by common characteristics) • Risk weights range from 20% to 80%	Correlations between two sensitivities (same bucket) are defined by a multiplication of factors related to commodity type, vertices and contract grade / delivery location
A unique relative risk weight equal to 30% applies to all the FX sensitivities or risk exposures	A uniform correlation parameter equal to 60% applies to FX sensitivity or risk exposure pairs

FRTB framework uses seven risk classes (2/2)

Credit spread risk (CSR)

Fig. 8 Overview of risk classes and corresponding risk buckets, risk weights and correlations (2/2)

	Risk buckets
CSR non-securitisation	16 buckets defined based on credit quality and sector
CSR correlation trading portfolio (CTP)	The same bucket structure as for CSR non-securitisation applies
CSR non-correlation trading portfolios (n-CTP)	25 buckets defined based on credit quality and sector

Risk weights	Correlations
• Risk weights are the same for all vertices within each bucket • Risk weights range from 0.5% to 12%	• Correlations between sensitivities within the same bucket are depending on names and vertices of the sensitivities, and related curves • Separate rules for “other sector” bucket
• Risk weights are the same for all vertices within each bucket • Risk weights range from 2% to 16%	The risk correlations are derived the same way as for CSR non-securitisation, but correlations based on curves differ slightly
Risk weights range from 0.8% to 3.5%	• Correlations between sensitivities within the same bucket and securitisation tranche are depending on names and vertices of the sensitivities, and related curves • Separate rules for “other sector” bucket

Linear risks within the Sensitivities-based Method are captured with delta and vega risk factors

The computational procedure for **linear risks** can be divided into the five calculation steps shown below. Delta and vega risk measures are based on sensitivities of bank's trading book positions to regulatory predetermined delta and vega factors, respectively. These measures are used to calculate the minimum capital requirements for Sensitivities-based method.

Fig. 9 Overview of the computational procedure for the linear risk charge

Calculation	Supervisory formulae	Details
1 Assignment of positions to risk classes, buckets and risk factors	All posi-tions → Risk class → Bucket → Risk factor	• Delta and vega risks are computed using the same aggregation formulae on all relevant risk factors • Separate calculation (no diversification benefit recognised)
2 Calculation of the risk factor's sensitivities	e.g. for GIRR: $s_{k,r_t} = \frac{V_i(r_t + 0.0001, cs_t) - V_i(r_t, cs_t)}{0.0001}$	• The sensitivities are defined by the supervisor • Sensitivities for each risk class are expressed in the reporting currency of the bank
3 Calculation of weighted sensitivities per bucket via given supervisory RW	$WS_k = RW_k \, s_k$	The corresponding RW are defined by the supervisor
4 Aggregation of weighted sensitivities per bucket	$K_b = \sqrt{\sum_{k=1}^{n} WS_k^2 + \sum_{k=1}^{n-1} \sum_{l=k+1}^{n} \rho_{kl} \, WS_k \, WS_l}$	The risk position for bucket b, K_b, must be determined by aggregating the weighted sensitivities to risk factors within the same bucket using the corresponding prescribed correlation ρ_{kl}
5 Aggregation of capital charge on risk class level	$RC = \sqrt{\sum_{b=1}^{m} K_b^2 + \sum_{b=1}^{m-1} \sum_{c=b+1}^{m} \gamma_{bc} \, S_b \, S_c}$	• The risk charge is determined from risk positions aggregated between the buckets within each risk class • S_b and S_c are the sums of the weighted sensitivities in the corresponding buckets

Non-linear risks within the Sensitivities-based Method are captured with the curvature risk factor

The computational procedure approach for **non-linear risks** can be divided into three calculation steps that are shown below. The curvature risk measure represents the incremental risk not captured by the delta risk of price changes in the value of an option.

