

Basel IV: Revised internal models approach for market risk

Our view on key aspects of the new models based approach for the capital requirements for market risk

New challenges for banks

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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.

Especially with regard to the latter one, the designation fundamental review is well deserved as the risk measure to be employed is changed from the Value at Risk (VaR) currently in use to a new metric, the so called Expected Shortfall (ES). This change is accompanied by a number of further revisions, covering inter alia the model approval process, taking account of market liquidity of positions, backtesting requirements and many more.

These changes, finalized in spring 2016 and, according to the BCBS's timeline, to enter into force in 2019 will have a profound impact on all banks using internal models to capitalize market risks. The amount of risk weighted assets is expected to increase markedly, depending on the trading strategies employed. But also the implementation of the new rules will require massive efforts by the affected banks

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

Kind regards,



Martin Neisen
Global Basel IV Leader



Dirk Stemmer
Internal Market Risk Model Leader

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

The Basel III framework mainly concentrated on banks' own funds requirements. Currently, the Basel Committee of Banking Supervision (BCBS) is revising a diverse list of topics including the standardised and internal models approaches for calculating capital requirements of all risk types. The industry already summarises these revisions under the term “**Basel IV**”. The revisions will have a fundamental impact on the calculation of **risk weighted assets and capital ratios** of all banks independent of their size and business model. Especially the extended modifications in the “Fundamental Review of the Trading Book” will have significant effects on both RWA and calculation processes. We anticipate a significant effort in implementing and especially customizing the requirements of the new IMA at trading desk level which go far beyond the simple implementation of capital requirements!

Fig. 1 Revisions to Basel III capital requirements

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

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

Fig. 2 Refinement of regulatory market risk framework

“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

- **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 VaR
- Changes to model approval process
- Floor based on standardised method

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

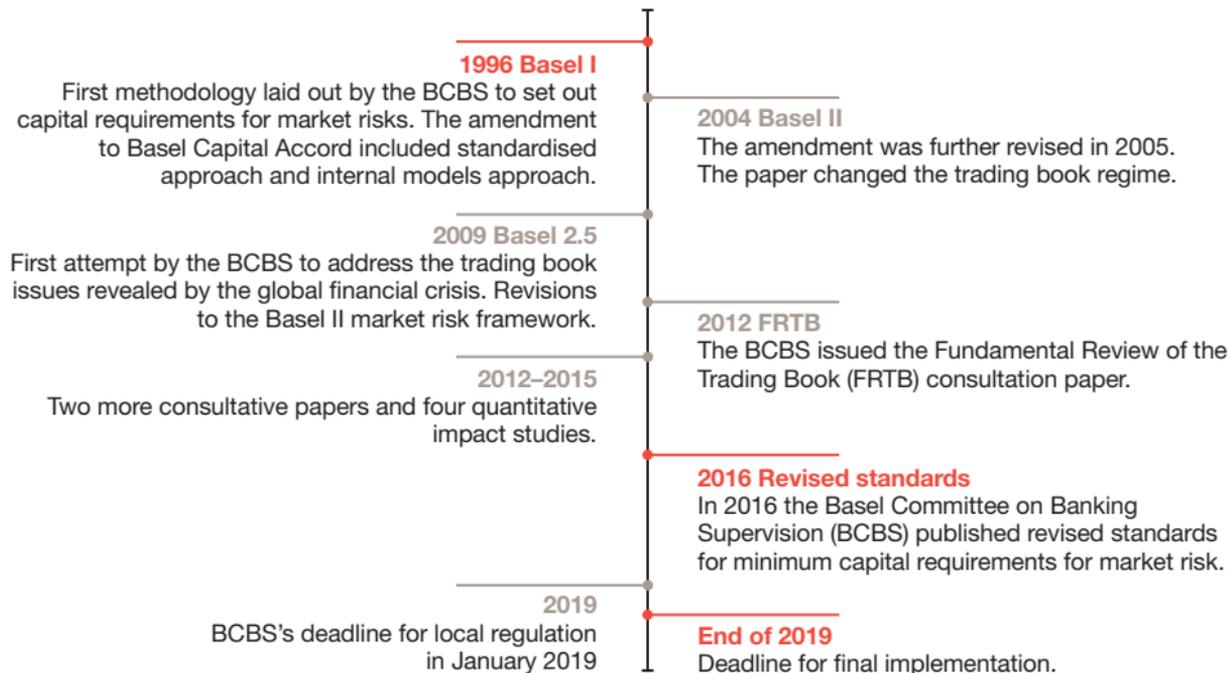
During the last crisis it turned out that the regulatory capital for market risk was not adequate enough to cover the risk. Therefore the Basel Committee for Banking Supervision has developed the Fundamental Review of the Trading Book (FRTB), a new framework to replace the old market risk regulation 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 Basel Committee

