Modelling and Managing Bank Capital post Basel 1

27th October 2005

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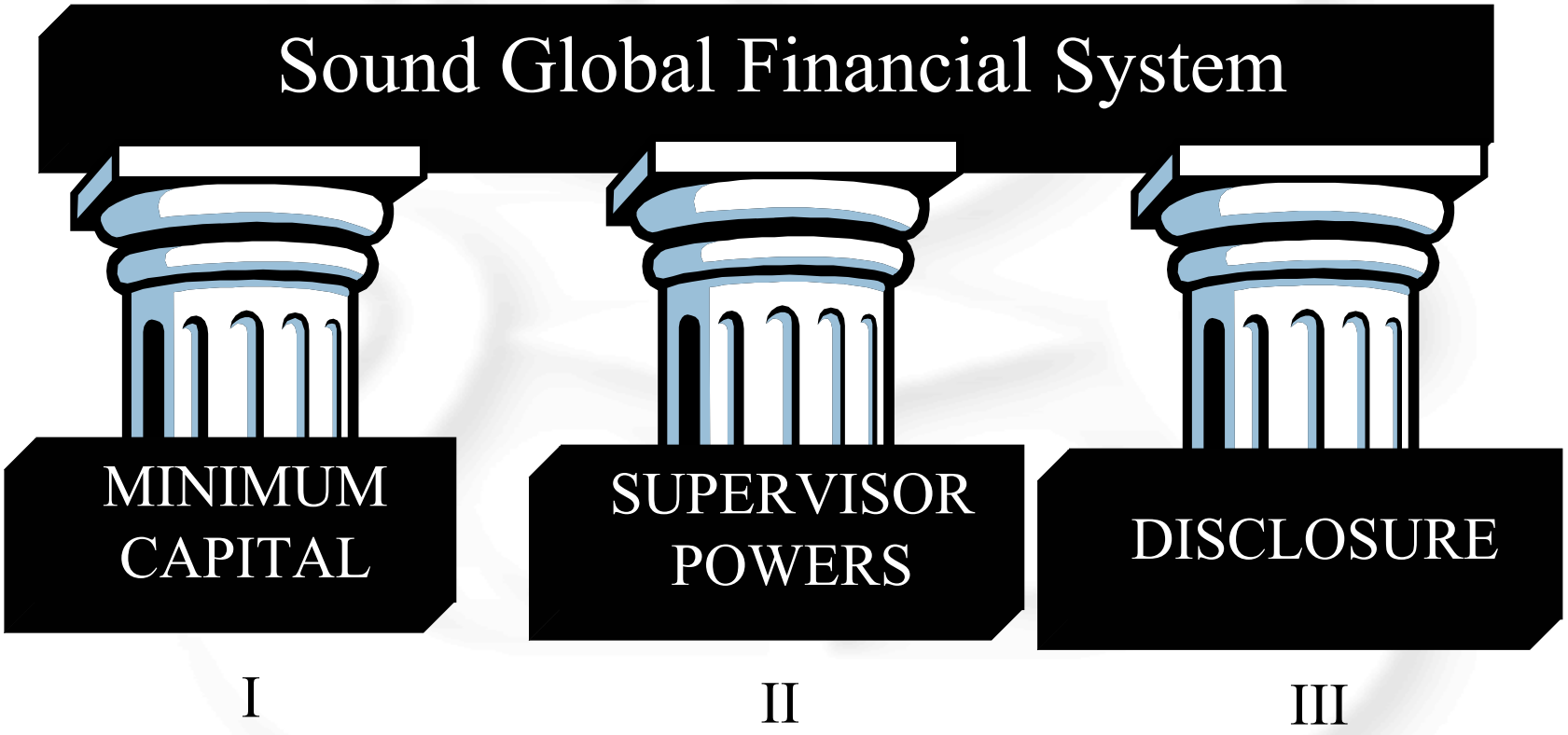
Overview - CRD Three Pillars



Pillar 1 : Minimum Capital Requirements

	Credit Risk	Operational Risk
	Risk calculation	
Simple	Standardised	Basic Indicator
Intermediate	Foundation IRB	Standardised
Advanced	Advanced IRB	Advanced Measurement Approach

Credit Risk: Internal Ratings Based Approach (IRB)

- Allows banks to use internal ratings (credit grades) to set regulatory capital
- An internal rating is an indicator of riskiness of loss in individual credit, due to a borrower's failure to pay as promised.
- Internal Ratings:
  - Probability of Default (PD) - probability of borrower defaulting, estimated over one year
  - Exposure at Default (EAD) - a measure of exposure
  - Loss Given Default (LGD) - the loss on the exposure after the borrower has defaulted
  - Maturity (M) - term of exposure

Credit Risk: IRB Approach Corporates, Banks & Sovereigns

	Measure	Source	Estimate
PD:	Probability of Default	Grading / Scoring	0.03%/4.00%
EAD:	Exposure at Default	Product Type	0-100%
LGD:	Loss Given Default	Security Type	0-50%
M:	Maturity	Term	1 - 5 years

