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Why Is It Important? – Real Cases

Legal Entity Impairments due to Natural and Man-made Cat Events (in the 1st decade of 21st century)

Name/Group	Year of Impairment	Domicile
AXA Corporate Solutions Re. Co.	2003	U.S.
Copenhagen Re. Co. Ltd.	2001	Denmark
Gerling Global	2002	U.S.
Olympus Reinsurance Co. Ltd.	2005	Bermuda
PXRE Reinsurance Ltd.	2006	U.S.
Quanta Reinsurance Ltd.	2006	Bermuda
Rosemont Re Ltd.	2005	Bermuda
Taisei Marine & Fire Ins. Co.	2001	Japan

*Rating prior to impairment = within 12 months of impairment news

Note: WTC = World Trade Center catastrophe event of September 11, 2001.

Source: Aon Benfield Analytics

Why Is It Important? – Rating Agency Perspective

- Property catastrophe reinsurers are subject to high capital requirements from rating agencies due to the inherent volatility in their book of business
- Capital requirements have evolved over time, reflecting heightened concern over potential severity and frequency of events
 - 2011 Catasrophe events
- In response rating agencies:
 - Increased capital requirements
 - Placed greater scrutiny on data quality
 - Emphasized the importance on ERM
 - Emphasized the importance of a clear risk tolerance
- **A.M. Best SRQ – Stress Scenarios**

Question 8 – Within each risk type listed in the table below, what has management identified to be its largest potential threat to the overall financial strength of the company?

Risk Type	Description of Risk/Event/Scenario	Est. potential impact (000s)	% of capital
Market Risk			
Credit Risk			
Underwriting Risk			
Operational Risk			
Strategic Risk			
Liquidity Risk			
Other Risk			

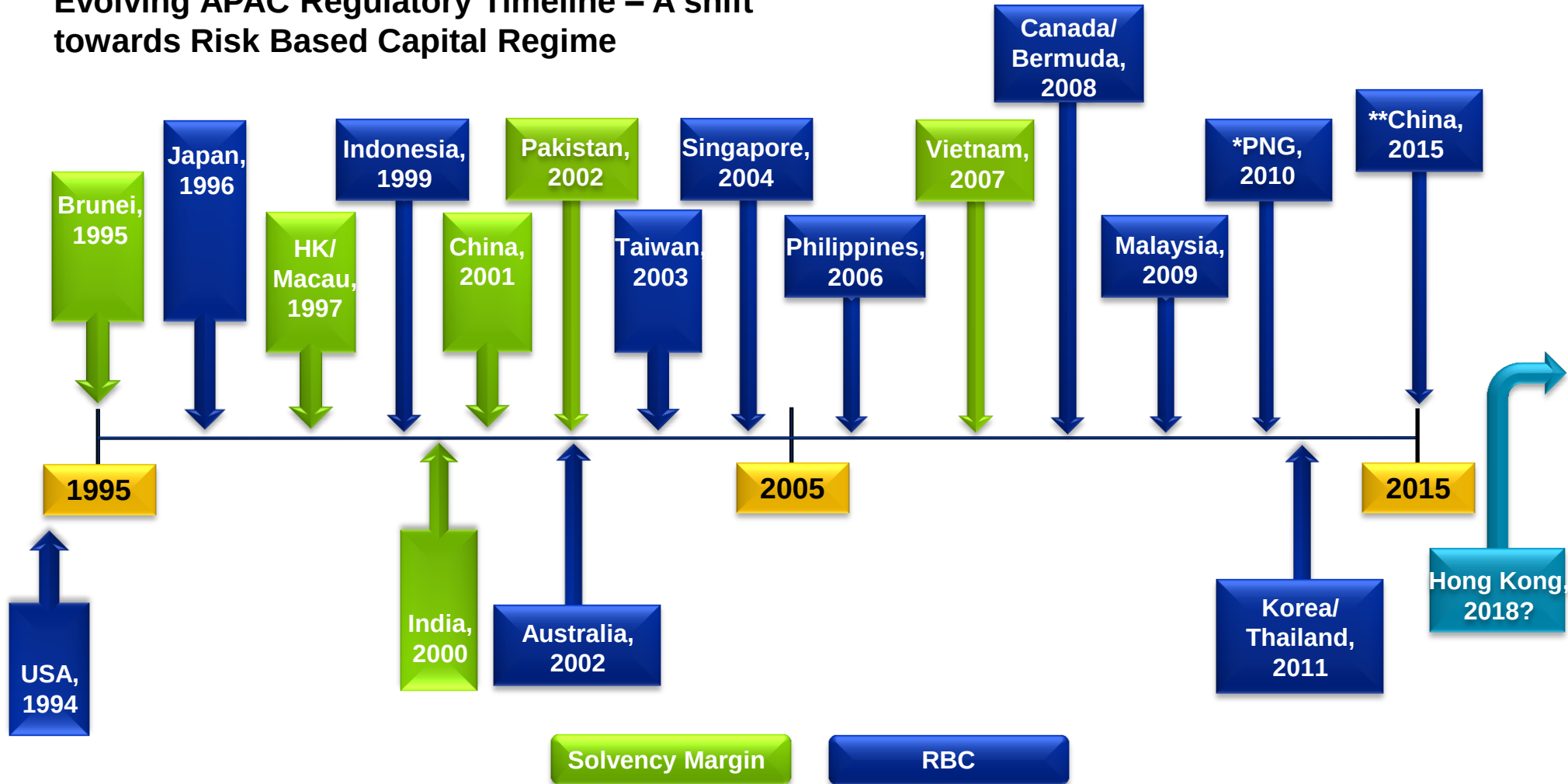
A.M. Best Stress BCAR Treatment

- A.M. Best requires insurers and reinsurers to maintain ample capital to absorb the impact of multiple catastrophe losses in a given year

