Diversification Between Different Risk Types

ISDA - London - March 2004

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Credit Risk Management

Deutsche Bank

Agenda

- What are DB's peers doing?
- How DB does it currently?
- How will DB do it in future?

JPMC EC adequacy disclosure

JPMorganChase

Available versus required capital

(in billions)	Yearly Averages 2002	2001
Common stockholders' equity	**$ 41.4**	$ 41.5
Required economic risk capital:		
Credit risk	**13.1**	12.8
Market risk	**4.8**	4.6
Operating risk	**8.7**	8.8
Private equity risk	**5.1**	6.4
Goodwill / Intangibles	**8.8**	8.5
Asset capital tax	**3.8**	3.9
Diversification effect	**(7.0)**	(7.2)
Total required economic risk capital	**37.3**	37.8
Capital in excess of required economic capital	**$ 4.1**	$ 3.7

Approx. 20% benefit from diversification

"The total required economic capital for JP Morgan Chase as determined by its models and after considering the Firm's estimated diversification benefits is then compared with available common stockholders' equity to evaluate overall capital utilization. The Firm's policy is to maintain an appropriate level of excess capital to provide for growth and additional protection against losses."

Source: JPMC 2002 Annual Report p41

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Barclays

BARCLAYS

	Average economic capital 2002 £m	2001 restated £m
Personal Financial Services	**2,100**	2,200
Barclays Private Clients	**850**	800
Barclaycard	**1,500**	1,000
Business Banking	**2,750**	2,500
Barclays Africa	**200**	200
Barclays Capital	**2,050**	1,800
Barclays Global Investors	**200**	100
Other operations[1]	**550**	600
Average economic capital	**10,200**	9,200
Goodwill	**4,700**	4,600
Capital held at Group centre[2]	**900**	700
Total average shareholders' funds	**15,800**	14,500

No diversification benefit mentioned

"The total economic capital required by Barclays, as determined by its internal risk assessment models and after considering the Group's estimated diversification benefits, is compared with available common shareholders' funds to evaluate overall capital utilisation. The Group's practise is to maintain an appropriate level of excess capital held at Group centre"

EC framework covers: Credit, Market, Business and Operational, Insurance, Fixed Assets, and Private Equity risks

Source: Barclays 2002 Annual Report and 2003 interim report p46

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Credit Suisse

At 99% CI, 1 year time horizon

CREDIT SUISSE GROUP

Key Position Risk Trends [1]

In CHF m	Credit Suisse Financial Services 31.12.02	Credit Suisse Financial Services 31.12.01	Credit Suisse Financial Services 31.12.00	Credit Suisse First Boston [2] 31.12.02	Credit Suisse First Boston [2] 31.12.01	Credit Suisse First Boston [2] 31.12.00	Credit Suisse Group [3] 31.12.02	Credit Suisse Group [3] 31.12.01	Credit Suisse Group [3] 31.12.00
Interest Rate, Credit Spread & FX ERC	**3,316**	4,671	6,334	**1,118**	2,130	1,833	**3,666**	4,619	6,857
Equity Investment ERC	**1,744**	6,341	6,589	**1,820**	2,825	2,676	**3,674**	10,522	11,929
Swiss & Retail Lending ERC	**2,097**	2,310	2,434	**0**	0	0	**2,097**	2,310	2,434
International Lending ERC	**373**	319	342	**3,467**	3,692	3,064	**3,840**	4,011	3,406
Emerging Markets ERC	**305**	339	295	**1,672**	2,341	2,413	**1,977**	2,680	2,708
Real Estate & Structured Asset ERC [4]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4,428
Insurance Underwriting ERC	819	753	722	0	0	0	819	753	722
Simple Sum across Risk Categories	**10,621**	16,780	18,642	**10,109**	13,364	12,511	**20,025**	29,266	32,485
Diversification Benefit	**(4,448)**	(7,861)	(8,126)	**(2,334)**	(3,256)	(3,114)	**(6,723)**	(11,309)	(13,215)
Total Position Risk ERC	**6,173**	8,919	10,517	**7,775**	10,108	9,396	**13,303**	17,958	19,270

Approx. 50% benefit from diversification

"Economic Risk Capital is the economic capital needed to remain solvent and in business even under extreme market, business and operational conditions, given the institution's target financial strength (e.g. credit rating, in our case AA)."

