Polish Chamber of Insurance

Full Value from Reinsurance only through an internal model

June 8, 2010

reDEFINING

Capital | Access | Advocacy | Innovation

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Topics for discussion

Section 1: Solvency & Reinsurance

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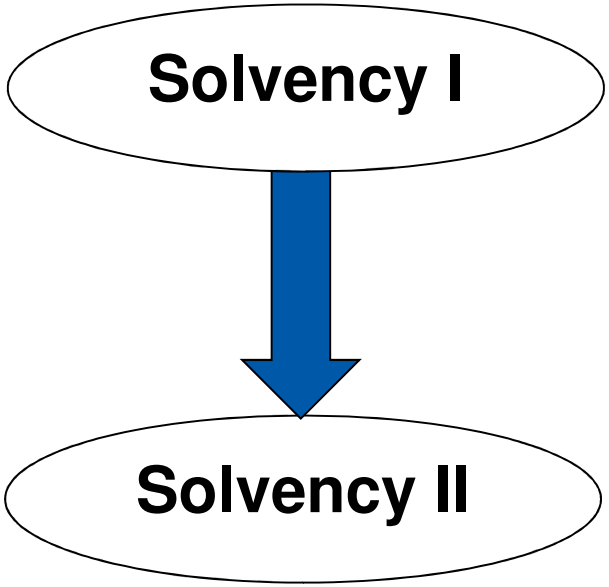
What will happen to reinsurance under Solvency II?

- Do insurers buy reinsurance
  - to avoid large losses or
  - to protect capital and reduce earnings volatility?

- Will Solvency II lead to more reinsurance purchasing?

From Solvency I to Solvency II



- Fair Value Balance Sheet principle
- Conservative principle
- Factor based
- Risk Based Capital requirement
- Does not adequately account for real
- Economic Valuation of all relevant risks
- risk exposures like
  - Quantitative and qualitative
  - Underwriting and lapse risks
- Credit given for reinsurance
  - Asset risk
  - Qualitative Risks
- Very limited credit for reinsurance

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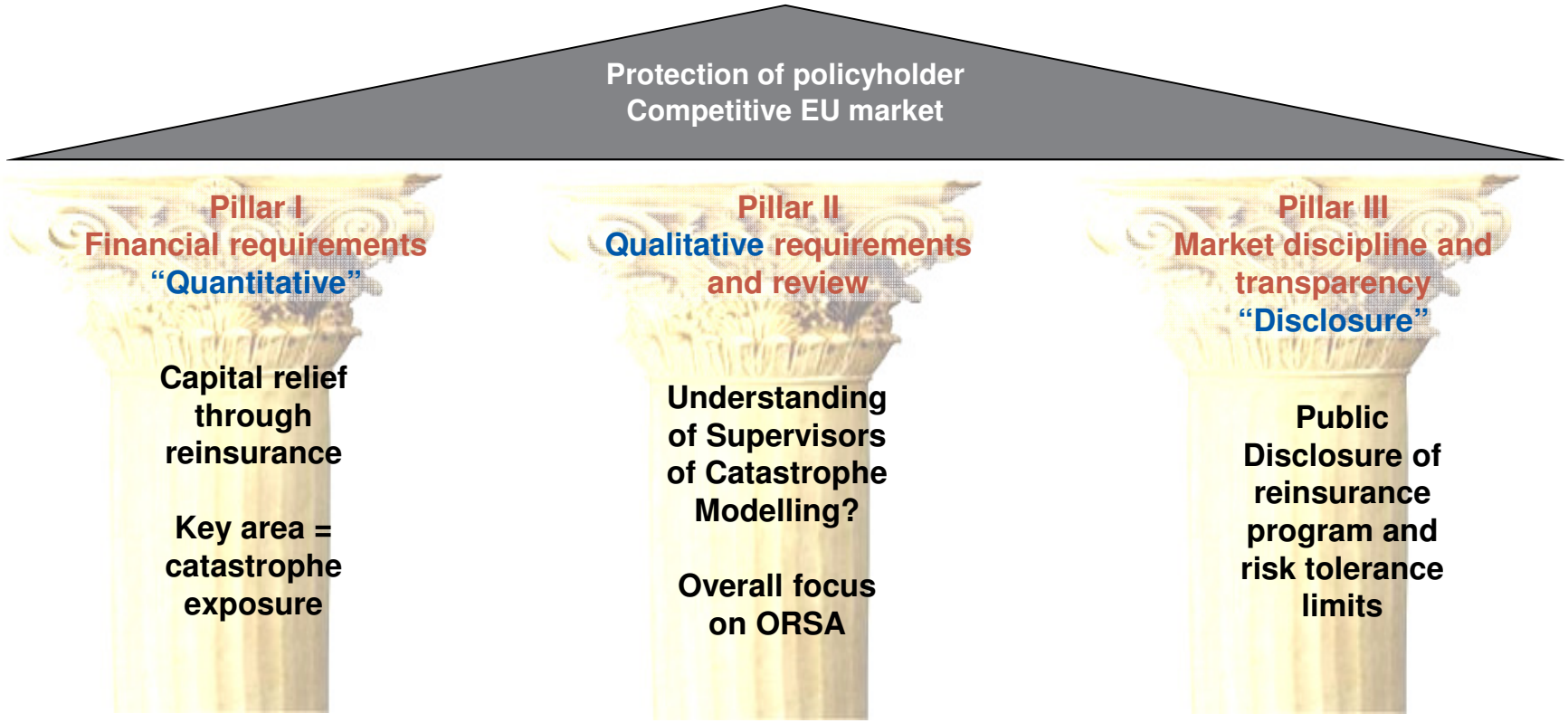
Solvency II: Reinsurance in the Three Pillar approach



- **Pillar 2 and 3 are probably more important than Pillar 1 !**

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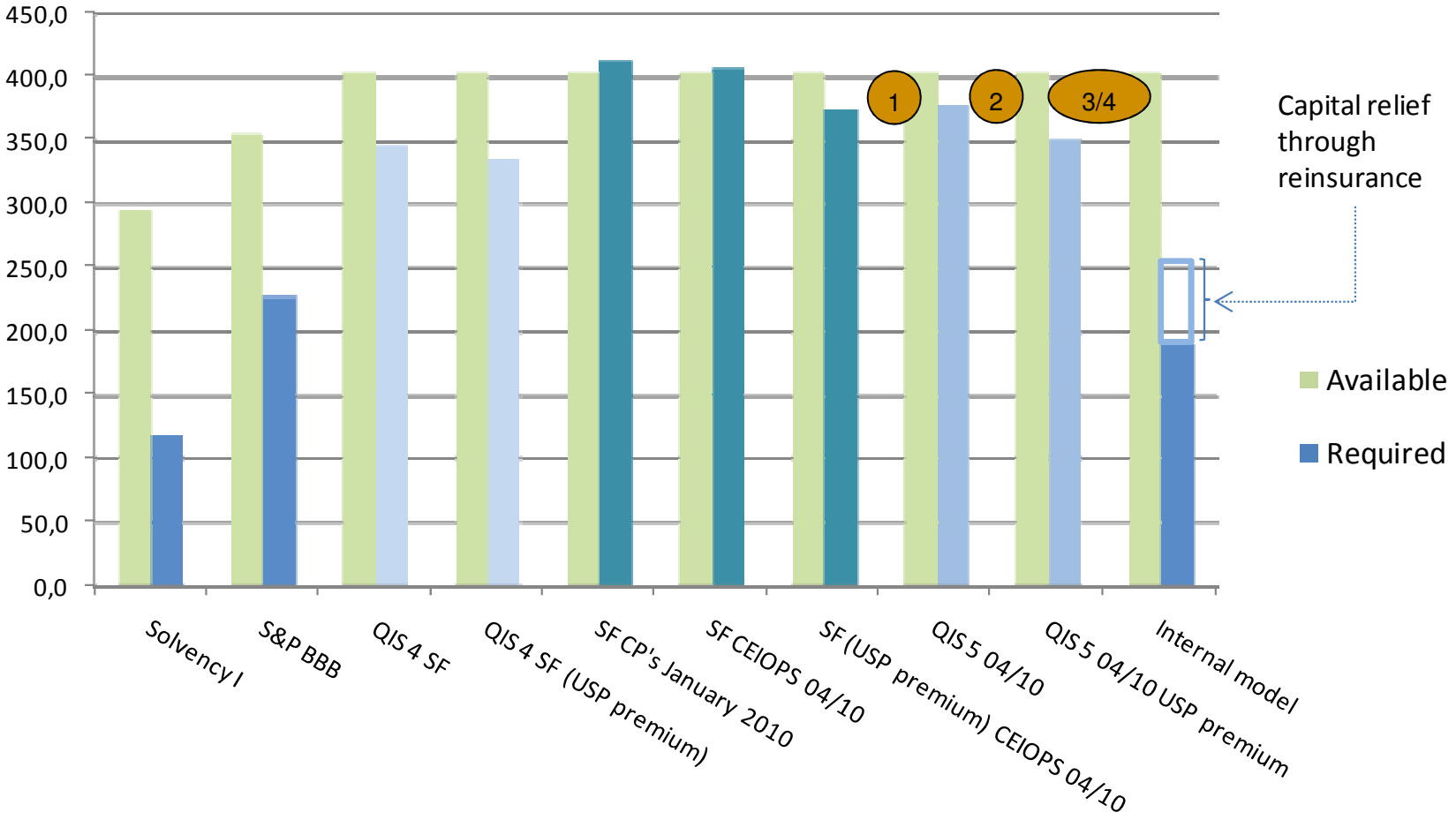
Solvency II will create pressure on capital

- Various options to calculate SCR… Level 2 only 100% final Q1 2011.



- Value of In-Force = Tier 1 Capital, therefore Lapse Risk module introduced

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Information from 15th April 2010 on Non-life calibration

CEIOPS EC

	QIS 4		CEIOPS (CP71)		QIS 5	
StDev	Reserve Risk	Premium Risk	Reserve Risk	Premium Risk	Reserve Risk	Premium Risk
Motor, third-party liability	12.0%	9.0%	12.5%	10.0%	9.5%	10%*(NCR/GCR)
Motor, other classes	12.0%	9.0%	12.5%	10.0%	10%	8.5%*(NCR/GCR)
Marine, aviation, transport (MAT)	10.0%	12.5%	17.5%	20.0%	14%	18%*(NCR/GCR)
Fire and other property damage	10.0%	10.0%	15.0%	12.5%	11%	12.5%*(NCR/GCR)
Third-party liability	15.0%	12.5%	20.0%	17.5%	15.5%	15%*(NCR/GCR)
Credit and suretyship	15.0%	15.0%	20.0%	20.0%	20%	21.5%*(NCR/GCR)
Legal expenses	10.0%	5.0%	12.5%	7.5%	9.0%	6.5%*(NCR/GCR)
Assistance	10.0%	7.5%	15.0%	10.0%	11%	5%*(NCR/GCR)
Miscellaneous	10.0%	11.0%	20.0%	20.0%	15%	13%*(NCR/GCR)
Non-proportional reinsurance – property	15.0%	15.0%	30.0%	30.0%	20%	17.5%*(NCR/GCR)
Non-proportional reinsurance – casualty	15.0%	15.0%	30.0%	30.0%	20%	17%*(NCR/GCR)
Non-proportional reinsurance – MAT	15.0%	15.0%	30.0%	30.0%	20%	16%*(NCR/GCR)

- CEIOPS vs AMICE: calculating the NCR/GCR ratio using their own historic data
- CEIOPS The ratio is based on the most recent 3 financial years
- CEIOPS are aware that the ratio may cause a net factor to be larger than the gross factor

Result = For key lines you must move on to a Partial Internal Model

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Section 2: Cat Reinsurance under Solvency II

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Solvency II – Catastrophe Risk is a key driver

- Catastrophe risk will become “the” main driver for capital since the Solvency II benchmark is to hold capital that can withstand a 1 in 200 year event over the next 12 months
- This includes natural catastrophes as well as man made disasters (eg Mont Blanc tunnel)
- A CEIOPS driven Catastrophe Task Force is deriving the scenarios that will be used in the Standard Formula based on exposure per geographic area. The first draft of the methodology will be circulated for comments in March 2010 and the final version for testing in QIS 5 will be published in June 2010.

