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Benchmarking and the future use of internal capital models



“The rationale for continuing with internal capital models in the Basel 3 world”

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London, January 28th 2014



Presentation Outline

Overview

Contextual review

Relationships of regulatory capital, economic capital and other measures

The BIS RCAP benchmarking reviews and implications

Concentrations
&
ICAAP

Practical uses of economic capital infrastructure in current regulatory context:

Examples from credit concentrations & ICAAP

- Single name concentration
- Sector concentration
- Country risk and country contagion

CVA and
CCR

Example from counterparty credit risk (CCR)

Conclusions

- Review of CVA & CCR modelling context
- Utilizing IMM outputs for enhanced internal views

Q & A

Conclusions

Q & A



Contextual Overview

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Concentrations
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CVA and
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Conclusions

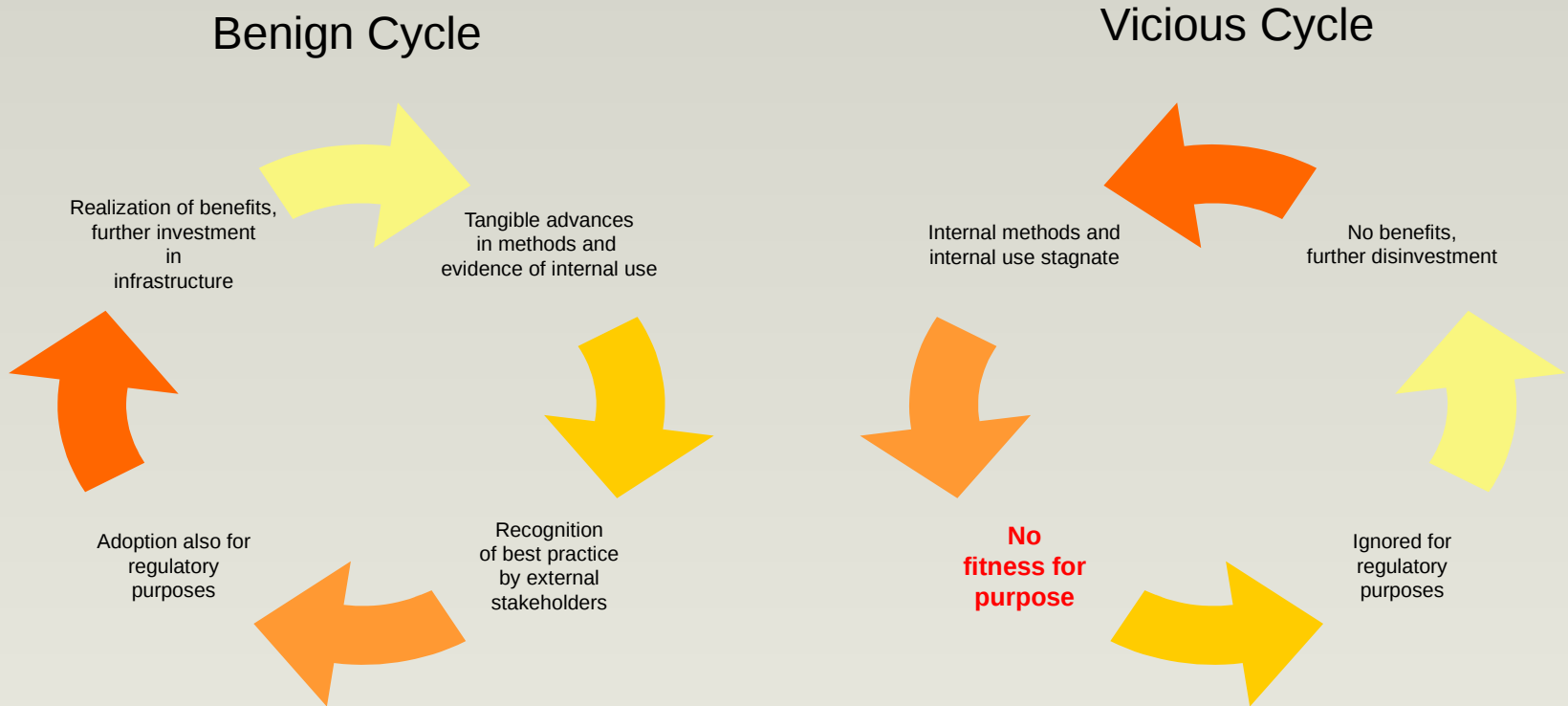
Q & A

- Relationships of regulatory capital, economic capital and other measures
- The BIS RCAP benchmarking reviews and implications



The benign and vicious cycles of internal modelling

Manifest fitness for purpose is the key consideration for reversing trends

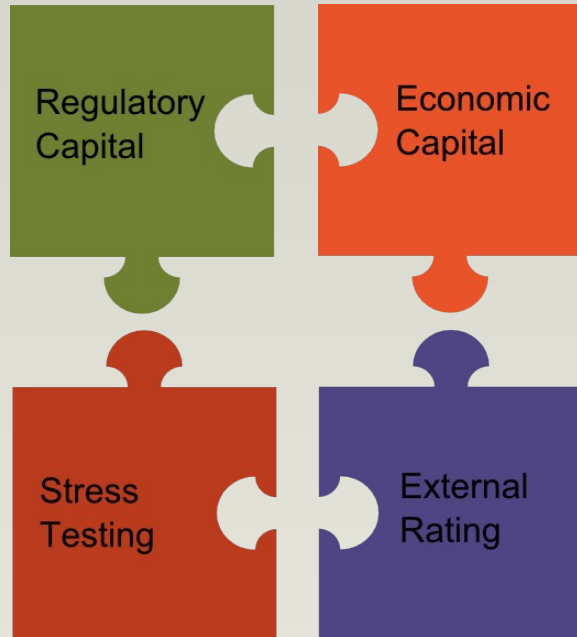


Unambiguous and widely accepted “fitness for purpose” requires transparency, hard nosed challenge and open discussion of weaknesses