Adjustment	Impact
1st Event – Larger of 1:100 Wind or 1:250 EQ or actual event	
Reduce AT-Net PML from surplus	Lowers adjusted surplus
Add 40% of PT-Net PML to reserves	Increases required capital
Add 40% of ceded recoveries to reinsurance recoverables	Increases required capital
Increase credit risk and reinsurance dependence factors	Increases required capital
2nd Event – Larger of 1:100 Wind or 1:100 EQ or actual event	
Reduce surplus by AT-Net PML	Lowers adjusted surplus

Why Is It Important? – Regulatory Perspective

Evolving APAC Regulatory Timeline – A shift towards Risk Based Capital Regime



Note: *PNG refers to Papua New Guinea

**Transition period in 2015 and formal implementation in 2016 expected

Source: Aon Benfield Analytics

Aon Benfield Analytics

Proprietary



2 Traditional Tools

Pros & Cons of External Rating

- **Pros**

- Global benchmarking
- Comprehensive risks covered
- Based on both public and private information
- Reflect both actuals and forecasts
- Has been tested for many years
- Widely accepted
- (rating) information easy to obtain and compare

- **Cons**

- Reflects capability to pay, but not willingness to pay
- Could be constrained by the criteria/methodology
- Not all companies are rated (especially in developing markets)
- Timeliness

Pros & Cons of External Rating

- Legal Entity Impairments due to Natural and Man-made Cat Events (in the 1st decade of 21st century)

Name/Group	Year of Impairment	Domicile	A.M. Best Rating Prior to Impairment*	S&P Rating Prior to Impairment*
AXA Corporate Solutions Re. Co.	2003	U.S.	A+ g (stable)	AA (stable)
Copenhagen Re. Co. Ltd.	2001	Denmark	A g (stable)	A (stable)
Gerling Global	2002	U.S.	A g (stable)	AA- (Watch Neg)
Olympus Reinsurance Co. Ltd.	2005	Bermuda	A- (stable)	NR
PXRE Reinsurance Ltd.	2006	U.S.	A g (stable)	A (stable)
Quanta Reinsurance Ltd.	2006	Bermuda	A- g (stable)	NR
Rosemont Re Ltd.	2005	Bermuda	A- (stable)	NR
Taisei Marine & Fire Ins. Co.	2001	Japan	NR	BBBpi

*Rating prior to impairment = within 12 months of impairment news

Note: WTC = World Trade Center catastrophe event of September 11, 2001.

Source: Aon Benfield Analytics

Common Tools for Cedants

- Approved reinsurer lists
 - An Aon Example – the 10-point check list we use
 - Financial strength
 - Country of origin
 - Ultimate ownership and inter-company relations
 - Insurance (Reinsurance/Retrocession)
 - Management
 - Type of business written
 - Government supervision and regulations
 - Currency regulations
 - Agency agreements for pools, underwriting agencies and binders
 - Market intelligence

Common Tools for Cedants (Cont.)

- Maximum exposure limits
- Credit Enhancements
 - Collateral
 - Letters of credit / trust funds
 - Parent / Third-party guarantee
- Cancellation / termination / commutation
 - Downgrade clause
- Differentiated reinsurance prices

Weakness of Traditional Tools

- Approved reinsurer lists
- Maximum exposure limits
- Credit enhancements
- Cancellation / termination / commutation
- Differentiated reinsurance prices