Inputs to capital formula

Capital calculation takes the form

Correlation

$$(R) = 0.12 \times \frac{\left(1 - e^{(-50 \times PD)}\right)}{\left(1 - e^{-50}\right)} + 0.24\left[\frac{\left(1 - e^{(-50 \times PD)}\right)}{\left(1 - e^{-50}\right)}\right]$$

Maturity adjustment

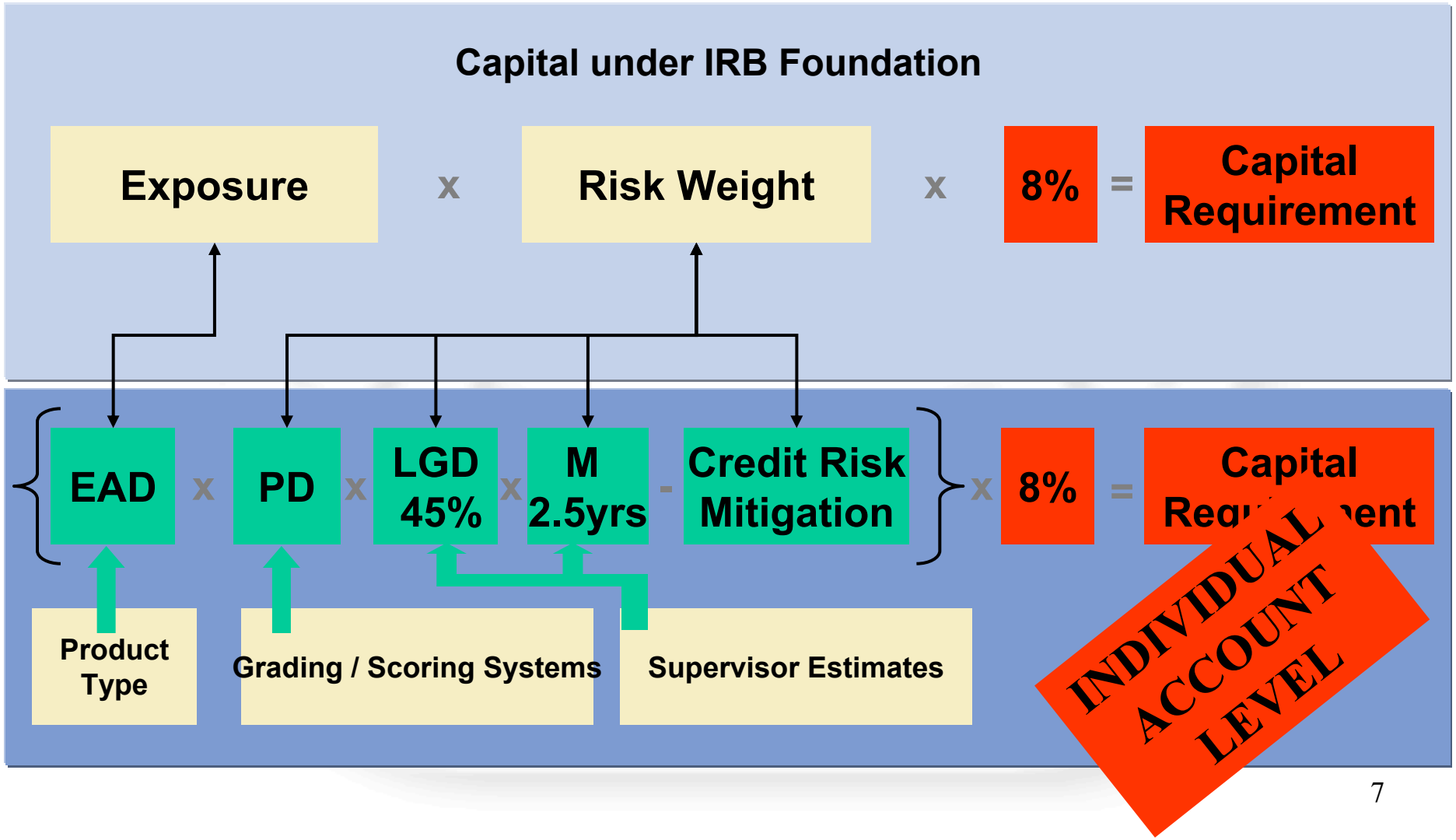
$$(b) = \left(0.11852 - 0.05478 \times \ln(PD)\right)^2$$