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



The FRTB introduces several enhancements to the existing framework addressing its known issues

Fig. 4 Key changes induced by FRTB

Regulatory boundary between trading and banking book

- New defined list of instruments presumed to be included either in the trading book or the 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.

Revised Standardised Approach

- Significant changes by introducing a sensitivities-based method.
- The revised standardised approach will act as a fall back solution and floor to the internal models approach.

From VaR to Expected shortfall

- Banks must calibrate the internal model to an expected shortfall measure and periods of significant market stress.
- This metric will help to capture the tail risk and to maintain adequate capital during periods of significant market stress.

Inclusion of market illiquidity

- Varying liquidity horizons included in the standardised and 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.

***Revised Market
Risk Framework***

Internal Models

Approach – New
methodology

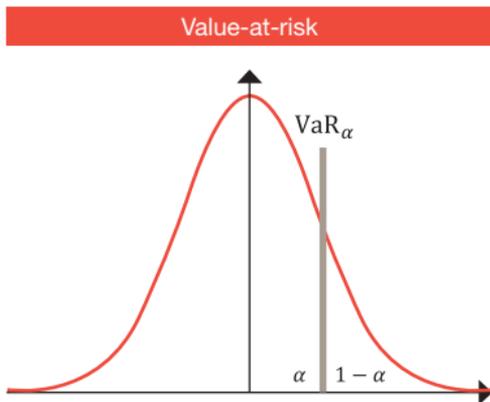
The new models based approach introduces a new risk measure to fully capture the risk

The **present** internal models approach for the calculation of capital requirements for market risk is based on the value-at-risk (VaR) measure, where a 99% quantile is used.

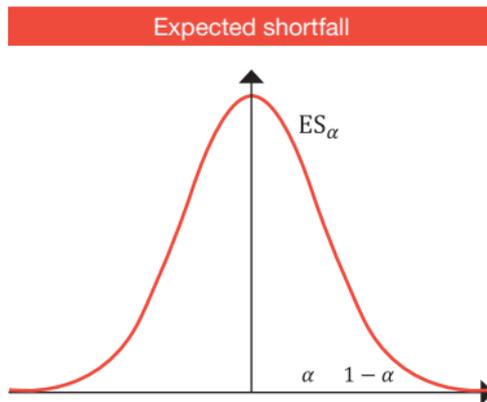
However, the VaR suffers from the drawback of not being a *coherent risk measure* as it lacks sub-additivity. Furthermore, VaR does not capture *tail risk*, i.e. high impact events with low probability do not affect the VaR. Thus, basing the capital requirements on VaR can lead to unwanted risk taking.

The **new** models based approach uses expected shortfall at a 97.5% quantile, addressing the issues described above. For a normal distribution, $ES_{97,5\%} \approx VaR_{99\%}$.

Fig. 5 Comparison of Value-at-risk und Expected shortfall



- Definition:
 $VaR_\alpha(X) = \inf\{x | F_X(x) \geq \alpha\}$
- The probability that the loss (modelled by random variable X) exceeds $VaR_\alpha(X)$ is not larger than $1 - \alpha$



- Definition:
 $ES_\alpha(X) = \frac{1}{1-\alpha} \int_\alpha^1 VaR_\gamma(X) d\gamma$
- The expected loss given that X exceeds $VaR_\alpha(X)$ (therefore also called conditional Value-at-risk)

The new methodology takes into account the different liquidity horizons of various instruments

