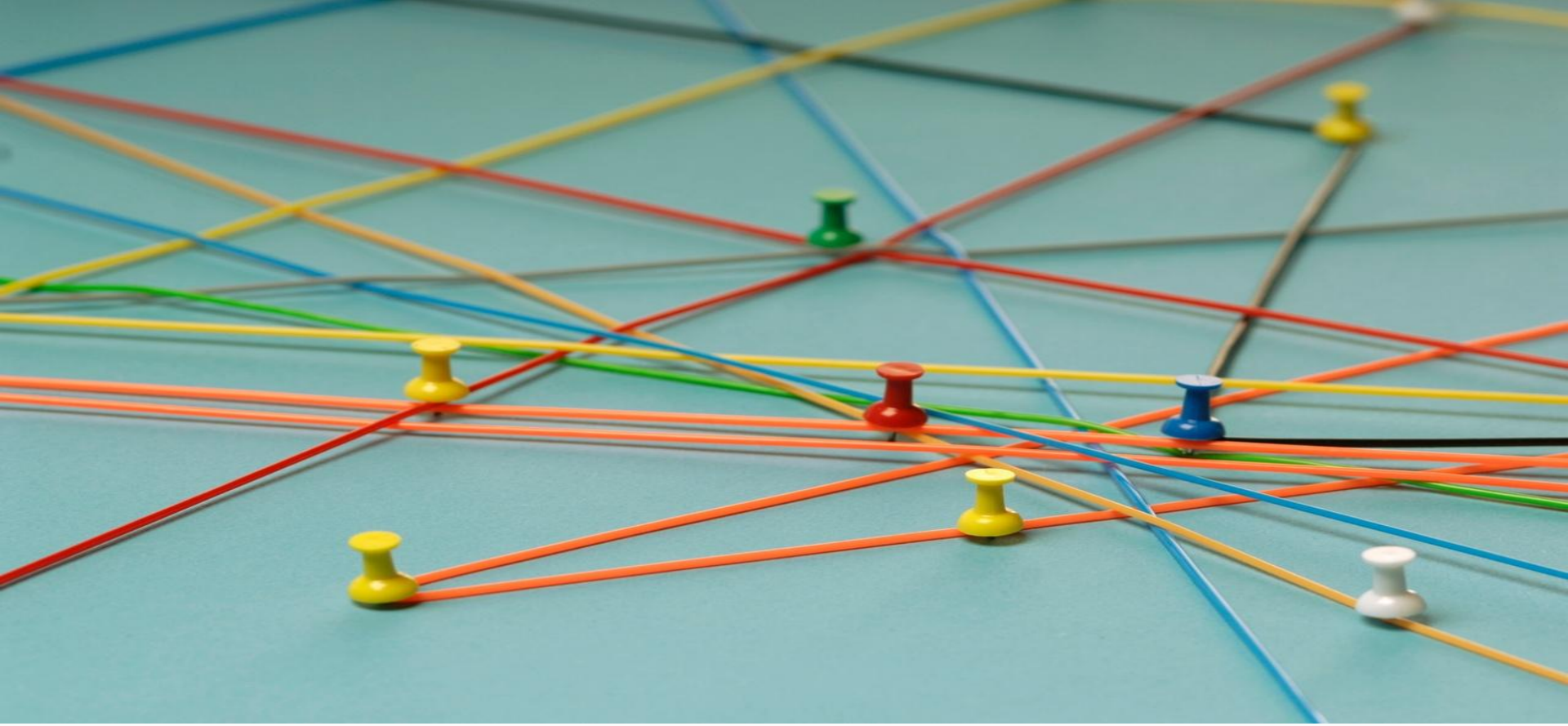


ERM IN THE NEW WORLD –

POST FINANCIAL CRISIS & WITH NEW REGULATORY FRAMEWORKS

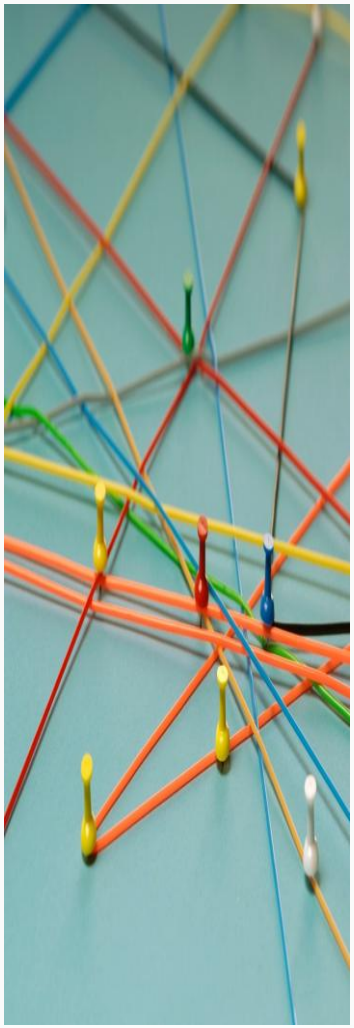
Gavin R. Maistry, FSA, FSAS, CERA, CFA
Chief Pricing Actuary, Life Asia

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ASSET, LIABILITY & CAPITAL MANAGEMENT: WHERE ARE YOUR RISKS?
SINGAPORE, 5 AUGUST 2010

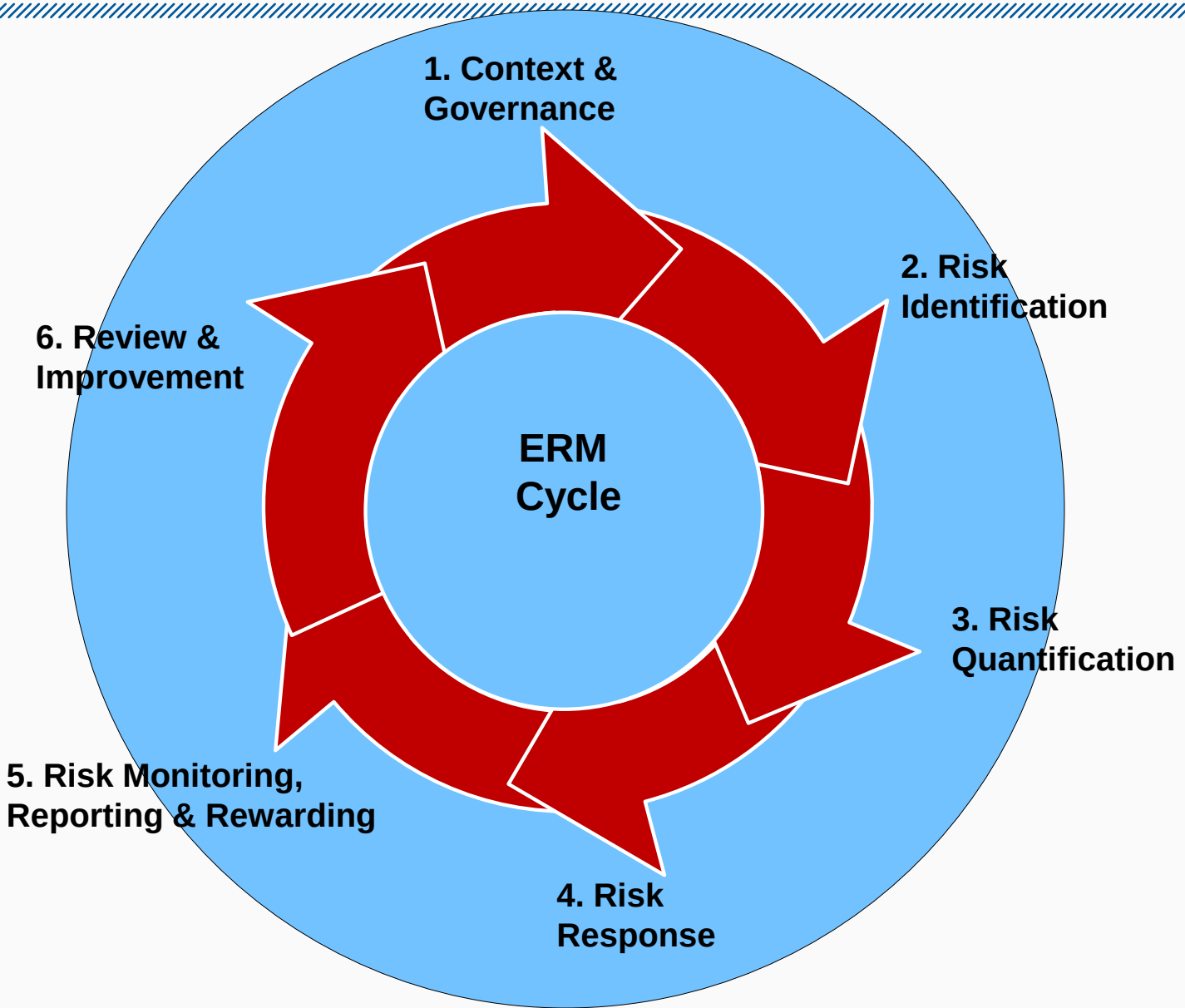
AGENDA…

- how will the **lessons** from the recent **GFC** impact **ERM**?
- how will the new **regulations** (e.g.Solvency II) impact **ERM**?
- how will new value measures(e.g. MCEV, IFRS)impact **ERM**?
- what **ERM** issues are specific to Asia?
- how will **ERM** evolve in Asia over time?



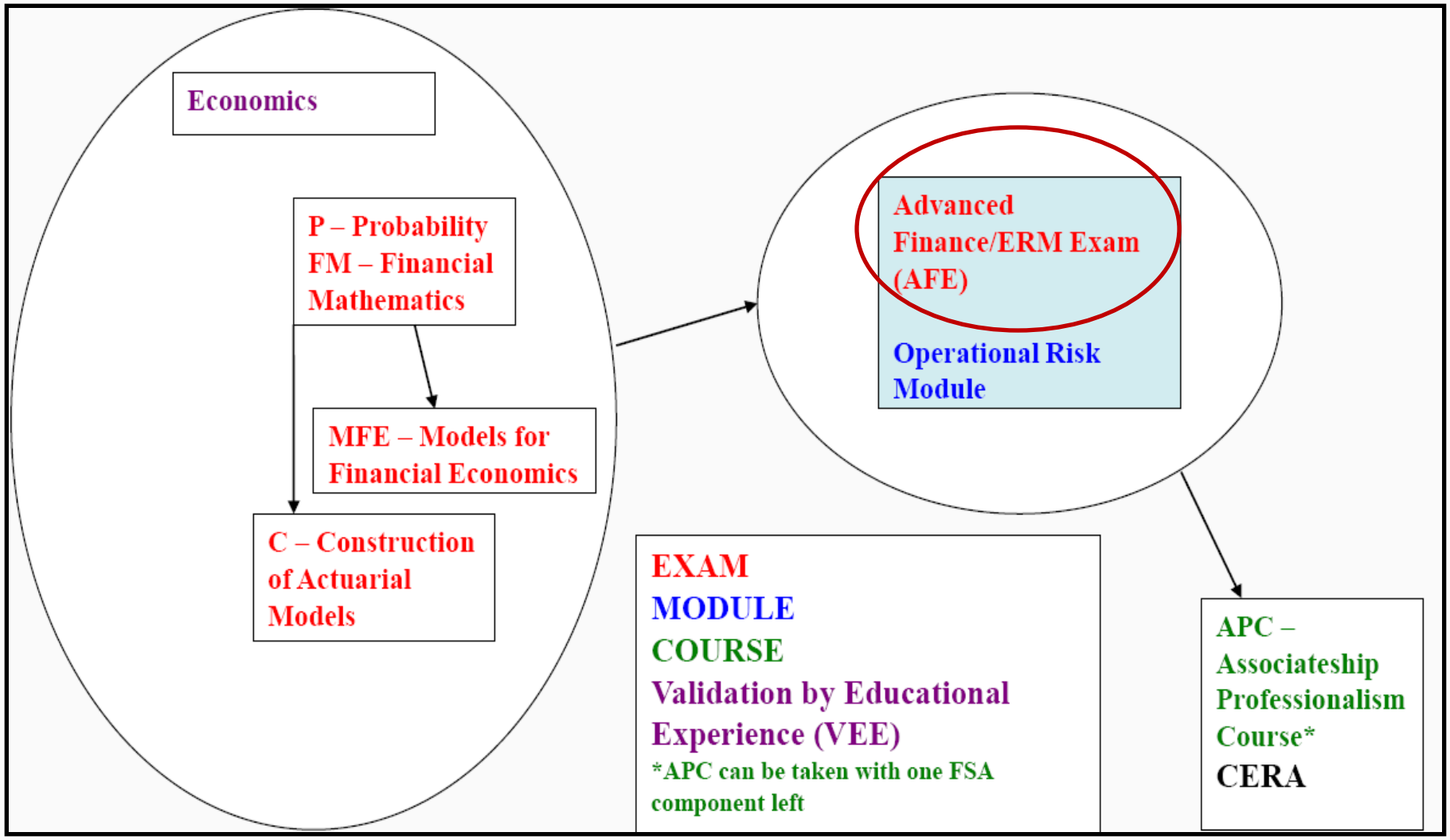
The ERM Cycle

can be used to structure the talk…



The SoA's CERA Curriculum

provides some good reference material…



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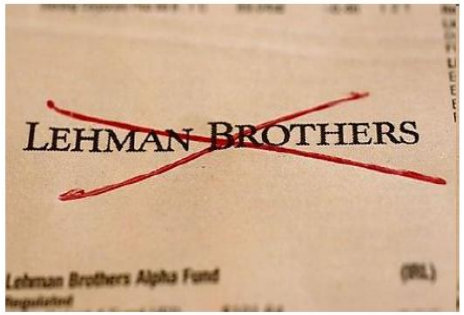
ERM Step #1: Context & Governance…

who/what will impact risk management – e.g. the Global Financial Crisis…

The Scream of the Banker…









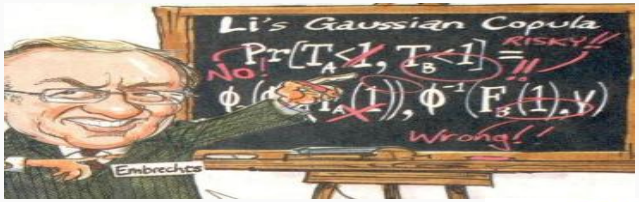


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Who is shaping the future of risk management

which bodies are influencing the development of ERM…

- Academics, etc.





