C33: Reinsurance Markets US and International

Casualty Actuarial Society Annual Meeting
New York City, November 10, 2014

John Buchanan, Principal, Excess & Reinsurance, Verisk / ISO

Agenda

- **Overview of Global Property and Casualty Markets**
  - Size and growth potential of various international markets compared to the US
  - Information condensed from the CAS International Webinar in February with Dave Sandeman (Axco)
- **International Property Topics**
  - Some New Insights into Large Commercial Risks
  - White Paper: Case Study Application to Netherlands
  - Information condensed from the GIRO Conference in Wales in September with Enrico Biffis (Imperial College of London / Lloyd's)
- **2014 Whirlwind Tour – CAS International**

An overview of the Macro Factors & Influencers for International Casualty and International Property

(Connecting the Dots)

***Extracts from full CAS International Webinar -2/2014** (full recording available CAS website)*

Dave Sandeman – Director: Content & Operations
Anna Brattstrom – Head of Statistics & Analytics

A quick view of the International Property & Casualty world – Macro

- *The Market……so how big is it all?*
- *Where are the premiums?*
- *Who is growing ? (Premiums vs. Penetration)*
- *Influencers?*

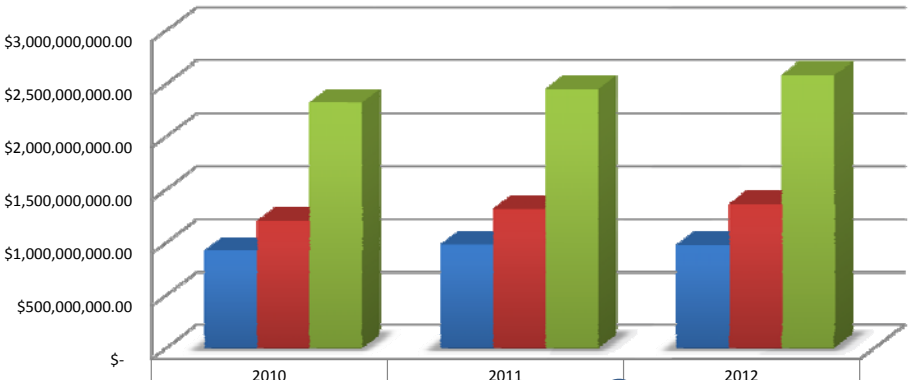
Dave Sandeman – Director: Content & Operations
Anna Brattstrom – Head of Statistics & Analytics

The Market……so how big is it?

	2012
PA & Healthcare	$ 981,205,000.00
P&C	$ 1,368,760,000.00
Life	$ 2,583,966,000.00
Totals	**$ 4,933,931,000.00**

Axco Global Statistics

Global Premiums

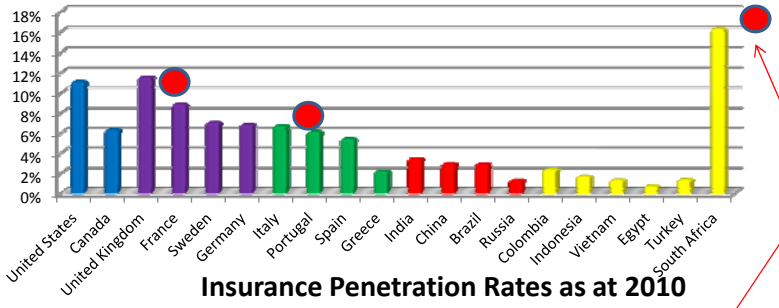


	2010	2011	2012
PA & Healthcare	$924,211,000.00	$983,830,000.00	$981,205,000.00
P&C	$1,206,671,000.00	$1,319,247,000.00	$1,368,760,000.00
Life	$2,324,810,000.00	$2,454,547,000.00	$2,583,966,000.00