CS use different confidence intervals: 99% for risk mgt purposes, 99.97% for capital mgt purposes

Only Credit & Market Risk EC figures made public: Business and operational risk referred to but not quantified

Source: Credit Suisse 2002 Annual Report p88-90

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“Classical” grouping of risk to enable easier management

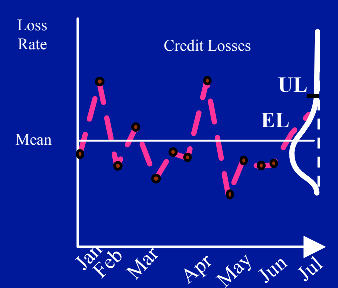
As with most banks, at DB risks are grouped into major “buckets” to enable them to be effectively managed by experts at a Group level

Group Risk

Volatility in earnings and impact on market capitalisation

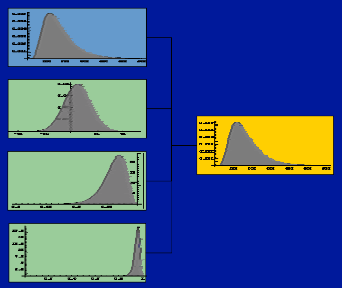
Credit Risk

Volatility due to variation in credit losses



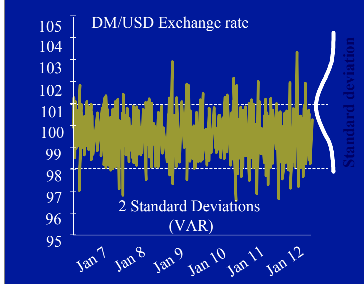
Operational Risk

Volatility due to operational inefficiencies and losses



Market Risk

Volatility due to variation in market prices, rates



Key developments are currently focusing on closer integration between market and credit risk “activities” and combining all three around the language of Economic Capital….more about this later!!

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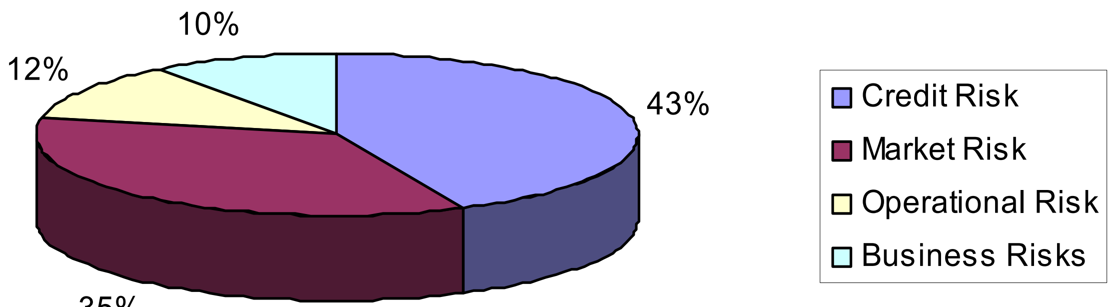
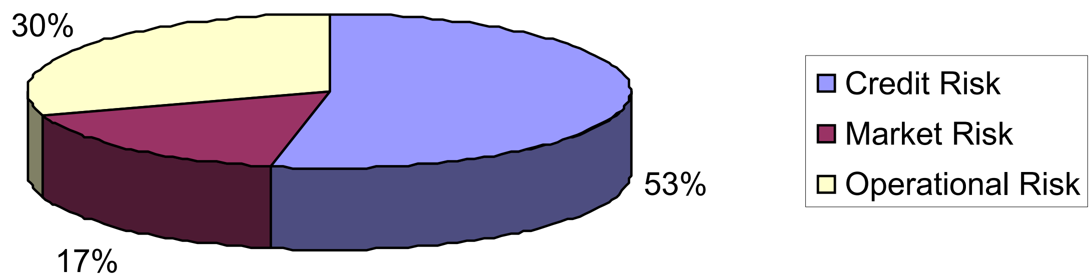
DB Total Risk as at 31.12.2002



Industry



Source: BBA, ISDA, RMA Operational Risk Study

Agenda

- What are DB’s peers doing?
- How DB does it currently?
- How will DB do it in future?

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EC calculation and allocation: integration of risk types

Standard procedure: standalone EC calculation for each risk type; total EC equals

$$EC(total) = EC(MR) + EC(CR) + EC(OR) + EC(BR)$$

Problem: adding up standalone ECs overestimates total risk because diversification effects are not reflected

Objectives:

- Calculation of diversified EC across risk types
- Allocation of diversification benefit

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Aggregation of risk types

Top-level integration:

– aggregation of loss distributions of individual risk types

– copula functions for modeling correlations

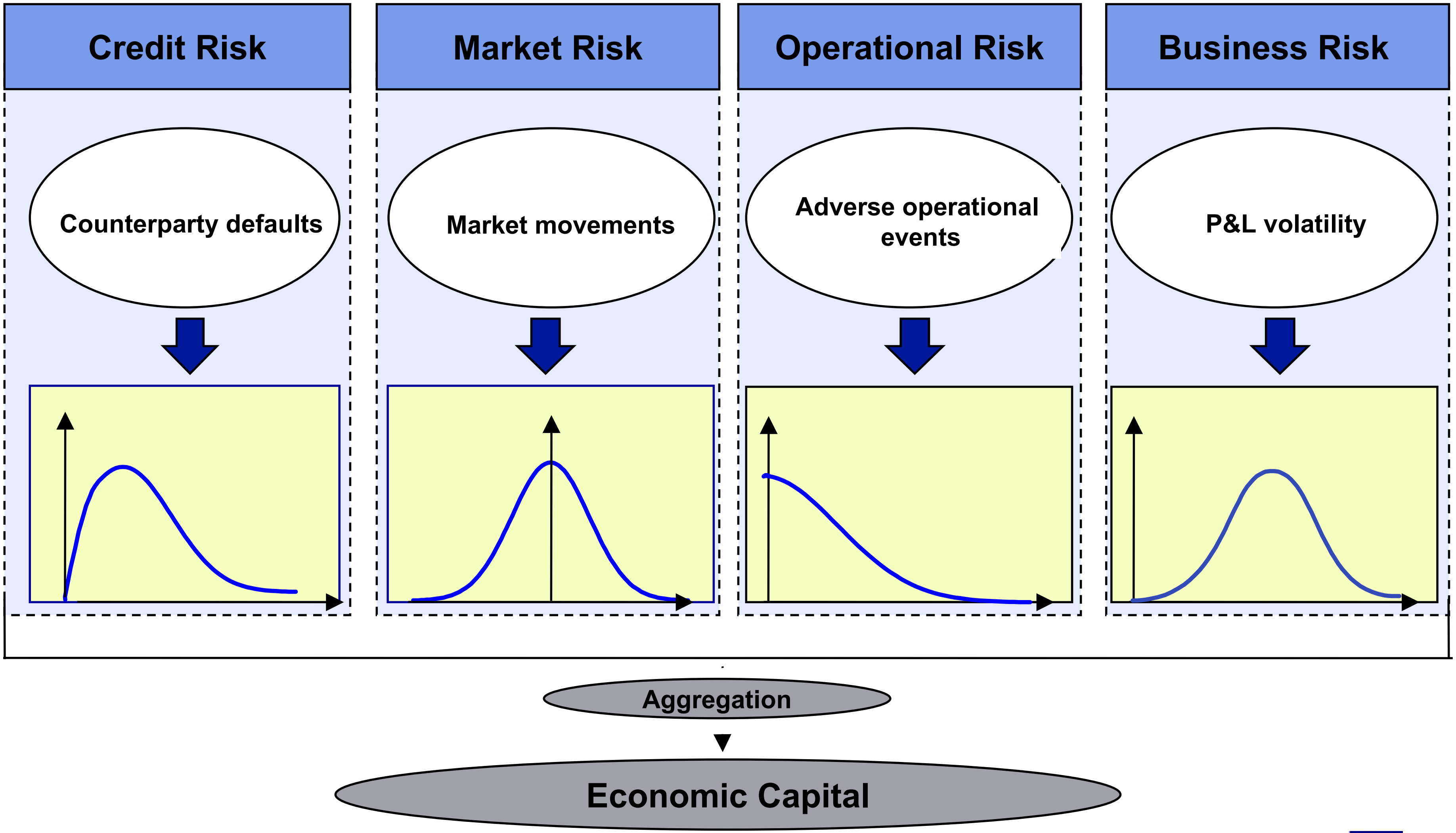
– allocation of diversification benefit using expected shortfall techniques

Full integration:

– joint Monte Carlo simulation integrating exposures across risk types

– focus on credit and market risk

Top-level integration



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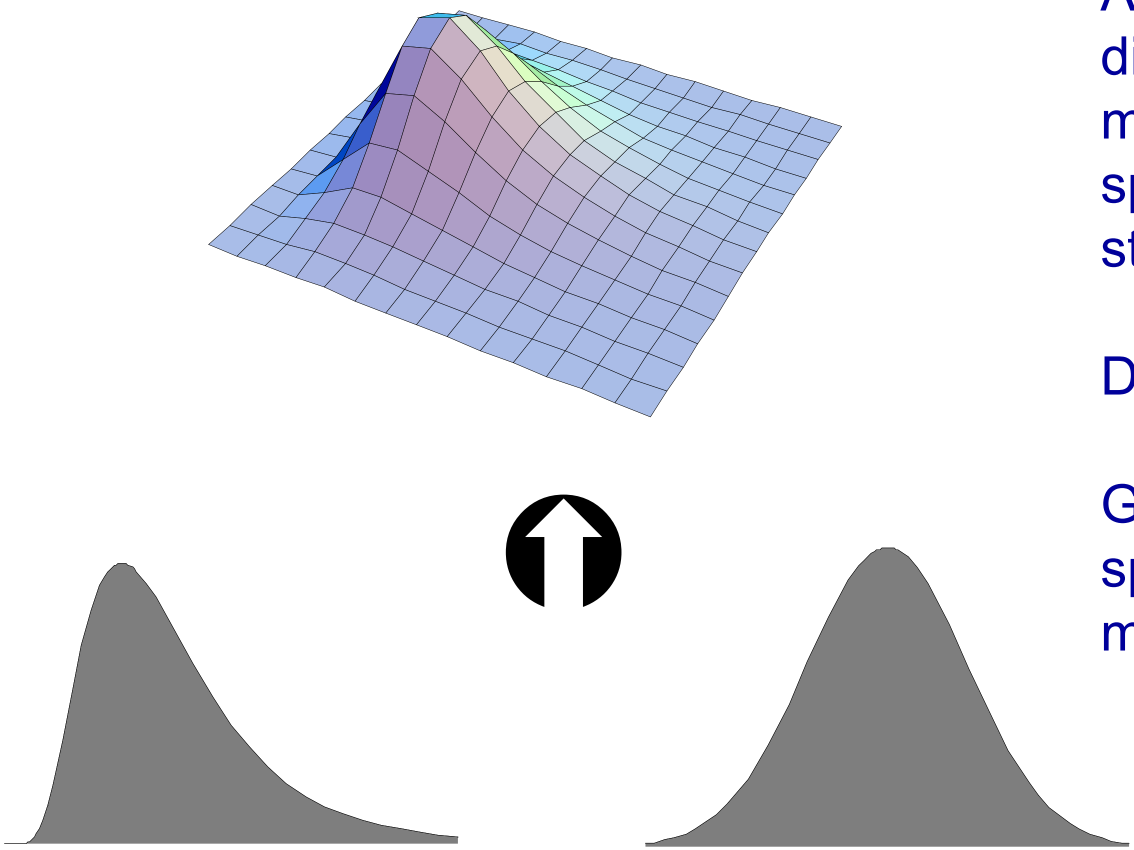
Modeling dependence through copulas



A copula links univariate distributions to the full multivariate distribution by specifying a dependency structure

Different types of copulas

Gaussian copulas: specified by correlation matrices

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Calculation of diversified EC and allocation to business units

Calculation of a loss distribution for each risk type

Specification of a correlation matrix for Market, Credit, Operational and Business Risk: the corresponding Gaussian copula specifies the aggregate loss distribution

Simulation of the aggregate loss distribution and calculation of EC

Allocation of EC to risk types, e.g. using expected shortfall allocation ESC(MR,total)

Calculation of the risk capital of a business unit for each risk type, i.e. $ESC(MR_{BU},MR)$

Proportional allocation to business units: the diversified MR capital of a business unit equals