The post-crisis capital models puzzle

At least four different overlapping frameworks / models



Objective is a rational integrated framework that enjoys widespread acceptance

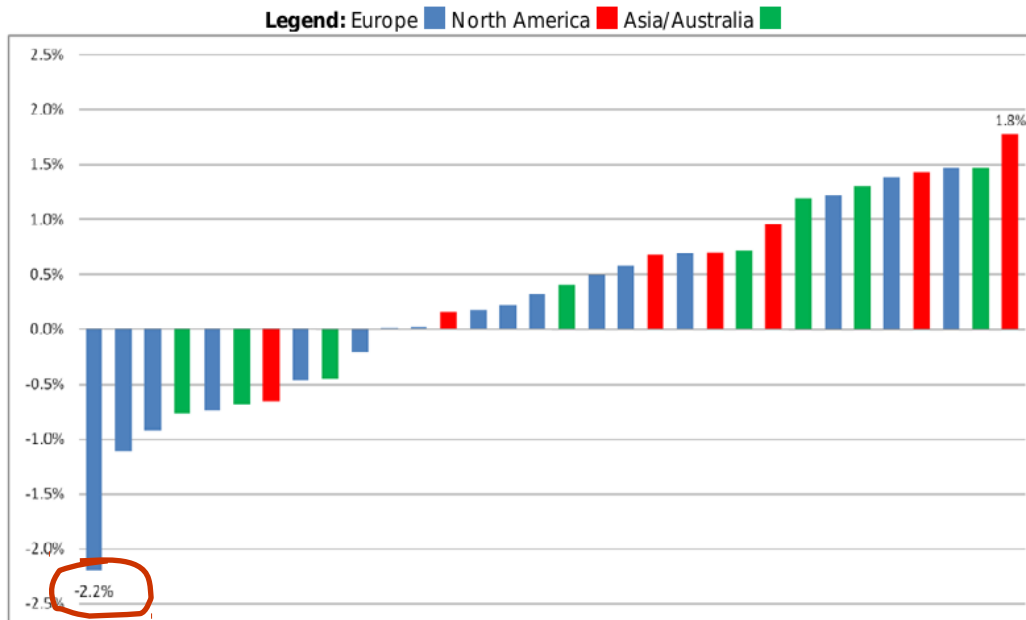
- Different stakeholders / use requirements / underlying philosophies and methodologies
- Interconnections and overall consistency of the overlapping areas are at present inadequately understood
- Regulatory Capital (Basel III) versus Economic Capital
 - Twin concepts joined at the hip with relationship is enshrined in various parts of the regulatory framework
 - Many joint elements in design and/or implementation
- Even magically setting the total amount of capital to a comfortably safe place would not solve key other problems. To sample:
 - Do we really capture all relevant risks (also as they will emerge from future activities)
 - Do we evaluate different risks fairly so that resources are allocated efficiently
 - Are the frameworks practical in terms of data requirements and computational time
 - Are the frameworks conceptually clear, explainable in live environments, embeddable in terms of management action levers
 - Verifiability of outcomes. Is there an objective basis and how solid is it



BIS Regulatory Consistency Assessment Programme

Credit Risk: Results from Hypothetical Portfolio Exercise

Chart 12: Illustrative impact on capital ratios



Change from 10% capital ratio if risk weights from bottom-up benchmarking are adjusted to the median. Each bar represents one bank. The chart assumes that variations observed at each bank for the hypothetical portfolios are representative for the entire sovereign, bank, and corporate portfolios of the bank and are adjusted accordingly, but makes no other adjustment to RWA or capital. The chart uses mean risk weight deviations for each bank, and non-zero exposures only.

- Hypothetical portfolio with exposures to corporates, sovereigns and banks
- Somewhat similar in scope to IACPM benchmarking exercises
- Material variation in outcomes (~ 4% absolute CT1 difference)
- Causes (model risk)
 - PD's for low default
 - LGD's

Internally this wide dispersion of measures for identical portfolios would not be acceptable for management purposes

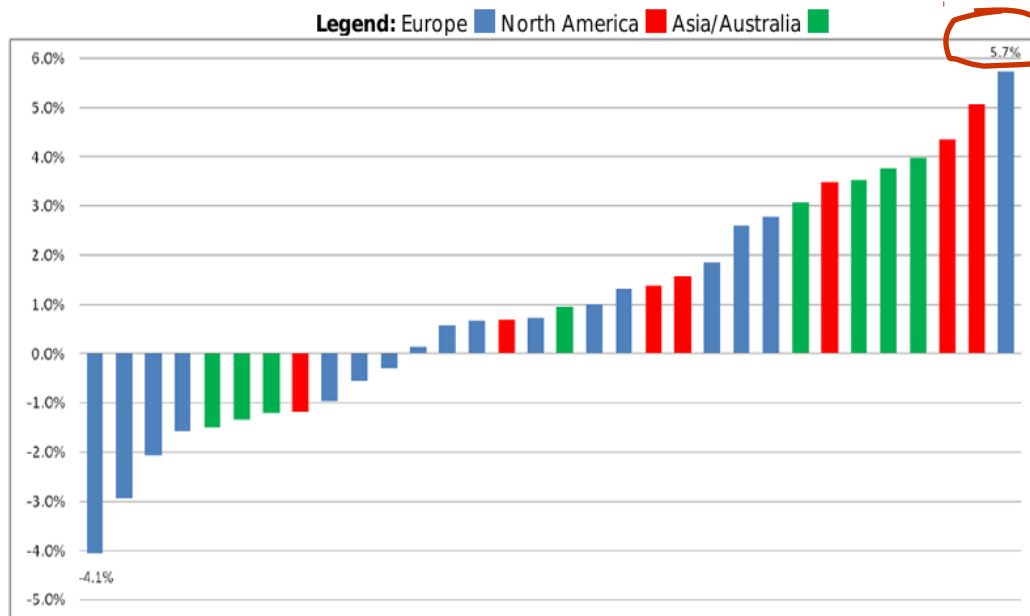
Source: BCBS 256



BIS RCAP Benchmarking (2 of 4)

Credit Risk: Impact of stylized inclusion of Retail books

Chart 13: Illustrative impact on capital ratios if deviations apply to entire Banking Book



Change from 10% capital ratio if risk weights from bottom-up benchmarking are adjusted to the median and applied to the entire banking book. The chart uses mean risk weight deviations for each bank, and non-zero exposures only.

Source: BCBS 256

- Non-inclusion of retail portfolios in HPE exercise illustrates challenge of assessing bottom-up consistency even for such significant elements of bank total risk / RWA
- Including Retail via proxy assumption that it is similar to Wholesale
- Cumulative impact of model risk on banking book credit can be considered very significant

Internal capital models for these portfolios are very similar to regulatory frameworks, hence we can easily infer there is similar dispersion of "views"



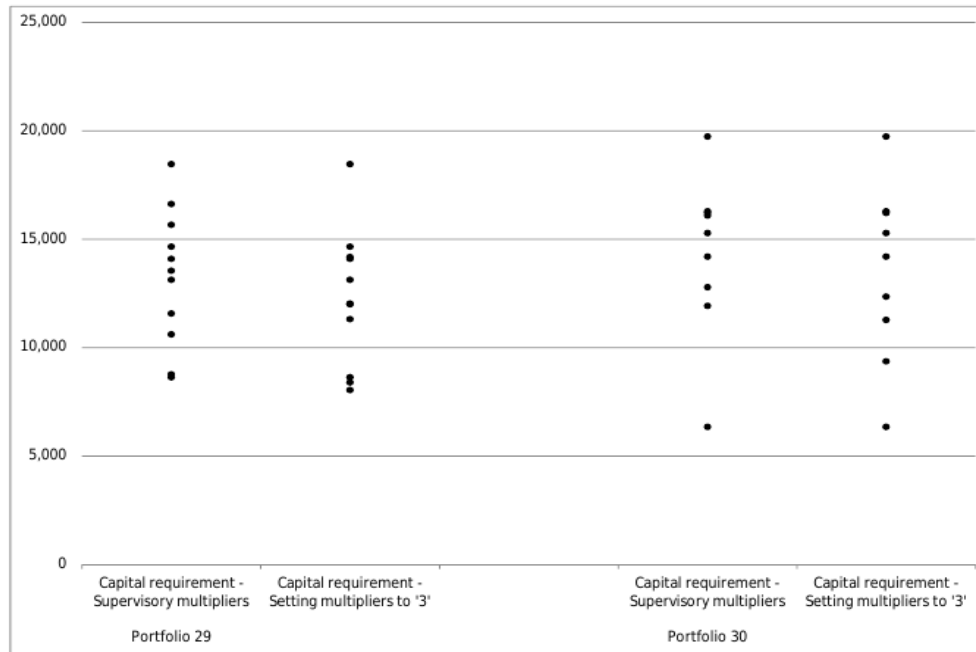
BIS RCAP Benchmarking (3 of 4)