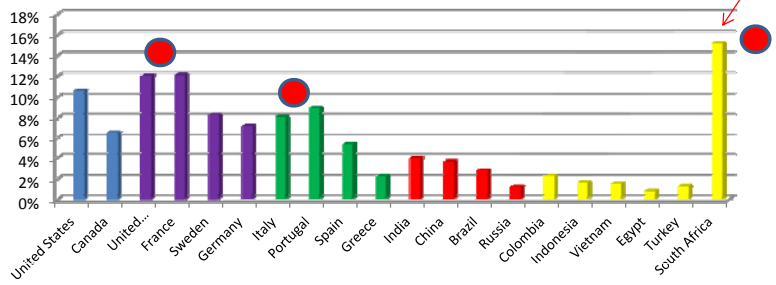
Axco Global Statistics

Who is growing ? (Premiums vs. Penetration)

Insurance Penetration Rates as at 2012



Insurance Penetration Rates as at 2010



Understanding the **Influencers**

(First World Financial Services
Third World Population
Major players look North)

Understand the **Influencers** – Inside the P&C numbers

	2012
PA & Healthcare	$ 981,205,000.00
P&C	$ 1,368,760,000.00
Life	$ 2,583,966,000.00
Totals	**$ 4,933,931,000.00**

Looking at 2011

Life	$ 2 455 000 000 000	51.68%
Property & Casualty	$ 1 314 000 000 000	**27.64%**
Prop $ 351 b (27% of P&C)		
Motor $ 598 b (45% of P&C)		
Rest (Casualty) $ 365 b (28% of P&C)	**or 7,67% of All Of it!**	
PA & Health	$ 983 000 000 000	20.68%

Influencer (USA = $ 607 = 61.74% of PA & Health)

TOTAL 2011 **$ 4 753 000 000 000**

Axco Global Statistics

"As reported ": - the split of P&C across the "standard classes"

So many different regulatory and association "types" of filings, that classes within classes are not consistent across the world, even though close on the principal lines

In order to get really deep, you need to burrow down into : -
Line of Business by Insurer – and the data set expands over 100 fold

Trends can then be "seen" and tracked on an individual line of business at the most granular level

A ten year look-back can open up the data by Line of Business and show how the regulatory changes In a country or region closely track and follow more mature markets

The catch up in claims trends is quite quick in the main motor and accident classes, less so in Liability and long tail areas

Property & Casualty 2011 Data

Exhibit of Europe/Worldwide/Developed & Developing CASUALTY Markets

MOTOR		Total	Property	Motor	Work Comp	Liability	MAT	Surety Credit
39%	United Kingdom	64,731.58	19,687.66	25,132.18		8,817.59	4,279.18	
42%	Germany	69,684.63	19,156.04	29,273.44		9,629.46	2,527.26	2,140.81
41%	France	64,571.71	22,547.97	26,245.73		4,239.91	1,431.84	1,404.04
43%	Sweden	7,772.68	4,100.13	3,328.74			147.24	87.52
		206,760.60	**65,491.80**	**83,980.09**	**-**	**22,686.96**	**8,385.52**	**3,632.37**
58%	Brazil	25,395.86	4,826.71	14,827.21		557.94	1,947.46	894.15
57%	Russia	16,473.57	4,651.65	9,363.69	231.58	570.88	1,243.72	412.05
53%	India	7,613.18	1,047.86	4,020.19		189.46	556.11	
75%	China	71,500.83	8,189.93	53,408.41		2,265.00	2,939.23	2,590.03
		120,983.44	18,716.15	81,619.50	231.58	3,583.28	6,686.52	3,896.23
	Class totals	**950,016.35**	**273,540.29**	**430,863.82**	**45,260.86**	**96,057.32**	**23,526.65**	**28,245.07**
	Percentage ALL COUNTRIES		29%	45%	5%	10%	2%	3%
	EU North		32%	41%	0%	11%	4%	2%
	BRICS		15%	67%	0%	3%	6%	3%

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Property & Casualty 2011 Data

Where are the premiums?