- Actuarial bodies

- Accounting bodies

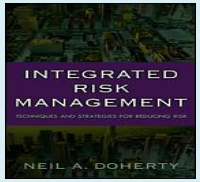
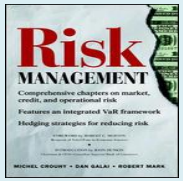
- Industry bodies

- Rating Agencies

- Regulators

CEIOPS
Committee of European Insurance and Occupational Pensions Supervisors

References…

1. Risk Context & Governance *(AFE References)*  	**ERM Risk Strategy**	❑ Doherty, Integrated Risk Management, Ch. 1, The Convergence of Insurance Risk Management & Financial Risk Management Ch. 7, Why Is Risk Costly to a Firm? Ch. 8, Risk Management Strategy: Duality and Globality ❑ Moody's: No Assurance of Good Governance: Observations on Corporate Governance in the U.S. Insurance Sector
	Enterprise Risk Management Framework	❑ SoA: Enterprise Risk Management Specialty Guide, 2006 ❑ Crouhy, Galai, & Mark, Risk Management, 2001, Ch. 3, Structuring and Managing the Risk Management Function in a Bank ❑ SoA: Dynamic Financial Condition Analysis Handbook, Ch. 1 (background only), 8 and Appendix A ❑ CAS: Dynamic Financial Models of Property-Casualty Insurers ❑ Wharton: "Risk Measurement, Risk Management and Capital Adequacy in Financial Conglomerates" ❑ Babbel & Fabozzi, Investment Management for Insurers, 1999 - Ch. 1, "Risk Management by Insurers: An Analysis of the Process",
	ERM Regulatory/Industry Perspective	❑ Crouhy, Galai, & Mark, Risk Management, 2001, Ch. 2, The New Regulatory and Corporate Environment" Ch. 3, Structuring and Managing the Risk Management Function in a Bank Ch. 17, Risk Management in the Future ❑ UK: Internal Control – Guidance for Directors on the Combined Code ❑ Basel: Principles for the Management of Interest Rate Risk ❑ OSFI (Canadian): Supervisory Framework – 1999 and Beyond ❑ COSO: ERM Integrated Framework ❑ SoA: "Actuarial Aspects of SOX 404", The Financial Reporter, Dec. 2004 ❑ SoA: "Responsibilities of the Actuary for Communicating Sarbanes-Oxley Controls" The Financial Reporter
	ERM Rating Agency Perspective	❑ S&P: Insurance Criteria: Refining the Focus of Insurer Enterprise Risk Management Criteria ❑ Best Rating: Risk Management and the Rating Process for Insurance Companies, January 2008. ❑ Moody's Looks at Risk Management and the New Life Insurance Risks

Academics shaping the future of risk management…

Risks Management: Lessons from the Crisis

Talk by Myron Scholes – NUS Policy Forum, July 2010 Singapore

- Lesson #1: Capital **Allocation** Model
- Lesson #2: Capital **structure** Issues
- Lesson #3: **Optimization** Tools
- Lesson #4: Plan for crisis, **scenario** analysis
- Lesson #5 **Feedback** Mechanism
- Lesson #6: **Reporting** system for risks
- Lesson #7: Firm **structure/compensation**

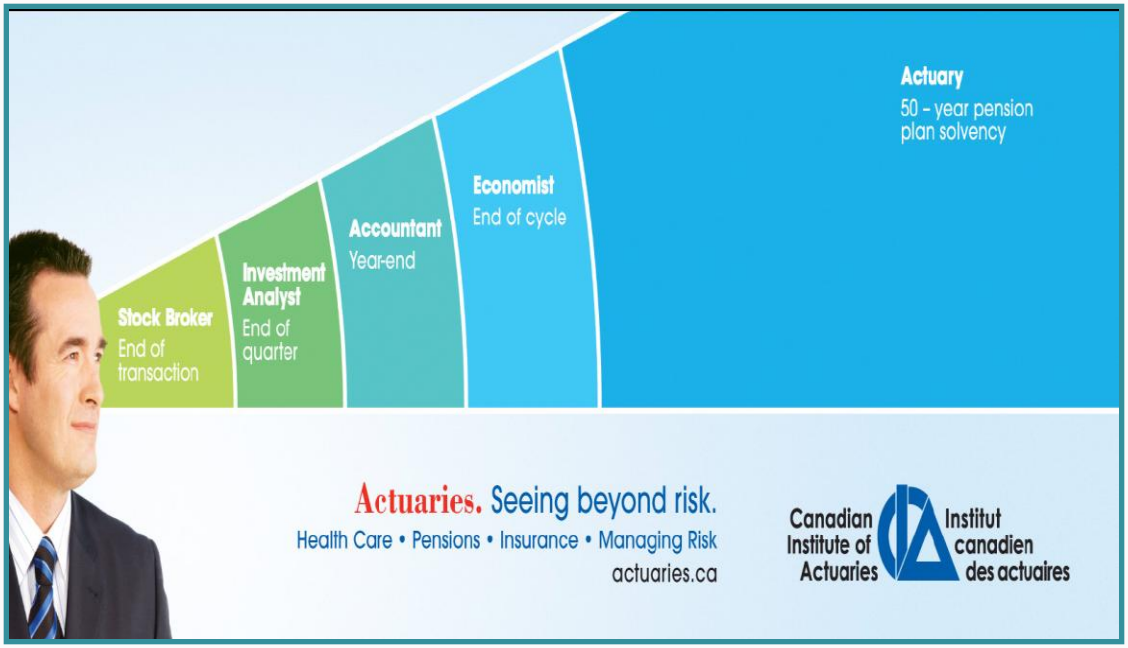


Actuaries shaping the future of risk management…

Evolution of the Actuarial Profession...

The Evolution of the Actuary	Emergence	Description	Time to Emerge
Actuary of the 1st kind	17th century	**life insurance** actuaries using deterministic methods	
Actuary of the 2nd kind	20th century	**casualty** actuaries using probabilistic methods	250
Actuary of the 3rd kind	1980's	**investment** actauries applying financial economics (Bühlmann)	70
Actuary of the 4th kind	current	actuaries working in **ERM** (Embrechts)	25

Source: Stephen P. D'Archy, CAS Presidential Address, 2005



Actuaries
Risk is Opportunity.®

Risk Management:
The Current Financial Crisis, Lessons Learned and Future Implications

Visions For The Future
Of The Life Insurance Sector

The Global Financial Crisis – What Next?

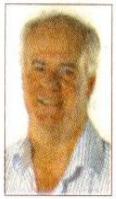
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Actuaries shaping risk management

actuarial profession at the forefront of risk manangement…

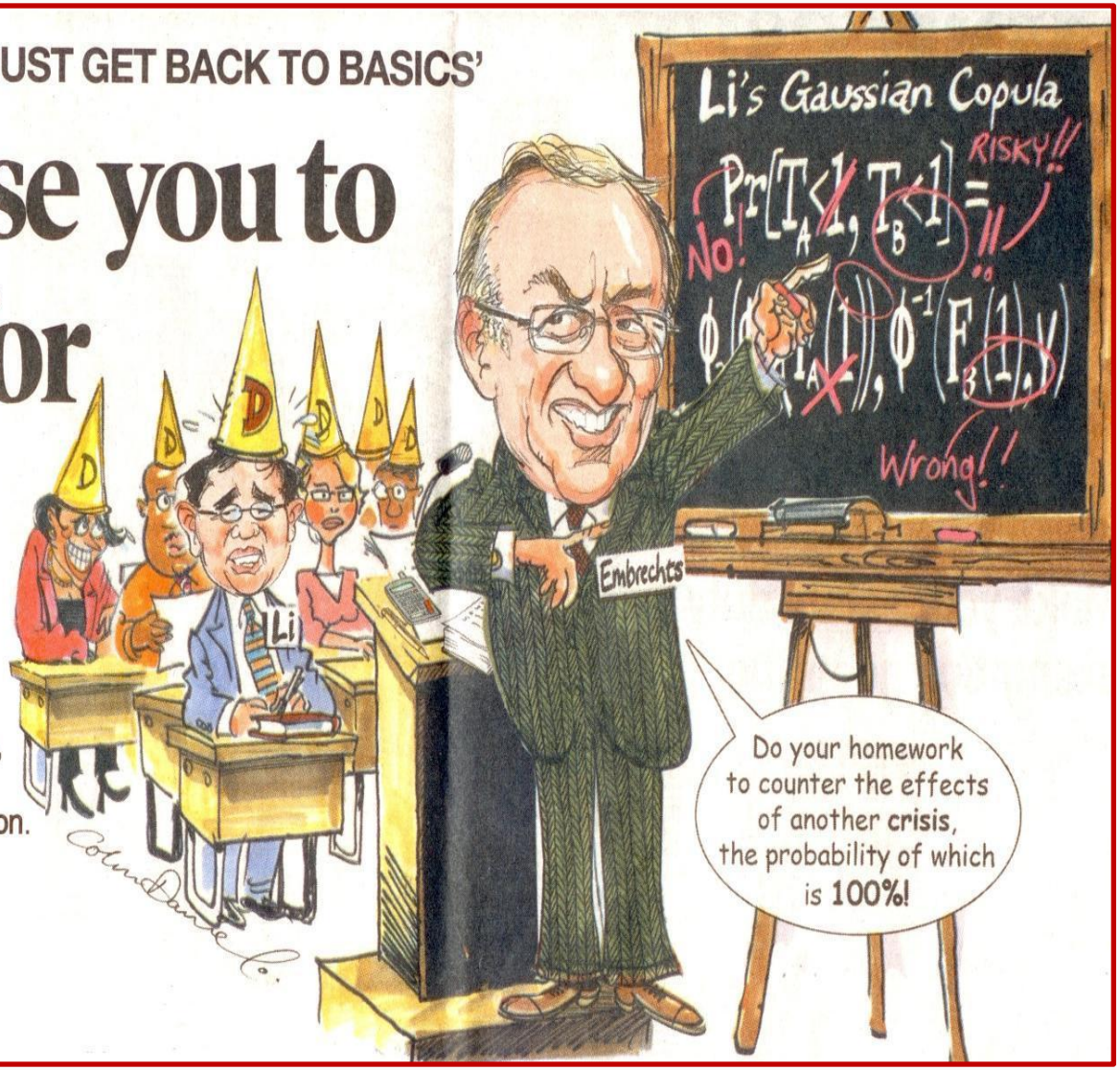
■ BANKERS AND ACTUARIES 'MUST GET BACK TO BASICS'

Boffins advise you to plan ahead for next crunch



Things went horribly wrong to cause the credit crisis, delegates at this week's actuarial congress reminded us, and they'll go wrong again. All you can do is be prepared, writes **Bruce Cameron**.