$$ESC(MR_{BU},MR) * ESC(MR,total) / EC(MR)$$

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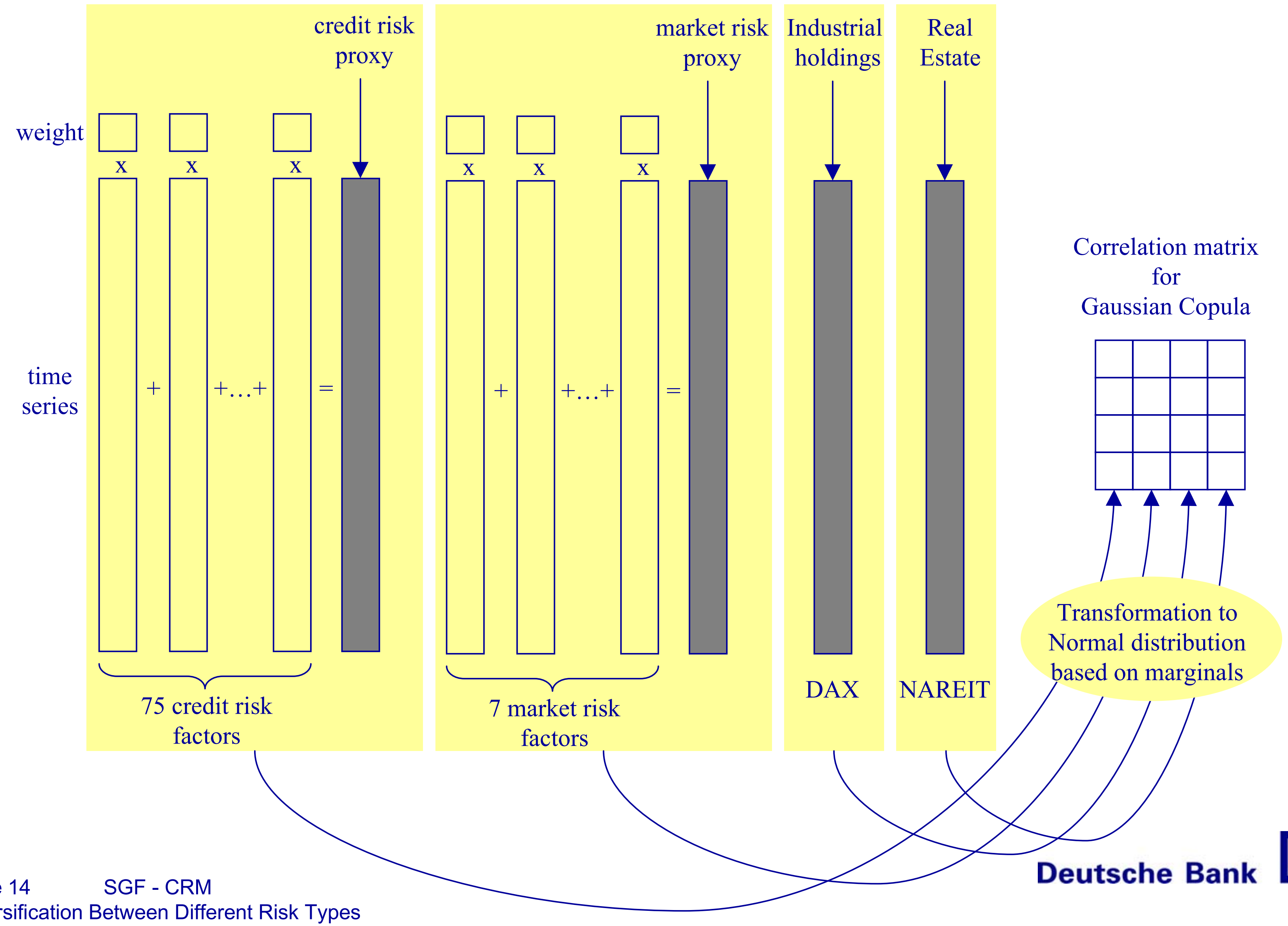
Risk type diversification: current status at DB



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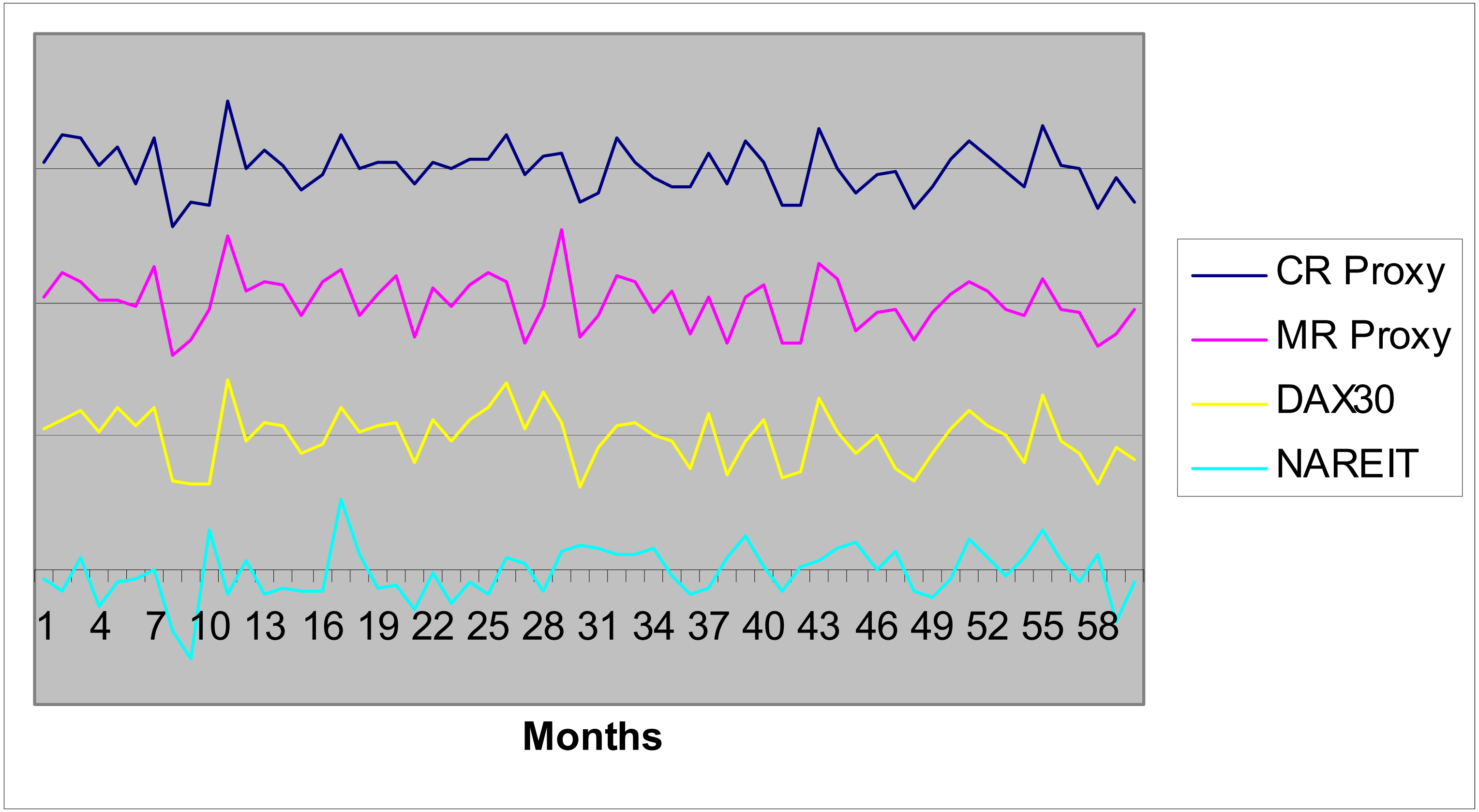
Time series of risk type proxies