Market Risk: Results for prescribed diversified portfolios

Dispersion of implied capital requirements for portfolios 29 and 30

Thousands of euros

Figure 1



- Hypothetical portfolio spans asset classes and models (VaR, SVaR, IRC)
- Sources of variation
 - Some regulatory discretion
 - Mostly modelling choices
- IRC shows highest variance

Is this the meaning of random number generation?

Source: BCBS 240 / 267



BIS RCAP Benchmarking (4 of 4)

Market Risk: Results for prescribed diversified portfolios

Implied capital requirements for portfolios 29 and 30 with and without actual multipliers

Thousands of euros except as noted

Table 1

	Implied capital requirement for diversified portfolio 29		Implied capital requirement for diversified portfolio 30	
	Using supervisory multiplier	Setting multipliers to 3	Using supervisory multiplier	Setting multipliers to 3
Min	8,628	8,036	6,337	6,337
Max	18,455	18,455	19,730	19,730
Median	13,541	12,027	15,276	14,193
Mean	13,244	12,260	14,312	13,445
Stdev	3,135	3,144	3,751	4,065
Stdev/ mean	24%	26%	26%	30%
IPD (90%)/ Median	58%	52%	40%	58%

- Portfolio spans asset classes and models (VaR, SVaR, IRC)
- Total book level variance not very different from credit risk picture

Source: BCBS 240 / 267

Harmonizing the regulatory multiplier actually increases variance (...)



Examples from credit concentrations & ICAAP

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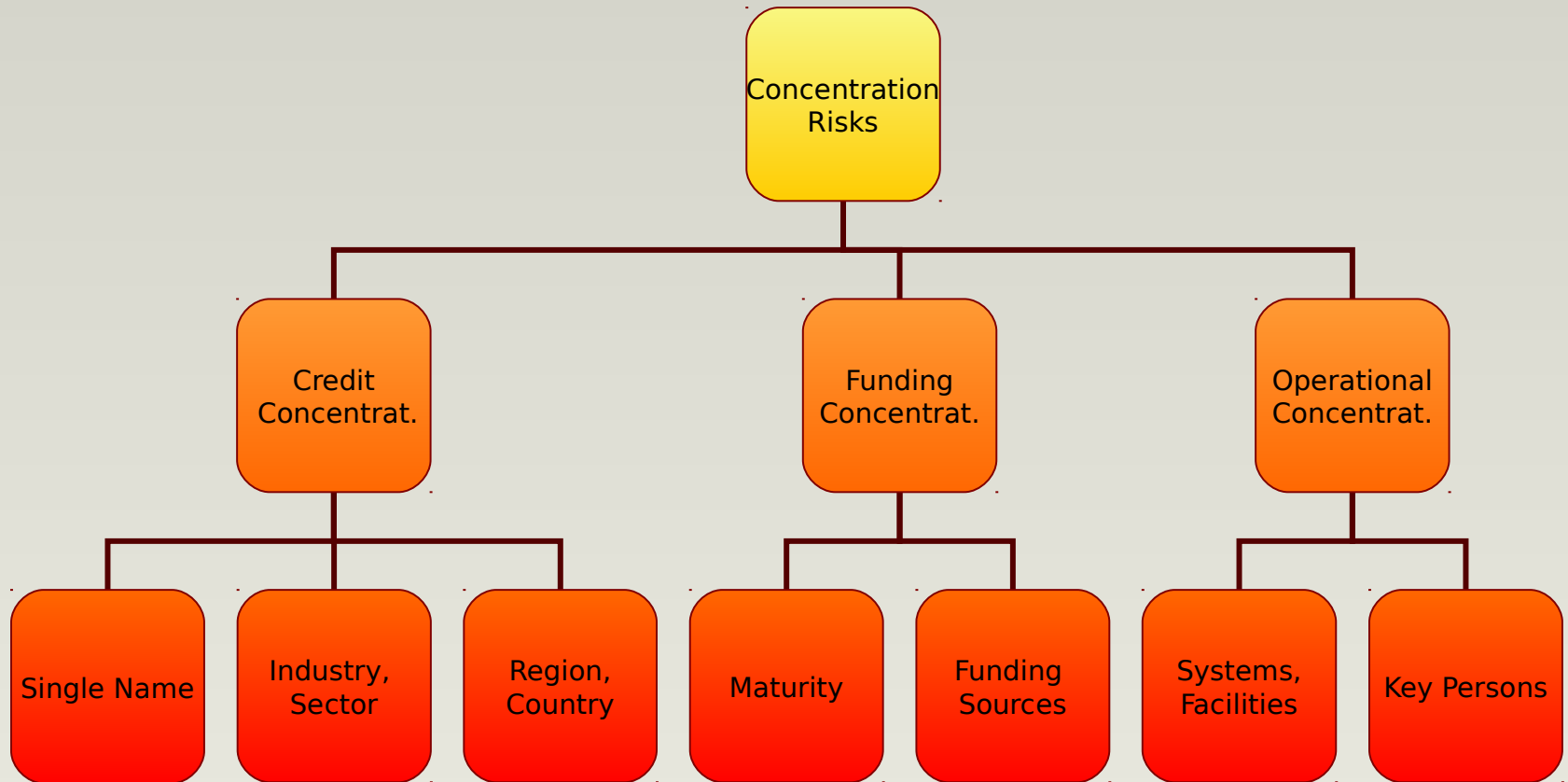
Q & A

- Regulatory framework around concentrations
- Single name concentration
- Sector concentration
- Country risk and country contagion