		Written Premiums (mn)	% of World Total Premium
N America	United States	1,741,374.00	35.29%
	Canada	115,171.16	2.33%
		1,856,545.16	**37.63%**
EU North	France	232,303.08	4.71%
	United Kingdom	281,322.31	5.70%
	Germany	232,046.10	4.70%
	Sweden	37,107.81	0.75%
		782,779.31	**15.87%**
EU South	Italy	135,068.56	2.74%
	Spain	74,042.33	1.50%
	Portugal	13,071.53	0.26%
	Greece	5,453.64	0.11%
		227,636.07	**4.61%**
BRIC's	China	245,359.85	4.97%
	India	64,915.80	1.32%
	Brazil	66,233.73	1.34%
	Russia	26,234.25	0.53%
		402,743.63	**8.16%**
CIVETS	Colombia	8,884.75	0.18%
	Indonesia	14,125.05	0.29%
	Vietnam	1,920.19	0.04%
	Egypt	1,770.54	0.04%
	Turkey	10,818.74	0.22%
	South Africa	62,602.00	1.27%
		100,121.27	**2.03%**

68% of the world's premium comes from 20 of the 180 Axco Reported Countries

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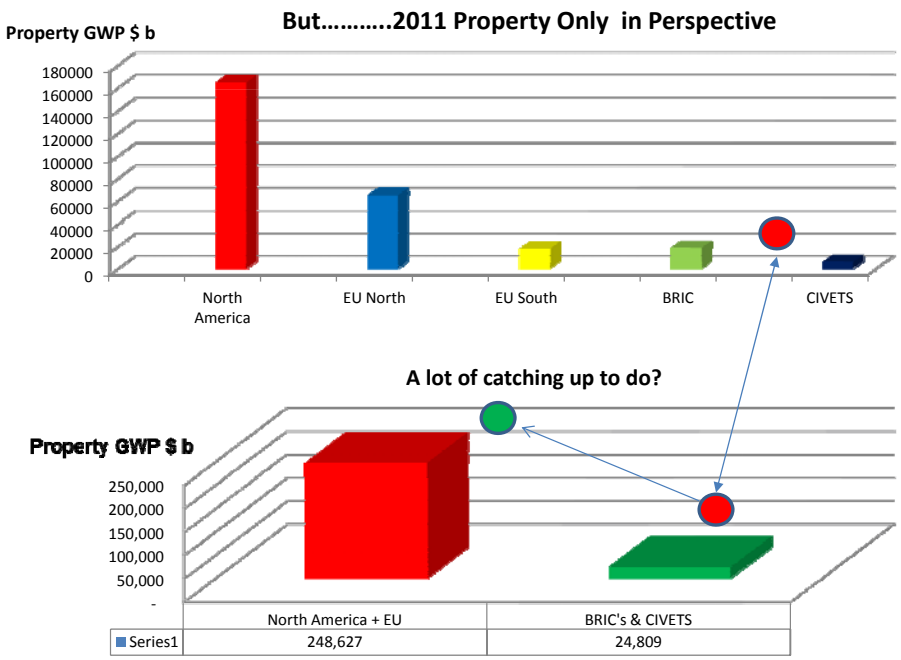
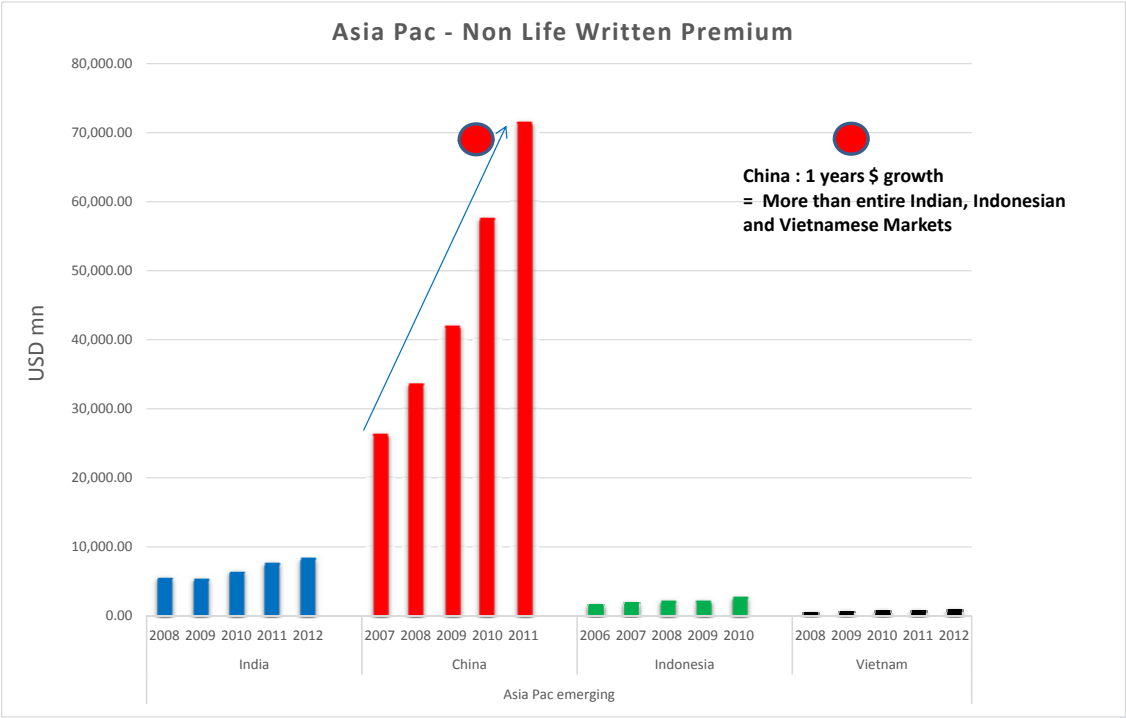
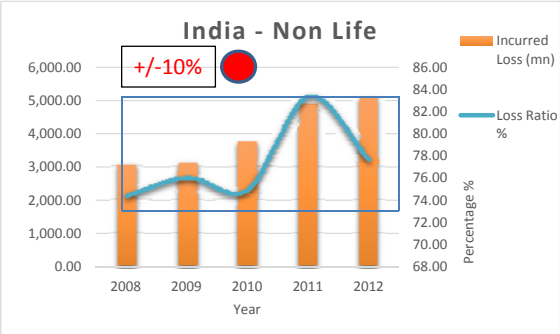
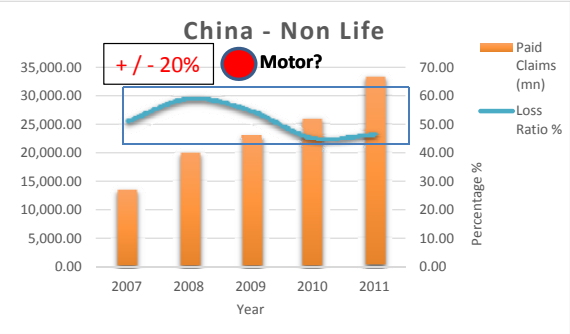