QIS4 (2008): Three options allowed	QIS5 (2010): Only two options allowed
Option 1: Using standard factors applicable per LoB’s expected net written premium (31%)	Factor based approach for miscellaneous LoB’s & where scenario’s cannot be provided
Option 2: Use market Cat scenarios and recalculate these to Company loss (eg based on market share) (39%)	Standardised scenarios applicable across Europe (Catastrophe Task Force)
Option 3: Based on Company personalised scenario’s (eg. nat cat models) (24%)	

Percentages indicate number of insurers that used this method in QIS 4

- Alternatively, companies can choose for a **(partial) internal model for their catastrophe risk based on the output from the commercial cat models (where appropriate)**. Using cat models in the Standard Formula was possible under QIS 4 but did not receive sufficient industry support !
- **Non-proportional reinsurance** will be **properly taken into account** and regulators will be asking for an explanation of how companies accounted for reinsurance

Factor method most conservative

	Line of Business	Scenario	Factor
1	Motor 3th party	Motor 3th party liability scenario	40%
2	Motor (other)	Storm	175%
		Flood	113%
		Quake	120%
		Hail	30%
3	MAT	MAT disaster	100%
4	Fire	Storm	175%
		Flood	113%
		Quake	120%
		Fire, explosion	175%
5	Third Party Liability	3th party liability disaster	85%
6	Credit		0%
7	Legal expenses		0%
8	Assistance		0%
9	Miscellaneous	Miscealleous disaster	40%
10	Non-prop. Reinsurance (property)	Property disaster	250%
11	Non-prop. Reinsurance (casualty)	Casualty disaster	250%
12	Non-prop. Reinsurance (MAT)	MAT disaster	250%

Charge = $$SCR_{CAT} = \sqrt{\sum_{t \neq 3,4,10,12} (c_t \cdot p_t)^2 + (c_3 \cdot p_3 + c_{12} \cdot p_{12})^2 + (c_4 \cdot p_4 + c_{10} \cdot p_{10})^2}$$

P=net written premium

Note that it is assumed that a proper premium allocation within one LOB to the different Nat Cat perils is assumed.

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Windstorm

1. Calculate the gross 1/200 OEP per country

$$CAT^{\,Country}_{\,Windstorm} = Q^{Country}_{Windstorm} \sqrt{\sum AGG \times (F_{Zone} \times TIV_{Zone}) \times (F_{Zone} \times TIV_{Zone})}$$

Provided per user

Total Insured Value per Cresta

!! All lines affected (Fire, Motor other…)

Vulnerability factor (Windstorm)

"Aggregation" Matrix (Windstorm)

1 in 200 OEP factor

Parameters-non-life-catastrophe-risk_en.xls
WS_CRESTA_NL

	A	B	C	D	E	F	G	H	I	J
2			Market Factor							
4			0,18%							
6		Cresta Zone	Cresta Relativity		Aggregation Matrix					
7						10	11	12	13	
8		10	0,75		10	1,00	1,00	1,00	1,00	1,00
9		11	1,00		11	1,00	1,00	1,00	1,00	1,00
10		12	1,00		12	1,00	1,00	1,00	1,00	1,00
11		13	1,25		13	1,00	1,00	1,00	1,00	1,00
12			1,50		14	1,00	1,00	1,00	1,00	1,00
13			1,25		15	1,00	1,00	1,00	1,00	1,00

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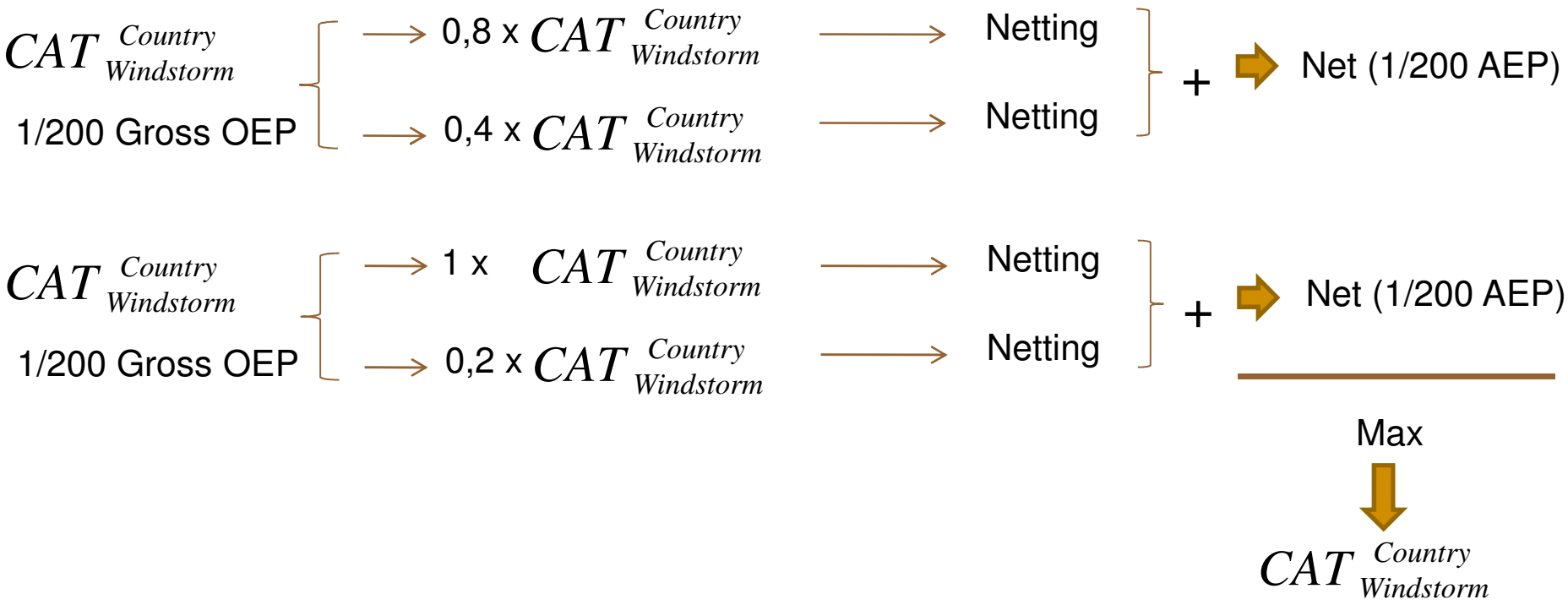
Windstorm

2. Calculate the (net) 1/200 AEP per country



Netting : Apply reinsurance effect (- recoverables + reinstatement)

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Flood

1. Calculate the gross 1/200 OEP per country

$$CAT_{Flood}^{Country} = Q_{Flood}^{Country} \sqrt{\sum AGG \times (F_{Zone} \times TIV_{Zone}) \times (F_{Zone} \times TIV_{Zone})}$$

Provided per user

Total Insured Value per Cresta

!! Fire, static Marine and aviation, Motor other

Vulnerability factor (Flood)

"Aggregation" Matrix (Flood)

1 in 200 OEP factor

Parameters-non-life-catastrophe-risk_en.xls
FL_CRESTA_BE

	A	B	C	D	E	F	G	H	I
1									
2			Market Factor						
4			0,10%						
6		Cresta Zone	Cresta Relativity		Aggregation Matrix				
7						1	2	3	
8		1	0,250		1	1,00	0,00	0,00	0,00
9		2	1,000		2	0,00	1,00	0,75	0,25
10		3	0,500		3	0,00	0,75	1,00	0,25
11			3,500		4	0,00	0,25	0,25	1,00
12			3,750		5	0,00	1,00	0,00	1,00

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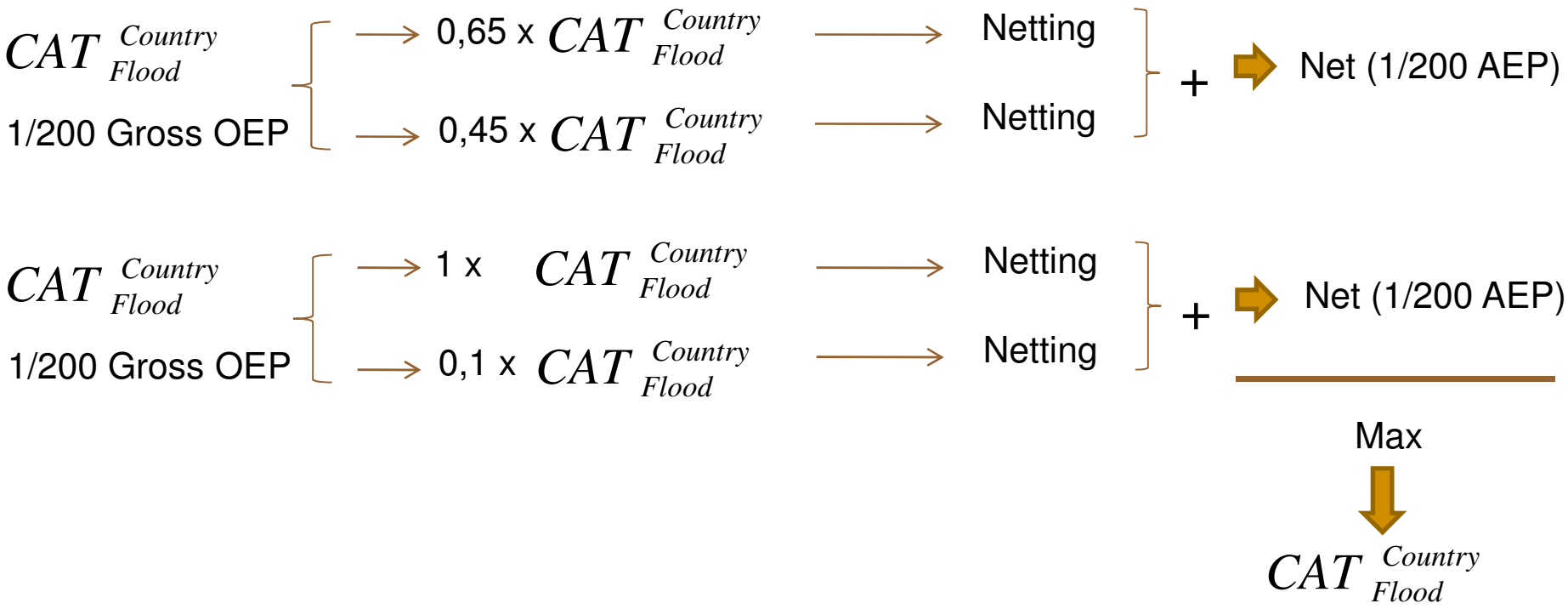
Flood