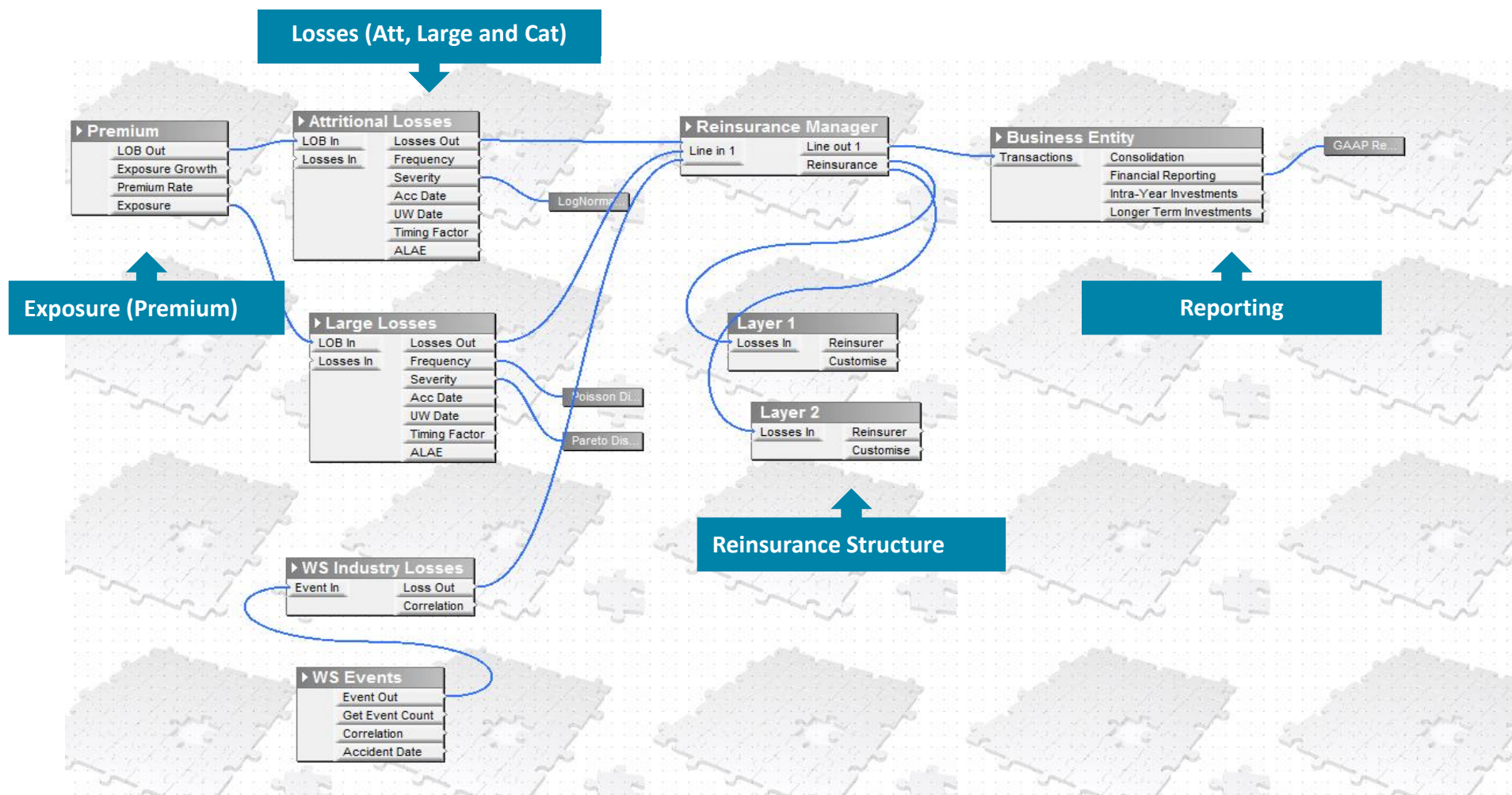
Quantifying Reinsurance Credit Risk

Modeling

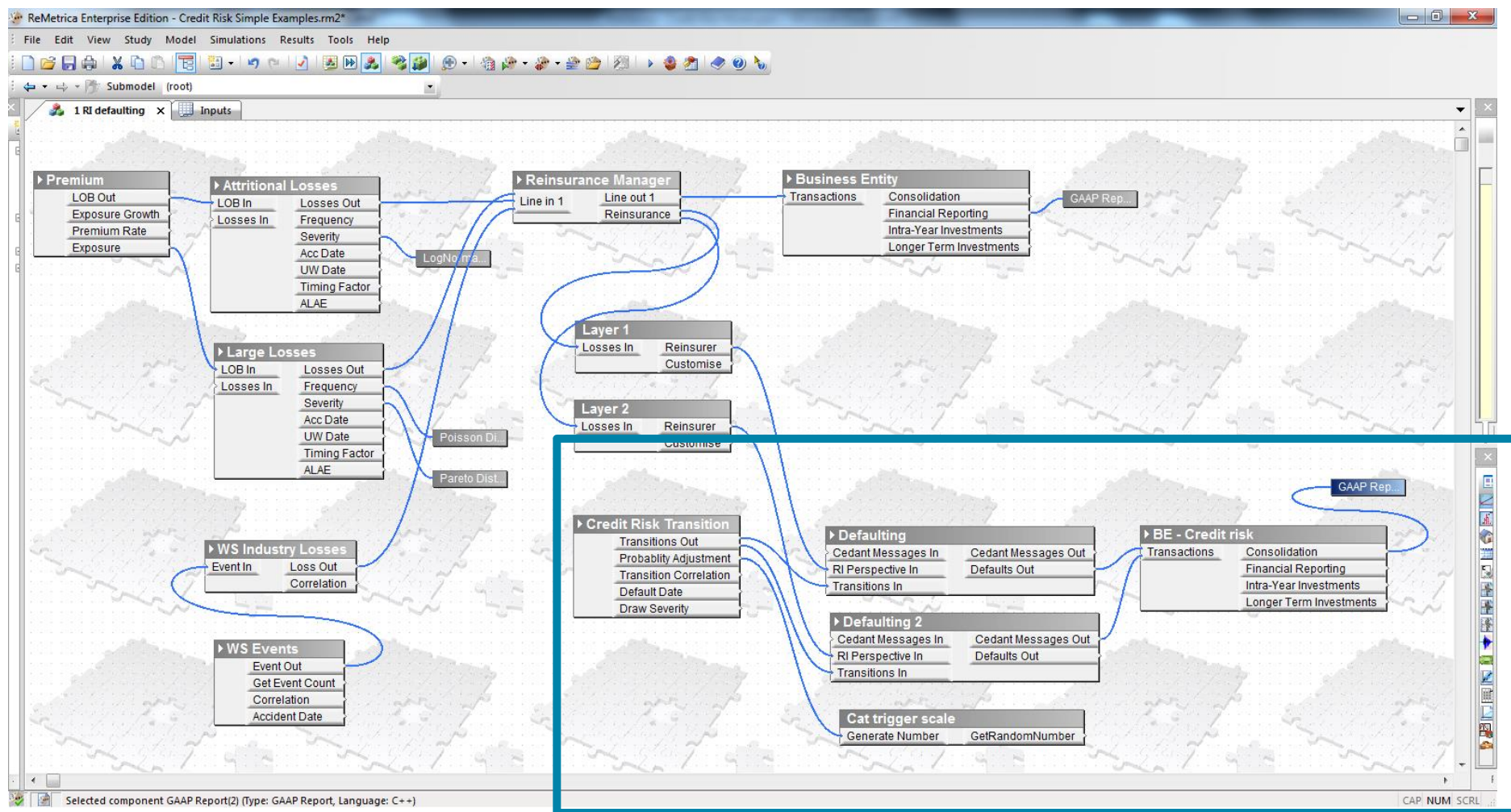
- Deterministic
 - Factor-based approach
- Stochastic
 - Key inputs
 - Balances at end of last period
 - Incremental reinsurance assets in the new period
 - Transition matrix / Recovery rate approach
 - Normal scenario
 - Stressed scenario (catastrophe events)
 - Output: Projected loss due to Reinsurance Credit Risk
 - A curve