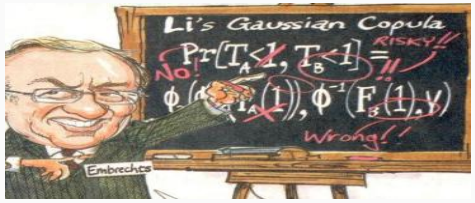
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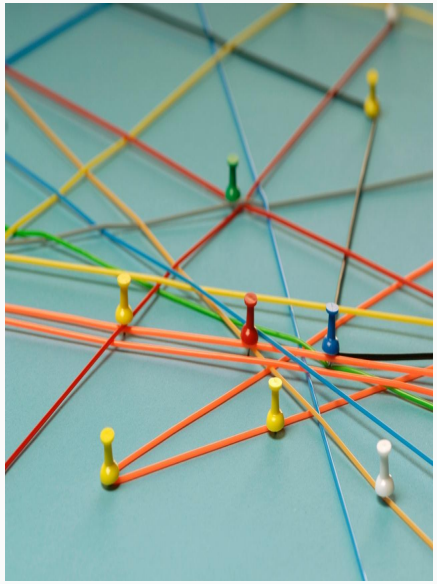
Risks Management: Lessons from the Crisis

especially for Actuaries – from ICA 2010

- Lesson #1: ***Monitor*** the **Market Environment**
- Lesson #2: ***Track*** the **Trends**
- Lesson #3: ***Crumbling*** of **Capital** During a Crisis
- Lesson #4: **Consider Credit Risk**
- Lesson #5 ***Lack*** of **Liquidity** During a Crisis
- Lesson #6: ***Sensitized*** to **Systemic Risk**
- Lesson #7: ***Beware*** of the **Black Swans**
- Lesson #8: ***Careful*** of **Contagion** & Tail **Correlation**
- Lesson #9: ***Mindful*** of Financial **Models**
- Lesson #10: **Regulation *Review***
- Lesson #10+: ***Back*** to the **Basics…**







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Industry Bodies shaping risk management

advice from the CFO Forum…

Integrated risk governance	• Sound and comprehensive internal risk governance • Risk management needs to be preemptive, independent and empowered • Clearly articulating and monitoring the company's risk tolerance • Compensation should be based on risk-adjusted performance
Risk models	• Indispensable tools for variety of reasons, increasingly used for regulatory purposes • But they can never be a substitute for common sense • Require regular improvement in the light of experience and need the complement of sound management judgment to be effective
Liquidity risk manage-ment	• Liquidity risk distinct from risk to capital adequacy • Liquidity risk management to rely on scenario testing • Liquidity risk of insurers is fundamentally different from that of banks
Valuation and risk disclosure	• Renewed market confidence requires accurate valuation and the prompt disclosure • Market-consistent valuation of both assets and liabilities should become the principle that underpins financial information and prudential oversight in insurance • Rating agencies should be brought under supervision • Use of ratings in financial regulation should be curtailed
Group supervision	• Crisis emphasizes the need for international cooperation among regulators • Principle and economic risk-based approach for the supervision of groups needed • Efforts of the IAIS should be strengthened by introducing binding standards that would accelerate regulatory convergence

Source: CRO Forum, April 2009

CFO FORUM

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Rating Agencies shaping risk management

increasing number of publications from rating agencies on ERM……

STANDARD &POOR'S

Insurance Criteria: Refining The Focus of Insurer Enterprise Risk Management Criteria

Moody's Corporation

Moody's Looks At Risk Management & The New Life Insurance Risks

BEST'S RATING Methodology

Insurance

January 25, 2008

Risk Management and the Rating Process for Insurance Companies

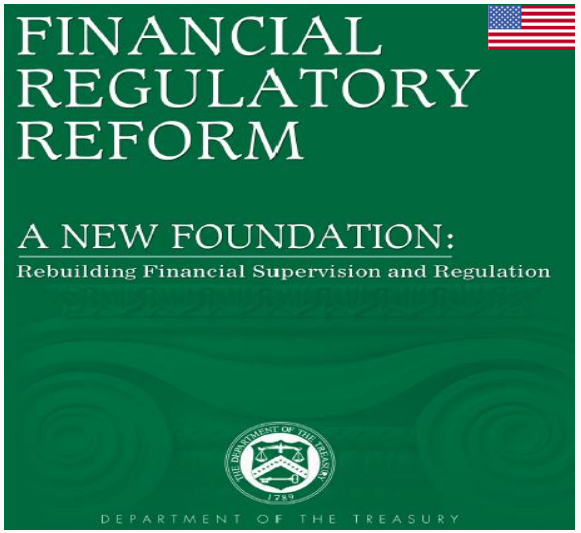
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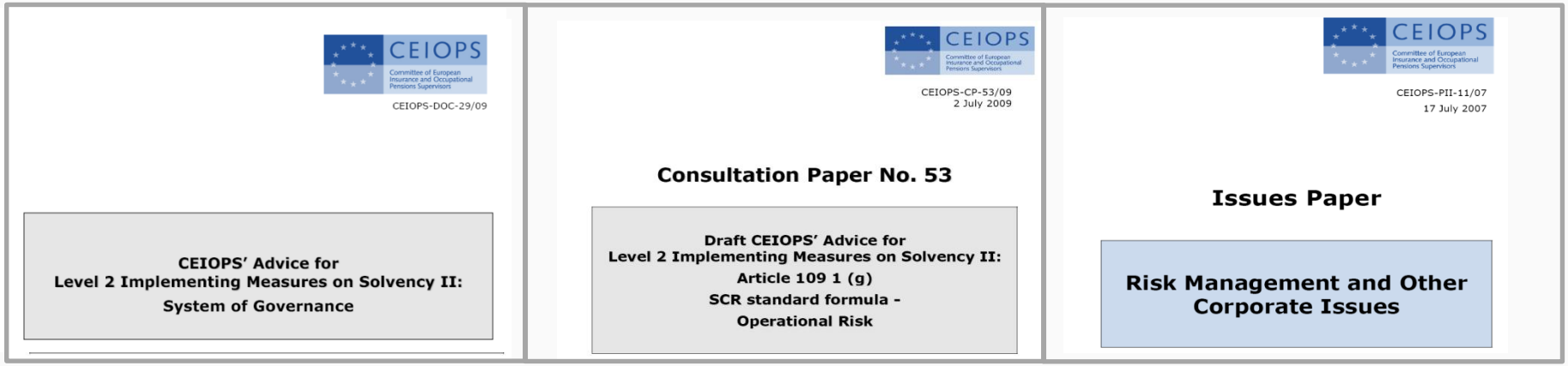
Regulations shaping risk management

focus on Basle III & Solvency II implications…

Basel Basics | A look at the international banking accord under negotiation

UNOFFICIAL NAME	Basel III, which derives from the Swiss city in which the pact is negotiated. The prior two versions were agreed to in 1988 and 2004.	
OVERALL	**The goal:** Require banks to maintain stronger, less-risky financial profiles	**The hitch:** Implementation of the rules is likely to take up to a decade
CAPITAL	**The goal:** Require banks to hold thicker capital cushions to insulate them from losses	**The hitch:** Countries are haggling over definitions and seeking exemptions for certain banks
LIQUIDITY	**The goal:** Require banks to hold more long-term, stable funding	**The hitch:** The proposal could cause huge funding shortfalls for banks world-wide
LEVERAGE	**The goal:** Require banks to cut down on risk-magnifying leverage	**The hitch:** Europe wants individual countries to have discretion, rather than a global rule

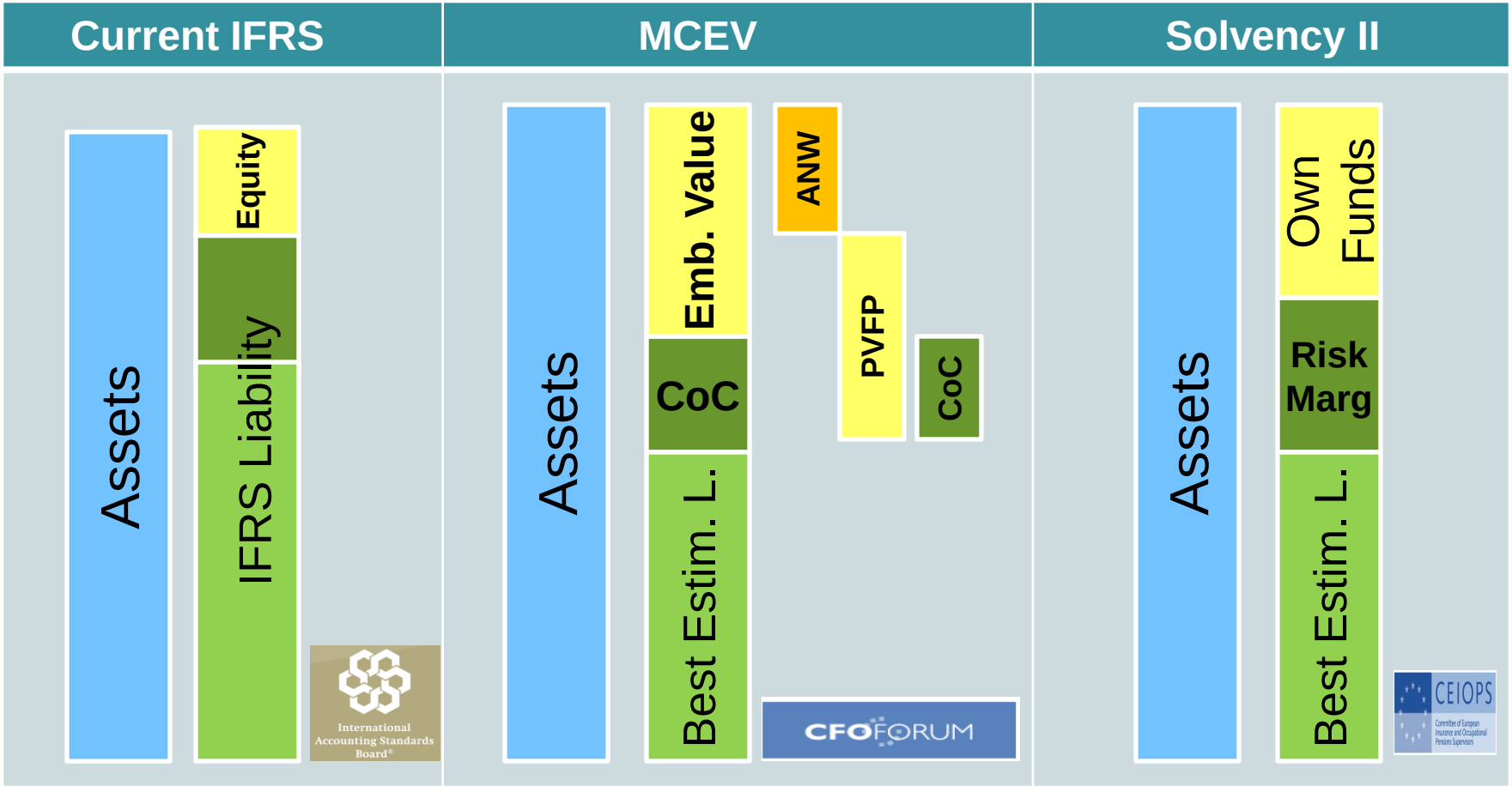




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Regulations shaping risk management

IFRS, MCEV & Solvency II – convergence to economic basis?



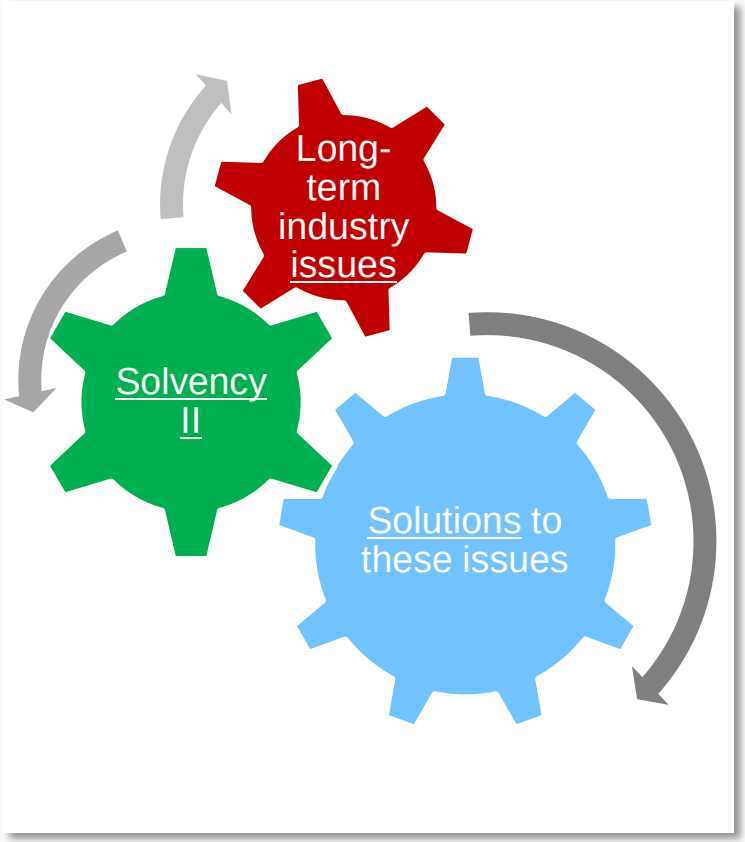
Current IFRS	MCEV	Solvency II
• Liability incl. implicit margin (PAD)	• CoC = Explicit risk margin	• Risk Margin ≈ CoC (same method ≠ parameter)
• No gain at inception	• Gain at inception (VANB)	• Gain at inception
• Lock in	• Current estimates	• Current estimates

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Regulations shaping risk management

implications of Solvency II for the insurance industry…

Solvency II acts as a catalyst…



…to resolve some old industry issues

Example: Primary life insurance

- Issue: Long-term guarantees and options often not properly priced and hedged
- Solvency II: Requires capital for mismatch; demonstrates where return is insufficient for risk taken
- Solution: Improving ALM, product design

Example: Reinsurance

- Issue: Reinsurance programmes not always optimal in terms of risk transfer
- Solvency II: Reinsurance matters for capital requirements
- Solution: Impact of reinsurance structures can be measured and optimised