Fig. 10 Overview of the computational procedure for the non-linear risk charge

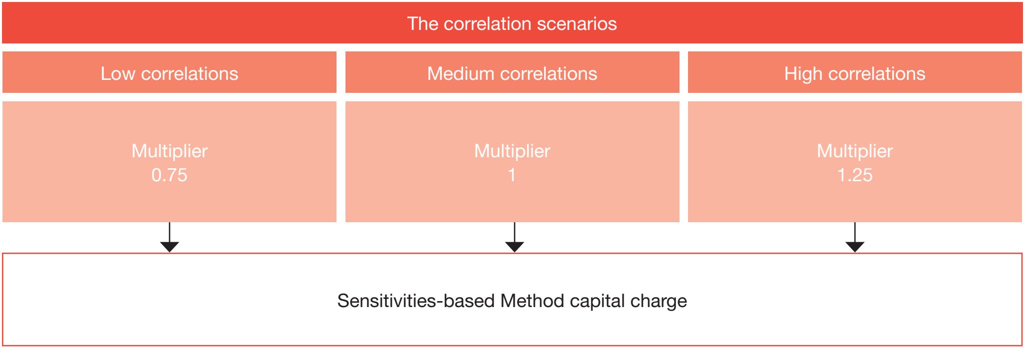
Calculation	Supervisory formulae	Details
1 Finding a net curvature risk charge CVR_k across instruments to each curvature risk factor k	$CVR_k = -min \left[\begin{array}{l} \sum_i \left\{ V_i \left(x_k^{(RW^{(curvature)}+)} \right) - V_i(x_k) - RW_k^{(curvature)} s_{ik} \right\} \\ \sum_i \left\{ V_i \left(x_k^{(RW^{(curvature)}-)} \right) - V_i(x_k) + RW_k^{(curvature)} s_{ik} \right\} \end{array} \right]$	• Only for risk positions with explicit or embedded options • Two stress scenarios are to be computed per risk factor (an upward shock and a downward shock) • The worse potential loss of the two scenarios, after deduction of the delta risk positions, is the outcome of the first scenario
2 Aggregation of curvature risk exposure within each bucket using the corresponding prescribed correlation ρ_{kl}	$K_b = \sqrt{max\left(0, \sum_k \max(CVR_k, 0)^2\right) + \sum_k \sum_{k \neq l} \rho_{kl} CVR_k CVR_l \psi(CVR_k, CVR_l)}$	• ψ (CVR_k, CVR_l) is a function that takes the value 0 if CVR_k and CVR_l both have negative signs • In all other cases, ψ (CVR_k, CVR_l) takes the value of 1
3 Aggregation of curvature risk positions across buckets within each risk class	$RC_{Curvature} = \sqrt{\sum_b k_b^2 + \sum_b \sum_{c \neq b} \gamma_{bc} S_b S_c \psi(S_b, S_c)}$	ψ (S_b, S_c) is a function that takes the value 0 if S_b and S_c both have negative signs. In all other cases, ψ (S_b, S_c) takes the value of 1.

The final risk charge for the Sensitivities-based Method is determined based on three correlation scenarios

In order to address the risk that **correlations increase or decrease** in periods of financial stress, three risk charge figures are to be calculated for each risk class. This is done by using **multipliers** for correlation parameters ρ (correlation between risk factors within a bucket) and γ (correlation across bucket within a risk class).

Capital charges must be calculated for each correlation scenario. The final capital charge is the largest of these scenario-related capital charges.

Fig. 11 Overview of the correlation scenarios



The default risk charge is intended to capture the jump-to-default risk

The default risk charge is **independent** from the other capital charges for CSR non-securitisations and securitisations in the standardised approach.

Fig. 12 Overview of the computational procedure for the default risk charge

Calculation	Supervisory formulae	Details
1 Calculation of gross JTD positions	$JTD\ (long) = \max(LGD\ x\ notional + P\&L, 0)$ $JTD\ (short) = \min(LGD\ x\ notional + P\&L, 0)$ $P\&L = market\ value\ - notional$	The jump-to-default (JTD) risk is computed for each instrument separately. JTD risk is a function of notional amount (or face value) and market value of the instruments and prescribed Loss given Default (LGD) figures.
2 Calculation of net JTD positions	e.g. Non-securitisation: long bond position and short equity position to the same obligor $netJTD = Bond_{long} - Equity_{short}$	The net JTD risk positions are calculated by using specified offsetting rules.
3 Hedge benefit recognition	$WtS = \frac{\sum netJTD_{long}}{\sum netJTD_{long} + \sum \lvert netJTD_{short} \rvert}$	In order to recognize hedging relationship between long and short positions within a bucket, a hedge benefit ratio is computed and applied to discount the hedge benefits.
4 Bucket allocation and calculation of weighted net JTD positions and default capital charge (DRC)	e.g. for non-securitization and securitization non-correlation trading portfolio (NCTP) $DRC_b = \max\left[\left(\sum_{i \in Long} RW_i netJTD_i\right) - WtS\left(\sum_{i \in Short} RW_i \lvert netJTD_i \rvert\right); 0\right]$	• JTD positions are allocated to buckets and weighted. For non-securitization risk weights are prescribed and for securitization risk weights are to be computed applying the banking book regime. • For non-securitization and securitization NCTP the overall capital charge is the simple sum of the bucket level risks. For the correlation trading portfolio capital charge is the sum of positive bucket level risks and half of the negative bucket level risks.