Taxonomies of concentration risks

Pillar 2 requirement to identify, measure and where appropriate capitalize



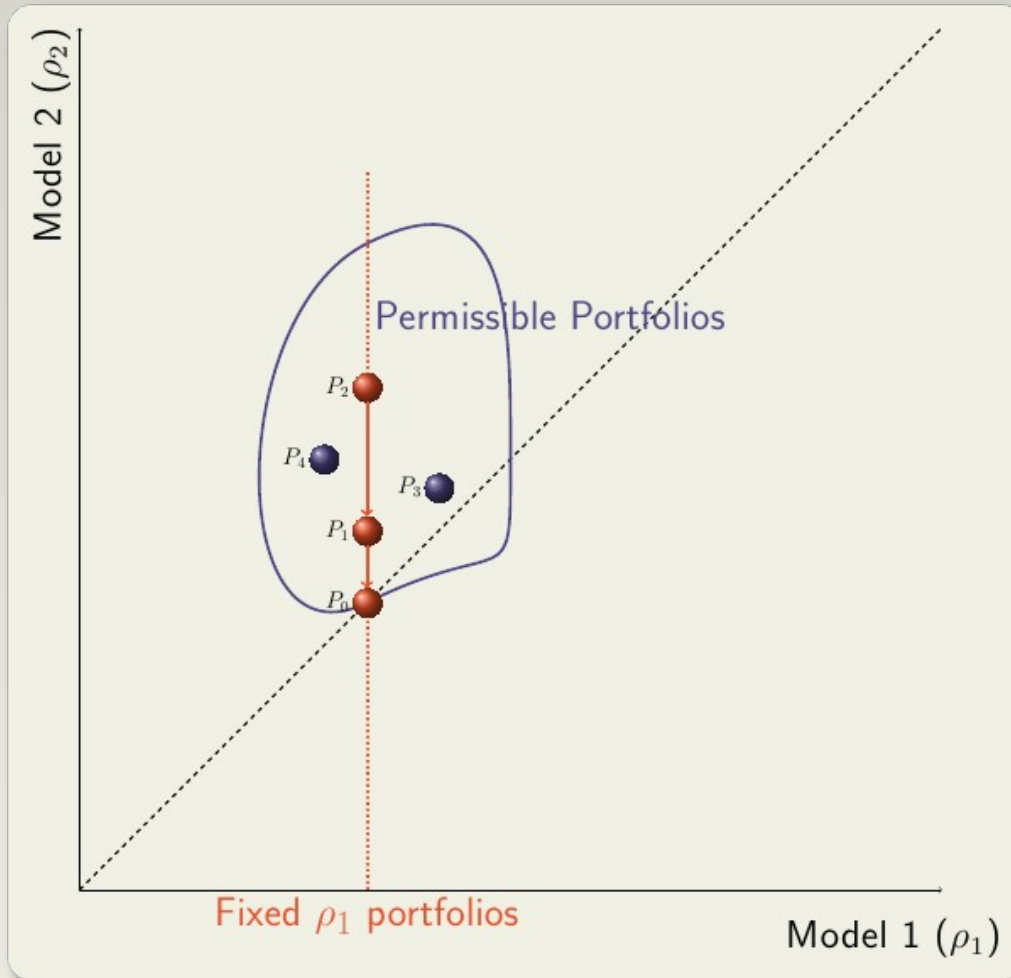
Sources: BCBS 246, WP15

Internal credit portfolio models are - in principle - well placed for helping with the task of quantifying credit concentrations, but the relationship with RC is complicated



Coping with multiple capital measures

Formalizing the concept of risk sensitivity and risk model arbitrage



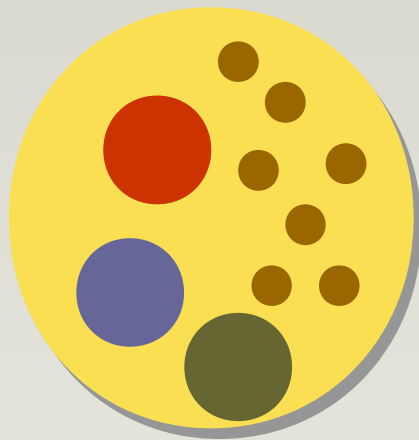
- Imagine we have two risk models and associated risk measures (e.g., VaR quantile, ES etc), both applied to the same portfolio of risks
- The outcomes (ρ_1, ρ_2) are different due to different model design, data, model factors etc.
- All portfolios are assumed to lie within some explicit permissible trading range (enclosed set)
- NB: A point in this diagram does not specify a unique portfolio, but all possible portfolios that have the same risk measure under the two models
- If there are **portfolio transformations** that change one measure but not the other, then we have a definition of a more risk sensitive model, or, equivalently, a model that admits risk arbitrage
- NB: Risk sensitivity does not necessarily coincide with higher risk estimates (The position versus the diagonal can be fairly variable for different portfolios and models)



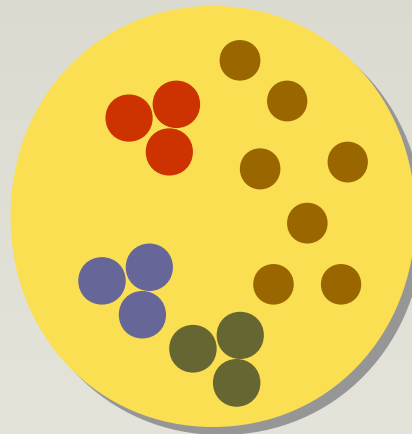
Revisiting single name concentration

Subject of early attention (granularity adjustment) due to A-IRB infinite granularity assumption

Actual Portfolio A



De-risked Portfolio B



Size linked to exposure, color to other risk attributes

- Each corporate name is replaced by large homogeneous pools with the same total exposure measure (e.g., EAD) while also keeping other risk parameters (PD, LGD, sector etc.) identical
- RWA capital charge is the same irrespective of size (both for standardized and A-IRB treatment) hence these portfolio transformations keep RC invariant
- An internal risk model that is sensitive to individual exposure size can quantify the amount of risk arbitrage implicit in the RC framework
- Quantification can be as simple as the absolute reduction is EC measure for the two portfolios, e.g., $EC(A) - EC(B)$



Revisiting single name concentration

Further discussion points

Methodology based on internal portfolio models is conceptually intuitive and technically sound and establishes an intuitive framework for discussion around the measurement and management of this risk

NB: If the de-risked portfolio is taken to be infinitely granular, then there is an element of conservatism embedded in that an “ideal” diversified portfolio is not attainable in practice. E.g. there is the natural limit of the granularity of the different corporate sectors (HHI was actually established to measure corporate oligopolies!). This is linked to the question as to whether RC is calibrated to cover any granularity at all (for an average bank in an average country?)