2. Calculate the (net) 1/200 AEP per country



Netting : Apply reinsurance effect (- recoverables + reinstatement)

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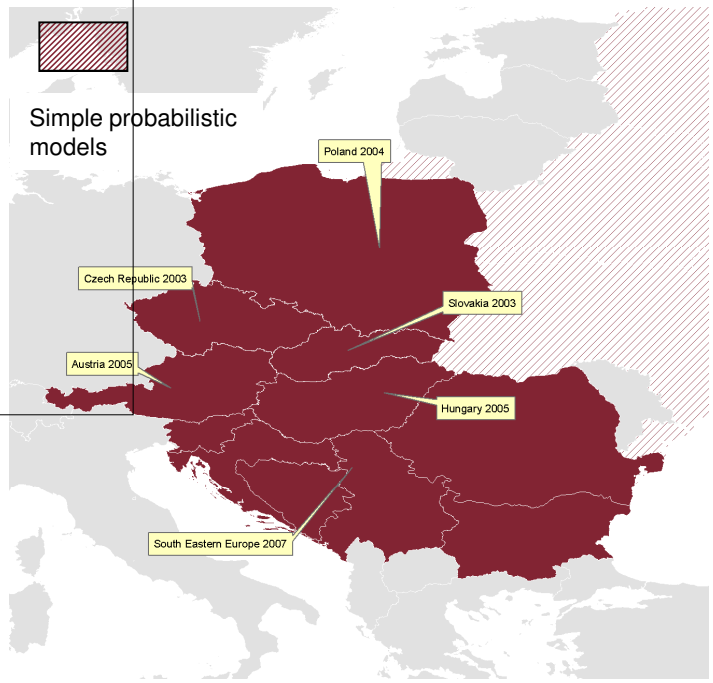
Impact Forecasting Flood Modelling in CEE

- IF Flood model history:
  - **Czech Republic → 2002, 2003** (update in 2009)
  - **Slovakia → 2003**
  - **Poland → 2004** (update in 2009)
  - **Hungary → 2005** (update in 2009)
  - **Austria → 2005** (update in 2010)
  - **South Eastern Europe → 2007**
  - **Russia & Ukraine & Belarus → 2008**
- First flood risk assessment modelling suite for the CEE
- Comprehensive claims database from 2002 Flood means the **vulnerability component is based on real losses**
- Models were tested on real events (1997, 2002, 2006)
- Regularly updated and detailed information on flood defences
- Detailed **DTM's** implemented (not DEMs!)
  - DTM – pure terrain elevation; DEM – top of the houses or vegetation cover
- **External support from local universities and hydro-meteorological institutes:**
  - *Charles University in Prague*
  - *University of Warsaw*
  - *Slovak University of Technology*
  - *Hungarian Water Research Centre (VITUKI)*
  - *EDAC Weimar*



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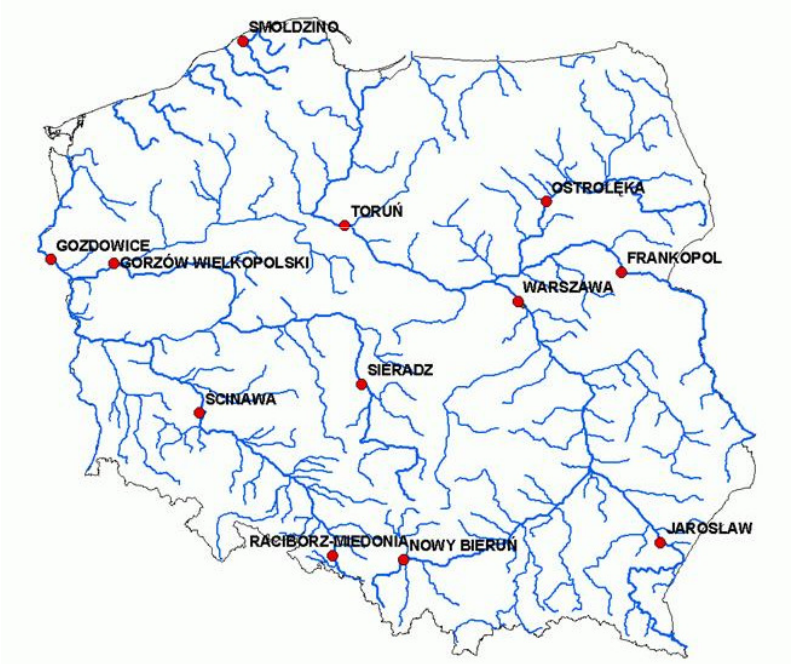
Impact Forecasting Flood Poland - Summary

Country	Poland
Unique Features	1st fully probabilistic flood model for Poland, real insurance loss data from 2002 event in Czech Rep.from the biggest insurance companies used for the vulnerability curves, extensive database of postcodes (over 20,000), flood defences updated in 2009
First Developed	2004, updated in 2007 and 2009
Model Basis	GAP Flood
Hydrological and Elevation data, Academic Support	The Polish Hydro-meteorological Institute (IMGW) provided the hydrological data and export support for the station selection. Cooperation with Prof. Tomasz Okruszko, Un. of Warsaw and Prof. Zbigniew W. Kundzewicz, Un. of Poznan in regards to flood defences information, 250 x 250 metres DTM, Warsaw tested on 5 x 5 metres DTM
Flood Defence Information	Aon Benfield postcode based database of defences, sources include: governmental (norms) & expert information, digital layer of defences, distance from the river andpopulation density
Vulnerability Function	Based on real loss data from 2002 event from the biggest Czech insurance companies, cooperation with Charles Un., Prague, takes into account the real behaviour of insured portfolio during a flood event

Hazard component – modelled rivers and main stations



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Critical success factor = Data Quality

- Reporting of key data elements
  - Was the important data captured?
  - Primary modifiers

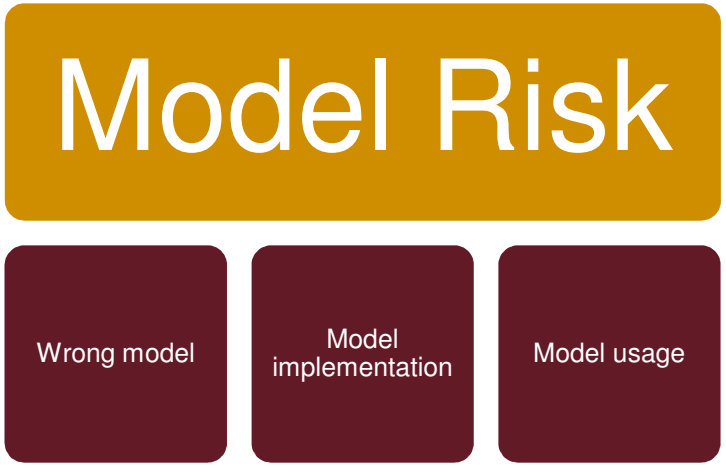
Proposed minimum data requirements:

	Example United States	Example Europe
Geocoding to Street Level or better	90%	5%
Geocoding to Post Code or better	95%	50%
Geocoding to City Level or better	99%	90%
Geocoding to County Level or better	100%	100%
Known Construction	80%	80%
Known Occupancy	100%	100%
Known Number of Stories	70%	50%
Known Year Built	80%	50%

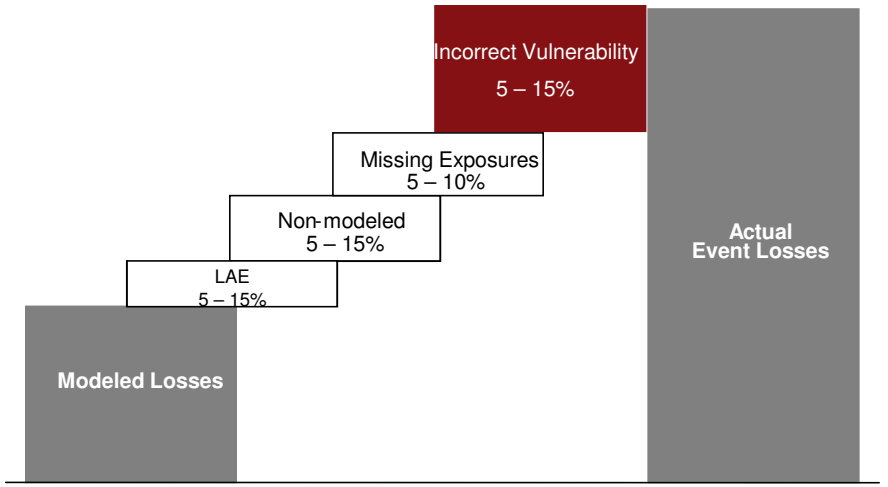
- Capture of secondary modifiers?
- Data completeness study
- Purpose
  - Understand strengths/weaknesses of exposure data
  - Benchmark datasets for peer comparisons

Model Risk and Model Miss should also be valued

- Wrong model
  - Which model fits best?
    - To judge this we use
      - » Stresstest
      - » Backtesting
      - » Analytical solutions
- Model implementation
  - IT Problems?
- Model usage
  - Data?
    - Analyse peer group data
  - Calibration?
    - Extensive knowledge through analytical work