The residual risk add-on is introduced to ensure that the model provides sufficient coverage of the market risks

As not all market risks can be captured with the standardised approach without necessitating an unduly complex regime, a **residual risk add-on** was introduced to the framework. It is to be calculated for **all instruments bearing residual risk separately and in addition** to any other capital requirements within the standardised approach. The scope of instruments that are subject to the residual risk add-on must not have an impact in terms of increasing or decreasing the scope of risk factors subject to the other standardised approach components.

Fig. 13 Overview of the residual risk charge

Calculation	Details
Residual risk add-on	• The residual risk add-on is the simple sum of gross notional amounts of the instruments bearing residual risks • RW = 1.0% for instruments with an exotic underlying (e.g. longevity risk, weather or natural disasters) • RW = 0.1% for instruments bearing other residual risks

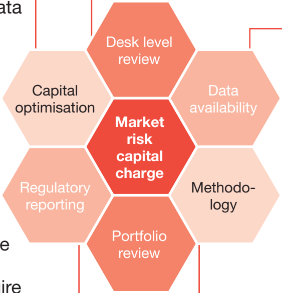
Criteria for instruments bearing other residual risks	
Instruments subject to vega or curvature risk capital charges in the trading book and with pay-offs that cannot be written or perfectly replicated as a finite linear combination of vanilla options with a single underlying equity price, commodity price, exchange rate, bond price, CDS price or interest rate swap	Instruments which fall under the definition of the correlation trading portfolio (CTP), except for those instruments which are recognised in the market risk framework as eligible hedges of risks within the CTP
A non-exhaustive list of other residual risks types and instruments that may fall within the criteria	The following risk types by itself will not cause the instrument to be subject to the residual risk add-on
Gap risk, correlation risk and behavioural risk	Smile risk (a special form of the implicit volatility risk of options) or dividend risk arising from a derivative instrument

FRTB Impacts

FRTB will have significant impacts on banks in terms of their operational capability, infrastructure, risk measurement, reporting and other areas

The institutions are faced with a variety of adjustments and changes in the methodology of calculating the capital charge for market risk. Results of the quantitative impact studies published by the Basel Committee (BCBS 346) predict a **simple mean increase of 41%** and **a weighted average increase of 74%** in total **market risk capital requirements**. Still, some of this impact can be mitigated by portfolio re-optimization.

Fig. 14 Impact of the FRTB



Capital optimisation

- Asset classes and trading desks contributing mainly to the capital charge should be identified and their portfolios analysed
- This may lead to the identification of data issues increasing regulatory capital
- Adapting the asset allocation can minimize the capital charge

Regulatory reporting

- Business specifications must be in place defining the aggregation & final reporting process
- Optionality features in the portfolio require an appropriate instrument valuation methodology for the curvature risk charge
- Broadened supervisory scope will require more communication between banks and the supervisors

Portfolio review

Banks need to review their trading book to understand how the new methodology impacts the capital consumption

Desk level review

- Desk level review will likely increase the complexity of internal models, which need to be tailored to each desk
- Banks need to consider if they need to restructure their desks to reduce complexity related to models and the capital calculation

Data availability

- Banks need to develop and maintain architecture and infrastructure capability
- The data processes must be checked to provide the necessary data for correctly mapping instruments to the trading or the banking book and capital calculation
- Insufficient data on instruments may result in instruments being mapped to residual buckets, thus increasing regulatory capital.