Source: Towers Watson

Basic Reinsurance Evaluation Model Structure in ReMetrica



Credit Risk Components



Functions of Credit Risk Components

► Credit Risk Transition	
	Transitions Out
	Probability Adjustment
	Transition Correlation
	Default Date
	Draw Severity

- This component models credit risk transitions per year. A credit risk transition occurs when a reinsurer changes from one rating to another, or defaults

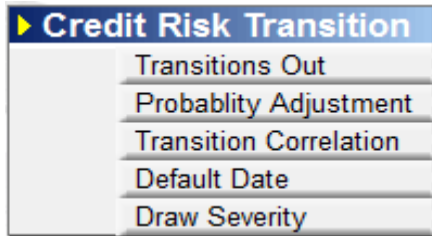
► Defaulting	
Cedant Messages In	Cedant Messages Out
RI Perspective In	Defaults Out
Transitions In	

- This component takes default messages generated by the Credit Risk Transition component, and applies them to debtor cashflows based on the shares of the reinsurers. Using the reinsurer transitions and defaults generated by the Credit Risk Transition component, it calculates the financial impact of a default on your P&L and balance sheet.

Cat trigger scale	
Generate Number	GetRandomNumber

- Modify the transition matrix during a simulation, for example to reflect changing economic conditions, or in response to extraordinary cat losses.

Input information for Credit Risk Components



The information to be used in the stochastic credit risk modelling:

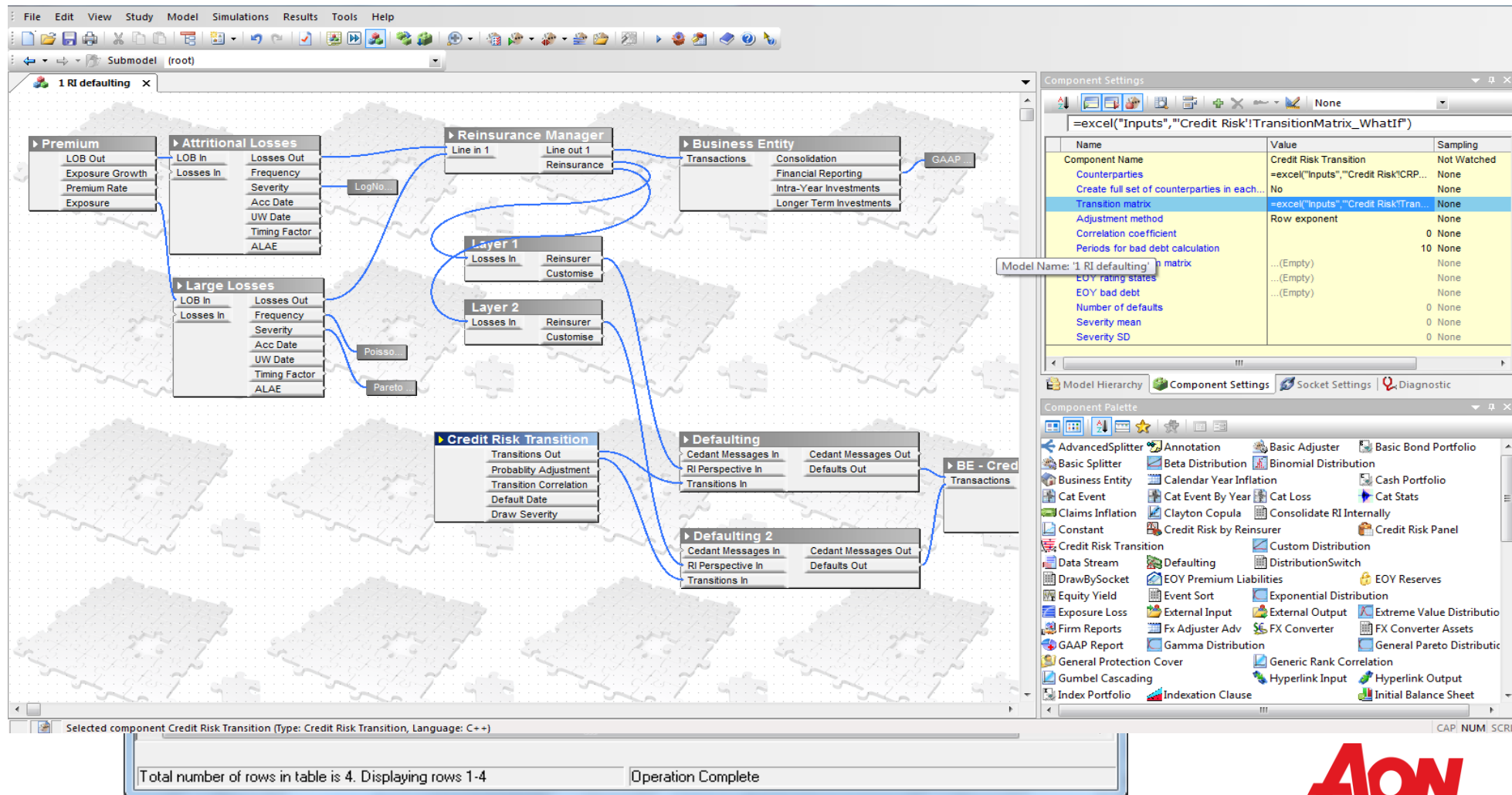
- Rating Transition Matrix
- Defaulting Probability
- Defaulting Severity (% of uncollectable from reinsurer)
 - The user can specify the distribution for defaulting severity, otherwise ReMetrica will set it as Beta Distribution
- Rating for Panel Reinsurers

Inputs.xlsx - [Credit Risk Simple Examples.rm2]

Credit Risk Input								
Transition Matrix								
Rating	AA-	A	A-	BBB+	Default Probability	Mean Severity	Mean SD	
AA-	0.0%	0.0%	0.0%	0.0%	100.0%	50%	20%	
A	3.8%	78.2%	12.0%	6.0%	0.0%	50%	20%	
A-	3.5%	10.1%	75.4%	11.1%	0.0%	50%	20%	
BBB+	0.0%	0.0%	0.0%	0.0%	100.0%	50%	20%	

Panel	Entity	Rating
	CP1	AA-
	CP2	AA-
	CP3	A
	CP4	A
	CP5	A
	CP6	A-
	CP7	A-
	CP8	BBB+
	CP9	BBB+
	CP10	BBB+

Input information for Credit Risk Components



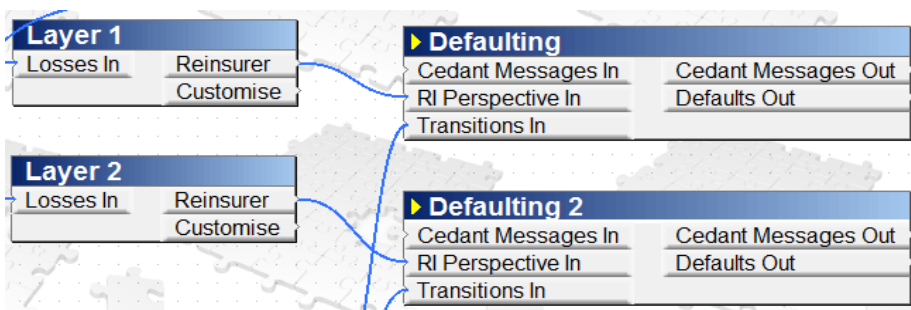
Input information for Credit Risk Components

The screenshot displays the Aon Benfield Analytics software interface. The main workspace shows a diagram of credit risk components including Premium, Attritional Losses, Reinsurance Manager, and Business Entity. A 'Component Settings' panel on the right lists various parameters and their values. A 'Initial Counterparty Ratings (Read Only)' dialog box is open, showing a table of 10 counterparties with their ratings. The table is as follows:

	Counterparty	Rating
1	CP1	AA-
2	CP2	AA-
3	CP3	A
4	CP4	A
5	CP5	A
6	CP6	A-
7	CP7	A-
8	CP8	BBB+
9	CP9	BBB+
10	CP10	BBB+

The dialog box also indicates 'Total number of rows in table is 10. Displaying rows 1-10' and 'Operation Complete'.