Model miss example for Cat models



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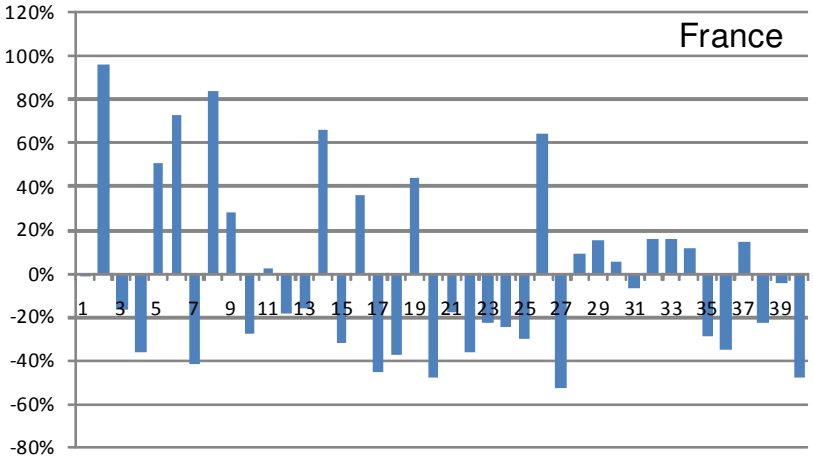
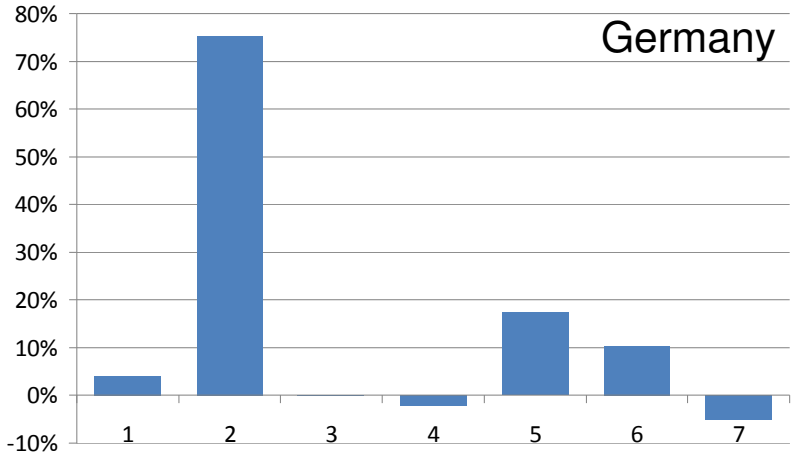
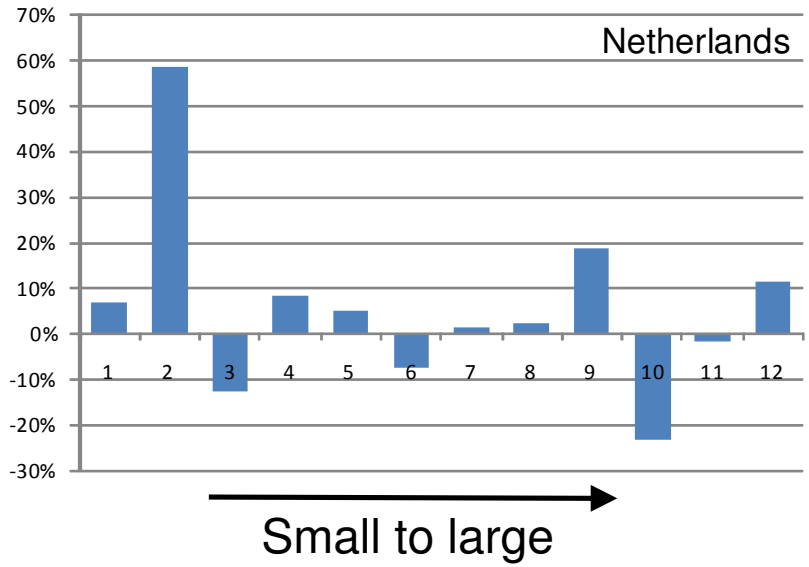
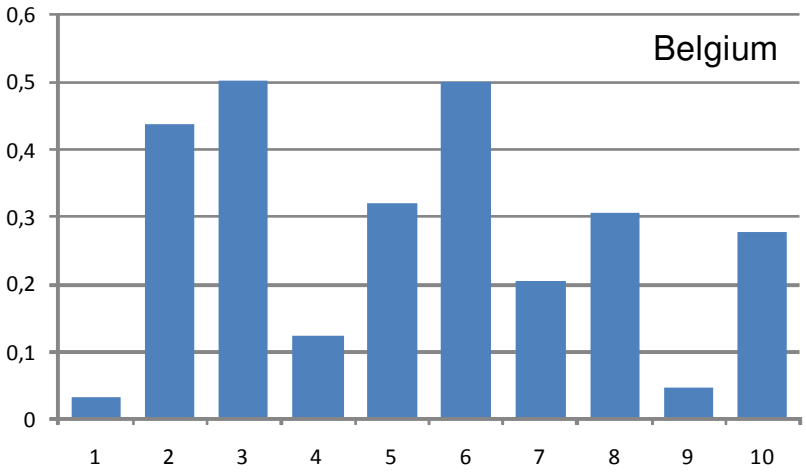
Standard Formula vs. Commercial cat model 1:200

Overall results acceptable although methodology 15 years back in time (CRESTA)









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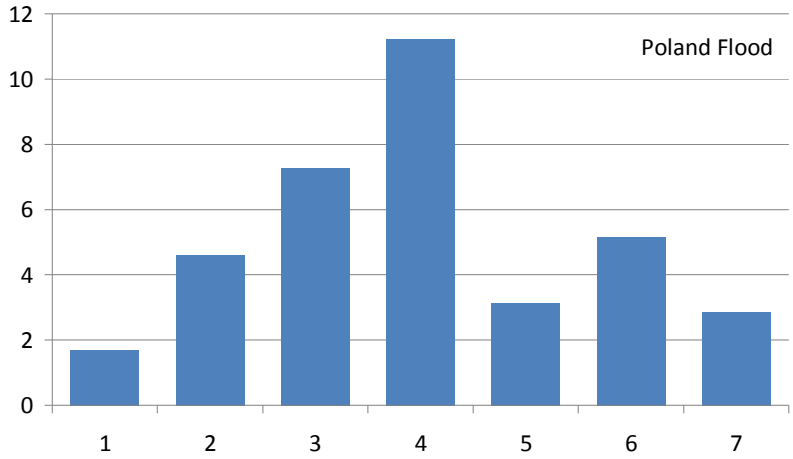
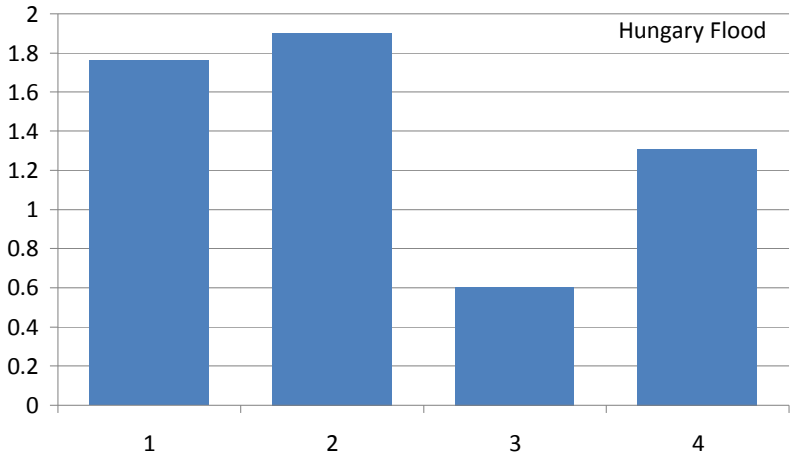
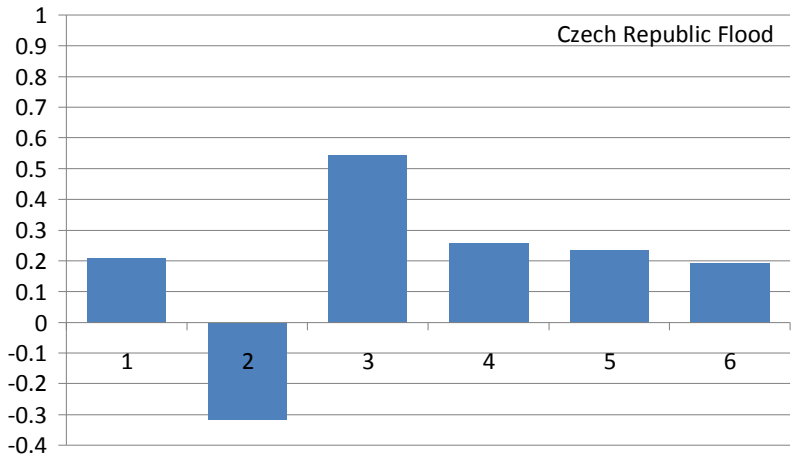
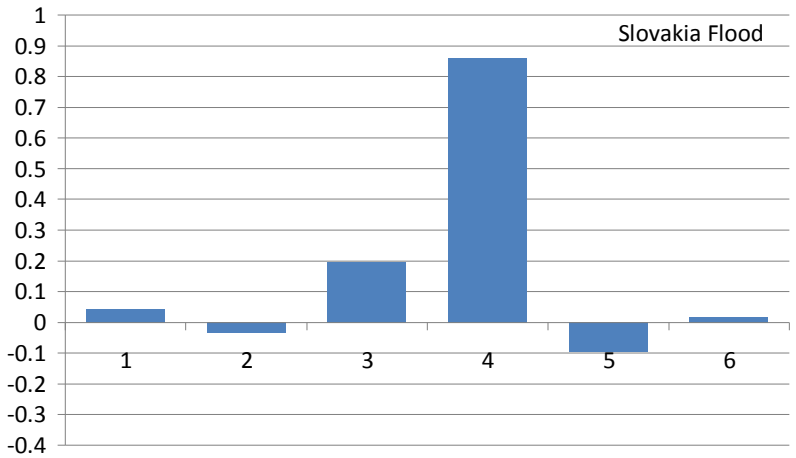
Standard Formula vs. Impact Forecasting model 1:200