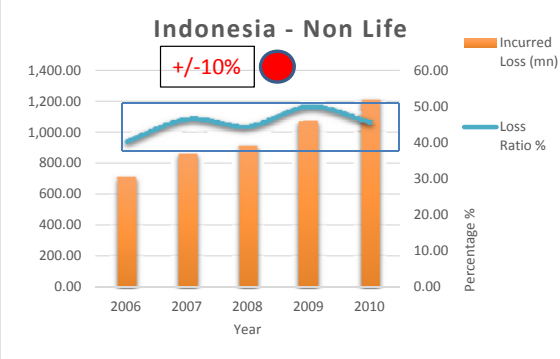
A whole different perspective

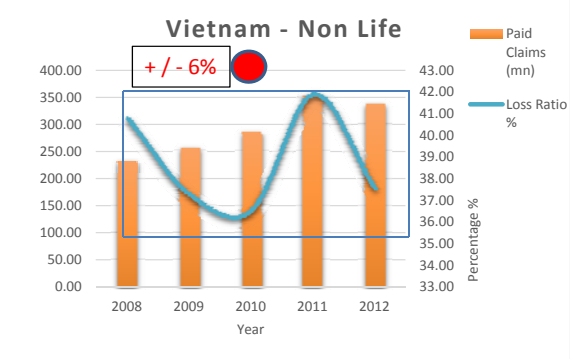


Curve volatility – can be "normal" – in a range – Influencers create this









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Non Statistical Factors (influencers)