Methodology

- Sensitivities-based methodology and expected shortfall are significant new additions
- Complexity of the methodology increases which may cause challenges especially for smaller institutions

Typically substantial regulatory changes can be challenging for institutions

Fig. 15 Overview of selected areas of regulatory change

Special attention must be paid to several aspects of the operations and support framework

Policy frameworks: As part of implementation of the revised standards banks need to review and revise their internal policies and related procedures (including the trading book policy, the market risk policy, the model management policy, and the model validation and backtesting policy)

Infrastructure: As calculation of the standardised approach capital charge will become mandatory for benchmarking and fallback purposes, the need to build, maintain and develop risk systems – as well as data availability and quality within the banks – increases

Processes, models and controls: We expect need for banks to reassess and organize their business processes and controls as a result of the new standards. The representation of risk may diverge further between business and regulatory needs. This is likely to be reflected in the processes and models needed to fulfil these needs

Resources: We expect that the changes will cause a (temporary) demand for additional skilled risk personnel within the banks

Banks will experience significant increase in capital charges under the revised standardised approach

Figure 16 shows the increase in capital requirements under the revised standardised approach compared to the current standardised approach. According to the FRTB – *interim impact analysis* from November 2015, capital requirements will increase for all risk classes. FX risk class faces the most radical increase. In total, the **mean increase in capital charge is 103%** and the **median is 83%**.

Fig. 16 Overview of the potential impact on capital requirements

Increase in capital charge	Mean	Median
Commodity risk	90%	30%
FX risk	115%	88%
Interest rate + Credit spread + Equity + Default risk	112%	37%
Total	103%	83%

Source: FRTB – interim impact analysis (BCBS346), page 8, Table 3c, November 2015.
Note: Results are not based on the final framework.

Our Services

PwC has developed an MS-Access-based tool that complies with the final BCBS 352 standards

Fig. 17 PwC SBA-Tool: Key facts

PwC Standardised Approach-Tool

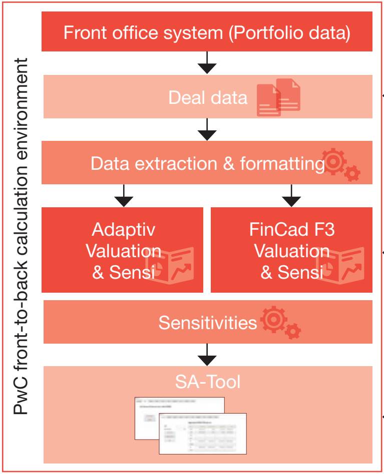
- ✓ MS Access-based tool for calculating the Standardised Approach
- ✓ High adaptability of the tool to client specific needs (e.g. specific analyses)
- ✓ High performance regardless of portfolio size

Implementation potential

- Pragmatic test calculations
- Calculation of capital requirements for delta-, vega-, curvature and default risk as well as additional risk add-on for all desks
- Calculations for all asset classes are possible
- High adaption flexibility for e.g. scenario analysis with different correlation parameters

With the tool we are able to do the necessary calculations for the standardised approach

Fig. 18 Overview of the front-to-back calculation environment



Data extraction

- ✓ XML standard for typical front office system supported (Murex, Summit)
- ✓ FPML format supported for Murex (other possible)
- ✓ CSV/Excel

Sensitivity computation

- ✓ Full coverage plain vanilla products (IR, FX, EQ, Credit) & some light exotics
- ✓ Extensions for other exotics possible
- ✓ Sensitivities/shifts delta/scenarios calculation

SA-Tool

- ✓ SBA methodology implemented (January 2016)
- ✓ Sensitivities/shifts delta/scenarios calculation

Our Expertise

Whether regarding the Basel Committee, EU-regulation or national legislation – we use our established know-how of the analysis and implementation of new supervisory regulation to provide our clients with high-quality services. Embedded into the **international PwC network**, we have access to the extensive knowledge of our experts around the world.

PwC's Basel IV Initiative was established to support you in all aspects of getting compliant with the new regulatory requirements to the **trading book** – accomplishing a prestudy as a first step, supporting you at quantitative impact studies (QIS) up to the implementation at all business units and areas of the bank.

PwC can draw on long lasting experience of implementing new regulatory requirements by supporting a number of banks in completing quantitative impact studies prior to the implementation of **Basel II and Basel III** and by the functional and technical implementation of the final regulations. The PwC-tools used during the QIS are flexible and will be updated automatically in case of new consultations by the Basel Committee.

About us

PwC helps organisations and individuals create the value they're looking for. We're a network of firms in 157 countries with more than 195,000 people who are committed to delivering quality in assurance, tax and advisory services. Tell us what matters to you and find out more by visiting us at www.pwc.com. Learn more about PwC by following us online: @PwC_LLP, YouTube, LinkedIn, Facebook and Google +.

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