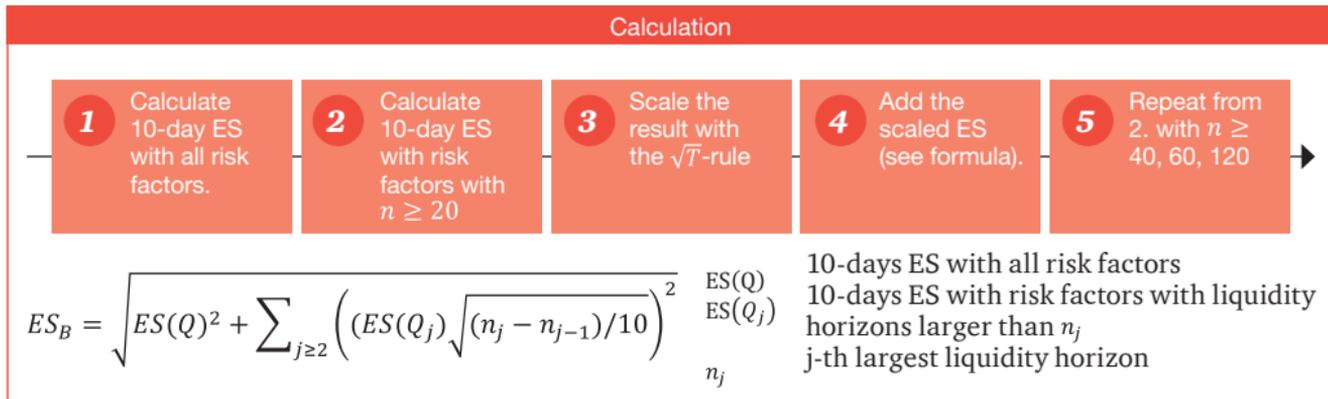
The **present** internal models approach uses the same 10-day liquidity horizon for all risk factors. This does not account for the fact that while e.g. plain vanilla interest swaps are traded daily on well organised markets, other instruments such as structured credit derivatives are much less liquid. Therefore, the **new** internal models approach introduces differentiated *liquidity horizons* as exemplarily shown in the table below.

Doubling the liquidity horizon amounts to an increase of the regulatory expected shortfall ES (c.f. formula below) by approx. 40%. Therefore, holding instruments with sensitivities to risk factors which have been assigned to a category with a large liquidity horizon, becomes disproportionately expensive from a capital requirement point of view.

Tab. 1 Liquidity horizons

Most important risk factor categories	Liquidity horizons (in days)
Interest rate (major currencies)	10
Equity volatility	20
Interest rate volatility	40
Credit spread – high yield	60
Credit spread – structured	120

Fig. 6 Calculation of regulatory ES

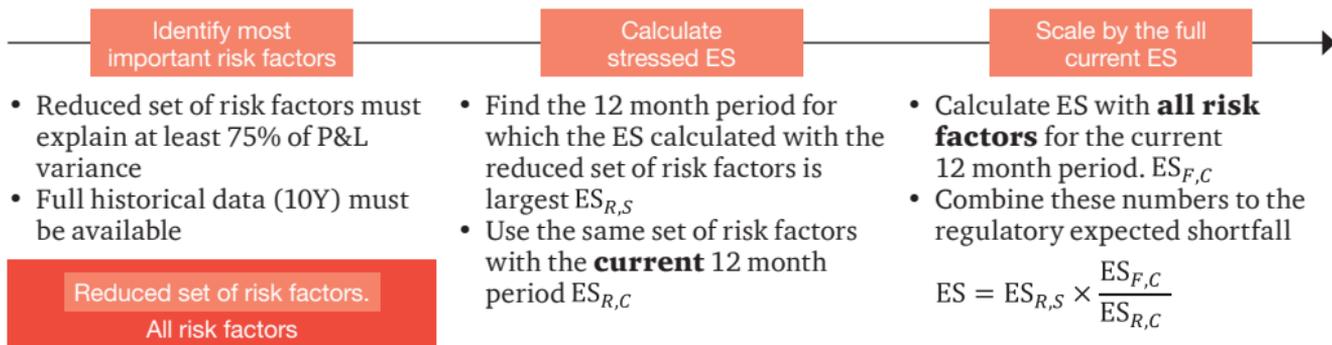


The new calibration rules lead to capital requirements based on the markets true behaviour in stress situations

In the **present** regime, the VaR is calibrated to the market movement of the *last year*. In calm, non-volatile periods, this methodology leads to capital requirements which have been proven to be insufficient in more turbulent times as the one following the default of Lehmann Brothers. For this reason, the present capital requirements contain another term, the *stressed value at risk* (SVaR) which is calibrated to stress periods.