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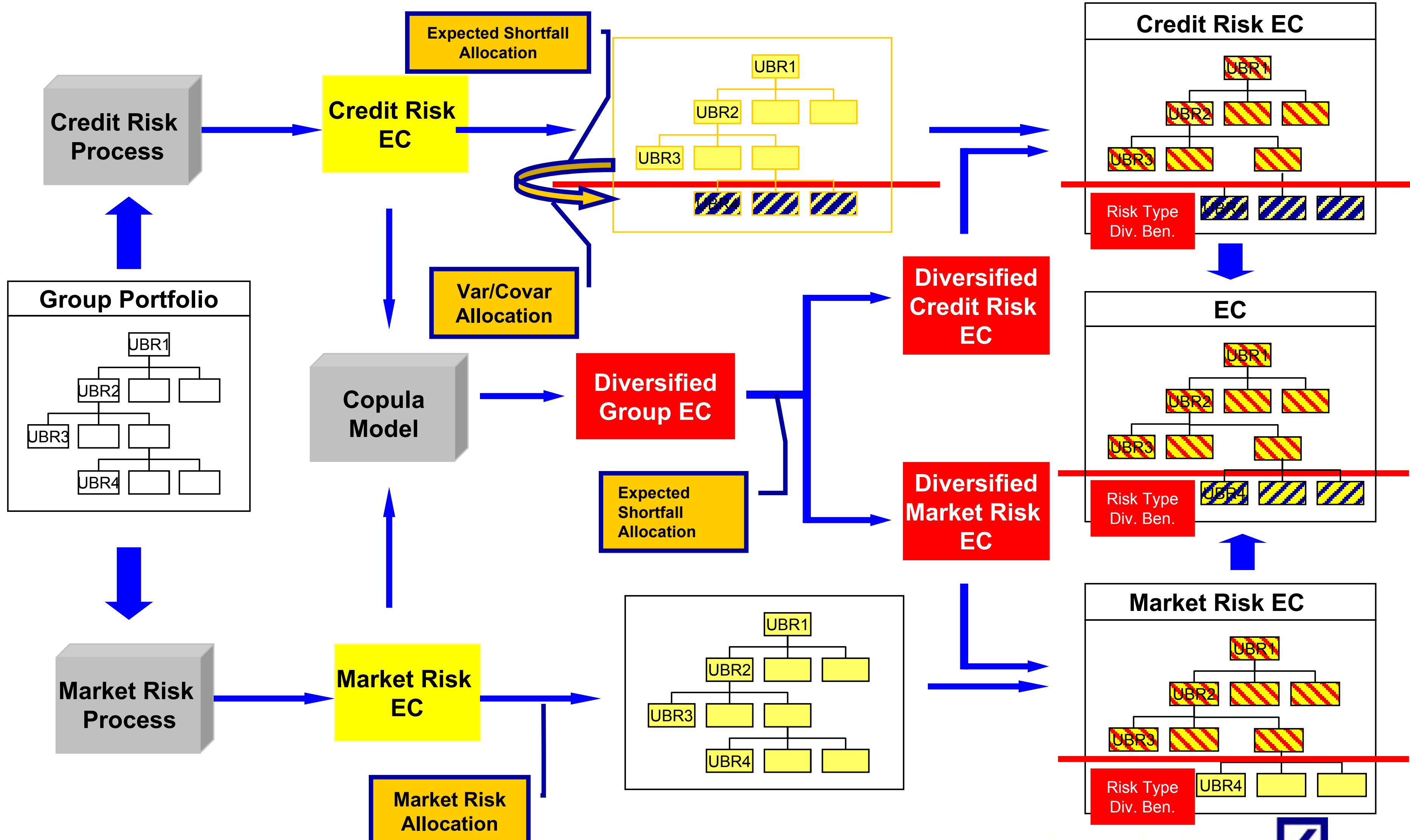
Calculation and Allocation Process