Using an internal model, when available, is superior to ad-hoc use of perturbation expansion methods (granularity adjustments)

- Focus on portfolio transformations rather than mathematics (no matter how brilliant!)
- Allows consistent analysis of name concentration impact at less extreme scenarios (e.g., 1 in 10) as capital view is typically only one element of risk appetite
- Hedges and reserves can be incorporated in more sophisticated models
- Allows consistent analysis for different loss definitions (default only, migration based revaluation)

Model requirements (indicative)

Starting requirements for an internal model fairly basic (must recognize idiosyncratic risk)

Requires accurate approach for related entity exposures

Specific outcome sensitivity is primarily to estimates of beta (idiosyncratic risk)

While not a very controversial application for an internal portfolio model, the example of single name concentration helps set the scene for developing similar style analysis for other concentration risks

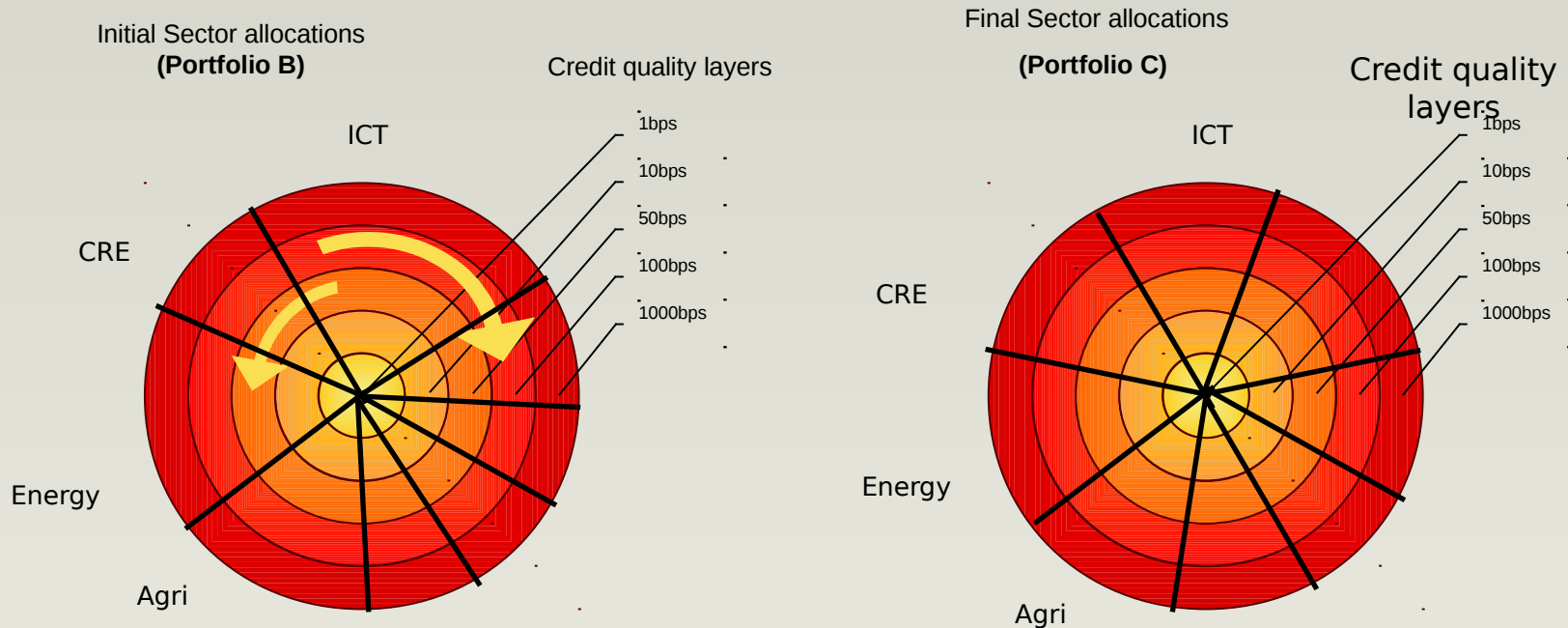


Industrial sector concentrations

Building on the principle of de-risking while keeping regulatory capital constant

De-risking sector concentration is intimately linked with portfolio optimization

Here we choose risk contributions per sector as the quantity to be minimized



Transformations (rebalancing) *within a credit quality layer* leave EL and RWA largely unchanged but will change EC (or other internal portfolio risk metrics), subject to the specific intra and inter-sector correlations of the internal model

The transformations can be done algorithmically or on an expert basis. Evidence for the de-risking is offered by total final risk and meeting limits on final sectoral risk contributions

Quantification can be simply: $EC(B) - EC(C)$



Industrial sector concentrations

Further discussion points

Methodology based on internal portfolio models is conceptually and technically sound and establishes an intuitive framework around assessing and managing this risk. E.g. ,can be directly linked to practical portfolio management activities (optimization), can be allocated etc.

Allows consistent analysis of sector concentration impact at less extreme scenarios (focusing on volatility rather than capital) and for different loss definitions (default only, migration based revaluation)

Perturbation methods not a real alternative (correlation structure needs to be estimated anyway!). There is also little hope of reconciling with the regulatory formula correlation assumptions

Requirements for an internal model increasingly more demanding:

- Must reliably recognize distinct sectoral risk profiles
- Requires robust approach for sector definition
- Model outcomes sensitivity to correlation structure

Definition of well diversified industrial portfolio is not unique (Examples: Market portfolio, Minimal risk portfolio etc.) but need to steer clear of academic rigor and focu

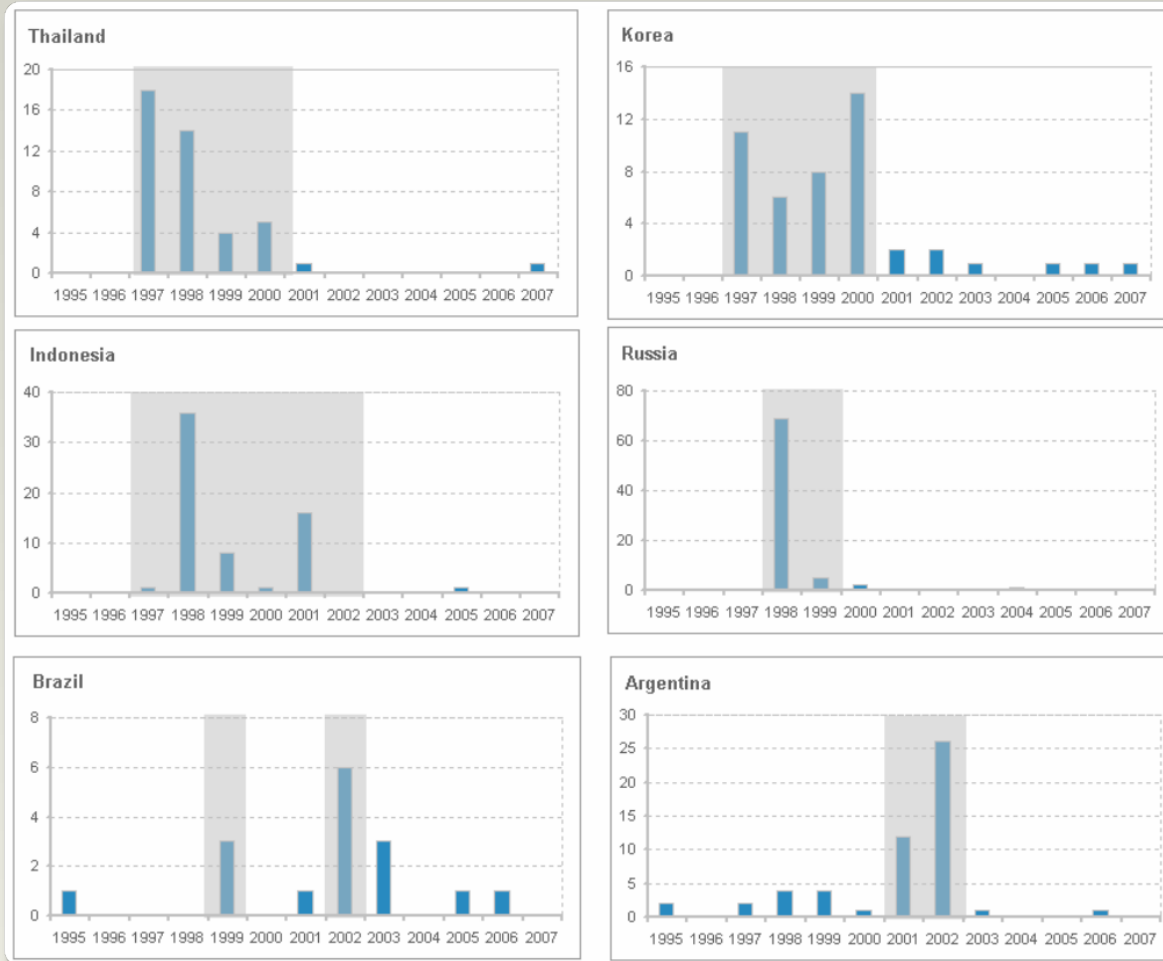
Business constraints need to be reflected to avoid unrealistic targets