Capital requirement

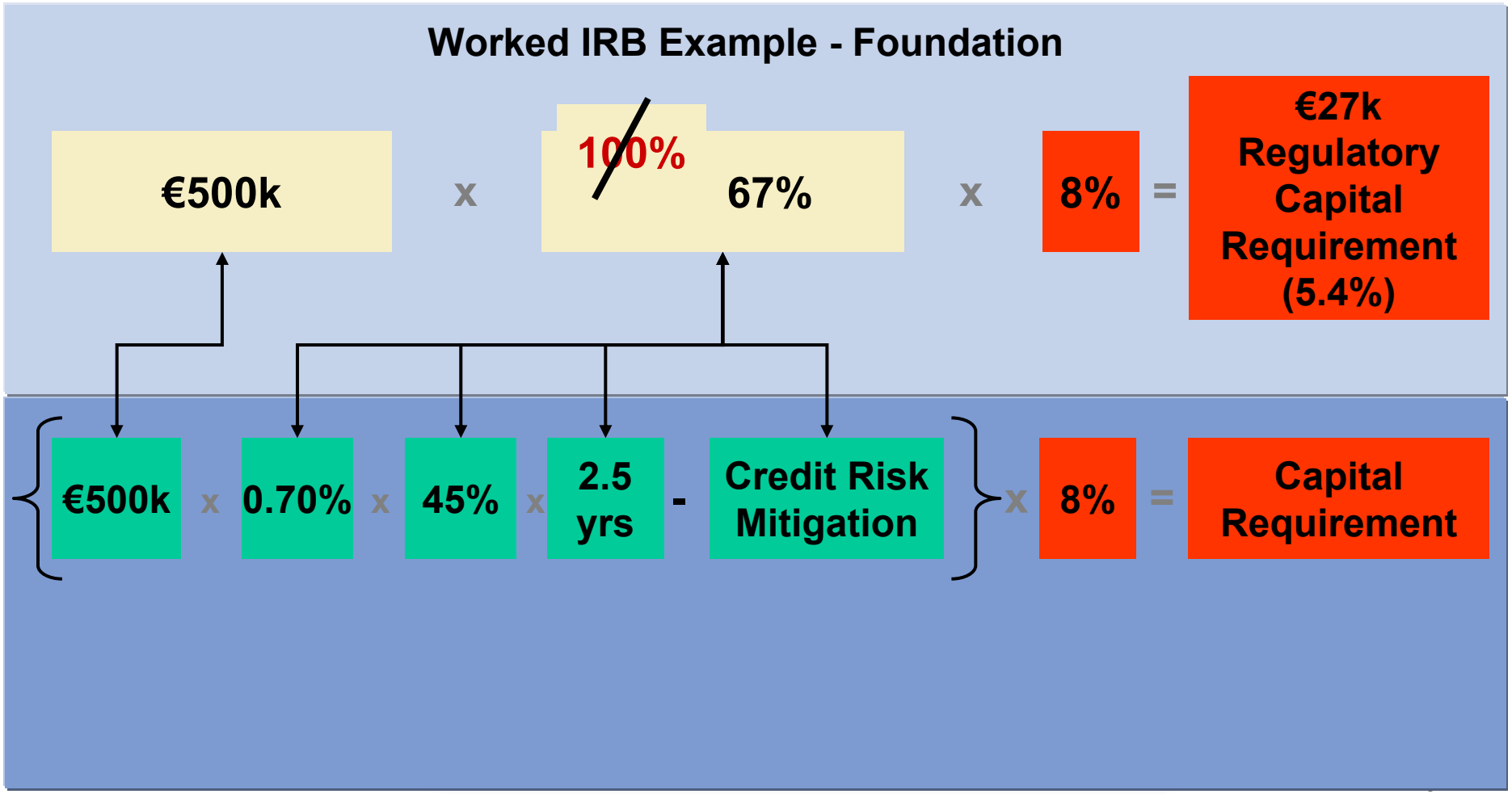
$$(K) = \left[LGD \times N\left[\left(1-r\right)^{-.05} \times G(PD) + \left(\frac{R}{[1-R]^{0.5}}\right) \times G(0.999)\right] - PD \times LGD\right]$$

$$\times[\left(1 - 1.5 \times b\right)^{-1} \times \left(1 + \left(M - 2.5\right) \times b\right)]$$

Credit Risk: IRB Capital Requirements



Credit Risk: IRB Capital Requirements



Illustration

- Drivers of capital reduction

	Foundation	Advanced
Default Estimates	Own Estimates	Own Estimates
Loss Given Default	Supervisor Estimates	Own Estimates
Exposure at Default	Supervisor Estimates	Own Estimates

Illustration

€10m loan to medium quality corporate

	Current	Standardised	Foundation	Advanced
Exposure	€10m	€10m	€10m	€10m
	x	x	x	x
RW	100%	100%	67%	41%
RWA =	€10m	€10m	€6.7m	€4.1m
Regulatory Capital:	**Regulatory Capital = RWA x 8%**			
	€800k	€800k	€536k	€328k