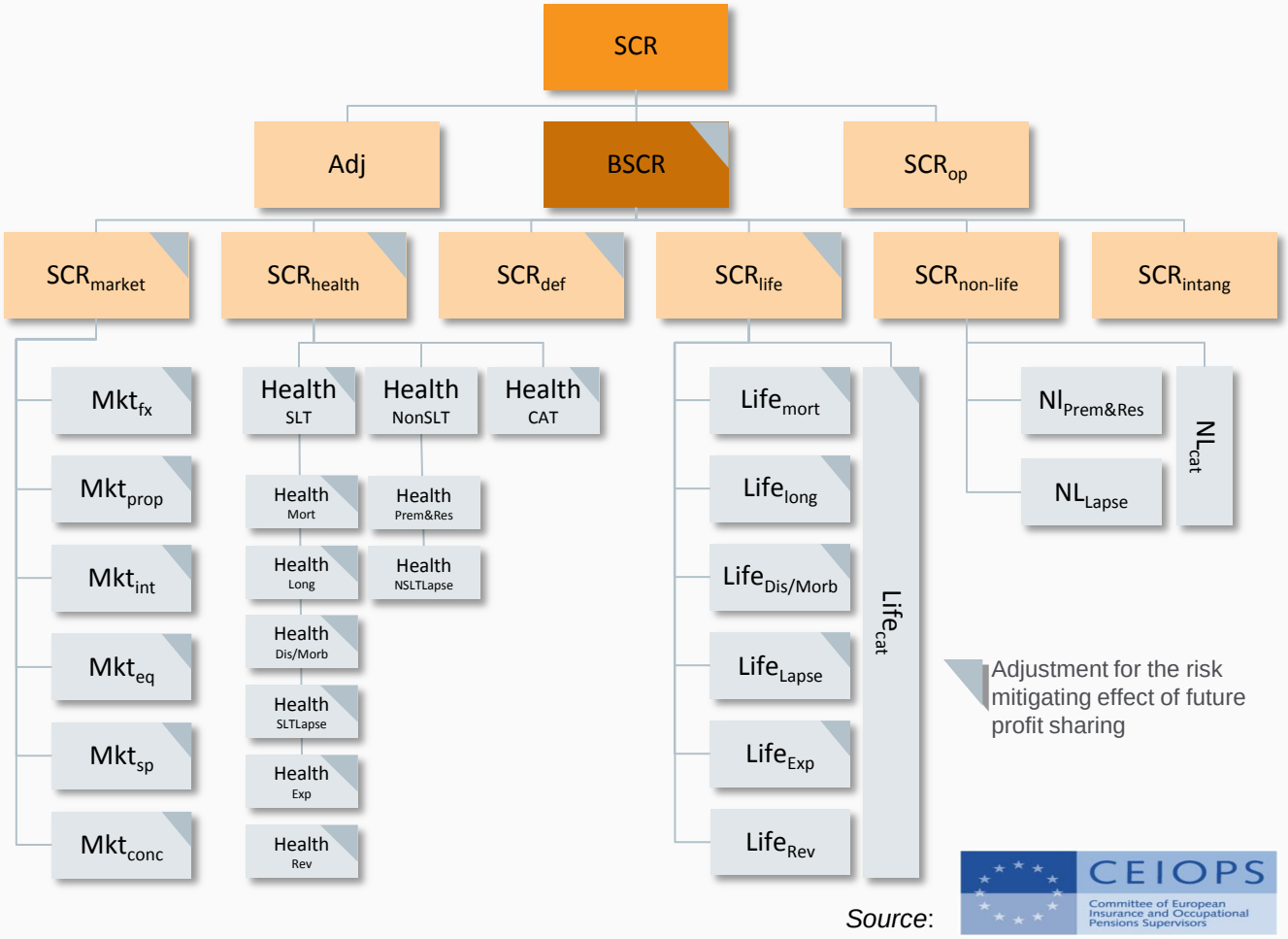
Example: Investments

- Issue: Insufficient profitability of underwriting compensated by taking high investment risks
- Solvency II: Risk capacity places limit on this strategy
- Solution: Focusing on profitable underwriting

Solvency II brings more discipline to the industry

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ERM Step #2: Risk Identification…



Source:

CEIOPS
Committee of European Insurance and Occupational Pensions Supervisors

SCR: Solvency Capital Requirement

Adj: Adjustments for loss absorbing effects

BSCR: Basic Solvency Capital Requirement

SCR$_{op}$: Operational risk

Market (SCR$_{market}$)
- Currency (Mkt$_{fx}$)
- Property (Mkt$_{prop}$)
- Fixed interest (Mkt$_{int}$)
- Equity (Mkt$_{eq}$)
- Concentrations (Mkt$_{conc}$)
- Spread risk (Mkt$_{sp}$)

Health (SCR$_{health}$)
- Similar to life techniques (Health$_{SLT}$)
- Non-Similar to life techniques (Health$_{NonSLT}$)
- Catastrophe (Health$_{Cat}$)

Counterparty/Default (SCR$_{def}$)

Life (SCR$_{life}$)
- Mortality (SCR$_{mort}$)
- Longevity (SCR$_{long}$)
- Disability / Morbidity (SCR$_{Dis/Morb}$)
- Lapse (SCR$_{Lapse}$)
- Expense (SCR$_{mort}$)
- Catastrophe (SCR$_{Exp}$)
- Revision (SCR$_{Rev}$)
- Catastrophe(SCR$_{Cat}$)

Non-Life (SCR$_{non-life}$)
- Premium and Reserve (NL$_{pr}$)
- Lapse(NL$_{Lapse}$)
- Catastrophe (NL$_{cat}$)

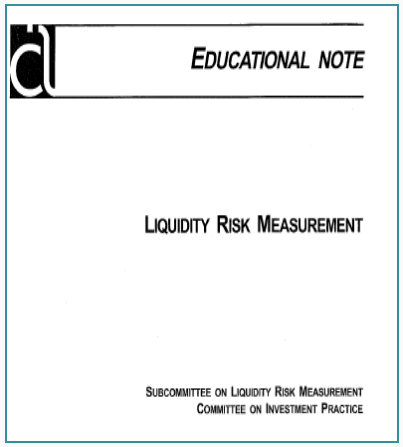
Intangible assets risks (SCR$_{intang}$)

2. ERM Risk Identification *(AFE Reference)*	❑ AAA: Mapping of Life Insurance Risks, Report to NAIC

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APPENDIX: Liquidity Risk References

Liquidity Risk Identification	Liquidity Risk Quantification	Liquidity Risk Management
Forced selling & margin calls	Stress testing	sizing of liquid versus liiliquid positions
Inability to satisfy liabilities	Scenario analysis	cash flow management
cashflow strain run on the bank hidden callable options	liquidity ratios; scenarios; etc.	diversification surrender charges contract design
AFE References	❑ Green: General American Life Can't Pay Investors, Looks at Suitors ❑ CIA: "Liquidity Risk Measurement," CIA Educational Note ❑ Brunnermeier: Deciphering the Liquidity and Credit Crunch ❑ SoA: Dynamic Financial Condition Analysis Handbook, Ch. 1 (background only), 8 and Appendix A	

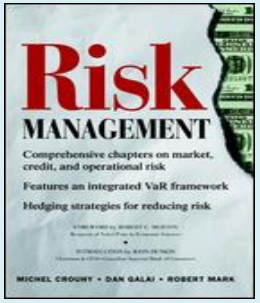






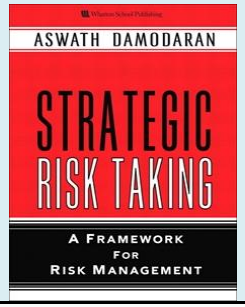


APPENDIX: Operational Risk References

Operational Risk Identification *The risk of direct or indirect loss resulting from inadequate or failed* internal processes, people, systems or from external events…	❑ Market Conduct (e.g., sales practices) ❑ HR risk, e.g., productivity, talent management, employee conduct ❑ Process risk, e.g., supply chain, R&D ❑ Technology risk, e.g., reliability, external attack, internal attack ❑ Judicial risk, e.g., litigation ❑ Compliance risk, e.g., financial reporting ❑ Internal and External fraud ❑ Execution risk ❑ Governance risk ❑ Supplier/partner risk ❑ Disaster risk, e.g., natural disaster, man-made disaster ❑ MODEL Risk
Operational Risk Quantification	Economic Capital (diificult)
Operational Risk Management	COSO Guidelines SoX …
AFE References 	❑ Shah: Insurance OP Risk: The Big Unknown ❑ SoA: "Operational and Reputational Risks: Essential Components of ERM", Risk Management, Dec 2006. ❑ SoA: Enterprise Risk Management Specialty Guide, 2006 ❑ Rebonato : "Theory and Practice of Model Risk Management" ❑ Crouhy, Galai, & Mark, Risk Management, 2001 Ch. 13, Mananging Operational Risk Ch. 15, Model Risk ❑ G30: Derivatives: Practice and Principles (pp. 13-24 and 43-52) ❑ Khan: "Why COSO Is Flawed," Jan 2005.

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APPENDIX: Strategic Risk References

Strategic Risk Identification *The risk of direct or indirect adverse impact on the operating results or value of the business unit as a result of the strategies not being optimally chosen, implemented or adapted to changing conditions…*	❑ Product sustainability risk ❑ Distribution sustainability risk ❑ Consumer preferences and demographics ❑ Geopolitical risk ❑ Competitor risk ❑ External relations risk ❑ Legislative/Regulatory risk ❑ Reputation Risk ❑ Sovereign risk
Strategic Risk Quantification	ERC, MCEV, RAROC, IRR, etc.
Strategic Risk Management	Risk Analysis & Quantification Tables
AFE References 	❑ HBR: "Countering the Biggest Risk of All" by Slywotzky and Drzik, April 2005 ❑ "Moody's Looks at Terrorism Risk in the U. S. Life Insurance Industry," ❑ Damoradan, Strategic Risk-Taking, 2006(?) • Ch. 9, Risk Management: The Big Picture • Ch. 10, Risk Management: Profiling and Hedging • Ch. 11, Strategic Risk Management • Ch. 12, Risk Management: First Principles

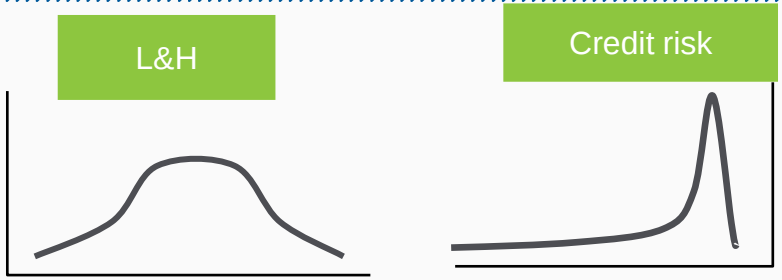
Type of risk	Severity (% of earnings at stake)	Probability	Expected timing in years 1	2	3	4	5	Changing probability over time
Industry								
Margin squeeze	80%	20%						Increasing
Rising R&D/capital expenditure costs	10%	40%						Increasing
Overcapacity								
Commoditization								
Deregulation								
Increased power among suppliers								
Extreme business-cycle volatility								
Other:								
Technology								
Shift in technology	60%	20%						Increasing
Patent expiration	10%	100%						Constant
Process becomes obsolete								
Other:								
Brand								
Erosion	40%	20%						Increasing
Collapse	70%	10%						Constant
Other:								
Competitor								
Emerging global rivals	40%	20%						Increasing
Gradual market-share gainer								
One-of-a-kind competitor	30%	5%						Increasing
Other:								
Customer								
Customer priority shift	20%	60%						Increasing
Increasing customer power	10%	50%						Increasing
Overreliance on a few customers								
Other:								
Project								
R&D failure	10%	80%						Constant
IT failure								
Business-development failure								
Merger or acquisition failure								
Other:								
Stagnation								
Flat or declining volume	20%	80%						Increasing
Volume up, price down								
Weak pipeline								
Other:								

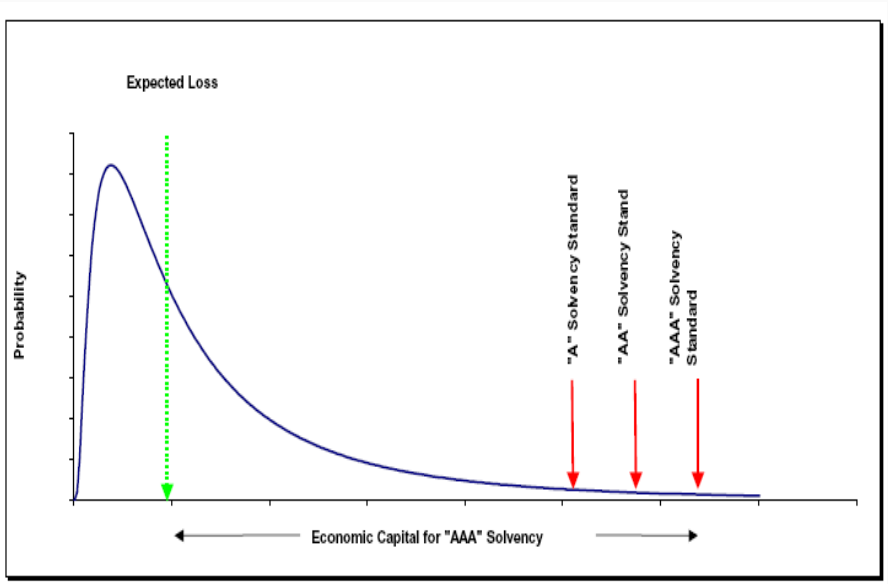
Harvard Business Review OnPoint ARTICLE

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ERM Step #3: Risk Quantification…

- key modern technique is **E**conomic **R**isk **C**apital (**ERC**)
- using **VaR**; **CTE**; etc, techniques
- increasingly **stochastic** modeling but also scenarios & factors
- VaR is well established for financial risks (Jorian, etc.)
- one year view sometimes difficult to apply for business with long term **insurance** risks
- Also use "**Greeks**" to quantify risk inherent in hedging platforms