Input information for Credit Risk Components



The information to be used in the stochastic credit risk modelling:

- Layer details
- Panel Reinsurers' Share on Each Layer

Inputs.xlsx - [Credit Risk Simple Examples.rm2]

	A	B	C	E	F	G	H	I	J	K
1	Reinsurance									
2										
3										
4		XL Layers	Layer 1	Layer 2						
5		Loss Attachment	20,000,000	40,000,000						
6		Loss Limit	20,000,000	60,000,000						
7		ROL	68.0%	39.0%						
8										
9		Reinsurers' Share								
10		CP1	25%	20%						
11		CP2	25%	0%						
12		CP3	0%	0%						
13		CP4	25%	20%						
14		CP5	0%	20%						
15		CP6	25%	20%						
16		CP7	0%	20%						
17										
18										

Input information for Credit Risk Components

The screenshot displays the Aon Benford Analytics software interface. A dialog box titled "Reinsurers' Share (Read Only)" is open, showing a table with 7 rows of reinsurer data. The table has two columns: "Name" and "Share". The data is as follows:

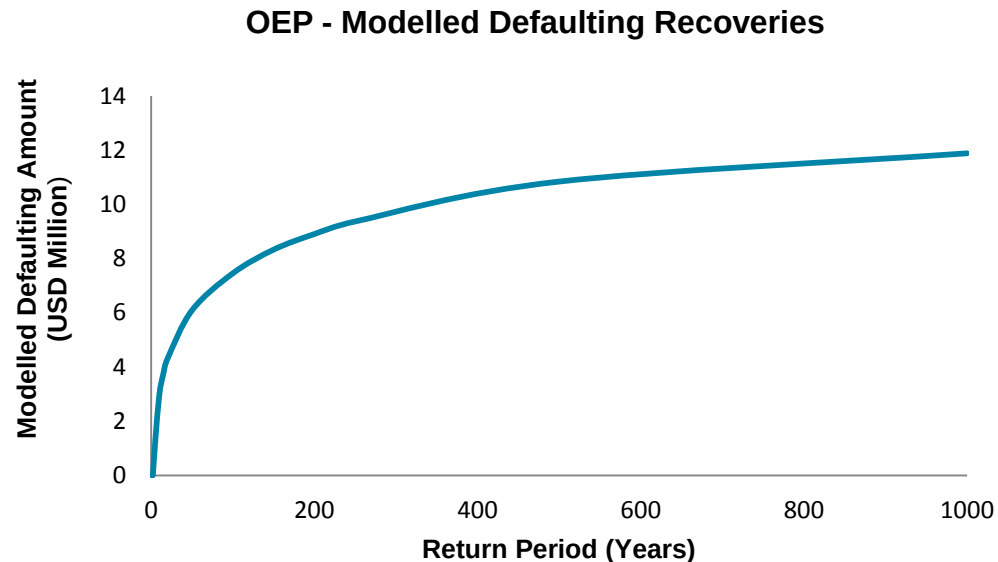
	Name	Share
1	CP1	25%
2	CP2	25%
3	CP3	0%
4	CP4	25%
5	CP5	0%
6	CP6	25%
7	CP7	0%

At the bottom of the dialog, a status bar indicates "Total number of rows in table is 7. Displaying rows 1-7" and "Operation Complete".

The background software interface includes a menu bar (File, Edit, View, Study, Model, Simulations, Results, Tools, Help) and a toolbar. The main workspace shows a "Submodel (root)" tree with tabs for "Premium", "Attritional Losses", "Reinsurance Manager", and "Business Entity". A "Component Settings" panel is open on the right, showing a list of components and their values. The "Reinsurance!RILayer1_Shares" component is selected, showing a value of "None".

Simulate the Defaulting Recoveries

- 50,000 simulations were executed in ReMetrica and the OEP curve for modelled defaulting amount can be extracted.

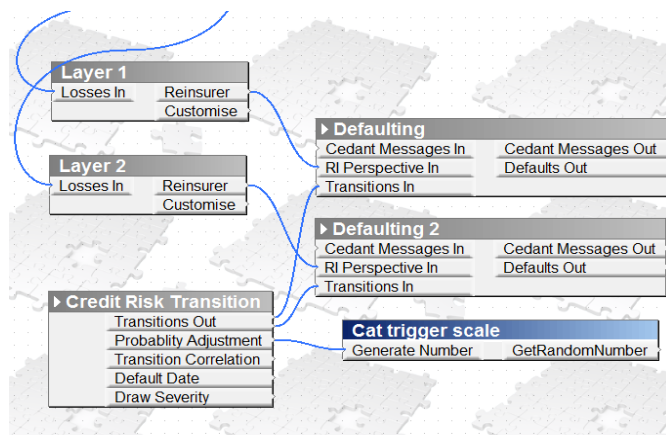


Simulation Manager

Model	Result	Re-run Information	Status
1 RI defaulting	1 RI defaulting	Trial Count: 50000	Trial 13238 of 50000

Stress Transition Matrix in Response to Cat Events

- The can model can stress the transition matrix during a simulation in response to extraordinary cat losses
- The probabilities of changing rating or of defaulting can be modified to reflect cat loss effect
- A threshold can be specified by user to trigger the change of transition matrix, e.g. Typhoon loss > 10 million USD



Component Settings

None

=if(ws Industry Losses!Max Loss per Year > 1e7,2,1)

Name	Value	Sampling
Component Name	Cat trigger scale	Not Watched
View Distribution	...(Empty)	None
Draw Count		1 None
Draw Total		2 None
Draw Mean		2 None
Mean	=if(ws Industry Losses!Max Loss per Year > 1e7,2,1)	
Standard Deviation		
What If		
Draw Max		
Draw Min		
Lower Bound		0 None
Upper Bound		0 None
LB Truncation Behaviour	Sample within Bounds	None
Last Draw		2 None