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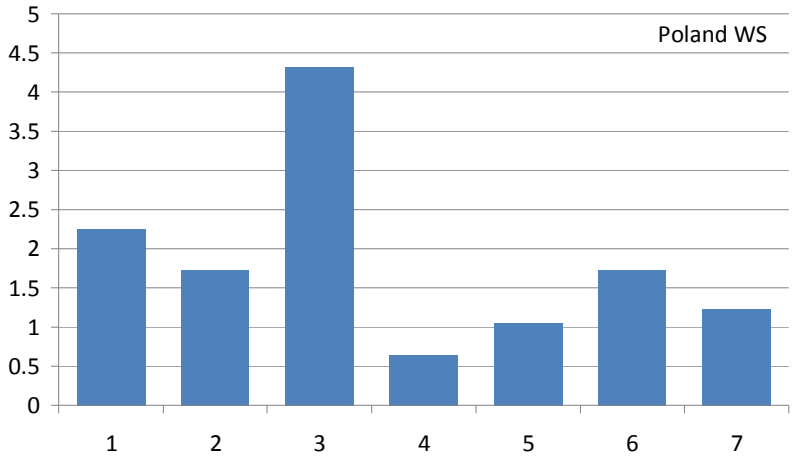
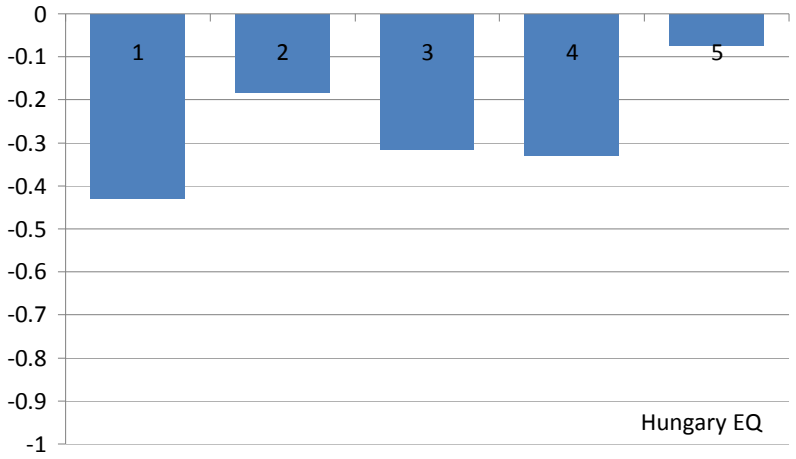
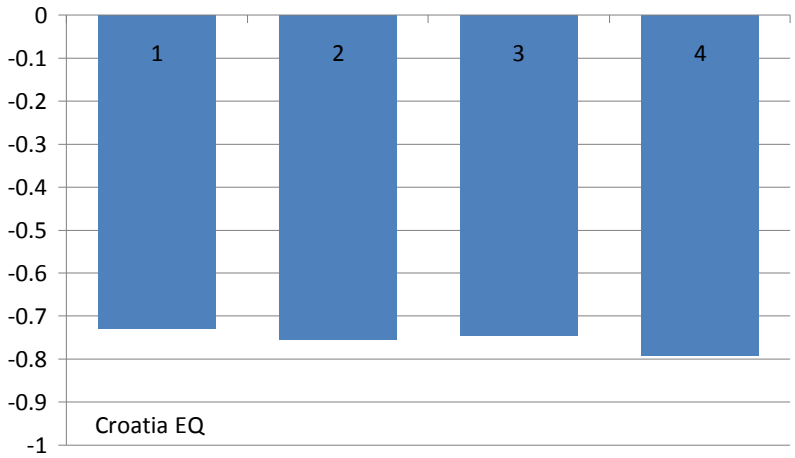
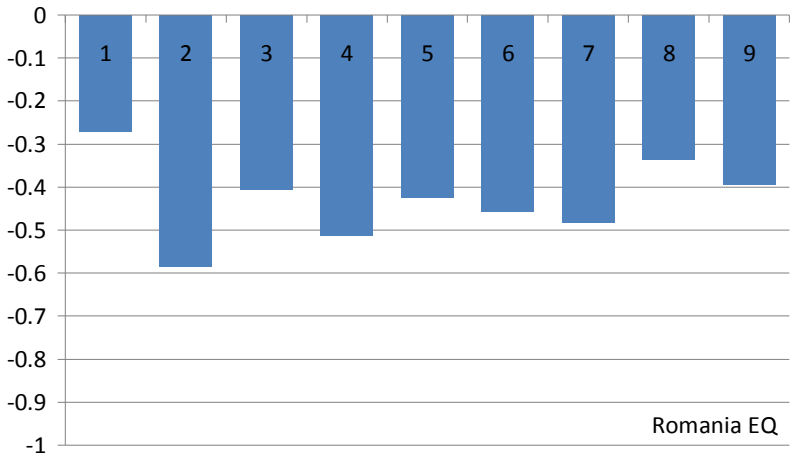
Standard Formula vs. Commercial / IF cat model 1:200









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An Internal Model allows for tailored results

- Using commercial cat models requires using a partial or a full internal model
- Six tests
  - Use test
  - Calibration
  - Statistical quality
  - Validation
  - Documentation
  - Profit & Loss attribution

Section 3: Non-Proportional Reinsurance in Solvency II

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CEIOPS position

- CEIOPS advice on Level 2 Implementation Measures: Standard Formula, calibration of Non-Life Underwriting Risk
- *"Our provisional analysis has shown that the reduction in claims volatility due to the presence of reinsurance may be less than the reduction in premium for many undertakings due to the cost of the reinsurance,* ***ie the appropriate net factor may often be larger than the gross factor****. Initially this may appear counter-intuitive, since it is common understanding that there are capital benefits through the purchase of reinsurance. However, we need to consider the following:*
  - *An increase in factor (net vs gross) is not inconsistent with a lower capital requirement, since this is being driven by a lower volume measure (net premium vs gross premium). Indeed, we would clearly expect a lower net capital requirement than the comparable gross capital requirement.*
  - ***The reinsurance protection is on a "to ultimate" basis, whilst the calibration is performed on a "1 year" basis. As a result, over the one year, not all the benefit of the reinsurance is realised. However, the reinsurance cost is all charged up front (other than reinstatements). As a result there is a mismatch between the benefit of the reinsurance that emerges over the one year and the change in the premium.***
  - *The difference between the gross and net premiums is not purely due to the claims benefits of the protection, but also used to fund the reinsurance expenses such as broker commissions, underwriting costs, etc and also to give the reinsurer an appropriate level of recompense for the level of risk they are accepting, ie risk loading, profit loading, etc."*

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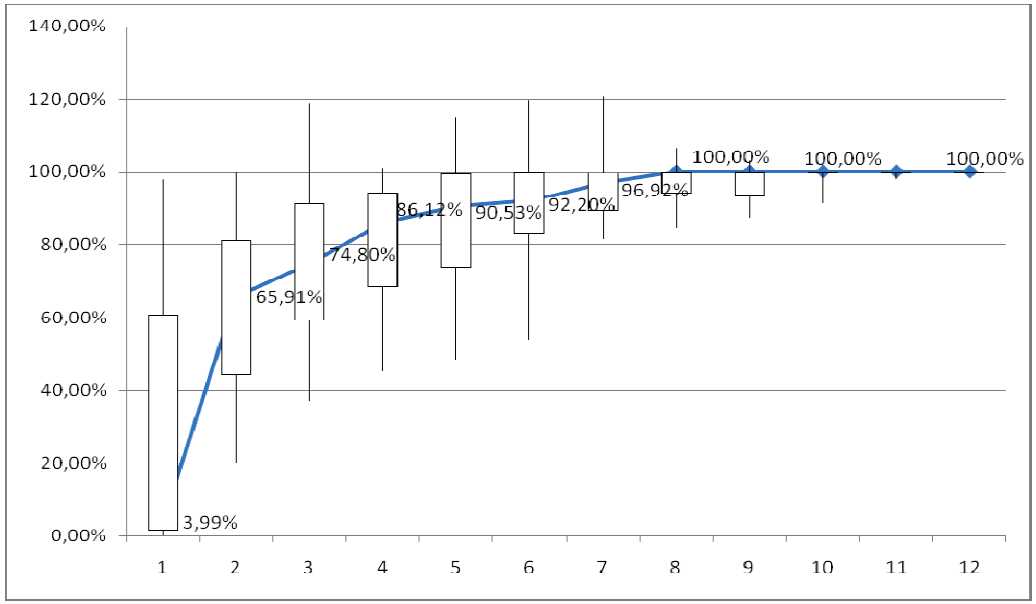
Emergence of reserve risk

- 185 large losses (> €1.5m) were adjusted as-if and calculated to ultimate
- How much of the ultimate value is recognized at the end of year 1, year 2…



- At the end of year 1, “on average”, 24% of the ultimate value is recognised.
- Does this mean that at the end of the first year, the XOL layers are not touched?

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MTPL Model results (internal model)

Reinsurance ?	no	yes	no	yes
Emergence ?	no	no	yes	yes
Gross Premium Earned	100.0%	100.0%	100.0%	100.0%
Gross Acquisition Costs Incurred	23.1%	23.1%	23.1%	23.1%
Operating Expenses (incl ULAE)	14.4%	14.4%	14.4%	14.4%
Paid Claims attritional	23.2%	23.2%	23.2%	23.2%
Paid Claims large	0.0%	0.0%	0.0%	0.0%
Discounted Gross EOY reserve attritional	29.7%	29.7%	29.7%	29.7%
Discounted Gross EOY reserve large	3.1%	3.1%	1.02%	1.0%
MVM (EOY)	1.6%	1.6%	1.6%	1.6%
Gross Losses Incurred	56.0%	56.0%	53.9%	53.9%
Gross Underwriting Result	**5.0%**	**5.0%**	**7.1%**	**7.1%**
Reinsurance Premium Earned	0.0%	1.3%	0.0%	1.3%
Paid Recoverables attritional	0.0%	0.0%	0.0%	0.0%
Paid Recoverables large	0.0%	0.0%	0.0%	0.0%
Discounted EOY reinsurance assets attritional	0.0%	0.0%	0.0%	0.0%
Discounted EOY reinsurance assets large	0.0%	0.6%	0.0%	0.3%
Recoveries Incurred	0.0%	0.6%	0.0%	0.3%
Net Premium Earned	100.0%	98.7%	100.0%	98.7%
Net Losses Incurred	56.0%	55.4%	53.9%	53.6%
Net Underwriting Result	**5.0%**	**4.3%**	**7.1%**	**6.1%**
Investment Income	2.0%	2.0%	2.0%	2.0%
Insurance Profit (Mean)	**7.0%**	**6.3%**	**9.1%**	**8.1%**
Insurance Profit (VaR 99,5%)	**-3.8%**	**-2.5%**	**-1.0%**	**-0.4%**

- XOL lowers the required capital and reduces earnings volatility

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Internal model adjusted to St Formula CEIOPS concept

- CAT MTPL is removed
- Profit is removed

Reinsurance ?	Unchanged risk profile		Changed risk profile	
	no	yes	no	yes
Emergence ?	yes	yes	yes	yes
Gross Premium Earned	100.0%	100.0%	100.0%	100.0%
Gross Acquisition Costs Incurred	23.1%	23.1%	23.1%	23.1%
Operating Expenses (incl ULAE)	16.1%	16.1%	16.1%	16.1%
Paid Claims attritional	25.8%	25.8%	25.8%	25.8%
Paid Claims large	0.0%	0.0%	0.0%	0.0%
Discounted Gross EOY reserve attritional	33.1%	33.1%	33.1%	33.1%
Discounted Gross EOY reserve large	1.1%	1.1%	1.1%	1.1%
MVM (EOY)	1.8%	1.8%	1.8%	1.8%
Gross Losses Incurred	60.0%	60.0%	60.0%	60.0%
Gross Underwriting Result	**-0.9%**	**-0.9%**	**-0.9%**	**-0.9%**
Reinsurance Premium Earned	0.0%	1.2%	0.0%	1.2%
Paid Recoverables attritional	0.0%	0.0%	0.0%	0.0%
Paid Recoverables large	0.0%	0.0%	0.0%	0.0%
Discounted EOY reinsurance assets attritional	0.0%	0.0%	0.0%	0.0%
Discounted EOY reinsurance assets large	0.0%	0.3%	0.0%	0.3%
Recoveries Incurred	0.0%	0.3%	0.0%	0.3%
Net Premium Earned	100.0%	98.8%	100.0%	98.8%
Net Losses Incurred	60.0%	59.8%	60.0%	59.8%
Net Underwriting Result	**-0.9%**	**-1.8%**	**-0.9%**	**-1.8%**
Investment Income	1.9%	1.8%	1.9%	1.8%
Insurance Profit (Mean)	**1.0%**	**0.0%**	**1.0%**	**0.0%**
Insurance Profit (VaR 99,5%)	**-10.1%**	**-9.5%**	**-30.0%**	**-31.0%**

- Unchanged risk profile (IM but no profit)
  - Net/Gross ~ 0.94
  - Applying standard formula concept

$$Net\,\Pr emium \times 3 \times \sigma_{IM}^{gross} \times ratio.net - gross = Net.Capital.\Pr emium.Risk$$

$$Gross\,\Pr emium \times 3 \times \sigma_{IM}^{gross} \times 1 = Gross.Capital.\Pr emium.Risk$$

$\Rightarrow$ Ratio net-gross = 0.95

$\Rightarrow \sigma_{IM}^{Gross}$ = 3.35%

- Changed risk profile (St Formula, no USP data)
  - σ_{IM}^{Gross} = 10% (QIS5)
  - Change IM attritional loss model to bring Stdev to 10%
  - Net/Gross ~ 1.05 : due to overweight in the tail of attritional losses which make that the reinsurance effect is not visible anymore (since only applied on large losses).