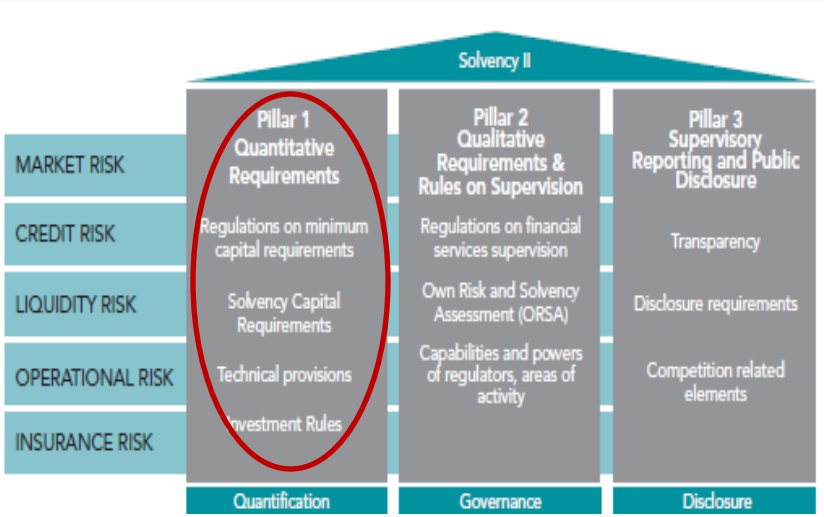
3. ERM Risk Quantification ***(AFE References)***	❑ SoA: Economic Capital for Life Insurance Companies, Monograph, 2008 ❑ Artzner: Coherent Risk Measures, NAAJ ❑ Song Zhang: "Risk Aggregation for Capital Requirements Using the Copula Technique", RM Newsletter ❑ CSFB: Credit Portfolio Modeling Handbook – Ch. 4 "Demystifying Copulas" ❑ SoA: "Actuaries, Stochasticity and Risk Management: The Real Lessons of LTCM

Risk Quantification under Solvency II

Pillar 1…

- various **levels** of capital modeling:
  - Full Internal Model (IM)
  - Standard Formula & Partial IM
  - Standard Formula with USP
  - Standard Formula
  - Simplification – for small risks

- CEIOPS pointed out the following issues post crisis:
  - due to the highly correlated nature of events caused by the crisis, the **standard formula** for SCR needs to be **revised**
  - **tail risks** tend to correlate in times of stress
  - **diversification** benefits may have been overstated in the recent past
  - risks considered less relevant previously (e.g. **liquidity**, **operational risks**) have hit banks in an unprecedented way
  - not all **own funds** are of the same **quality**; only high-quality capital elements can truly be a first line of defence
  - **approval** for IM's now more demanding…



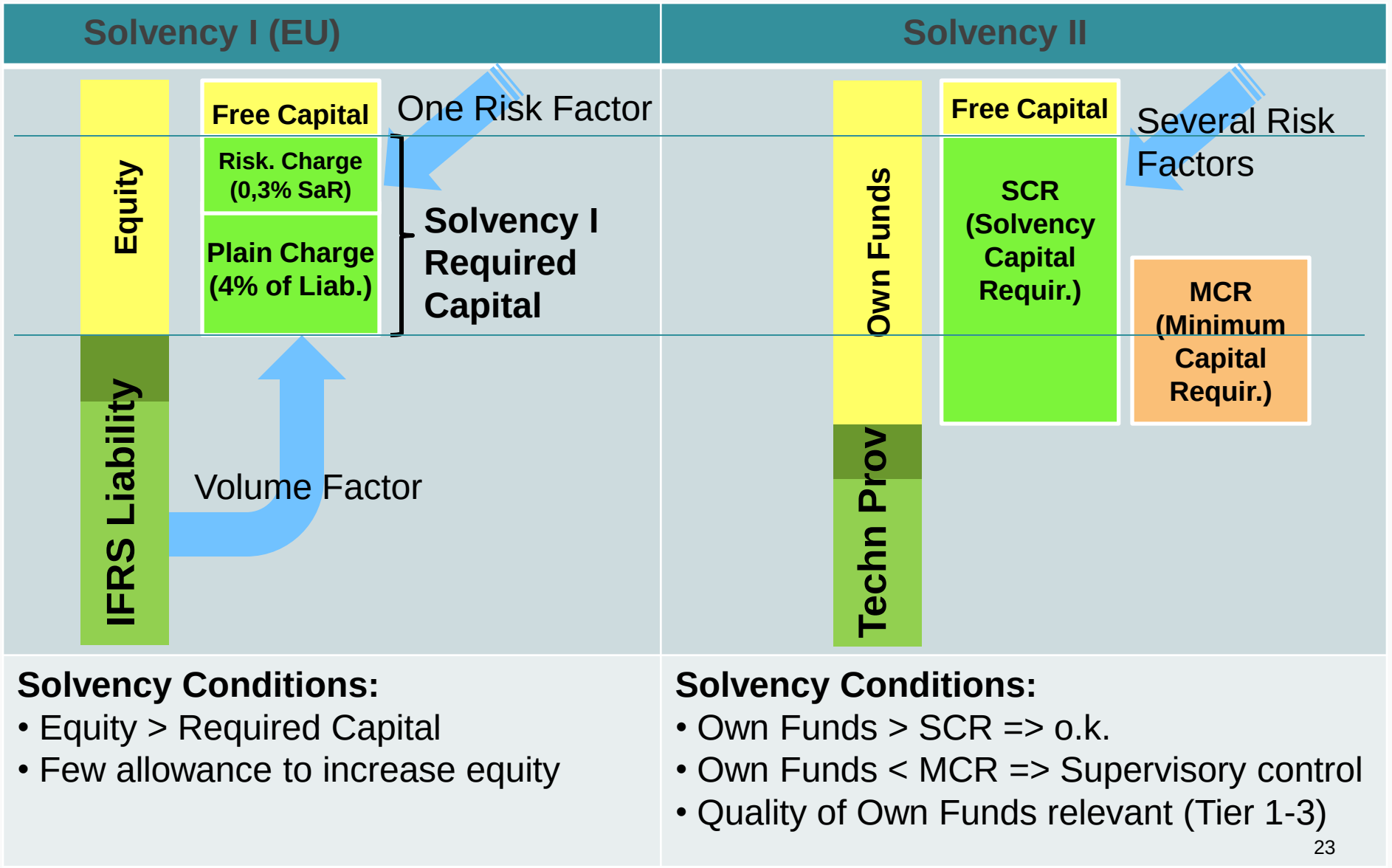
	What is it?	What does it include?	Who develops?	Who decides?
Level 1	Solvency II Directive	Overall framework principles	European Commission	European Parliament +Council Ministers
Level 2	Implementing measures	Detailed implementation measures	European Commission	European Commission, but with consent of EIOPC and European Parliament
Level 3	Supervisory Standards	Guidelines to apply in day-to-day supervision	CEIOPS	CEIOPS
Level 4	Evaluation	Monitoring compliance and enforcement	European Commission	European Commission

Source: CEIOPS Reports

Risk Quantification - Solvency II, Pillar 1

solvency requirements…

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Solvency Conditions:

- Equity > Required Capital
- Few allowance to increase equity

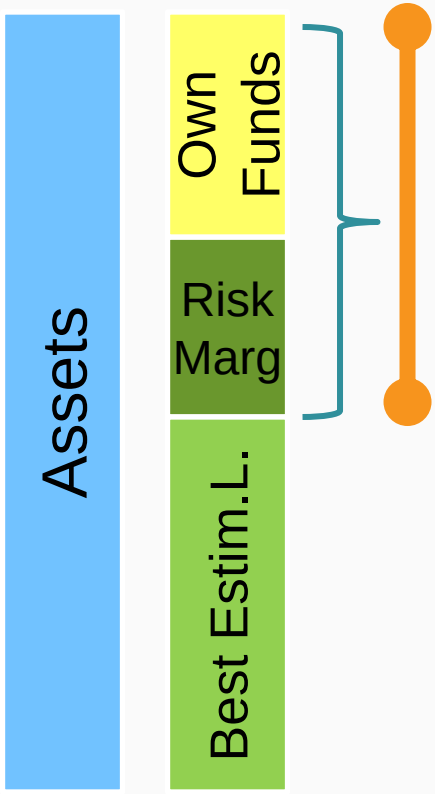
Solvency Conditions:

- Own Funds > SCR => o.k.
- Own Funds < MCR => Supervisory control
- Quality of Own Funds relevant (Tier 1-3)

Risk Quantification - Solvency II, Pillar 1

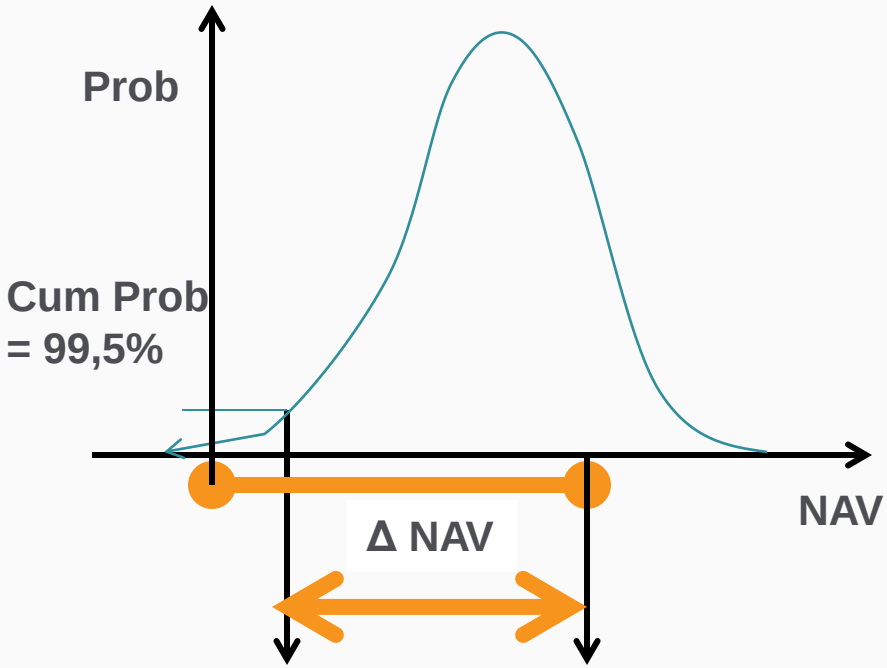
change of Net Asset Value determines the SCR…

The Solvency II Economic Balance Sheet



Net **A**ssets **V**alue =
Assets
minus
Best Estimates
Liabilities

Distribution of NAV
=> Solvency Capital Requirement



ΔNAV =
NAV (@ balance sheet date)
minus
NAV (@ worst 1 year scenario)

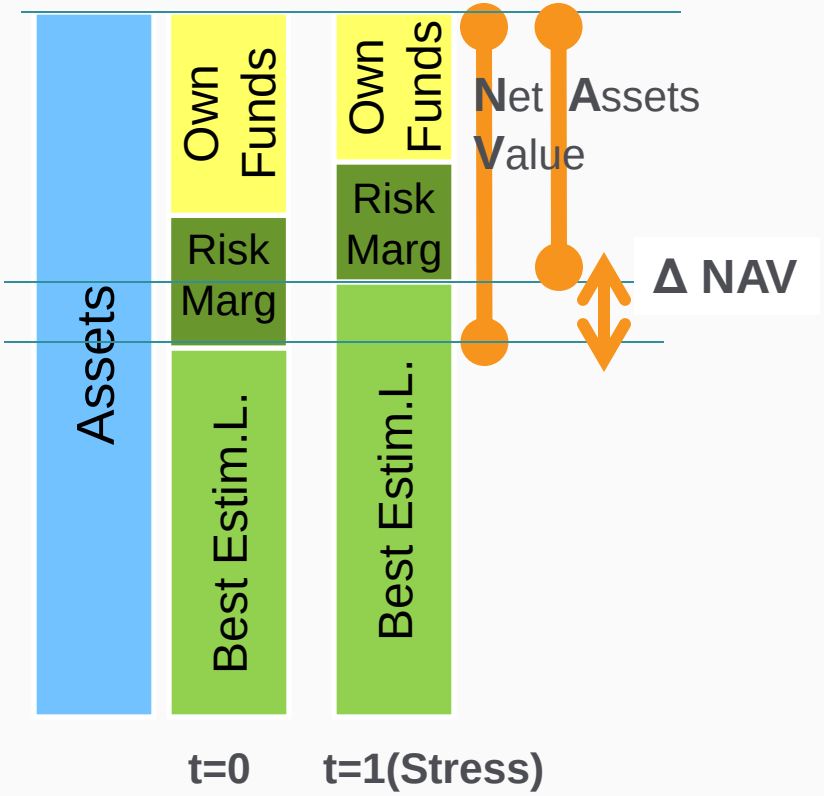
SCR = Δ NAV @ 99,5% VaR

Risk Quantification - Solvency II, Pillar 1

change of Net Asset Value - cases 1 & 2

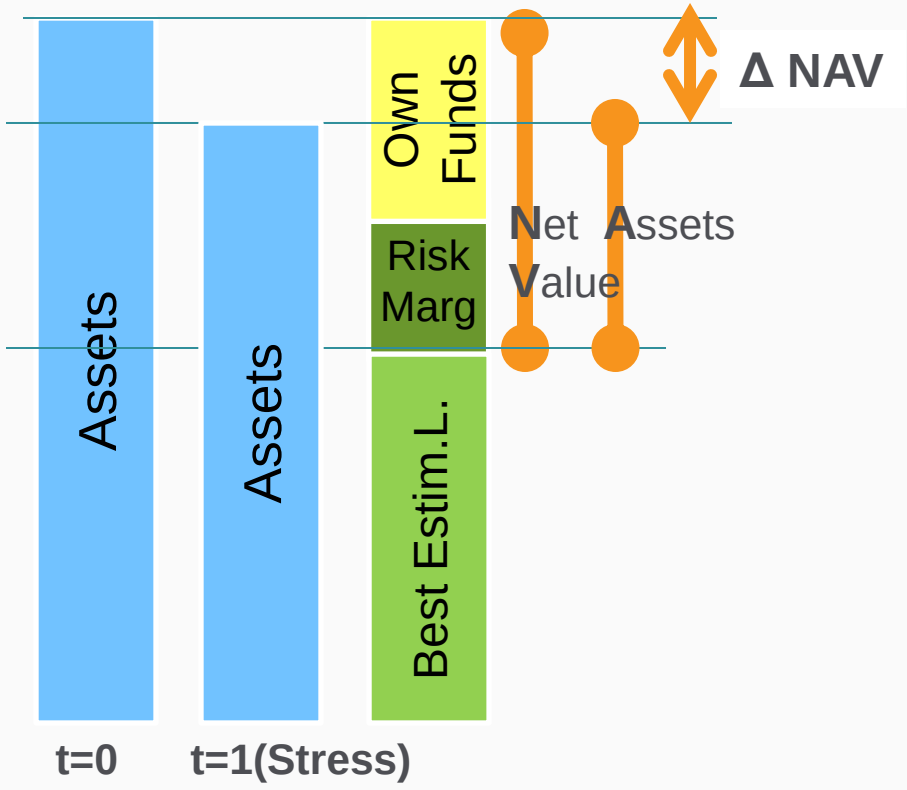
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Case 1 - Pure Liability Stress