Culture & Religion	Community vs. Balance Sheets - Takaful / Sharia
COPE	Written vs. Actual – Services & Enforcement **(Levy spent?)**
UK example = Maturation following Risk Controls & Management ?	
Wales 1 /Scotland 1 / England 63	**Cut backs = reduction in Fire Services?**
Incidence = Down - Severity = Down - Facilities = Reduce?	
Economic Activity (Manufacturing vs. Services)	Many vs. Major (Thailand Supply Chain Concentration)
Economic Asset make up	Again – COPE and focus
Value Perception	Insured Values / Insured Risks / Insurance as a "Value"

Assume nothing – investigate how your traditional risk pricing expectations will be **influenced**

"sensitivities and pitfalls of having incomplete data"

Dave Sandeman – Director: Content & Operations
Anna Brattstrom – Head of Statistics & Analytics

Property & Casualty 2011 Data

MOTOR	Country	Total	Property	Motor	Work Comp	Liability	MAT	Surety Credit	Sub Total	"Rest"
40%	United States	480,652.81	152,547.08	190,044.28	44,236.67	58,121.52	4,409.37	16,335.75	465,694.67	14,958.14
46%	Canada	36,946.30	12,614.97	17,015.38		4,776.31	612.84	1,570.64	36,590.14	356.16
		517,599.11	165,162.05	207,059.66	44,236.67	62,897.83	5,022.21	17,906.39	502,284.81	15,314.30
39%	United Kingdom	64,731.58	19,687.66	25,132.18		8,817.59	4,279.18		57,916.61	6,814.97
42%	Germany	69,684.63	19,156.04	29,273.44		9,629.46	2,527.26	2,140.81	62,727.01	6,957.62
41%	France	64,571.71	22,547.97	26,245.73		4,239.91	1,431.84	1,404.04	55,869.49	8,702.22
43%	Sweden	7,772.68	4,100.13	3,328.74			147.24	87.52	7,663.63	109.05
		206,760.60	65,491.80	83,980.09	-	22,686.96	8,385.52	3,632.37	184,176.74	22,583.86
	Italy	42,682.41	6,934.76	28,753.37		4,077.07	843.06	926.93	41,535.19	1,147.22
	Spain	31,792.15	9,420.40	14,639.52		1,650.30	746.97	951.52	27,408.71	4,383.44
	Portugal	4,120.89	932.07	1,999.41	749.80	128.01	85.37	51.20	3,945.86	175.03
	Greece	3,250.52	685.53	2,056.29		98.71	68.16	63.60	2,972.29	278.23
		81,845.97	17,972.76	47,448.59	749.80	5,954.09	1,743.56	1,993.25	75,862.05	5,983.92
58%	Brazil	25,395.86	4,826.71	14,827.21		557.94	1,947.46	894.15	23,053.47	2,342.39
57%	Russia	16,473.57	4,651.65	9,363.69	231.58	570.88	1,243.72	412.05	16,473.57	-
53%	India	7,613.18	1,047.86	4,020.19		189.46	556.11		5,813.62	1,799.56
75%	China	71,500.83	8,189.93	53,408.41		2,265.00	2,939.23	2,590.03	69,392.60	2,108.23
		120,983.44	18,716.15	81,619.50	231.58	3,583.28	6,686.52	3,896.23	114,733.26	6,250.18
						3%	6%			-
45%	Colombia	3,726.72	710.28	1,690.30		290.53		441.12	3,132.23	594.49
35%	Indonesia	3,287.69	984.99	1,143.55		65.83	596.09	142.36	2,932.82	354.87
36%	Vietnam	845.75	90.46	303.78		22.14	295.72	1.16	713.26	132.49
40%	Egypt	867.90	90.00	345.72			220.34		656.06	211.84
57%	Turkey	6,807.40	1,694.94	3,902.85	42.81	180.89	374.54	35.26	6,231.29	576.11
46%	South Africa	7,291.77	2,626.86	3,369.78		375.77	202.15	196.93	6,771.49	520.28
		22,827.23	6,197.53	10,755.98	42.81	935.16	1,688.84	816.83	20,437.15	2,390.08
						4%				
	Class totals	950,016.35	273,540.29	430,863.82	45,260.86	96,057.32	23,526.65	28,245.07	897,494.01	52,522.34
	Percentage		29%	45%	5%	10%	2%	3%		6%