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Internal model adjusted to St Formula AMICE concept

- Internal model Net/Gross ratio ~ 0.94
- CEIOPS suggestion for ratio: Averaged Net Combined/Gross Combined Ratio ~ 1.05
  - What with non-working layers (which are most capital efficient)?
  - Volatility?
- AMICE proposal Net/Gross ratio ~ 1
  - Theoretical framework (lognormal for all losses, Poisson for all losses ?)
  - Correct ? Internal model provided a Net/Gross ratio (according to the Standard Formula concept) of 0.94. The average loss was €3,445, CoV unknown => CoV maximum value has to be 500% otherwise it would overstate the real risk transfer. How realistic – in a lognormal world – would it be to generate a €2.5Mio Claim (hitting the XOL layer)?

		VaR individual loss			
		99.950%	99.990%	99.999%	99.9999%
E[X]	3,445	2,000	10,000	100,000	1,000,000
CoV					
100%	1.000	37,709	53,873	84,869	127,464
200%	1.000	100,152	172,480	344,743	640,706
300%	0.995	160,576	307,652	704,362	1,478,238
400%	0.974	212,508	437,126	1,095,588	2,493,277
500%	0.939	256,555	556,003	1,489,340	3,597,163
600%	0.898	294,200	664,141	1,873,920	4,741,550

  - How big is the CoV of individual claims? Market/Company benchmarks?

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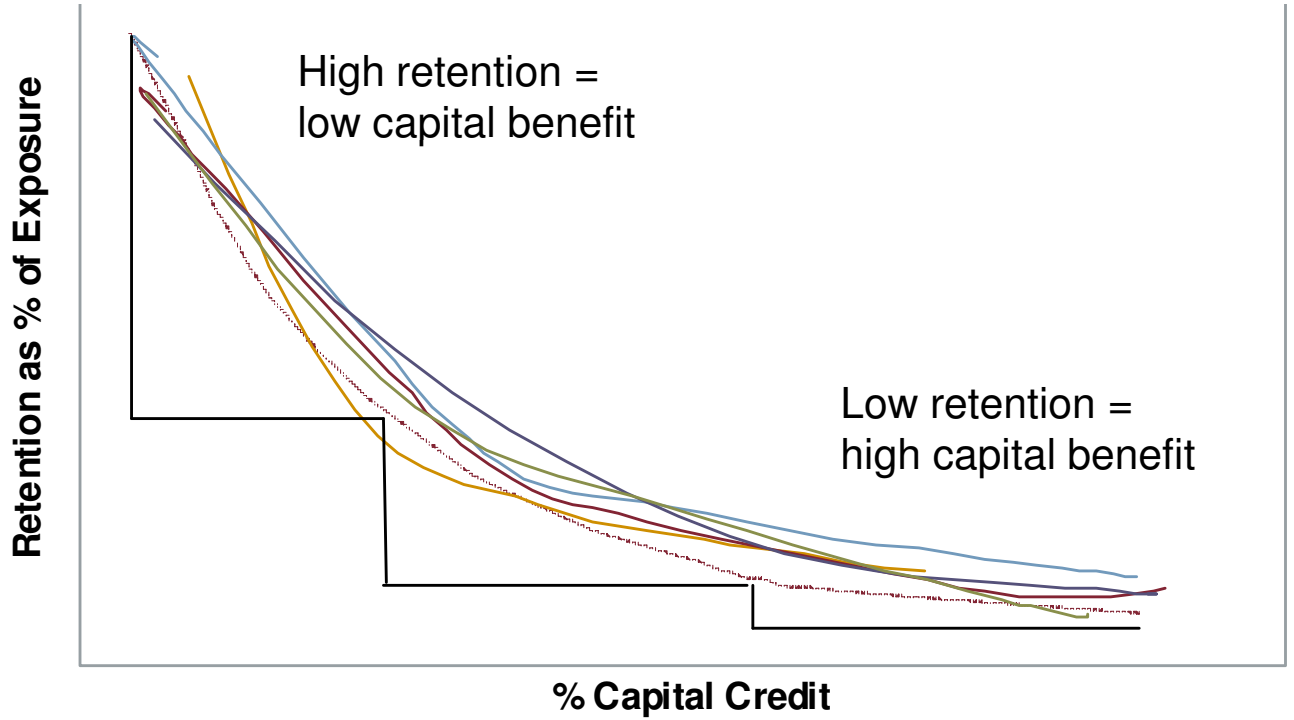
Aon Benfield proposal 2008

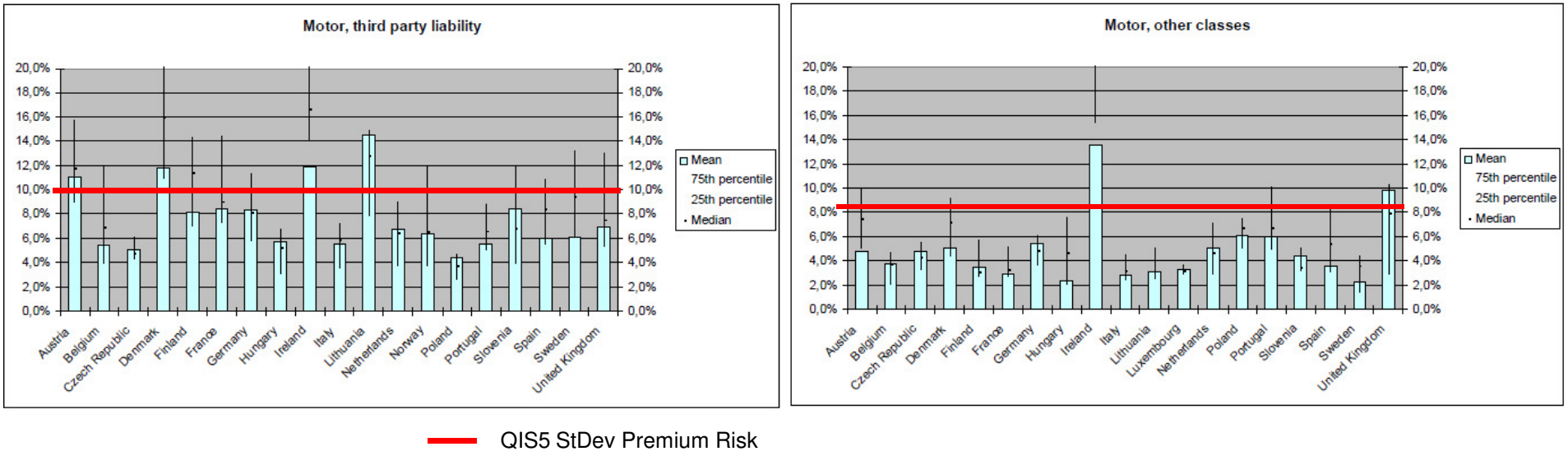
- Capital benefit of XL by using a proportionate exposure curve
- Retention of an XL programme as a proportion of total exposure (eg. premiums) defines amount of capital credit based on a probabilistic model using 1:200 year probability of insolvency.



Solvency II

- Full methodologies on how the factors have been derived
- Output tables showing the factors by region
- Conservative or aggressive? Depending on size and correlation exposure.

QIS 4 Undertaking Specific Parameters



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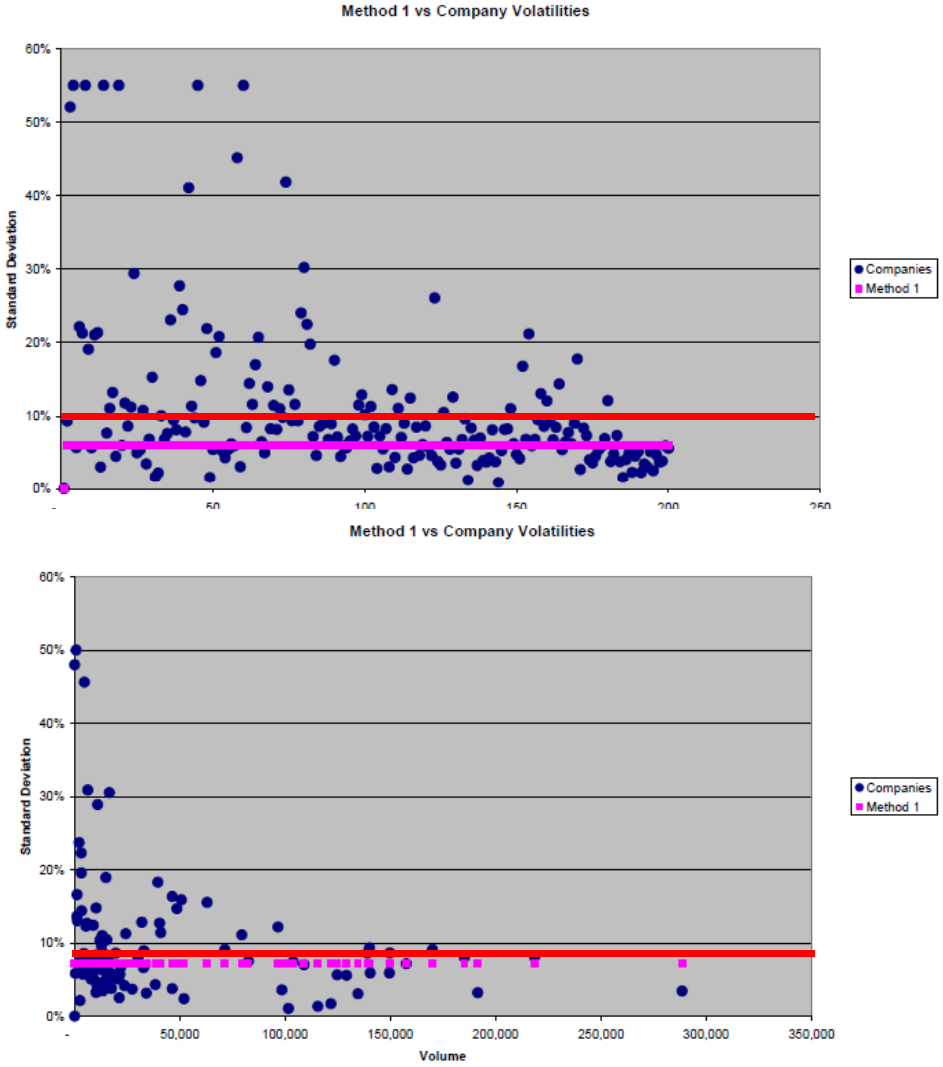
Solvency II: Standard Formula conservatively calibrated

