Solvency II

Internal models requirements and an example

Solvency II introduced the possibility to use an internal model to estimate solvency capital requirements (SCR)

- No cherry-picking allowed
- Six approval tests to be fulfilled
  - Validation standards
  - Documentation standards
  - Statistical quality test
  - Calibration standards
  - P&L attribution
  - Use test (will be covered later)
- Need to map risks in internal model to the standard formula
- Application to and approval by FSA
- Management buy-in
- Excepted to lower capital requirements
- Business benefits

Time-plan for internal model implementation and approval

Draft Framework Directive published

Level I Directive adopted

Solvency II system in operation

Member states to transpose into law

2007	2008	2009	2010	2011	2012

QIS 4

Level II Implementing measures

Level III Guidance for supervision

FSA application 1 year?

FSA Review Max 6 months

Use of model 2 years?

Development and implementation

General conditions for the approval of the IM: Article 110

- SCR calculation using full or partial IM allowed

- Partial model can be used for one or more risk modules or sub-modules, for operational risk, for the adjustments, to the whole business or to one or more major BU

- Application through documentary evidence that compliance with Articles 118-124 (Requirements on internal models) exists

- Internal models are allowed for use in the undertakings for business purposes (no approval by the supervisory authority required only when SCR calculated with the standard formula)

- Approval required (and consequently compliance with respective Standards) if SCR is calculated with the Internal model

Requirements on IM

- Use test (Article 118)

  − Fit the business and reflect the risk profile

  − Understanding the model and providing on-going appropriateness of IM

  − Widely usage within the undertaking, in conducting business, risk management and in economic/solvency capital assessment and allocation

  − IM Governance System is part of the overall Governance System

- Statistical quality (Article 119)

  − Calculation methodology and assumptions

  − Data quality: accurate, complete and appropriate

  − Data quality control/monitoring and review process

  − Risk ranking

  − Diversification effects between risks

  − Management actions

Requirements on IM

- Calibration standards (Article 120)
  - Time period and risk measure: equivalence of policyholders' protection
  - Use of approximations for SCR calculation allowed
  - Benchmark portfolios for calibration purposes allowed
- P&L Attribution (Article 121)
  - Review of sources and causes of P&L for each major BU
  - Linkage to Use test
  - Categorisation of risk reflects sources and causes of P&L
- Validation standards (Article 122)
  - On-going model validation process
  - Validation policy
  - Sensitivity, stress and scenario testing

Requirements on IM

- Documentation standards (Article 123)
  - Documentation shall demonstrate compliance with the requirements on IM
  - Design and operational details
  - Theory, assumptions and mathematical and empirical basis
  - Circumstances under which the IM does not work effectively
  - Major changes
- External models and data (Article 124)
  - Consistency with the standards for IM
  - Understanding of external models and data
  - Suitable to undertaking's risk profile
  - Risks of outsourcing

Case
Topdanmark

There are 120 non-life insurance companies in Denmark

The 10 larges companies have a marked share of approx. 80%

Company	Marked share
Tryg	21
Topdanmark	18,7
Codan	13,4
Alm. Brand	9,4
Total	62,5

The case company

	Fire	Privat	Motor	Storm	Liability	Sum
Gross premium	1.585.000.000	1.500.000.000	2.800.000.000	0	323.000.000	6.208.000.000
Reinsurance premium	74.495.000	0	4.200.000	153.010.000	14.696.500	246.401.500
Net premium	1.510.505.000	1.500.000.000	2.795.800.000	-153.010.000	308.303.500	5.961.598.500
Gross claims	1.155.000.001	1.062.500.000	1.787.500.000	300.000.000	257.142.857	4.562.142.858
Reinsurance claims	0	0	0	100.000.000	0	100.000.000
Net claims	1.155.000.001	1.062.500.000	1.787.500.000	200.000.000	257.142.857	4.462.142.858
Gross result	429.999.999	437.500.000	1.012.500.000	-300.000.000	65.857.143	1.645.857.142
Result of reinsurance	-74.495.000	0	-4.200.000	-53.010.000	-14.696.500	-146.401.500
Net result	355.504.999	437.500.000	1.008.300.000	-353.010.000	51.160.643	1.499.455.642
Gross claims ratio	73%	71%	64%	#DIV/0!	80%	73%
Reinsurance claims ratio	0%	#DIV/0!	0%	65%	0%	41%
Net claims ratio	76%	71%	64%	-131%	83%	75%
Costs	226.575.750	225.000.000	419.370.000		46.245.525	917.191.275
Result before run-off	128.929.249	212.500.000	588.930.000	-353.010.000	4.915.118	**582.264.367**
Discounted						
Discounted run-off result net	0	0	0	0	0	**0**
Insurance technial result	128.929.249	212.500.000	588.930.000	-353.010.000	4.915.118	582.264.367
Combined ratio	91%	86%	79%	-131%	98%	90%