Implementations Challenges

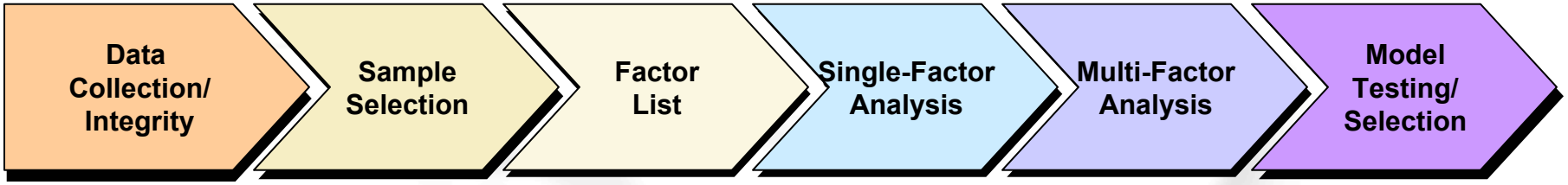
(1) Rating Tool Development

(2) Validation

(3) Low PD Portfolios

(4) LGD / EAD

Implementation Challenges (1): Rating Tool Development



- Data collection and health checks
- Representative 'Goods' and 'Bads' sample
- Factor long list
- Factor evaluation
- Factor short list
- Set of multi-factor models
- Correlation matrices
- Testing of model variants
- Final model specifications

- Calculation of Central Tendency
- Calibration of scores to PDs (Stand-alone Rating)
- Definition of associated Rating Process, e.g. group logic, warning signals, overrides
- Final Rating PD) for regulatory and business applications
- Initial use test phase
- Collection of feedback
- Changes to model if necessary
- Annual review of rating performance
- Changes to model if necessary

Implementations Challenges (2) Validation

448: Internal estimates of PD, LGD and EAD must incorporate all relevant, material and available data, information and methods.

449: Estimates must be grounded in historical experience and empirical evidence, and not based purely on subjective or judgmental considerations.

500: Banks must have a robust system in place to validate the accuracy and consistency of rating systems, processes and the estimation of all relevant risk components. A bank must demonstrate to its supervisor that the internal validation process enables it to assess the performance of internal rating and risk estimation systems consistently and meaningfully.

501: Banks must regularly compare realised default rates with estimated PD's for each grade and be able to demonstrate that the realised default rates are within the expected range for that grade. Banks using the advanced IRB approach must complete such analysis for their estimates of LGDs and EADs. Such comparisons must make use of historical data that are over as long a period as possible. The methods and data used in such comparisons must be clearly documented by the bank. This analysis and documentation must be updated at least annually.

Validation

- **Model development**
  - Credit Logic
  - Statistical Model Build
  - Data Governance and Controls
  - Model Governance and Approval
  - Use Test
- **Model Usage**
  - Backtesting

Implementations Challenges (3)
Low PD Portfolios

- Benchmarking against the output of other models (Internal, KMV or other)
- Applying a Distribution Curve
- Comparison with external data - including market prices
- Internal Ratings Migration
- Developing Causal Models (e.g. cash flow models)

Implementations Challenges (4) LGD & EAD

- **FSA High-Level Principles (July 2004)**
  - the need to pursue accuracy at the level of individual facilities as opposed to broad portfolio averages (where the expected range of errors is larger, the margin of conservatism shall be larger)
  - the need for estimates to take account of the experiences and practices of the firm in question , as opposed to just that of the industry as a whole (data used for estimation must be comparable with the firm's exposures and standards); and
  - the need for estimates, although based on empirical experience, to be aimed at providing estimates of losses in the future (information shall enable the firm to forecast future performance)

Loss Given Default (LGD)

- Defined as the fraction of credit exposure not recovered after default on an obligation;
- Measure on Economic loss basis (not accounting loss);

$$\text{Loss Given Default} = \frac{\text{EAD} - (\text{PV Inflows} - \text{PV Outflows})}{\text{EAD}}$$

- Inflows are recoveries (secured & unsecured), outflows are costs (direct & indirect);
- Use risk-adjusted interest rate to discount cash flows back to date of default ('distressed' debt or opportunity cost);
- Adjust measure for proportion of accounts that default but subsequently revert to performing grade ('cure rate') otherwise measure too conservative.

$$\text{Adjusted LGD} = [\text{Cure Rate} \times \text{Cost of Cure}] + [(1 - \text{Cure Rate}) \times \text{LGD}]$$

Implementing Pillar 2

Two interrelated processes lie at the heart of Pillar 2 implementation:

1. **Supervisory Review Process (SRP)**
2. **The Internal Capital Adequacy Assessment Process (ICAAP)**