Industrial sector concentration measurements are one of the main capabilities of standard “pre-crisis” multi-factor portfolio models and should be refined and standardized for more rigorous use



Country concentrations

Sovereign contagion is an example of another risk imperfectly captured in RWA



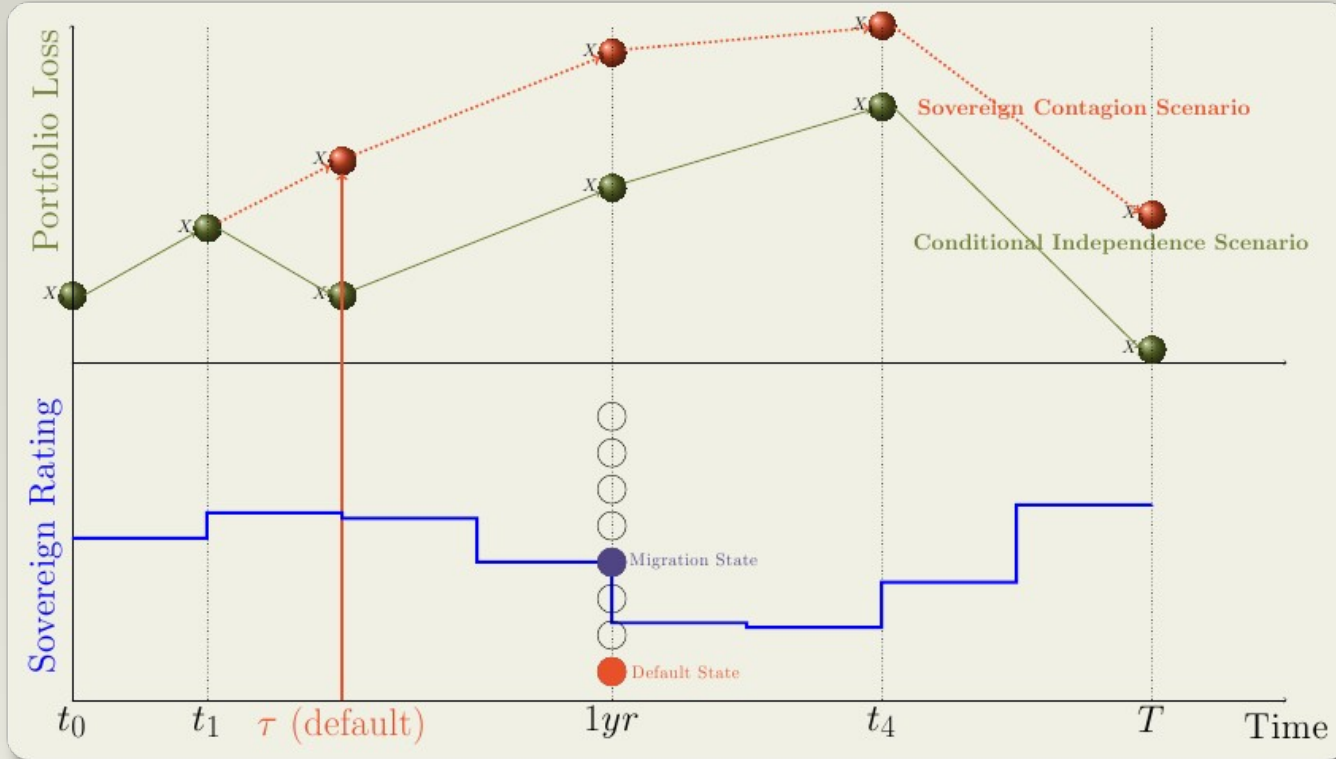
Source: Moody's

- RWA capital charge is the same irrespective of country, with the exception of country rating cap
- A rating cap may not fully capture the tail risk implicit in the sharp rise of loss in the event of a sovereign event
- Conditional independence as the basis of both Basel II and market standard portfolio models does not properly reflect this risk (for any typical correlation matrix)
- Internal models with direct asymmetric contagion can best incorporate such tail scenarios



Internal model extension to include contagion

Direct modelling of realistic stressed losses when there are sovereign events



- Asymmetric contagion from the sovereign to corporate and retail segments
- Start with drivers for correlated migrations / default based on market data (as usual)
- But, conditional on sovereign event, calculate stressed losses on corporate / retail pools, with scenario severity assessed quantitatively and / or qualitatively
- Contagion events can add significant tail risk

Incorporating lessons learned from the financial crisis is essential for internal model rehabilitation



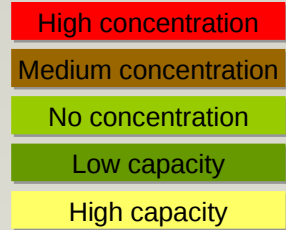
De-risking in the presence of sovereign contagion