CEIOPS calibration method 1



- Standard Formula Premium Risk
  - No Profit assumption;
  - “Average” StDev;
  - Only recognition of reinsurance in Cat (Nat, man-made) scenario’s.
- Internal model
  - Include profit as a cushion;
  - Allow for all kinds of risk mitigating techniques;
  - Using the companies risk-profile.
  - Use Test
  - Minor and major assumptions
  - Best estimate +

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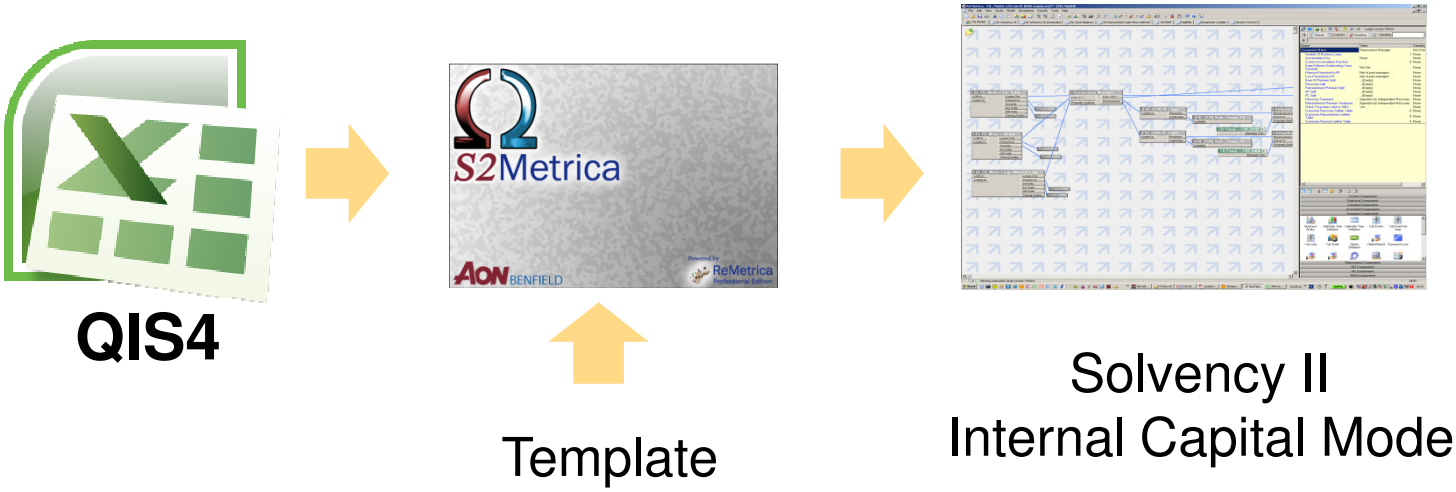
Section 4: S2Metrica

Automating part of the Solvency II Internal Model Builds



- S2Metrica reads in the standard spreadsheet and automatically constructs a basic Solvency II internal model
  - Allows customisations of model in key areas not captured well by standard formula **including Reinsurance**
  - Simple user interface but can look **inside the box**
  - Can use full **ReMetrica** model for further customisation

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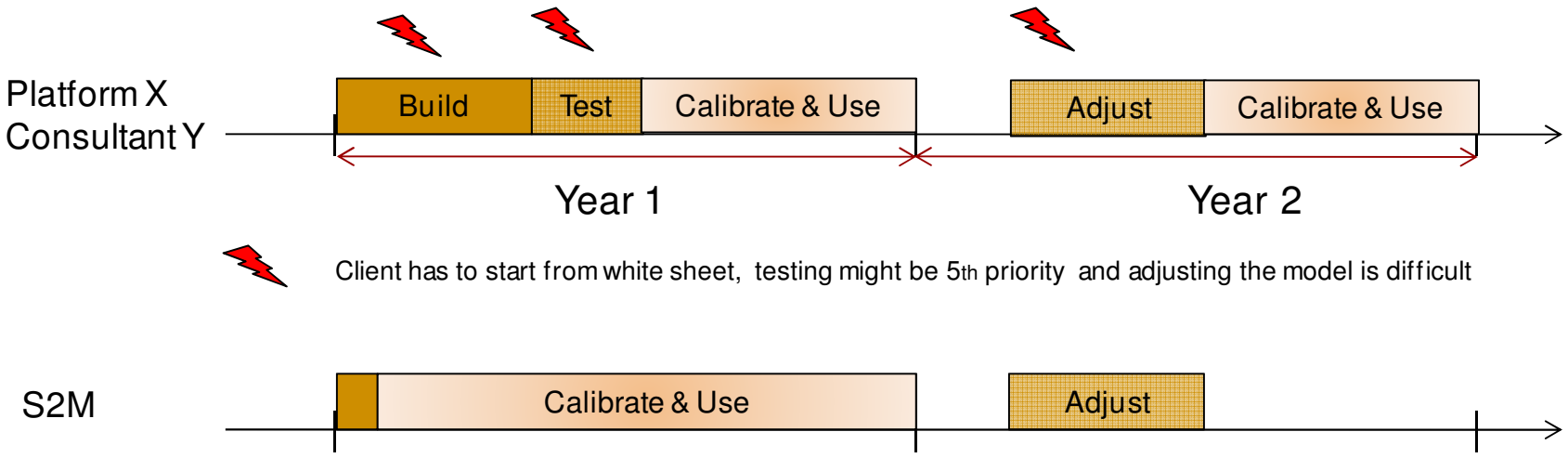
Unique Selling Points

- S2Metrica models company's risk better than the standard formula
- … including cat and reinsurance
- Creates an Internal Model without many weeks of work
- … which saves time and money
- S2Metrica is transparent
- … the user can see inside the box to check intermediate results
- Based on ReMetrica - market leading flexible Capital modelling tool
- … whereby the User can change assumptions
- Includes Euro-zone economic scenarios for Asset risk and discounting
- Aon Benfield will update for changes in QIS 5 and Standard Formula

S2Metrica speeds up building an Internal Model

Demo



Implementation comes with 3 days of consultancy from AonBenfield

- Additional consultancy will come from AGRC or other consultant of choice
- Commitment from client with respect to their input / resource is required to ensure the project is a success.

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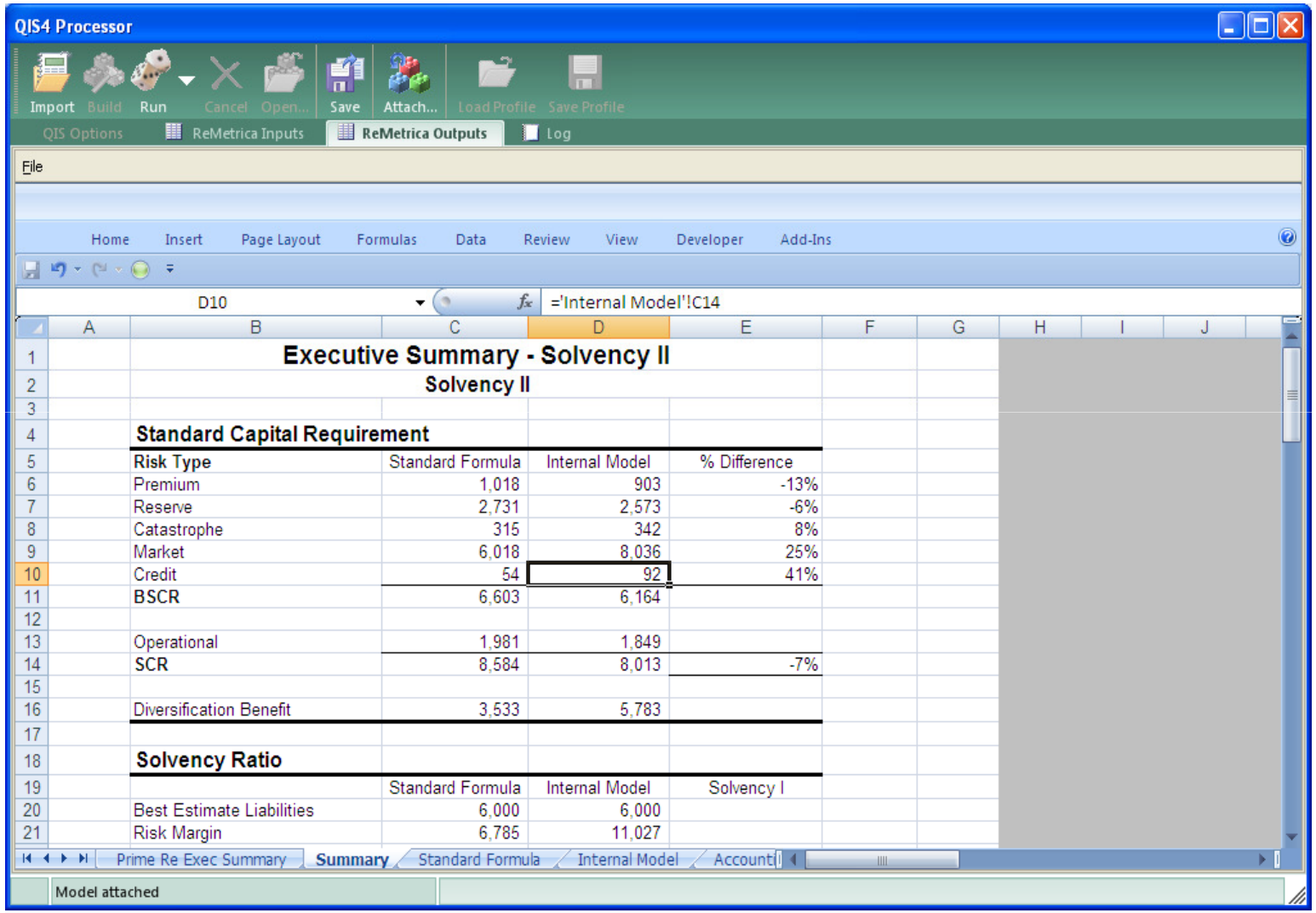
S2Metrica: Output Exhibits