Summary of main Pillar 2 Compliance issues

Principle 1

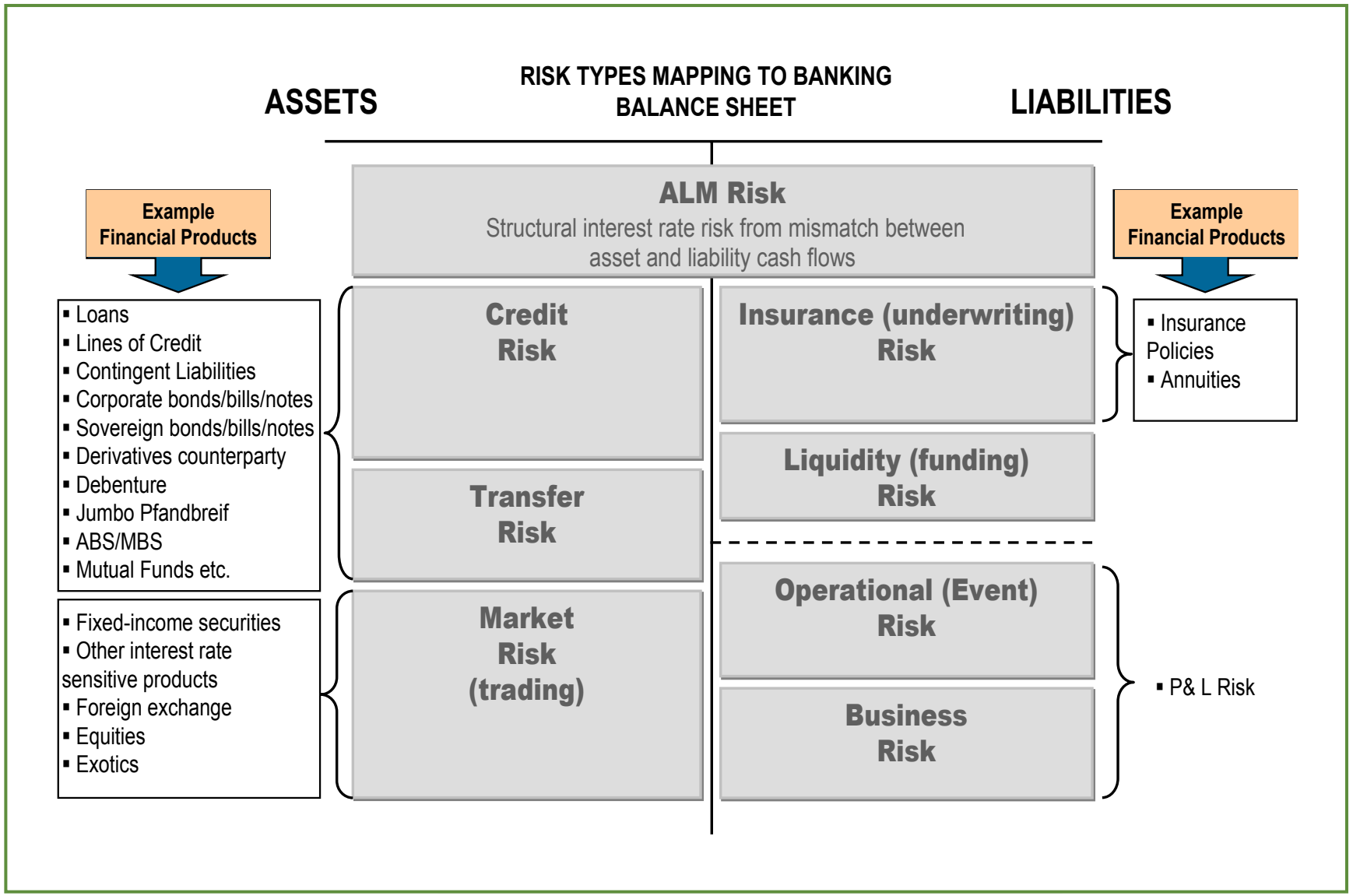
Capital (and other) adequacy vs. Risk

Principles 2 - 4

Supervisory Review, Requirements and Intervention

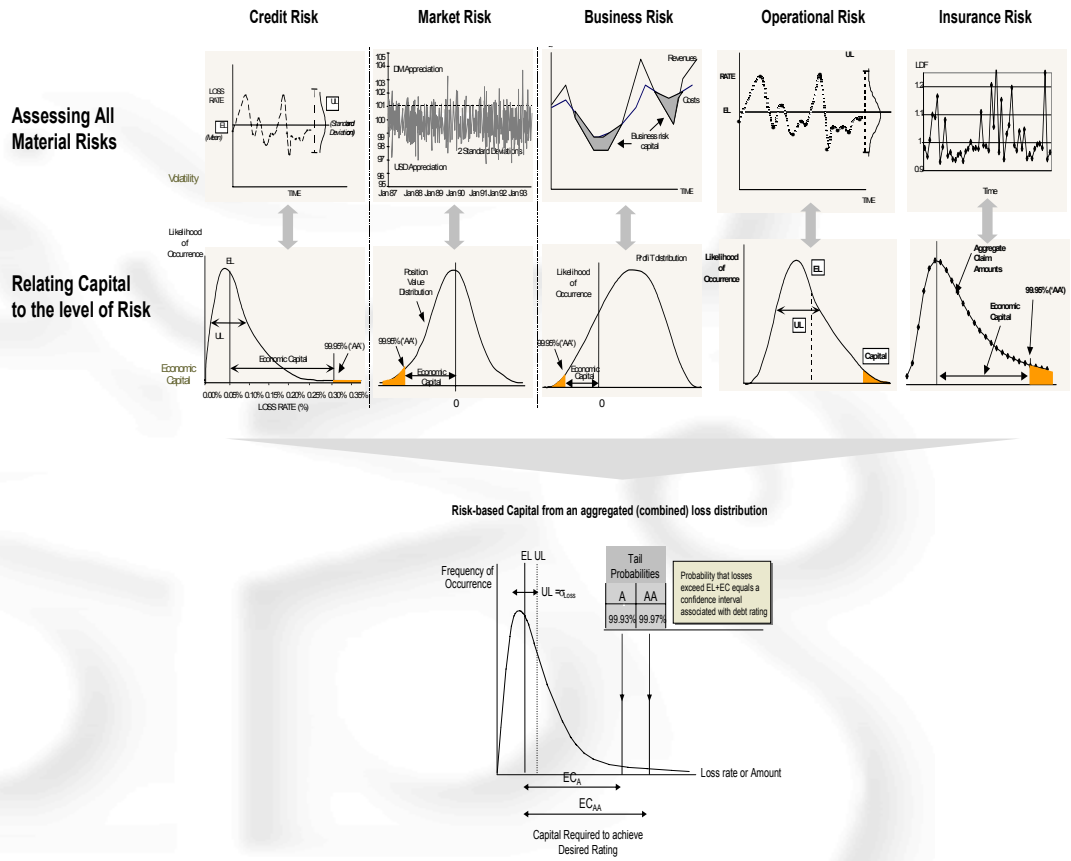
Board & Management Oversight	Assess resources vs. risk	Comprehensive Assessment of Risks	Monitoring and Reporting	Internal Control Review
• Need to understand nature and level of all material risks • Define risk appetite • Oversee financial planning vs. risk assessment • Decide on capital and funding strategies • Set policies and procedures	• Financial planning to consider risks of unexpected loss • Implement stress-testing and scenario analysis • Relate capital to risk where appropriate • Test the adequacy of funding and capacity to liquidate assets	• GENPRU 1.2.30R Risks • **Other Risks** • *Compliance and Regulator* • *Strategic* • *Business* • *Reputational* • *Pension* • *Fiduciary*	• Review, monitor, control and report on all material risks • Sensitivity analysis of key assumptions • Produce reports for senior management and the Board	• Internal and external reviews • Monitor compliance • Stress testing • Identification of concentrations

Key Business Requirements - Risk Assessment



Key Business Requirements - Linking Capital to the Level of Risk

- **Linking capital to level of Risk:** to calculate internal capital required for each risk type. Relating capital to level of risk should at the minimum:
  - Consider unexpected events in setting internal capital levels
  - Cover a wide range of external conditions and scenarios
  - Establish a process that relates capital to the level of risks
- **Aggregating capital figures:** All risk types should be incorporated in the internal capital assessment process, aggregated to final capital figure to provide the basis for strategic planning, limit setting and business line performance