Notes:

Reference material : -

Axco Global Statistics
Axco Insurance Market Reports
Axco Natural Perils
Axco Database

White Paper

Large Commercial Property Risk Loss Estimation: A Practitioner's Application to the Netherlands

John Buchanan (Verisk/ISO)
Enrico Biffis (Imperial College Business School)
25 Sept 2014

Presented at IFoA/GIRO Conference
Wales, September 2014

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Large Commercial Property Risk Loss Estimation: A Practitioner's Application to Netherlands

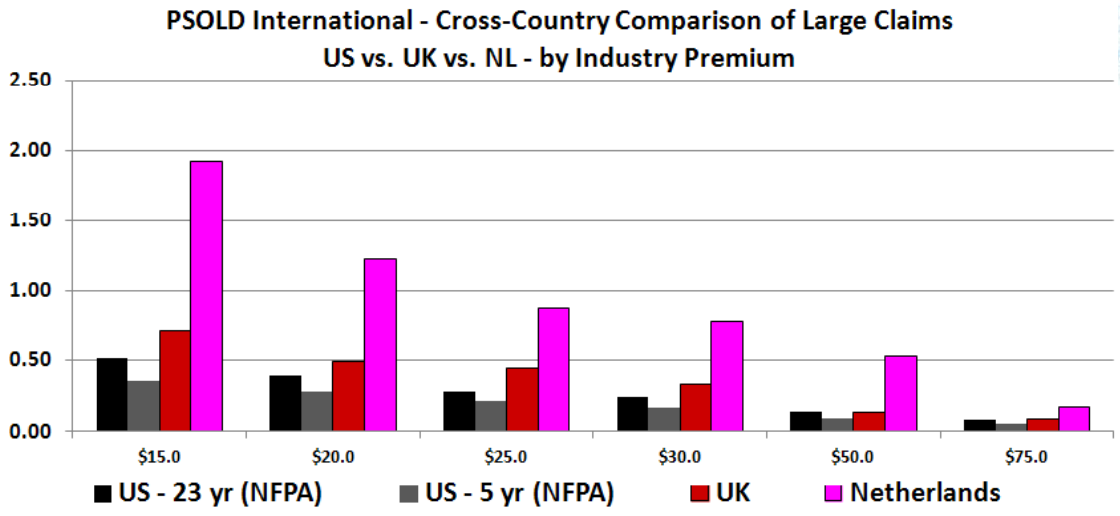
John Buchanan (Verisk / ISO)
Enrico Biffis (Imperial College Business School)
Kevin Hilferty (Guy Carpenter)
30 November, 2014

Abstract
Reinsurance pricing actuaries and underwriters are confronted with many challenges when attempting to produce credible loss estimates for the layering of large commercial risks globally. Of particular difficulty is amassing, validating, and applying various 1) excess size-of-loss curves, 2) total ground-up non catastrophe losses, 3) potential catastrophe losses for these risks and 4) pulling it all together. Using Netherlands as an interesting puzzle and example of the concepts, in this paper we present methodologies and validation procedures to utilize information from local and global sources to illustrate producing various property benchmarks and apply them in a real setting reflecting unique country exposing characteristics.