Example: **Mortality Risk**

Case 2 - Pure Asset Stress



Example: **Equity Market Risk**

Risk Quantification - Solvency II, Pillar 1

QIS 4 results…

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Solvency II (QIS4 results)	% of SCR	% of UW-Risk
Market Risk	81.7%	
Counterparty Risk	4.7%	
Underwriting Risk	38.7%	100%
Lapse risk		59.1%
Expenses risk		19.9%
Mortality risk		10.2%
Longevity risk		23.9%
Disability risk		9.2%
Catastrophe risk		15.8%
Diversification effects	–25.1%	–38.0%

Solvency II (QIS4 results)	% of SCR	% of Market-Risk
Market Risk	81.7%	100%
Interest rate risk		48.5%
Equity risk		50.8%
Spread risk		16.6%
Property risk		10.2%
Concentration risk		4.8%
Currency risk		7.5%
Counterparty risk	4.7%	
Underwriting risk	38.7%	
Diversification effects	–25.1%	–38.3%

Source: JP Morgan European Equity Research, Jan 19 2010
CEIOPS Report on QIS4 for Solvency II, page 193

Risk Quantification - Solvency II, Pillar I

scenarios for Standard Formula approach…

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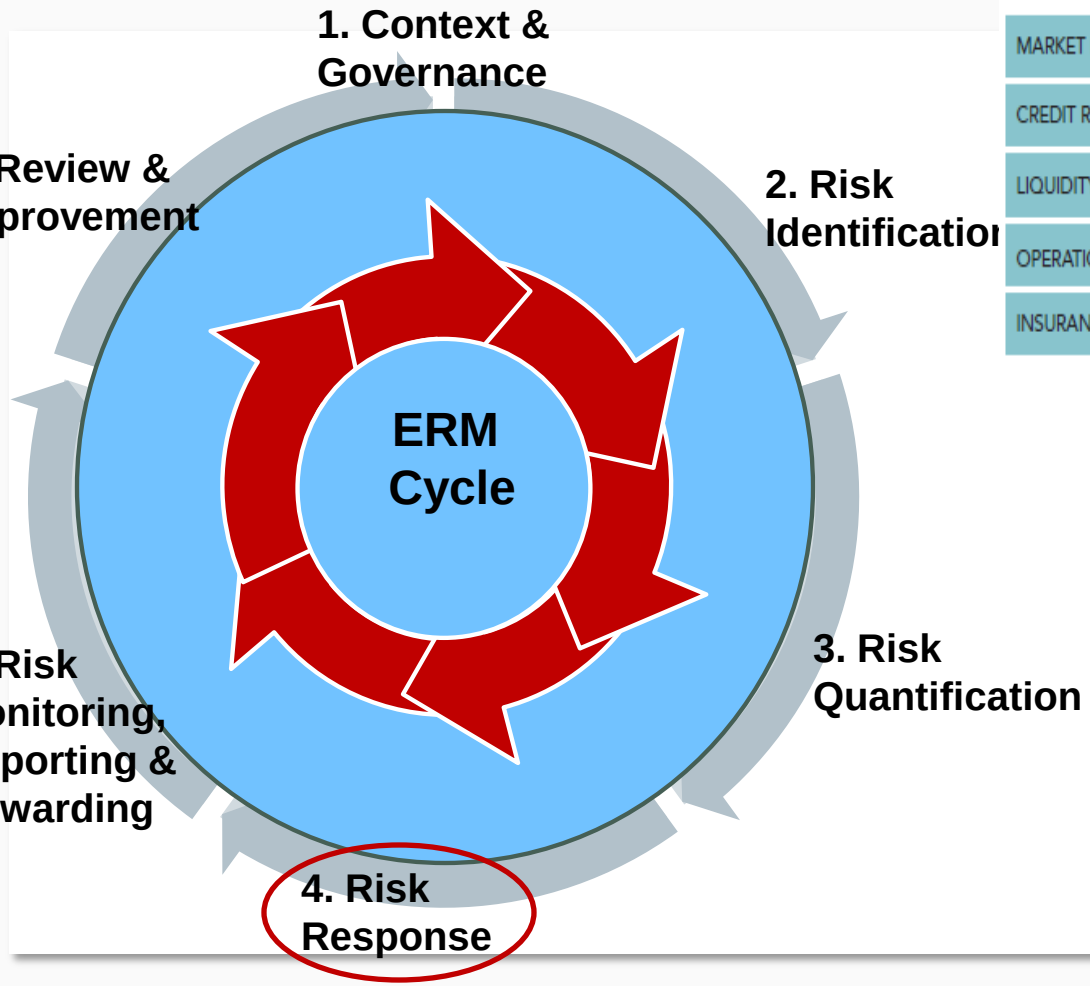
Sub module	QIS4	CEIOPS Level 2 (Oct 2009)	IM 24 (draft June 2010)
Mortality	+10% mortality rate	+15% mortality rate	As CEIPOS Level 2 Advice
Longevity	- 25% mortality rate	As QIS 4	- 20% mortality rate
Disability/ Morbidity	1st year: + 50% disability rate Subs. yrs. + 25% disability rate	1st year: + 50% disability rate Subs yrs.:+ 25% disability rate - 20% recovery rate	1st year + 35% disability rate Subs yrs.: + 25% disability rate - 20% recovery rate
Lapse	+50% lapse rate -50% lapse rate Mass lapse event 30% with positive surrender strain	As QIS 4 Additional: 70% for non-retail with positive surrender strain	As CEIPOS Level 2 Advice
Expense	+ 10% future expense + 1% p.a. expense inflation rate	As QIS 4	As CEIPOS Level 2 Advice
Revision	+3% annual amount payable (in practice immaterial)	As QIS 4	As CEIPOS Level 2 Advice
Catastrophe	+1.5 ‰ mortality rates over following year	As QIS 4	As CEIPOS Level 2 Advice

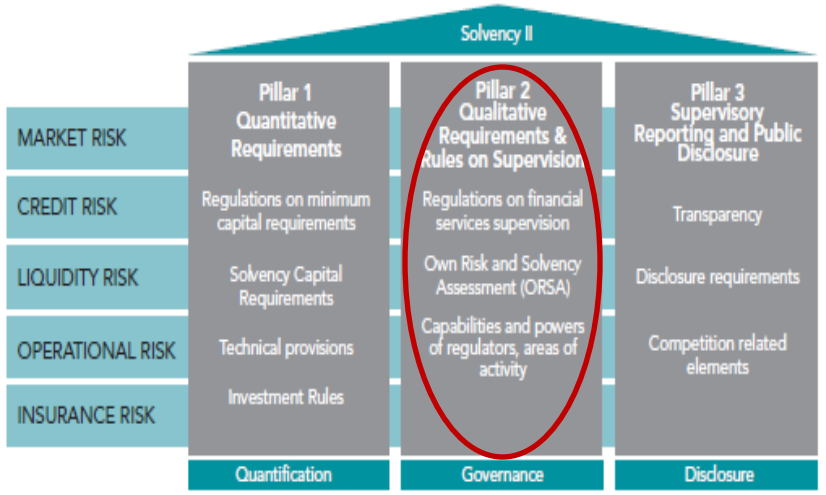
ERM Step #4: Risk Response

Pillar 2 - qualitative requirements under Solvency II…

4. Risk Response

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- **resources** needed to comply with the qualitative requirements are often underestimated!
- some European Regulators expect that approx. 75% of the **effort** of a certification process will be spent on Pillar 2 ...

Risk Response - Solvency II, Pillar 2

the basics…

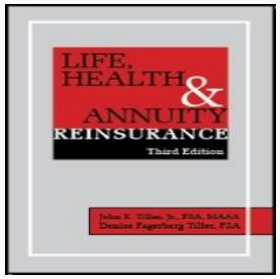


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Avoid	not accept the risk - e.g. exit the business
Accept	accept the level of risk and take no further action to minimize it further
Transfer	transfer the risk - e.g. to a reinsurer or the capital markets (securitization)
Mitigate	take action to manage risk through natural hedges or other controls

	Reinsurance	ILS
Credit risk	Will depend on rating of the reinsurer	Cat bonds avoid credit risk to the issuer
Basis risk	None – as reinsurance is based on company's actual portfolio	Significant – as insurer pays own losses but receives payoff on index
Moral Hazard	Primary firm may be lax in uw – reinsurer needs to align interests	Defining ILS on index controls moral hazard
Size & Costs	Could be done for smaller deals & on a less costly basis.	Need to be of a certain size to be economically viable. Costly.
Capacity	Limited capacity	Independent capacity
Price Dependency	Prices may depend on market cycle	Limited dependency on insurance market cycle

4. Risk Response ***(AFE References)***	**Reinsurance**	❑ Tiller, Life, Health and Annuity Reinsurance, 3rd Edition., 2005, Ch. 5, "Advanced Methods of Reinsurance" Ch. 16, "Assumption" Ch. 17, "Special Purpose Reinsurance Companies"
	Securitization	❑ Wharton: Securitization of Life Insurance Assets and Liabilities



Risk Response - Solvency II, Pillar 2

the system of governance



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Principle oriented Solvency II framework

Management body is fit and proper

Responsibility of Management: business and risk strategy

Principle of proportionality

Governance Requirements

- Transparent organizational structure
- Clear segregation of responsibilities
- written policies
- Regular review

Internal Control System

and Compliance Function

Risk Management System

- Quantitative requirements
- Risk Management Function
- Contingency plans
- Internal model

ORSA

Actuarial Function

Outsourcing

Internal Audit

Information, documentation, reports

Risk Response - Solvency II, Pillar 2

supervisory practices…

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Supervisory practices (Pillar 2)

Governance processes of the insurance company

- Business organization
- outsourcing
- Fit and proper of management and key personalities
- Early warning system
- **Risk management**
- **"Own Risk & Solvency Assessment" (ORSA)**
- **Actuarial function**
- **Internal controls**

Dialogue

Control

Supervisory review process (SRP)

Control and review of processes to fulfill all rules and regulations

Control and review of Governance System

Review of companies' risk situation and risk management

SRP final Review

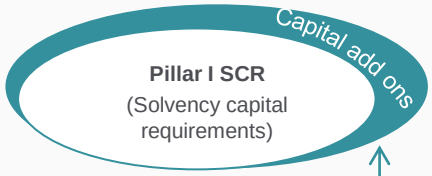
Supervisory review of continuous fulfillment of regulatory requirements

Without complaint

With complaint

Supervisory Intervention:
- Correction of drawbacks
- Change of admitted assets (Quantity / quality)
- Fully / partial internal model

certain exceptional cases



Harmonization of supervisory processes

- Intervention areas
- Cooperation of supervision authorities
- Supervisory practices
- Supervisory tools
- Supervision authorities
- Control of expertise
- Peer Reviews
- Authorization of new insurance companies
- Enlargement of business areas
- Further authorizations
- Continuous supervision, on site control

Source: BaFin: Solvency II-Conference, Wasserwerk, Bonn (20th of June 2007)

Risk Response - Solvency II, Pillar 2

risk management & actuarial function…



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Supervisory practices (Pillar 2)

Governance processes of the insurance company

Business organization

Early warning system

outsourcing

Risk management

Fit and proper of management and key personalities

"Own Risk & Solvency Assessment" (ORSA)

Actuarial function

Internal controls

Risk Management (Art. 44) – must have an effective risk management system…

- comprising strategies, processes and reporting procedures ➔ monitor, manage and report the risks on a continuous basis.
- well integrated in the organizational structure
- contain contingency plans
- cover all material risks and inform about risk mitigating techniques
- implement an independent risk management function
- for partial or internal model: a risk modelling function needed - design, implementation, testing, validation, documentation and for the integration of the internal model in the risk management system (use test)!