The **new** internal models approach to be introduced with FRTB replaces both VaR and SVaR with a single risk measure based on expected loss which is calibrated to the one-year period of most severe stress from 2005 up to now. As good quality data going back so long is often not available for all relevant risk factors, a simplified treatment is allowed by the methodology (see below). Thus, long data history is only required for a subset of risk factors explaining at least 75% of the full P&L variance. For all other modelled risk factors, only data for the last year is needed and considered.

Fig. 7 Scaling approach for regulatory ES



For illiquid risk factors, stress scenarios are used to determine the capital charge

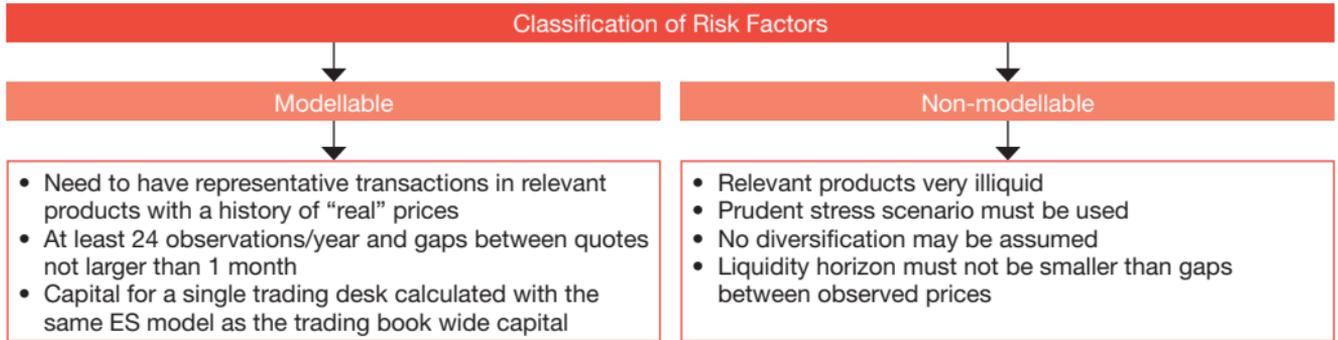
The calculation of a meaningful expected shortfall requires a good data quality for the risk factors. Therefore, the **new** rules proposed by the BCBS make a distinction between *modellable risk factors*, for which such data exists, and *non-modellable* risk factors for which appropriate data does not exist.

For the latter (mostly stocks of minor companies), capital requirements have to be calculated by using *stress scenarios* (which are subject to the supervisor's approval). For idiosyncratic credit risk, correlations between the risk factors may be neglected given that the institute can prove to the supervisors that this is indeed the case. For other risk factors, e.g. equities, worst case correlations must be assumed.

If there are L non-modellable idiosyncratic credit risk factors with stress losses $ISES_i$ and K other non-modellable risk factors with losses SES_j , the aggregated risk measures is

$$SES = \sqrt{\sum_{i=1}^L ISES_i^2 + \sum_{j=1}^K SES_j^2}.$$

Fig. 8 Modellable and non-modellable risk factors



“Default Risk Charge” replaces the present “Incremental Risk Charge” and avoids double counting

Fig. 9 Changes in treatment of default risk

Present regulatory framework

In the **present** CRR framework, the capital requirements for market risk under the internal models approach are calculated as a sum of three components:

$$\text{CapitalRequirement}_{\text{CRR}} = \text{VaR}_{\text{CCR}} + \text{SVaR}_{\text{CCR}} + \text{IRC}_{\text{CCR}}$$

The last term, the *incremental risk charge* (IRC_{CCR}) accounts for losses occurring when an issuer defaults or its rating deteriorates.