Country diversification versus safe havens

Portfolio C



Portfolio D



Transformations must focus of risk reduction, not nominal diversification

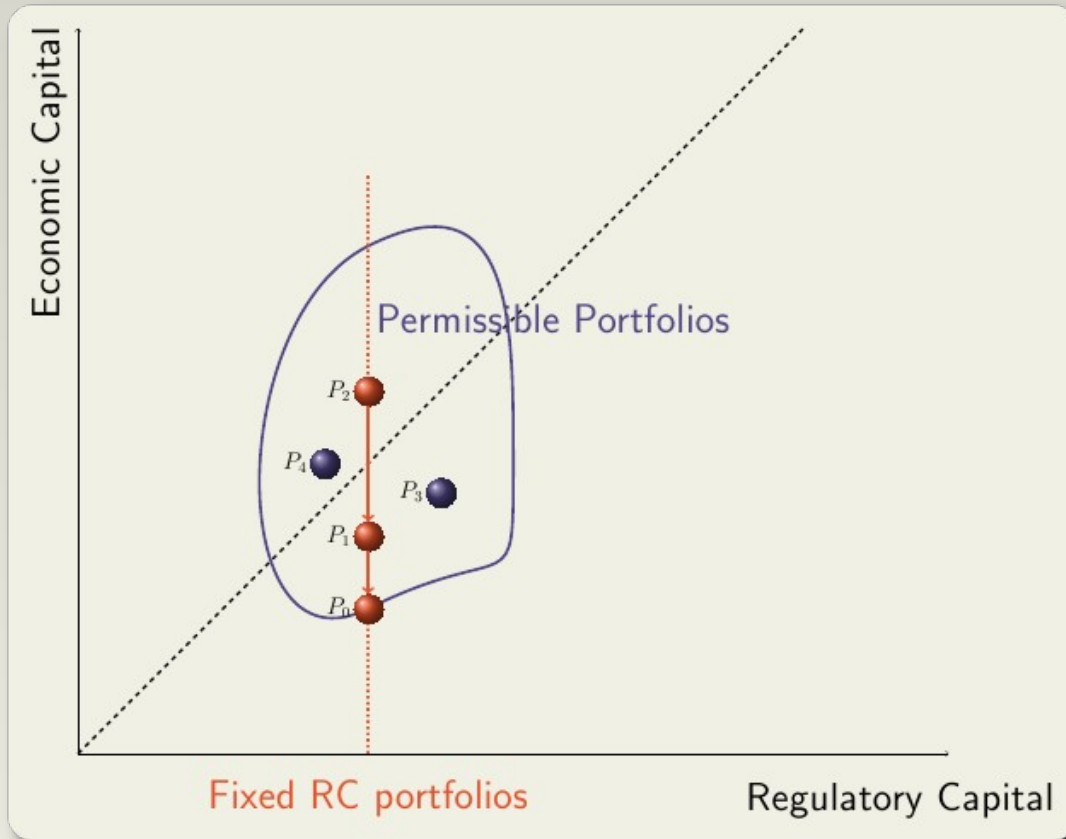
Ranking of countries / portfolios according to incremental EC due to contagion mechanism. E.g., portfolio in better rated country with significant financial services exposure may be more risky than lower rated with commodities exposure

Need to ensure transformed portfolios are realistic (existing business, potential to increase exposure)



Use for ICAAP

Relation with regulatory capital



- Key problem: Fully diversified EC will in general not agree with RWA capital
- Impossible to bridge the differences in a meaningful way (correlation structure, treatment of long date exposures etc. etc.)
- One conservative approach is as a strictly positive add-on:
$$K_T = K_{RWA} + DEC$$
- Where DEC is the total EC reduction from de-risking along a fixed RWA trajectory
- Key question is to have sharp definitions of which portfolios are deemed adequately covered by RC

Using an appropriate internal model and portfolio transformations from point A (Current) to point D (Reasonably achievable but with same RWA) offers a consistent manner of quantifying risks not in the RWA view of the world



Consistent CVA and CCR views in internal models

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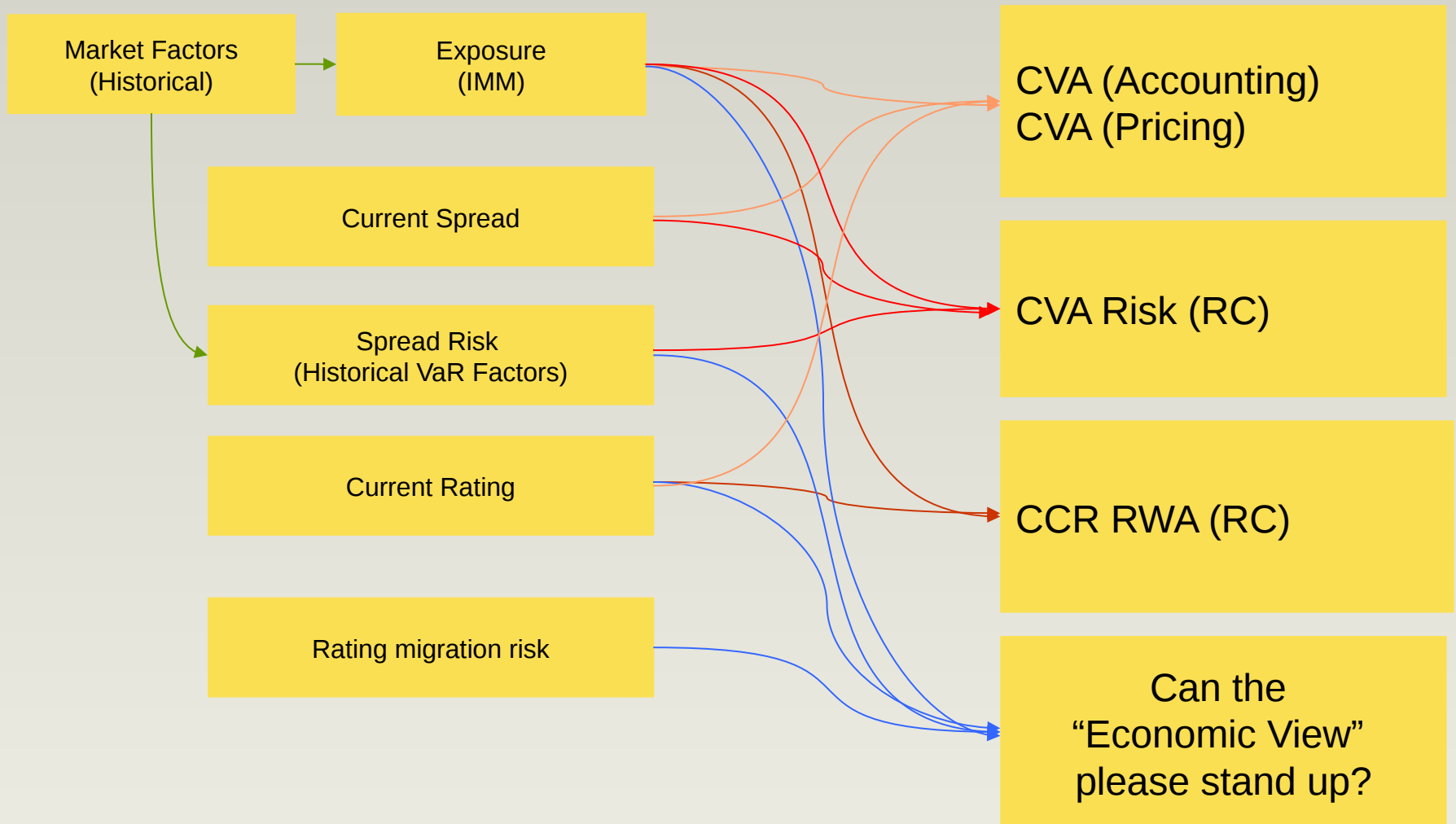
Q & A

- Brief review of regulatory situation
- CCR versus other credit risks
- Utilizing IMM outputs for enhanced internal views