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Risk type diversification: rationale for using copulas and shortfall allocation

Gaussian copulas

- Copulas can be applied to arbitrary univariate distributions. This property is an important advantage in view of the potentially large variety of loss distributions which have to be considered in risk type diversification.
- Gaussian copulas are a straightforward generalisation of the correlation concept used for normal distributions. They are easy to specify and simulate.

Expected shortfall allocation

- Shortfall methodology is needed to distribute diversification benefits across risk types because loss distributions of different shape have to be combined.

Consequences of full allocation of diversification benefit

The risk capital of a business unit reflects its contribution to the diversified EC of the bank.

Diversification effects beyond the control of a business unit might significantly impact its risk capital. This is a serious problem for performance measurement.

Full allocation is more appropriate for credit risk (portfolio view) than for market risk (risk management at desk level).

Full allocation or standalone EC calculations?

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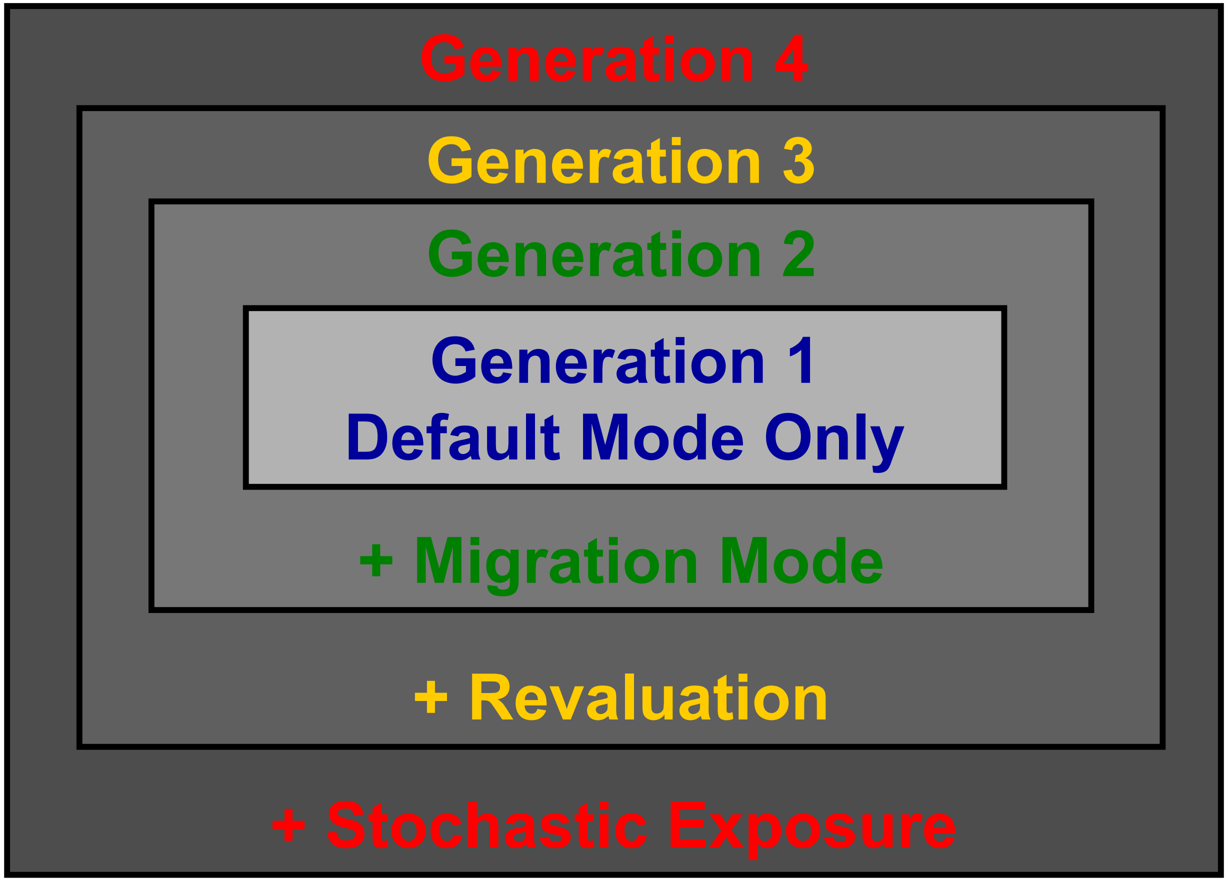
Full integration of credit and market risk