New internal models approach

In the **new** internal models approach, the IRC is replaced by the *Default Risk Charge* (DRC). This measure only captures default risk as the risk of migration has to be included in the ES calculation.

For the calculation of the DRC, banks have to use a *two-factor model* default simulation model, with the following requirements:

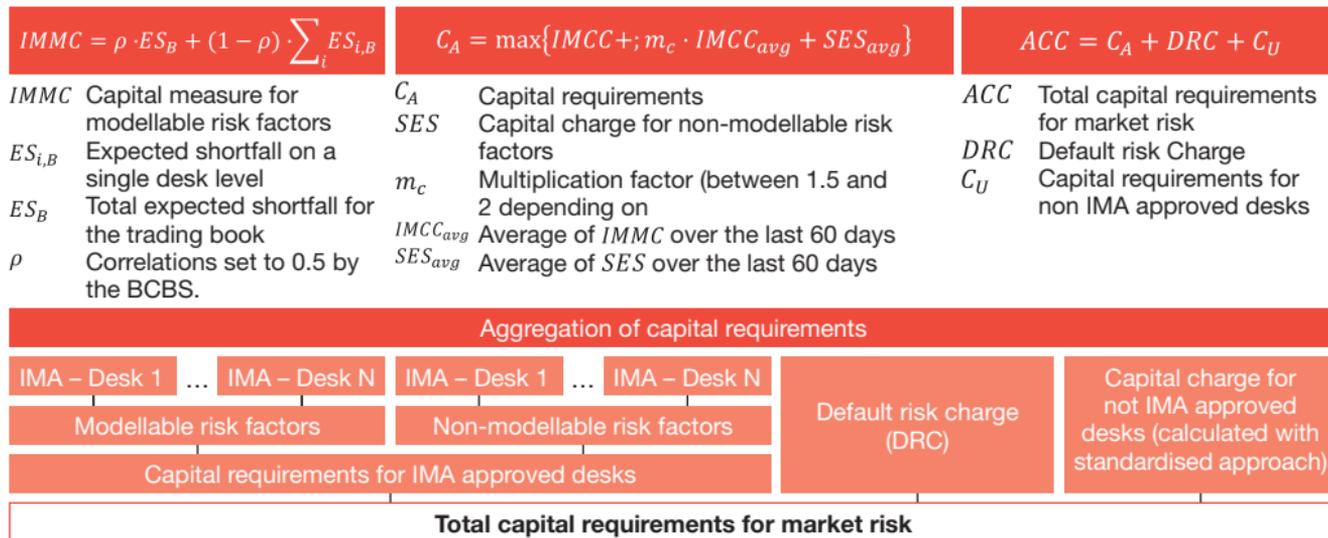
- VaR Model at 99.9% quantile
- One year time horizon
- Weekly calculation
- Correlations based on credit spreads or equity prices. 10y history

- No market implied PDs to be used.
- PDs floored at 0.03%
- When possible PDs/LGDs consistent with IRB-approach are to be used.
- 5y calibration period minimum for PDs

Capital requirements are calculated on the level of trading desks and are aggregated for the whole trading book

The new capital requirements are calculated on the level of trading desks which increases the calculation effort compared to the present regime. Results are then aggregated.

Fig. 10 Aggregation of capital requirements



Model approval is required on desk-level and involves new requirements on back-testing

In the **new** internal models approach, trading desks will require approval by the component authority. The respective process is outlined below.

As back-testing *ES* suffers from theoretical limitations (c.f. Carver, L.: “Back-testing expected shortfall: mission possible?” Risk.net. 2014), back-testing will be still based on *VaR*. This exercise needs to be performed both for the “actual trading outcome” and for the “hypothetical trading outcome” where effects of intraday trades have been removed.