The tangled web of CCR/CVA inputs and outputs

Evolving regulatory and internal landscapes





The CVA and CCR nexus

Notable differences versus other types of credit risk

- Accounting differences
 - trading book versus banking book accounting of the credit exposure (CVA)
- Product differences
 - Derivative contracts (leverage, off balance sheet)
 - Contractual uncertainty in future exposure (but linked to market factors)
- Business line organizational differences
 - Product and trading versus client orientation
 - Specialized practices for risk mitigation: Margining, hedging
- Financial counterparty universe structural differences
 - Concentrations to small number of entities (now also the CCP). Significant contagion potential, currently only reflected the 1.25 correlation multiplier of Basel III
 - CCR exposure to counterparties can be incidental to intermediating in derivatives markets. Complication for credit risk pricing and valuation when credit quality is symmetrical

The difficulties to a consistent view of CCR risk stem from the above fault-lines. Ideally there should be a unified approach versus credit exposures, (at least at high level)

How precisely should an out of the money swap be treated differently from an accounting, risk and capital perspective compared to a loan to the same counterparty? (and why)



CCR: The moving parts

Credit and market factors, historical and risk neutral measures



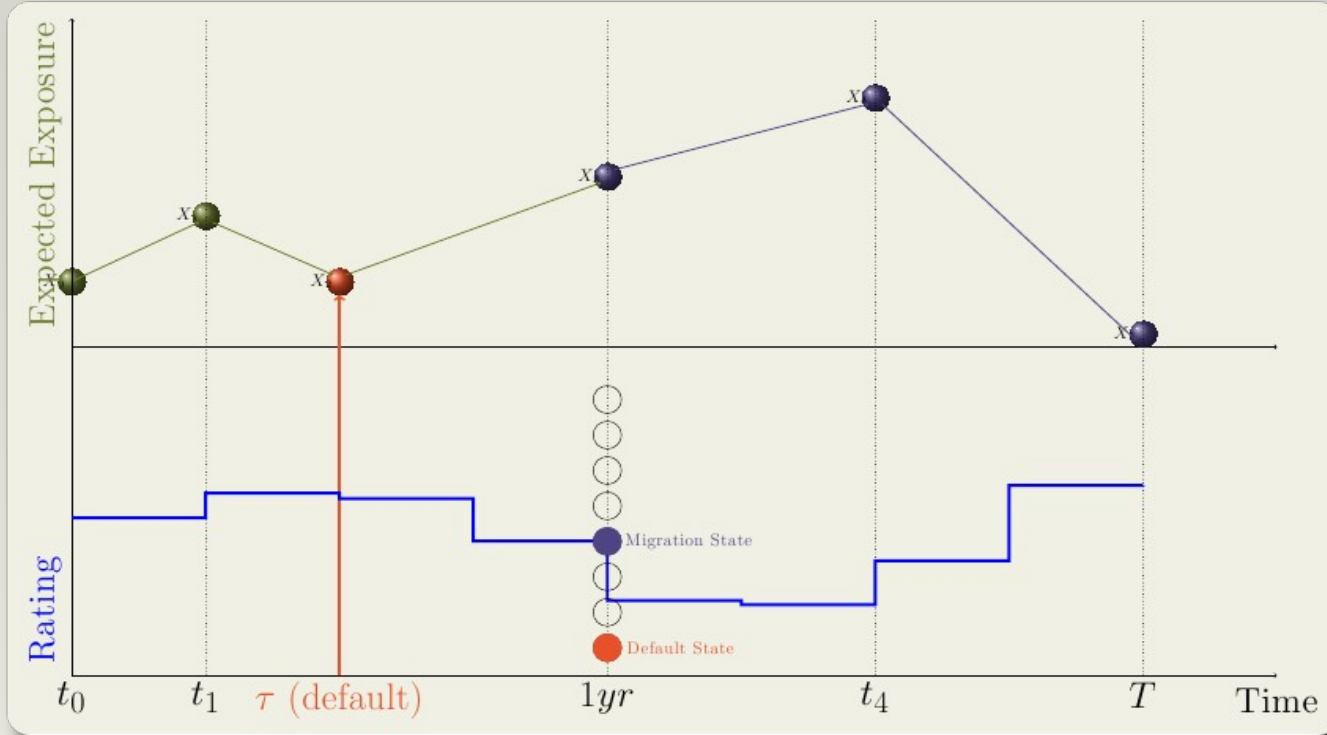
- Three risk horizons of importance (*10day* for CVA risk, *1yr* for default risk, revaluation, capital multiplier, *maturity* for valuation)
- Stack similar pictures for all counterparties in all joint scenarios
- IMM models focus on upper component (essentially a macro perspective on likely exposure unconditional on any credit events)
- CCR RWA uses IMM and loan equivalence concept to size credit capital
- CVA brings in a market view of credit quality
- CVA Risk brings in a market view on short term credit volatility

IMM methods / infrastructure force a specific sequence for constructing final measures in what is essentially only a simplification strategy and may not offer the best credit risk perspective



Reusing IMM exposure calculations

Such internal use can avoid some limitations of loan equivalence



- IMM averages unconditional market uncertainty and produces variety of exposure measures (EE, PFE etc.) (upper panel)
- Exposure profile up to the risk horizon produces more accurate default loss estimate
- Exposure profile after the risk horizon produces more accurate revaluation profile
- Use of stressed exposure can offer additional insights

An effective internal capital measure would cover for both CVA Risk capital and CCR RWA capital with a transparent attribution to the respective risks



Using IMM outputs in internal capital models

Further discussion

CCR RWA Based on IMM models and loan equivalence. The use of IMM infrastructure (expected exposure, stressed expected exposure) allows moving beyond loan equivalence for a more accurate internal view:

- Benefits
 - Better risk sensitivity (exact tenor of trades – no caps / floors, exposure profile)
 - Timing of default
 - Stressed exposures using PFE outputs
- Requirements for implementation:
 - Integrating IMM systems (feeds) with internal capital model systems
 - Multi-year credit curves
- Hedges can be incorporated in parameters in pre-processing or modeled separately
- Weaknesses
 - Link with CVA Risk / Market view not explicit
 - Does not directly quantify wrong way risk / relying on alpha for a prudent view



Conclusions

“The rationale for continuing with internal capital models in the Basel 3 world”

Overview

Need to reverse vicious cycle of mistrust regarding the fitness for purpose of internal models
Significant challenge, with many pitfalls, hence scope and ambition must be set properly
Already current generations of internal models offer added value versus outsourcing all risk assessment to the regulatory authorities

Concentrations
&
ICAAP

Credit concentration assessment and management is a tangible example of symbiosis of internal / regulatory approaches. We gave concrete examples of:
Name concentration management (using basic credit portfolio models)
Sector concentration management (using market standard credit portfolio models)
Country concentration management (using more advanced credit portfolio models)

CVA and
CCR

Significant conceptual and practical advantage over a collection of ad-hoc add-ons

Conclusions

CVA and CCR Basel III is example of a problem area where currently there is little consensus

- Need to think also in total portfolio context and not just business line perspective
- We provided example of using IMM outputs to obtain total portfolio view that improves on loan equivalence
- Much more work needed to reach a conceptually and practically adequate framework

Q & A

Roll up our sleeves!



Questions and further Information

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