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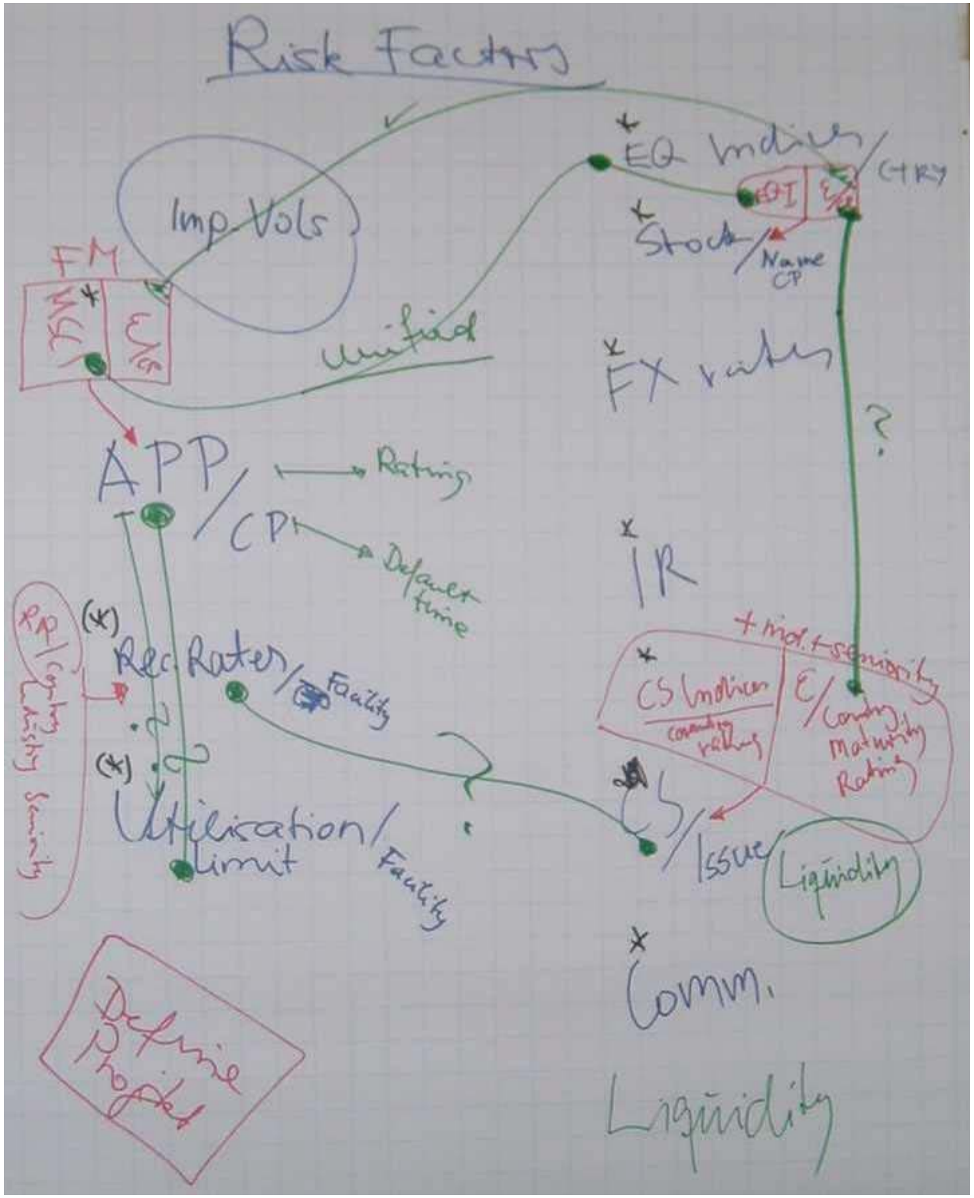
Risk Factors



What is the universe of risk factors to be considered?

How best to describe their relationships and dependencies?

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Summary

Diversification across risk types

- Importance: risk type aggregation based on realistic correlation estimates leads to a significant reduction of EC
- Modeling techniques:
  - top-level integration based on copula functions and expected shortfall allocation
  - full integration of credit and market risk by joint Monte Carlo simulation

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