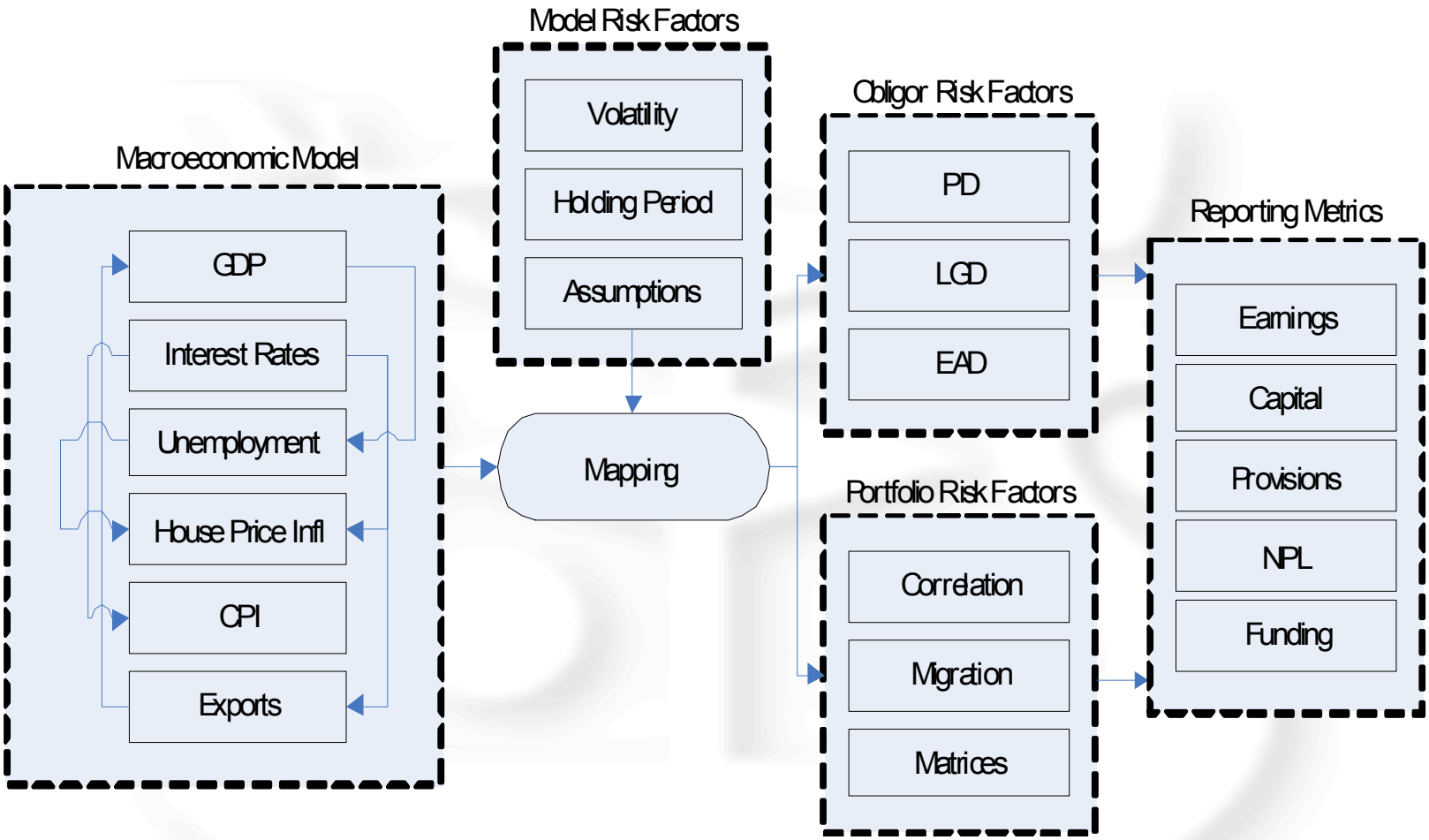


Key Business Process - Stress Testing and Scenario Analysis

FSA Survey on firm's current use of Stress-Testing (May 2005)

Stress Test	Type of Risk					Correlation	
	Market	Liquidity	Credit	Operational (Basel Definition)	Other	Market/ Credit	Other
Single variable ⇩ Multi variable ⇩ Complete scenarios						Rarely	Never
Aggregated across the firm	Often	Often	Rarely				

Stress Testing Execution



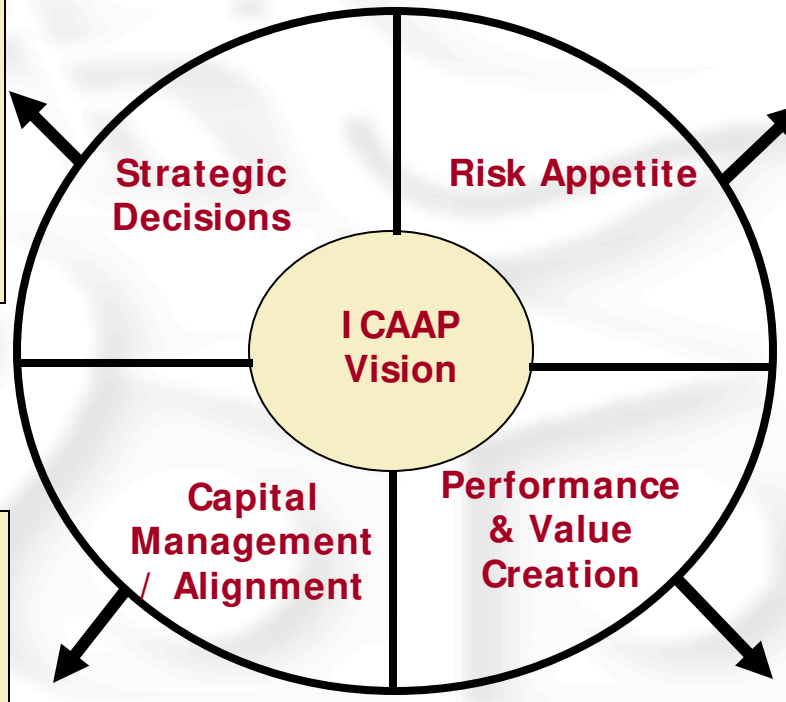
Embedding ICAAP

Enhance Strategic Decision- Making

- Evaluate/compare opportunities
- Determine value creating/destroying opportunities
- Redirect resources
- Optimise return vs risk