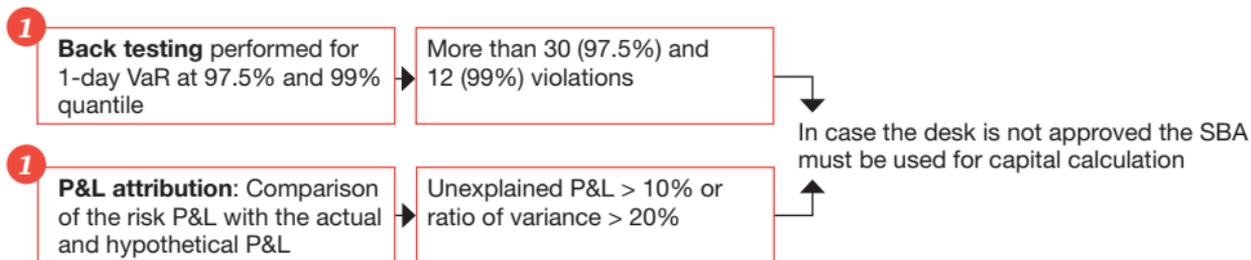
Fig. 11 Approval of trading desks

Definition of Trading Desks



- The new model approval rules lead to significant amount of new work to be done.
- Model approval process requires a wide range of skills:
 - Regulatory
 - Quantitative
 - IT
 - Processes
- Impact studies are requirement to assess for which desks to seek model approval and for which to use the standardised approach.

Evaluation of model on trading desk level



Regulatory Framework Revision Impacts

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

Fig. 12 Impact on banks

Capital charge

- Capital requirements are expected to increase notably. Risk factor classes credit (median: +48%) and equity (median: +29%) affected most strongly (c.f. BCBS 346 (2015): Fundamental review of the trading book – interim impact analysis)
- Consistent with liquidity horizons. No or only moderate increase for interest rates and FX
- Huge variance across the reporting banks

Desk level review

- Defining the trading desks requires a clear strategy to realise the optimisation potential
- The required supervisory approval might require the revision and extension of existing process documentation and policies

Calculation and reporting requirements

- Every bank must, in addition to the internal models approach also calculate the standardised approach
- Standardised approach used as fall-back when a desk loses its approval
- Calculation must be performed both on a desk level and for the full trading book
- All results must be reported to competent authority
- Supervisors will monitor the difference between internal models approach and standardised approach values

Methodology

- New methodology (expected shortfall, liquidity-horizons, aggregations rules) must be implemented in the bank's IT systems
- Processes need to be set up to ensure the required ongoing validation

Methodology

- Banks need good quality data which goes back to 2005
- Requirements on the quality of P&L-explain may require banks to extend their risk management systems by new risk factors for which data sources must be defined
- Non-modellable risk factors need to be identified and the required stress scenarios must be derived
- As deeming a risk factor to be non-modellable leads to substantially higher capital charges, all effort should be taken to fulfil the requirements for being modellable

Banks employing internal models will face additional challenges regarding methodological questions, data availability, IT capabilities, and process management

Fig. 13 Aspects requiring particular attention

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 have 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 that banks need to reassess and organize their business processes and controls as a result of the new standard. 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



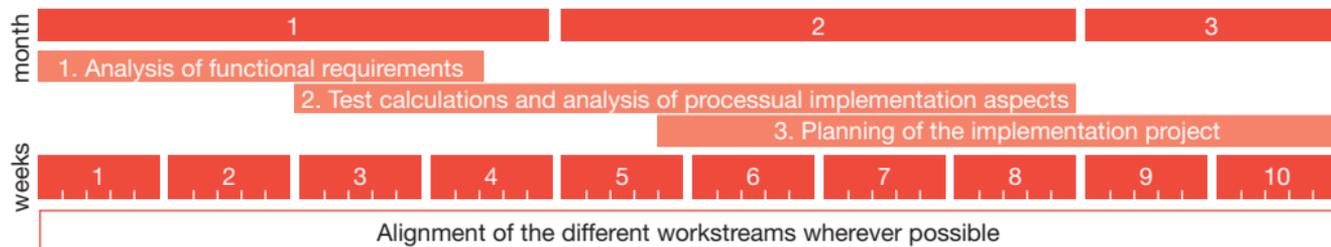
Resources: We expect that the changes will lead to a (temporary) demand for additional skilled risk personnel within the banks