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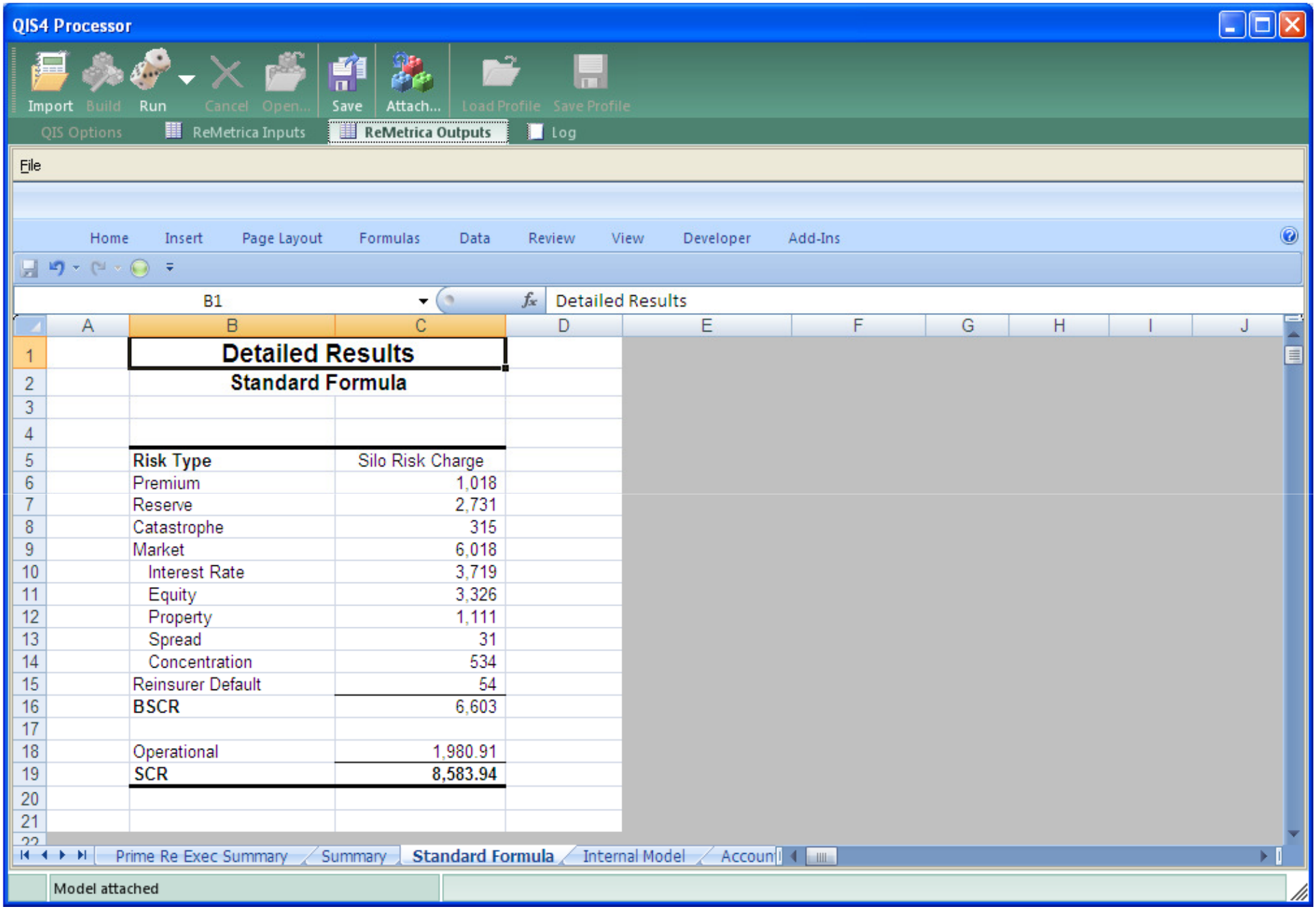
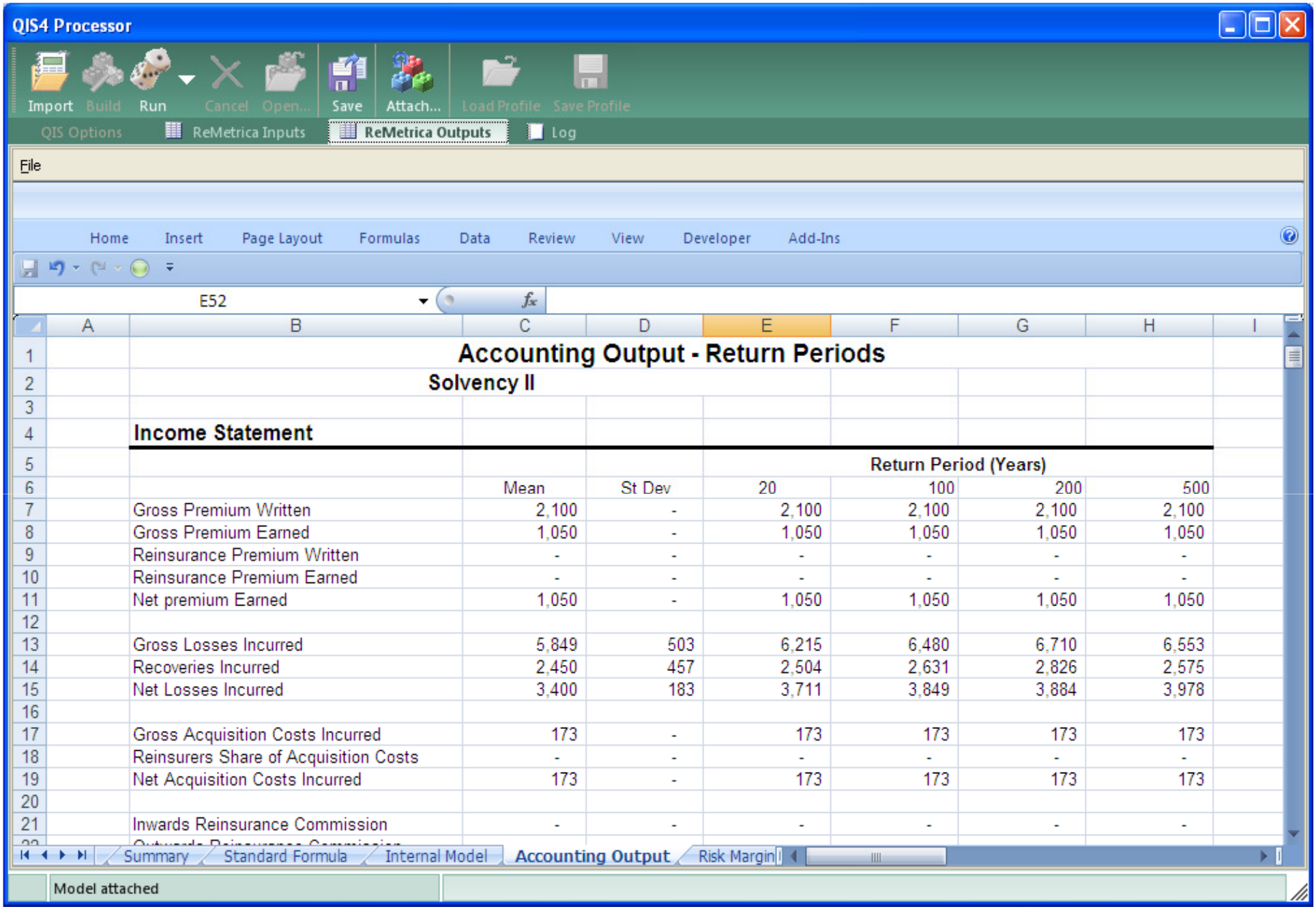

QIS4 Processor
Import
Build
Run
Cancel
Open...
Save
Attach...
Load Profile
Save Profile
QIS Options
ReMetrica Inputs
ReMetrica Outputs
Log
File
Home
Insert
Page Layout
Formulas
Data
Review
View
Developer
Add-Ins
B1
Detailed Results
Detailed Results
Standard Formula
Risk Type
Silo Risk Charge
Premium 1,018
Reserve 2,731
Catastrophe 315
Market 6,018
Interest Rate 3,719
Equity 3,326
Property 1,111
Spread 31
Concentration 534
Reinsurer Default 54
BSCR 6,603
Operational 1,980.91
SCR 8,583.94
Prime Re Exec Summary
Summary
Standard Formula
Internal Model
Model attached



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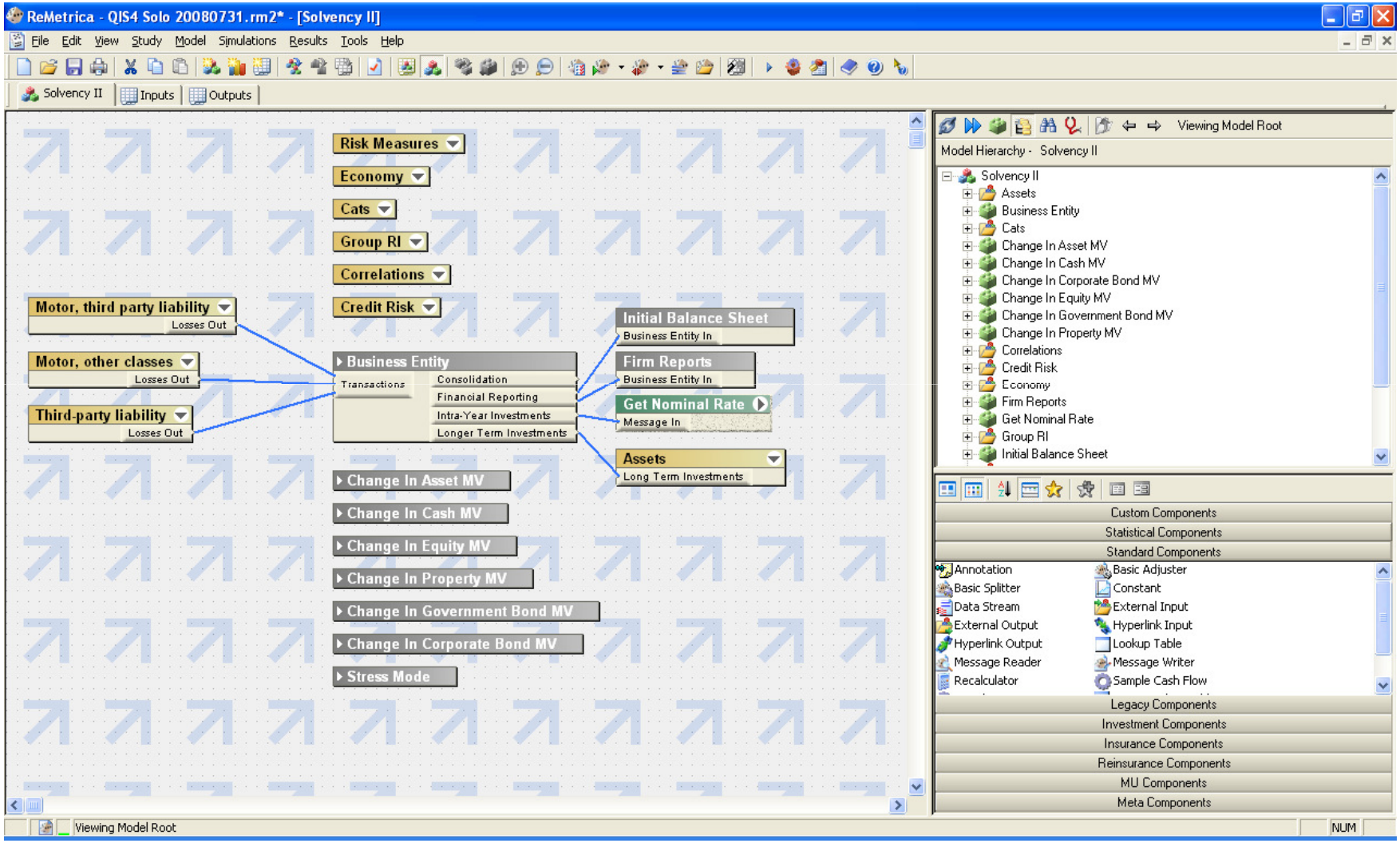
Model can be viewed and run directly in the ReMetrica



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