Actuarial function (Art. 48) – must have an effective actuarial function…

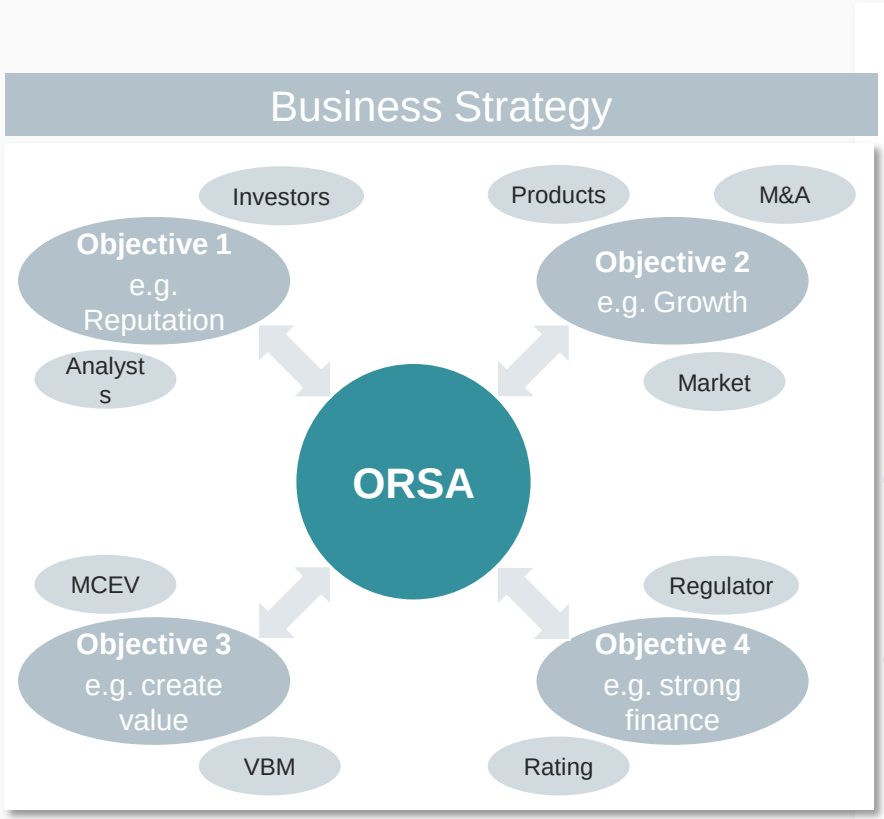
- understanding of the stochastic nature of the business (risk, finance, ALM) and the use of actuarial methods (probabilities of insurance risks, statistical methods, risk mitigation, discounted cash flows etc.)
- assessment of: underwriting and investment policy; risk mitigation techniques; claims management procedures; appropriateness of methods, models, assumptions and sufficiency and quality of the data used in the calculation of technical provisions
- comparison of the best estimate against experience
- actuarial function shall deliver a written report to the management with its findings and recommendations

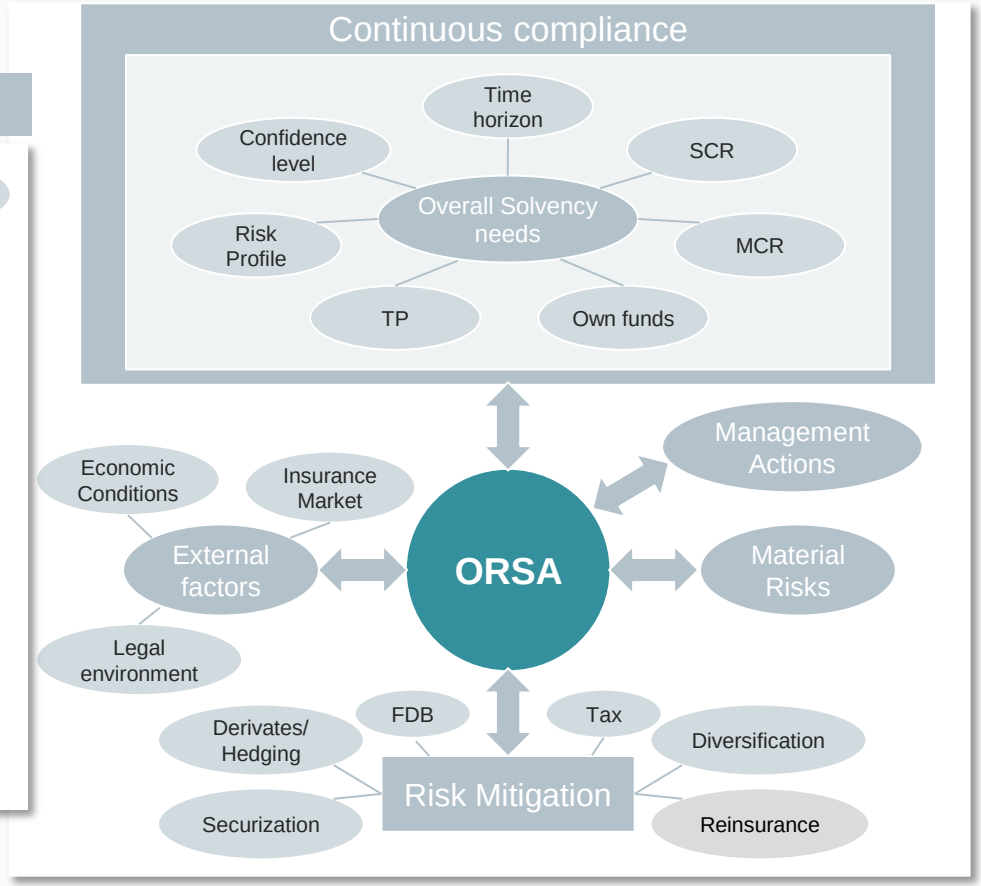
Cardiff Pro Ops

Munich RE

Risk Response - Solvency II, Pillar 2

Art. 45 – Own Risk & Solvency Assessment (ORSA) …





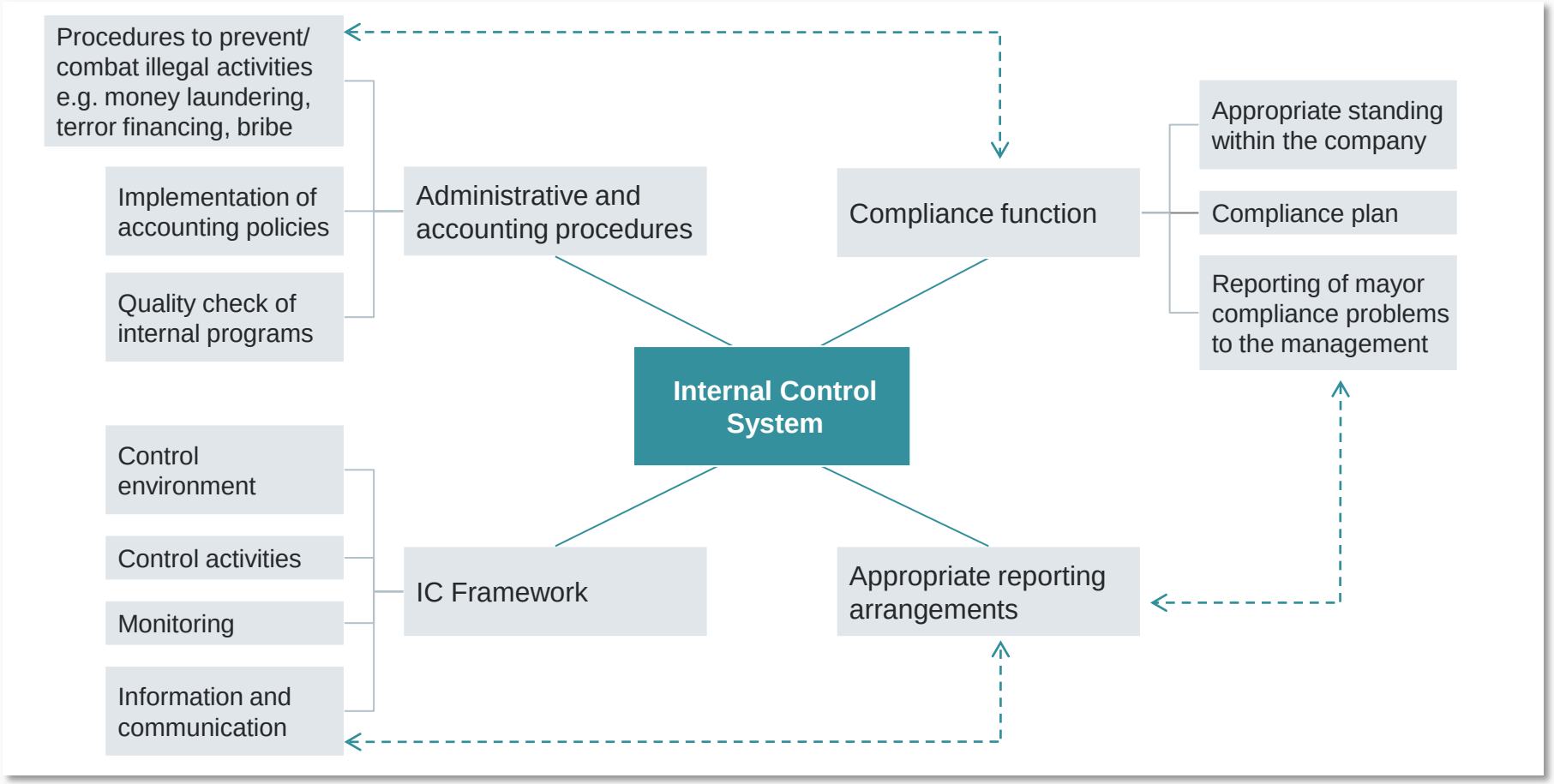
ORSA is the entirety of the processes and procedures employed to identify, assess, monitor, manage and report short and long term **risks** which a company faces or may face and determine the **own funds** necessary to cover the overall solvency needs at all time.

Risk Response - Solvency II, Pillar 2

Art. 46 – Internal Control System…

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Companies should have in place an effective internal control system.



ERM Step #5: Risk Reporting & Rewarding…

Solvency II vs. MCEV & ERC…

- Market Consistent pricing **– risk management** @ point of sale
- **Explicit** risk capital (CoNHR) – based on **ERC** & frictional charges based on **Reg. Capital**
- Also values **options & guarantees** – optionality.
- Value added can be used for **value based** management
- Various **issues** including:
  - risk-free discount rates; liquidity premium
  - stability of results; etc.

VANB = PVFP – CoNHR – PV_TaxCoC – PV_IExpCoC

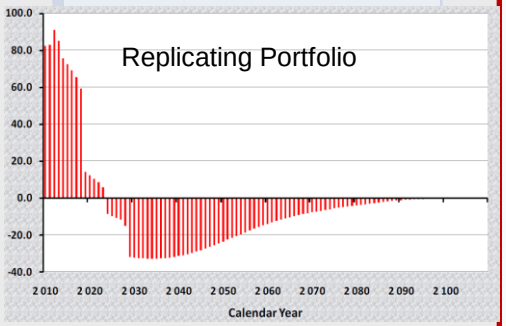
Allowance for non-hedgeable risks

Cost of non-hedgeable risks

Annual charge	Economic risk capital for non-hedgeable risk X Non-hedgeable risk rate
Cost of non-hedgeable risk	Present value of annual charge discounted at risk-free interest rate

Approach to calculating cost of non-hedgeable risk entirely in line with Munich Re's risk capital model

TaxCoC	Reflects the fact that the investment return on the assets backing RC is subject to taxation twice
IExpCoC	Reflects the expenses related to the investment of the assets backing RC