Model Hierarchy | Component Settings | Socket Settings | Diagnostic

Stress Transition Matrix in Response to Cat Events

- For example, consider the following row from a simple transition matrix:

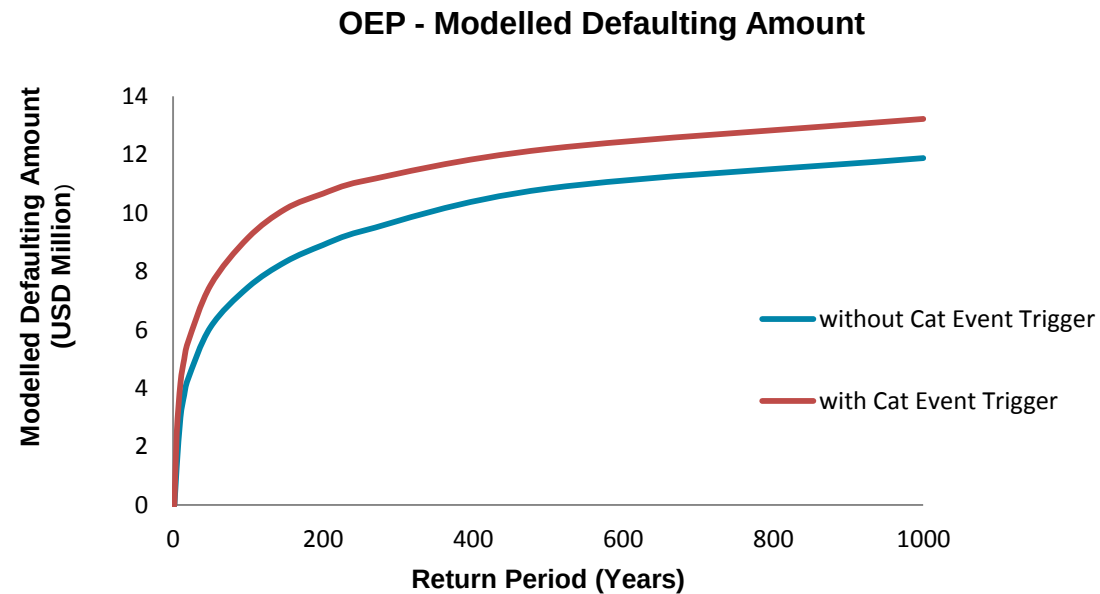
	A	BBB	Default
A	90%	7%	3%

- The number can come from Cat Trigger Scale component, e.g. the returned number is 2
- The number is used as an exponent to the value of the first column, so the **A value becomes 0.9^2**
- The value of the second column is added to the original value of the first column and raised to the exponent, then the new value of the first column is subtracted. So the **BBB value becomes $(0.9 + 0.7)^2 - 0.9^2 = 0.13$**
- Note: If there were more ratings columns, they would be modified in a similar way: sum all original values from the columns up to and including the current one, and raise the result to the exponent, then subtract the sum of all new values to the left of the current column
- Calculate the probability of defaulting by subtracting from 1 the total of all the previous columns, so the **Default value becomes $1 - [0.81 + 0.13]$**
- Thus the corresponding row in the Adjusted Transition Matrix would be:

	A	BBB	Default
A	81%	13%	6%

Stress Transition Matrix in Response to Cat Events

- 50,000 simulations were executed in ReMetrica and the OEP curve for modelled defaulting amount can be extracted.
- When there is a Cat Event Trigger in the model, the defaulting amount curve is higher.



Rating Transition (Migration)

Best's Cumulative Average Impairment Rates

U.S. life/health and property/casualty data from 1977 to 2013.