Our Services

PwC has developed a framework to show what steps a bank needs to take to implement the new rules

Fig. 14 Steps needed to implement the new rules



Analysis of functional requirements

- Review of banking and trading book positions to analyze impact of the new methodology to capital consumption
- SBA and ES are significant new additions
- As SBA capital charge calculation will become mandatory, banks have to analyze the bank specific degree of complexity that will be required
- Adapting the asset allocation can potentially minimize the capital charge
- Desk level review will likely increase the complexity of internal models

Test calculations and implementation aspects

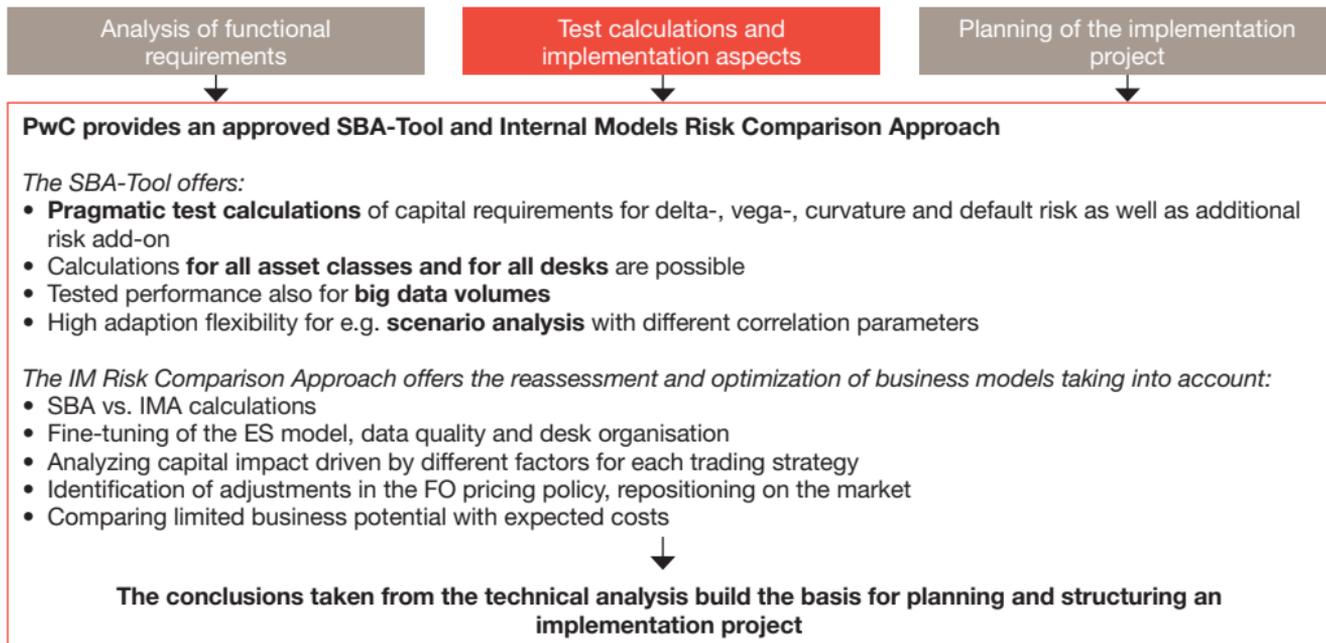
- Consider need to restructure desks to reduce complexity related to models and the capital calculation
- Develop and maintain architecture and infrastructure capability to incorporate the granular desk level data into risk and finance systems
- Identify and analyze portfolios for those asset classes, risk factors and trading desks contributing mainly to the capital charge
- Potential identification of data issues increasing regulatory capital

Planning of the implementation project

- Business specifications must be identified for the aggregation & final reporting process
- Deduction and finalisation of implementation requirements for IT-infrastructure adjustments
- Development of a business case and preparation of strategic decisions
- Deviation of project scope, sub-projects and timelines incl. milestones
- Analysis of costs and impacts to the project and capital needs
- Broadened supervisory scope will require more communication between banks and the supervisors

In addition, the capital requirements under the new rules can be estimated and implications on the bank's business model and strategy can be determined

Fig. 15 Further steps



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 Global 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.