Define Risk Appetite

- Determine top-down risk appetite
- Align with bottom-up risk appetite
- Define the capability to effectively manage the risks taken



Align Internal Capital to Risk Appetite

- Align capital planning to risk appetite
- Identify opportunities for redeployment of capital
- Monitor differences between internal and regulatory capital estimates and uses

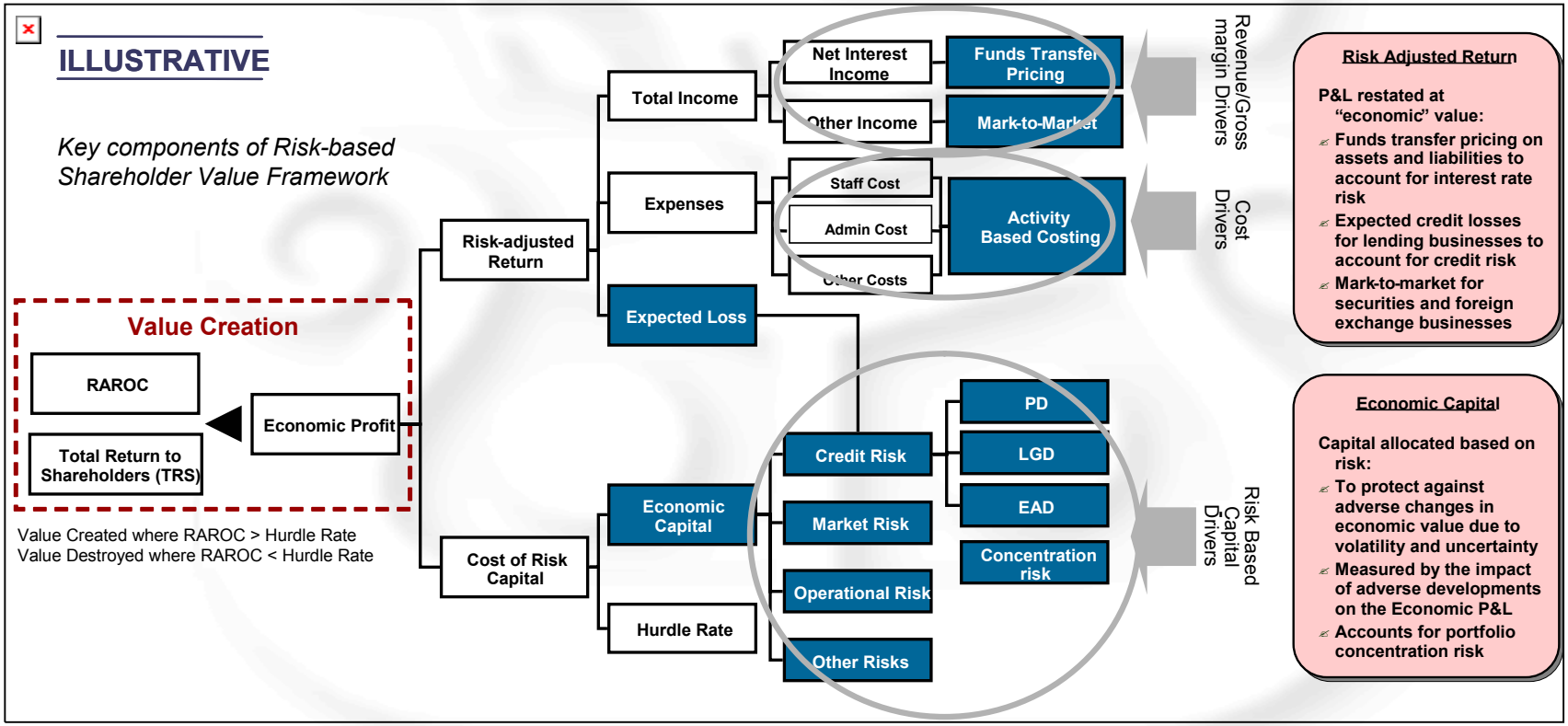
Assess Performance & Value

- Develop / enhance EVA / RAROC Tools
- Place all LOBs/Asset classes on comparable methodology
- Use as basis for performance measurement and compensation

Linking ICAAP with Economic Value Added (EVA)

Embedding Pillar II within the business aligns the internal financial and risk measures of performance which in turn directly drives the creation of shareholder value. The key components of performance management are:

- Economic Profit (EP)
- Risk-Adjusted Return on Capital (RAROC)
- Total Return to Shareholders (TRS)



Summary

- Pillar I rules are posing major challenges for model builders
  - data quality
  - risk factors
  - calibration
  - validation
  - through the cycle estimates
  - low PD portfolios
  - default definitions
  - LGD/ EAD
  - governance
- Pillar 2 is motivating significant work on stress-testing, concentration risk analysis and upgrading economic capital measurement and process
- All development work is aimed at improved risk management processes - must win hearts and minds at the front-line

Questions?