The case company

Balance			
Bonds	6.000.000.000	Technial provisions	3.274.616.512
Equity	1.093.270.640	Premium reserves	818.654.128
		Shareholder capital	3.000.000.000
Total	7.093.270.640	Total	7.093.270.640

The case company
Reinsurance program on fire

Excess program

Layer	Cover	Retention	AAD	No. reinstatement	Premium for reinstate	Placed	Rate
Layer 1	25.000.000	25.000.000		3	100%	100%	1,0000%
Layer 2	50.000.000	50.000.000		3	100%	100%	1,0000%
Layer 3	400.000.000	100.000.000		2	100%	100%	2,0000%
Layer 4	500.000.000	500.000.000		1	100%	100%	0,7000%

Layer	Premium	Reinstatement premium	Total reinsurance premium	ROL
Layer 1	15.850.000	0	15.850.000	63,4%
Layer 2	15.850.000	0	15.850.000	31,7%
Layer 3	31.700.000	0	31.700.000	7,9%
Layer 4	11.095.000	0	11.095.000	2,2%

The case company
Run-off dynamics

Liabilities

Year	1	2	3	4	5	6	7	8	9	10	11	12
Percent paid total	19%	44%	62%	72%	81%	86%	90%	93%	95%	97%	99%	100%
Paid per year	19%	25%	18%	10%	9%	5%	4%	3%	2%	2%	2%	1%
Standard diviation	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%

Fire

Year	1	2	3	4
Percent paid total	60%	95%	99%	100%
Paid per year	60%	35%	4%	1%
Standard diviation	10%	10%	10%	10%

Private

Year	1	2	3	4
Percent paid total	60%	95%	99%	100%
Paid per year	60%	35%	4%	1%
Standard diviation	10%	10%	10%	10%

Motor

Year	1	2	3	4	5	6	7	8	9	10
Percent paid total	60%	80%	85%	90%	95%	97%	98%	99%	99,5%	100%
Paid per year	60%	20%	5%	5%	5%	2%	1%	1%	1%	1%
Standard diviation	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%

Storm

Year	1	2	3	4
Percent paid total	60%	95%	99%	100%
Paid per year	60%	35%	4%	1%
Standard diviation	10%	10%	10%	10%