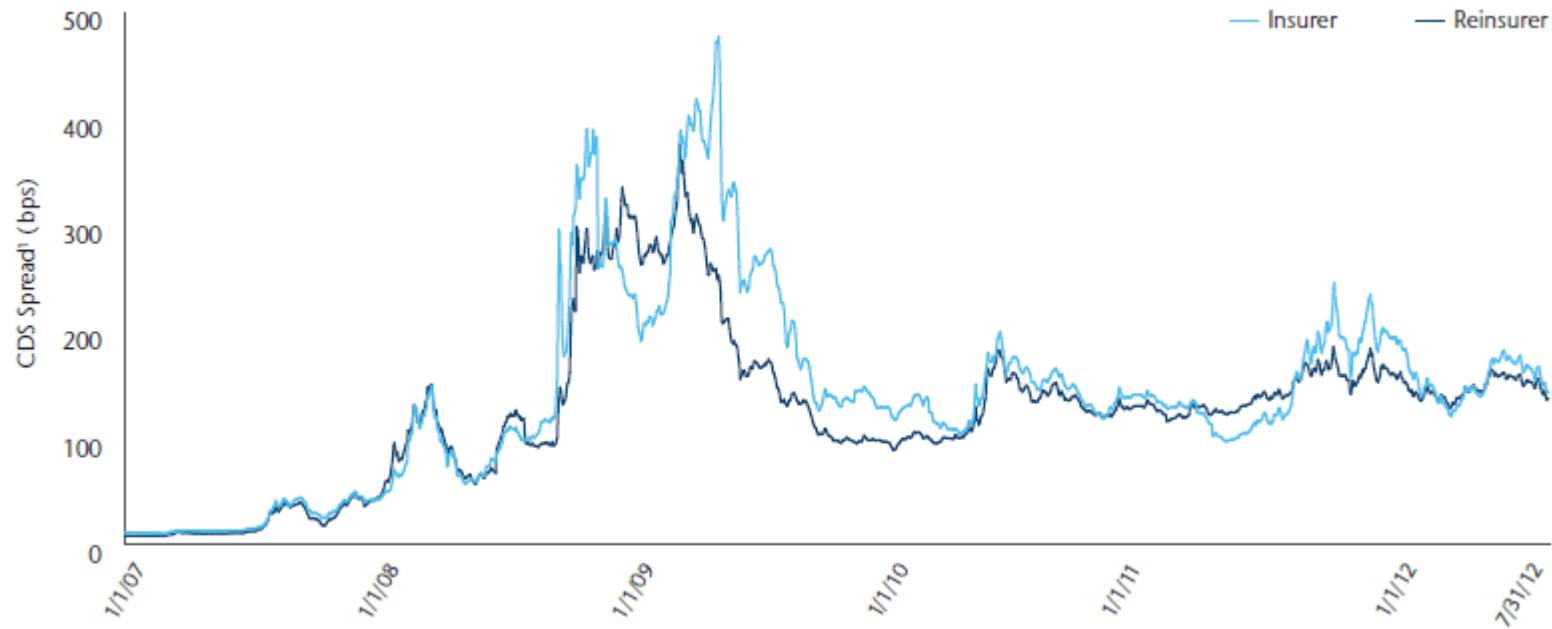
Rating	1-Year	2-Year	3-Year	4-Year	5-Year	6-Year	7-Year	8-Year	9-Year	10-Year	11-Year	12-Year	13-Year	14-Year	15-Year
A++/A+	0.05%	0.17%	0.31%	0.46%	0.61%	0.82%	1.04%	1.27%	1.56%	1.85%	2.15%	2.53%	2.93%	3.34%	3.65%
A/A-	0.16	0.49	0.93	1.37	1.86	2.38	2.89	3.47	4.01	4.52	5.02	5.46	5.87	6.21	6.53
B++/B+	0.74	1.75	2.75	4.00	5.34	6.50	7.65	8.57	9.31	10.07	10.80	11.58	12.28	13.01	13.58
B/B-	2.20	4.49	6.67	8.54	10.47	12.42	14.25	15.82	17.39	18.95	20.53	22.04	23.44	24.69	25.81
C++/C+	3.78	6.31	9.31	12.21	14.64	17.23	19.43	22.54	25.05	26.94	28.34	29.42	30.55	31.83	32.95
C/C-	5.84	9.19	12.03	15.04	18.00	21.58	25.08	28.85	31.81	34.46	37.52	40.05	42.29	44.58	46.74
D	7.60	12.74	17.68	22.06	26.29	30.61	34.18	37.19	39.83	42.29	44.72	46.67	48.36	49.86	51.10
Secure	0.23	0.60	1.02	1.50	2.00	2.51	3.02	3.51	3.98	4.45	4.90	5.37	5.82	6.25	6.60
Vulnerable	3.78	6.72	9.62	12.24	14.79	17.47	19.87	22.20	24.28	26.20	28.07	29.70	31.20	32.61	33.85
All	0.64%	1.31%	2.01%	2.73%	3.46%	4.21%	4.93%	5.64%	6.30%	6.93%	7.56%	8.17%	8.76%	9.31%	9.78%

Source: A.M. Best data & research

Market Perception based Approach

- Credit Default Swaps (CDS) allows the credit risk of the financial instrument to be transferred without actually transferring legal ownership of the asset.
- The CDS spread represents the annual price of buying protection against the issuer's default. This spread, measured in basis points, should be multiplied against the value of the asset to arrive at the annual cost of the credit protection. Therefore, CDS spreads may be seen as a measure of counterparty credit risk as determined by the capital markets and can be used to generate and compare market-consistent estimates of counterparty risk.
 - The higher the CDS spread, the greater the credit risk of the organization as perceived by the capital markets.
 - CDS spreads are only available for companies whose debt is actively traded in the capital markets and where there is a market for the issuer's CDS.

Market Perception based Approach



Source: Bloomberg

- A high correlation in the CDS spreads between the insurance and the reinsurance sectors.
- Average spreads peaked to between 300 and 500 basis points in 2008/2009, but have declined to below 200 basis points in 2012.

An Integrated Approach

- Regulator
 - Centralized reinsurer registration system (information platform)
 - Capital requirement & Discriminatory treatment
- Cedants
 - Approved list (Set selection criteria)
 - Avoid concentration risk
 - Quantify / Rank the risk
 - Deterministic
 - Stochastic
 - Security Rating Index ®
- Reinsurers
 - Increase transparency
- Brokers
 - Provide database / information platform
- Rating agencies
 - Calibrate / Enhance the current approach. (Stochastic, CDS based, etc.)

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