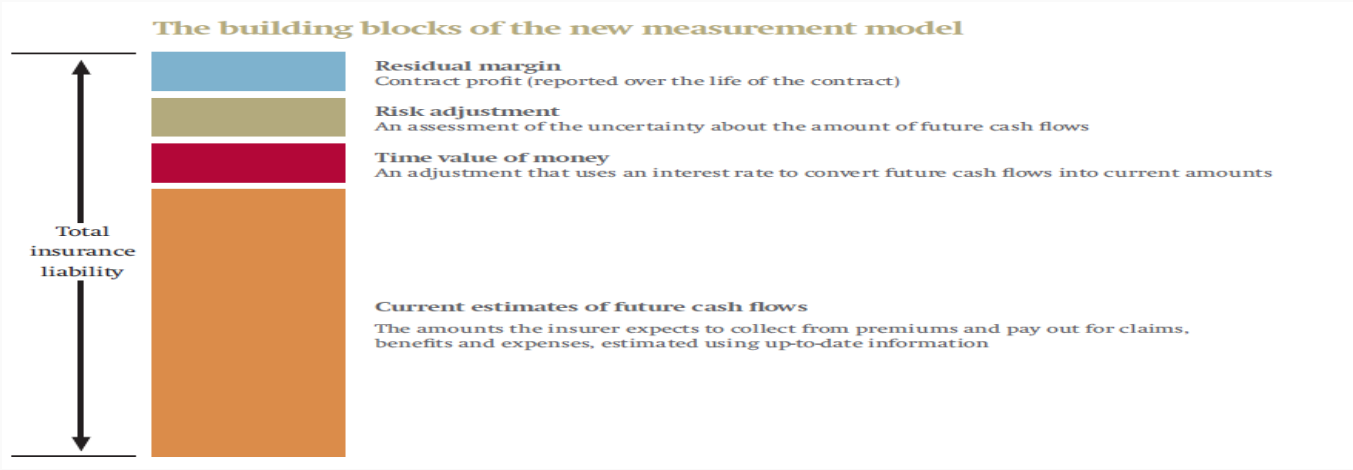


5. Risk Reorting & Rewarding ***(AFE References)***	**Economic Measures**	❑ Stern Stewart: "EVA and Strategy" - ❑ Staple Inn Actuarial Society: "Modern Valuation Techniques," ❑ Babbel: "Fair Value – Financial Economics Perspective", NAAJ ❑ AAA: "Fair Valuation of Insurance Liabilities: Principles and Methods," Monograph ❑ H. Mueller: "An Overview of Embedded Value" , Financial Reporter ❑ Wallace: Performance Measurement Using Transfer Pricing ❑ Crouhy: Ch 14 Capital Alloc. & Performance Measurement ❑ Ho: Total Return Approach to Performance Measuremen ❑ Ho: Risk Mgmt the Total Return Approach ❑ Willis: Maximizing Value
	Accounting Measures	❑ Fridson: Ch. 1-4 & 13 of Financial Statement Anaysis ❑ Tilman: Ch. 24 Acc Stds & Requirements ❑ FASB: Summary of Statement 157 ❑ CIA: Stochastic Techniques Under Canadian GAAP

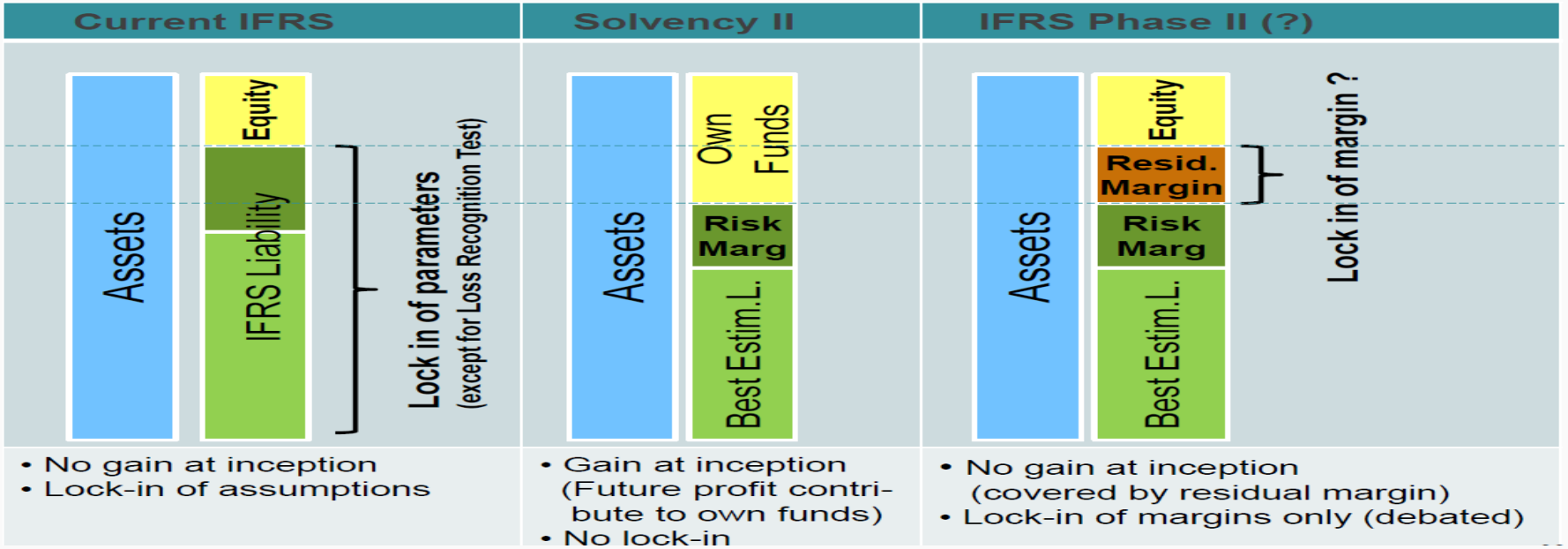
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ERM Step #5: Risk Reporting & Rewarding…

Solvency II vs. IFRS…







ERM Step #5: Risk Reporting & Rewarding…

Solvency II impacts in Asian countries…

other Asia specific issues:

- **subsidiaries** of European companies will also have to comply with Solvency II – Group issues
- many **regulators** in Asia are following Solvency II closely (see below)
- reserving & capital requirements under Solvency II will **increase** for **Par** blocks & **decrease** for **non-par** blocks.
- ERM in Asia will **evolve** over time – need platform of sound pricing & valuation processes.

Country		Regulator	Rules/Principles	Reserves	Mortality	Required Capital
India		IRDA	Principles	GP valuation	BE + PAD	Solv I (2 factor)
Singapore		MAS	Principles	GP valuation	BE +PAD	RBC (5 factor)
Malaysia		Bank Negara	Principles	GP valuation	BE +PAD	RBC (5 factor)
China		CIRC	Rules	1 yr FPT or Zillmer	presecribed	Solv I (3 factor)
HK		OCI	Rules	NP valuation	BE + PAD	Solv I (2 factor)
Taiwan		Insurance Bureau	Rules	FPT	presecribed	Solv I (2 factor)
Korea		FSS	Rules	NP valuation	presecribed	Solv I (2 factor) RBC by March 2011
Japan		FSA	Rules	NP valuation	presecribed	RBC (5 factor)





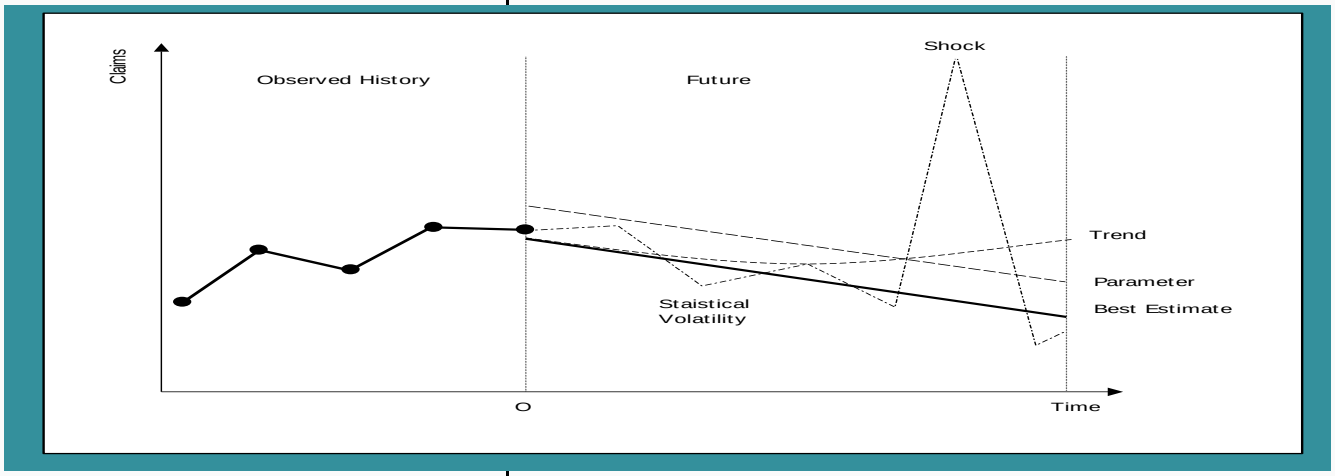
THANK YOU VERY MUCH FOR YOUR ATTENTION

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Chief Pricing Actuary, Life Asia
gmaistry@munichre.com

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APPENDIX: Insurance Risk References

Insurance Risk Identification	Insurance Risk Quantification	Insurance Risk Management
❑mortality risk ❑morbidity risk ❑lapse risk ❑product risk, and ❑embedded options **look at components - level, volatility, trend, shock**	Economic Capital	margins capital reinsurance, securitization
References	❑Atkinson & Dallas, Life Insurance Products and Finance mortality risk, morbidity risk •FE-C169-09: Ch. 3, Pricing Assumptions •FE-C151-08: Ch. 13 Annuity and Investment Products ❑ Max Rudolph: "Influenza Pandemics: Are We Ready for the Next One", RM section newsletter ❑ SoA: "Death Benefit Focused UL", PD newsletter, April 2003 ❑Tilman, Asset/Liability Management of Financial Institutions, 2003 Ch. 16 - Understanding Options Embedded in Insurers' Balance Sheets, by L. Rubin	



APPENDIX: Interest Rate Risk References

Interest Rate Risk Identification	Interest Rate Risk Quantification	Interest Rate Risk Management
Interest rate level	Duration; convexity; VaR; CTE; etc.	Treasuries; Hedge - interest rate derivatives; Treasury & Eurodollar options
Yield curve shape	Key rate durations; scenarios; VaR; etc.	Above + structured notes
Volatility	Volatility durations; VaR	Swap-options; caps; floors; etc.
Credit spread	Spread duration; VaR; holding limits	Interest rate swaps; credit default swaps; etc.
AFE References	❑ Tilman: Asset/Liability Management of Financial Institutions, Ch. 1, The Task of Asset/Liability Management ❑ Briys: Life Insurance Pricing and the Measurement of the Duration of Liabilities (interest rate risk) ❑ Ho: Key Rate Durations: Measures of Interest Rate Risks ❑ SoA: Fixed Annuities in Low Interest Rate Environment", Product Development newsletter, April 2003	❑ Swiss Re: Asset Liability Management for Insurers ❑ Glacy: Asset/ Liability Management, IASA Handbook ❑ Rubin: Hedging with Derivatives in Traditional Insurance Products ❑ Rubin: Long-Term Economic and Market Trends and Their Implications for Asset-Liability Management of Insurance Companies ❑ Basle: Principles for the Management of Interest Rate Risk ❑ Tilman, Asset/Liability Management of Financial Institutions, 2003 - Ch. 25, Implications of Regulatory and Accounting Requirements for Asset/Liability Management Decisions, by Hida, Habayeb, Yetis, & Sethi.

APPENDIX: Other Market Risk References

Market Risk Identification	Market Risk Quantification	Market Risk Management
Equity - guarantees retained by the company	Betas; VaR; CTE; stress testing	hedge, ALM - Equity derivatives dynamic hedging
Commodity	Notional exposures; VaR; stress testing	Commodity futures & options
Foreign exchange	Notional exposures; VaR; stress testing	Forward rate agreements; foreign excahenge options; currency swaps; etc.
Reinvestment	Cash flowprojections; scenario analysis	Forward contracts
AFE References	❑ Brizeli: Variable Annuity – "No Loss" Propositions ❑ Hardy, Investment Guarantees, 2003 (equity risk) Ch.1, Investment Guarantees, Ch. 6, Modeling the Guarantee Liability Ch. 8, "Dynamic Hedging" Ch.9, "Risk Measures" Ch.10, "Emerging Cost Analysis" Ch.11, "Forecast Uncertainty" Ch.11, "Guaranteed Annuity Options" ❑ SoA: "Managing Variable Policyholder Behavior Risk", PD newsletter, March 2005 ❑ SoA: "Whither the Variable Annuity", PD newsletter, November 2003 ❑ Crouhy, Galai, & Mark, Risk Management, 2001 Ch.5, "Measuring Market Risk: The VaR Approach Ch.6, "Measuring Market Risk: Extensions of the VaR Approach ❑ Moody's: Hedging the Bet, Variable Annuity Bells and Whistles. ❑ Evans: Variable Product Hedging Practical Considerations	



APPENDIX: Credit Risk References

Credit Risk Identification	Credit Risk Quantification	Credit Risk Management
Credit spreads	Spread duration; VaR; CreditMetrics	interest rate swaps; credit default swaps; total return swaps
Default risk	Credit ratings; KMV	credit default swaps; structured products; Ratings; capital
Counter-party risk **Receivables**	Credit limits default probabilities	credit derivatives, diversification, concentration limits, and credit support agreements. due diligence and aggregate counter-party exposure limits.
References	❑ Crouhy, Galai, & Mark, Risk Management, 2001 Ch. 7, Credit Rating Systems Ch. 8, Credit Migration Approach to Measuring Credit Risk Ch. 9, The Contingent Claim Approach to Measuring Credit Risk Ch. 10, Other Approaches: The Actuarial and Reduced-Form Approaches to Measuring Credit Risk Ch. 12, Hedging Credit Risk ❑ Tilman, Asset/Liability Management of Financial Institutions, 2003 - Ch. 9, “Measuring and Marking ❑ CSFB Credit Portfolio Modeling Handbook – Ch. 2, "The Default No Default World and Factor Models" ❑ CSFB Credit Portfolio Modeling Handbook – Ch. 9 “Risk measures: how long is a risky piece of string?” ❑ Fitch: Role and Function of Rating Agencies in the Operation of Securities ❑ US Senate: Financial Oversight of Enron: The SEC and Private-Sector Watchdogs (pp. 97-127 only) ❑ C. Smithson, Credit Portfolio Management - Ch. 1, The Revolution in Credit – Capital Is the Key	