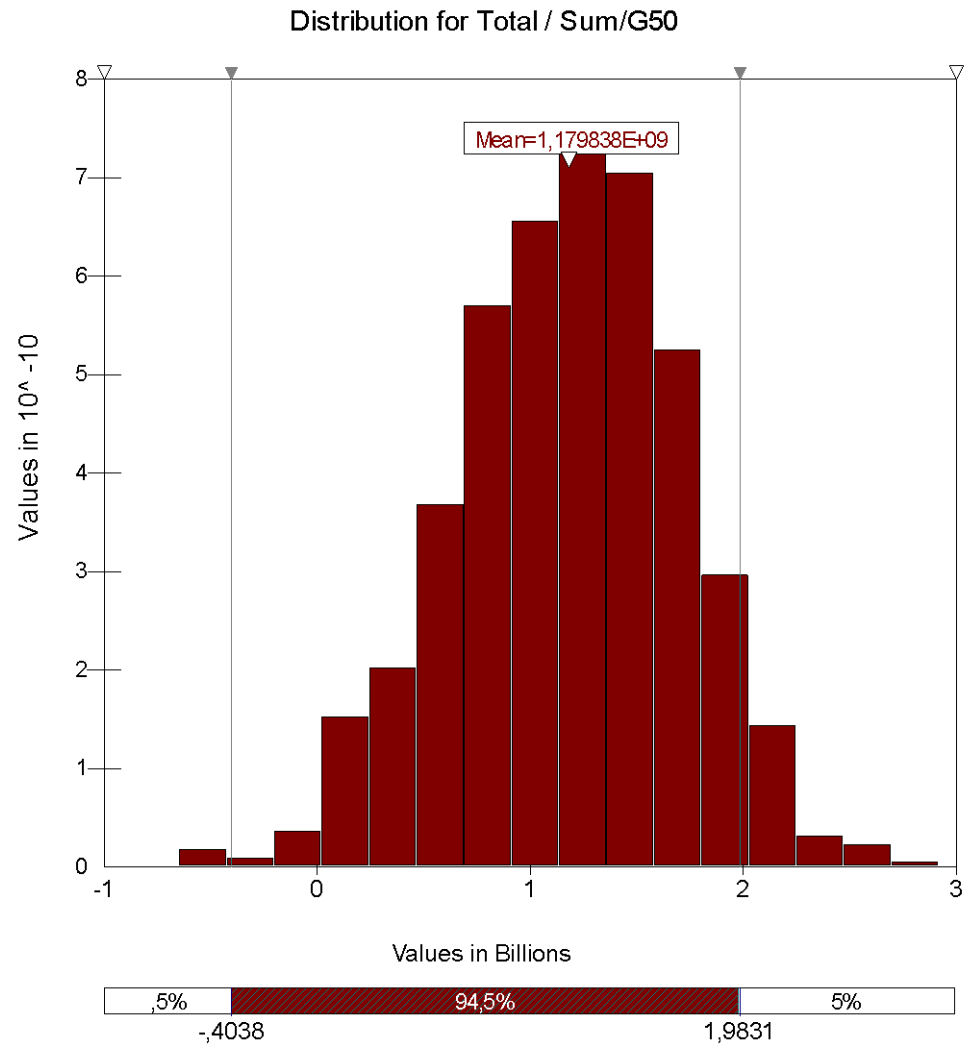The case company
Modeling of claims

Each LoB is modeled as:

- small claims := claims less then e.g. 5 mill
  - here we model the total claim amount as
    - small loss frequency x average small claim size
- large claims := claims bigger then e.g. 5 mill
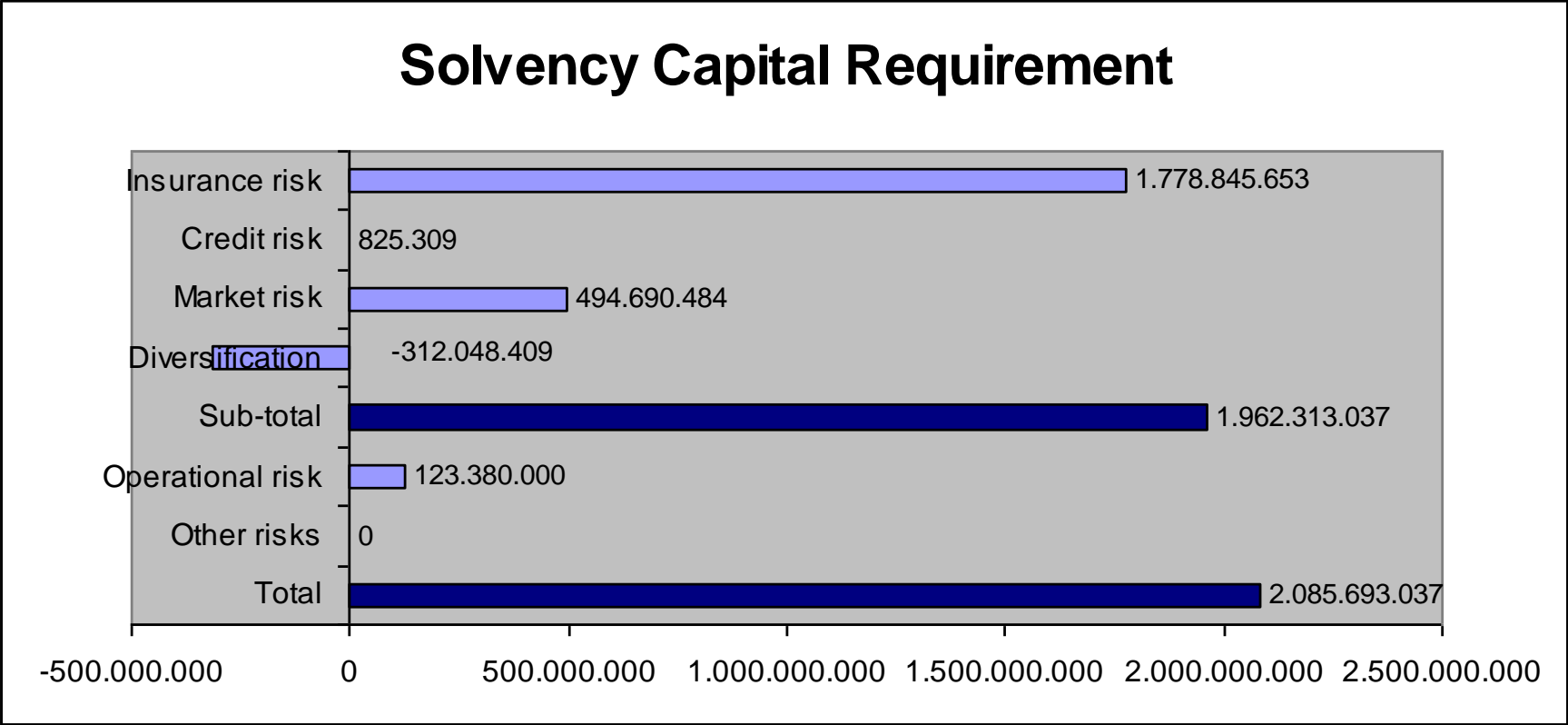 - here we model first the no. of claims and for each claim we model the claim size.

The assumptions on the claims distributions is made due to the data history of the company supplemented by benchmark data

EC calculations
Distribution of result

Distribution for Total / Sum/G50

QIS4 for the case company

Solvency Capital Requirement

Category	Value
Insurance risk	1.778.845.653
Credit risk	825.309
Market risk	494.690.484
Diversification	-312.048.409
Sub-total	1.962.313.037
Operational risk	123.380.000
Other risks	0
Total	2.085.693.037

Solvency I:	1.198.819.530
Factor:	1,74

Capital relations QIS4 and internal model
EC capital calculated over a time horizon of 1 year

Expected profit	1.180.096.000
0,5 percentile internal model	-223.695.500
0,5 percentile without profit	-1.403.791.500
QIS4	-2.085.693.037
Capital saving from QIS4 to internal model	32,69%

Challenges with capital management

Challenge	Common causes	Financial impacts
Lack of integration of capital management with business and risk management	Unclear articulation of risk appetite Exclusive pursuit of a regulatory not business agenda Commercial benefits identified but not realised	Capital too high Value not optimised Capital misallocated
Focus on technical modelling, not business management	Over complexity – false precision Group initiatives lack traction with the business Underestimation of systems and data issues	Unnecessary cost Lost revenue opportunities
Insufficient attention to change management issues	Insufficient senior involvement Silo behaviour: poor programme management Poor integration with other projects	Delayed benefits Unnecessary cost

Use of internal models training day 1

What is an internal capital model?

Reinsurance optimisation

Capital allocation

Asset & Liability management

Investment optimisation

Dynamic strategy

Setting risk limits

Use of internal model training day 2

Recap from day before

Risk based profitability and performance indicators

Pricing and product development

Comparison between an internal model and standard formula for SCR

Experiences from ICAs and discussions with rating agencies

Use-test and linkage to ORSA

Wrap-up