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Contacts

Global Basel IV Leader

Martin Neisen

Partner

Friedrich-Ebert-Anlage 35–37

60327 Frankfurt am Main

Tel: +49 69 9585-3328

Fax: +49 69 9585-947603

martin.neisen@de.pwc.com

Austria

Andrea Wenzel

Tel: +43 1 501 88-2981

andrea.x.wenzel@at.pwc.com

Belgium

Alex Van Tuykom

Tel: +32 2 710-4733

alex.van.tuykom@be.pwc.com

Malorie Padioleau

Tel: +32 2 710-9351

malorie.padioleau@be.pwc.com

CEE

Jock Nunan

Tel: +381 113302-120

jock.nunan@rs.pwc.com

Cyprus

Elina Christofides

Tel: +357 22555-718

elina.christofides@cy.pwc.com

Denmark

Janus Mens

Tel: +45 3945-9555

janus.mens@dk.pwc.com

Lars Norup

Tel: +45 3945 9195

lars.norup@dk.pwc.com

Estonia

Ago Vilu

Tel: +372 614-1800

ago.vilu@ee.pwc.com

Finland

Marko Lehto

Tel: +358 20 787-8216

marko.lehto@fi.pwc.com

France

Marie-Hélène Sartorius

Tel: +33 1 56575-646

marie-helene.sartorius@fr.pwc.com

Germany

Dirk Stemmer

Tel: +49 211 981-4264

dirk.stemmer@de.pwc.com

Greece

Georgios Chormovitis

Tel: +30 210 6874-787

georgios.chormovitis@gr.pwc.com

Hungary

Emöke Szántó-Kapornay

Tel: +36 1461 9295

amoke.szanto-kapornay@hu.pwc.com

Ireland

Ronan Doyle

Tel: +353 1 792-6559

ronan.doyle@ie.pwc.com

Italy

Pietro Penza

Tel: +39 6 57083-2158

pietro.penza@it.pwc.com

Gabriele Guggiola

Tel: +39 346 507-9317

gabriele.guggiola@it.pwc.com

Latvia

Tereze Labzova

Tel: +371 67094-400

tereze.labzova@lv.pwc.com

Lithuania

Rimvydas Jogela

Tel: +370 5 239-2300

rimvydas.jogela@lt.pwc.com

Luxembourg

Jean-Philippe Maes

Tel: +352 49 4848-2874

jean-philippe.maes@lu.pwc.com

Malta

Fabio Axisa

Tel: +356 2564-7214

fabio.axisa@mt.pwc.com

Netherlands

Abdellah M'barki

Tel: +31 88 792-5566

abdellah.mbarki@nl.pwc.com

Jan Wille

Tel: +31 88 792-7533

jan.wille@nl.pwc.com

Poland

Piotr Bednarski

Tel: +48 22 746-7049

piotr.bednarski@pl.pwc.com

Zdzislaw Suchan

Tel: +48 22 746-4563

zdzislaw.suchan@pl.pwc.com

Portugal

Luís Barbosa

Tel: +351 213 599-151

luis.filipe.barbosa@pt.pwc.com

Russia

Nikola Stamenic

nikola.stamenic@rs.pwc.com

Slovenia

Pawel Peplinski

Tel: +386 1 5860-00

pawel.peplinski@si.pwc.com

Czech Republik

Mike Jennings

Tel: +420 251 152-024

mike.jennings@cz.pwc.com

Spain/Andorra

Alvaro Gonzalez

Tel: +34 915 684-155

alvaro.benzo.gonzalez-coloma@
es.pwc.com

Sweden

André Wallenberg

Tel: +46 10 212-4856

andre.wallenberg@se.pwc.com

Switzerland

Reto Brunner

Tel: +41 58 792-1419

reto.f.brunner@ch.pwc.com

Ukraine

Lyudmyla Pakhucha

Tel: +380 44 3540-404

liusia.pakhuchaya@ua.pwc.com

United Kingdom

Nigel Willis

Tel: +44 20 7212-5920

nigel.willis@uk.pwc.com

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