We will also go through a practical application of this information to illustrate striking a balance between the macro benchmarks that are presented in this paper; weighed with detailed granular multi-level adjustments. These adjustments are needed to reflect substantial heterogeneity in the individual risk exposing characteristics such as protections, constructions, occupancies and other geographical forces specific to Netherlands. This paper will also describe the various interesting issues raised by changing currencies and rebuilding costs between countries, and their effect on size-of-loss curve applications between countries.

Large Commercial Property Risk Loss Estimation: A Practitioner's Application to the Netherlands

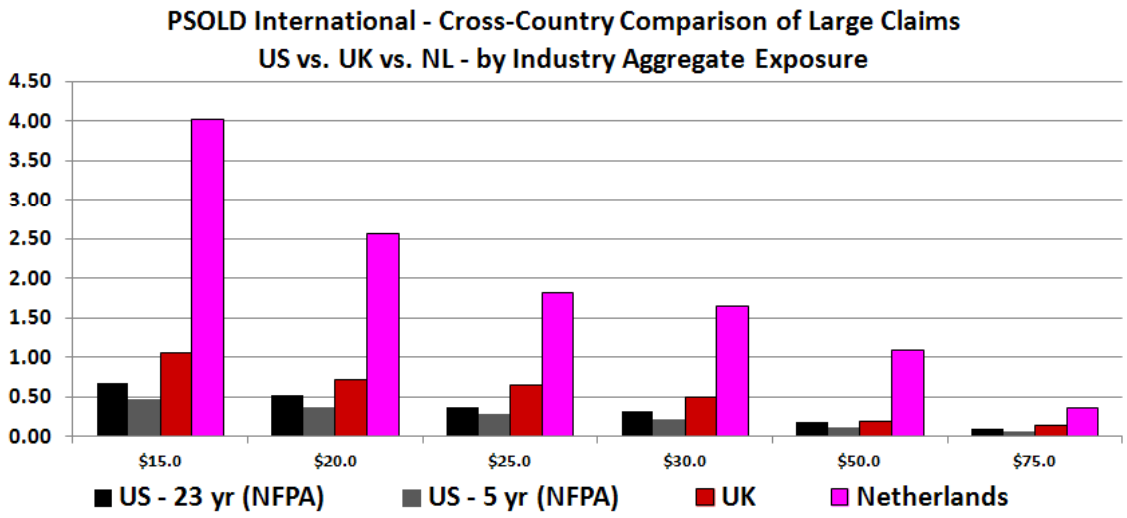
- **Overview**
  - o Netherlands vs. US and UK
  - o Attempting to solve the Puzzle – Non-cat Excess vs. Ground-up
- **A. Non-cat Excess Loss Estimates**
  - o Important link between exposures and losses
  - o US vs. International loss scales – COPE-ARM adjustments
  - o Cross-country validations – macro and micro view
- **B. Non-cat Ground-up Loss Estimates**
  - o Breakdown by perils – Fire, Wind, other causes of loss
  - o Scaling adjustments
- **C. Cat Estimates**
  - o Hazards by country
- **D. Bringing It All Together**
  - o Case Study – 1000 NL Offices and Light Manufacturing



# of Large Claims Per $Bn of Subject Premium (Thresholds in $M)

Source: US: National Fire Protection Association (1990-2012)
UK: Fire Protection Association (2000s)
Netherlands: NIVRE/VVV (2010-2013)

Why does NL proportionately have so many larger claims than US or UK?



# of Large Claims Per $Tn of Industry Aggregate Exposure Database - AIR (Thresholds in $M)

Source: US: National Fire Protection Association (1990-2012)
UK: Fire Protection Association (2000s)
Netherlands: NIVRE/VVV (2010-2013)

Why does NL proportionately have so many larger claims than US or UK?

Non-Cat and Cat Perils

Non-Catastrophe Risks

- Fire
- Vandalism and theft
- Lightning
- Explosion
- Water leakage

Catastrophe Risks

- Tropical cyclone (hurricanes, typhoons)
- Severe thunderstorm (tornado, hail, straight-line wind)
- Extratropical cyclone (includes U.S. winter storm)
- Earthquake
- Flood
- Terrorism

US data sources split non-cat and cat losses into three components. Relative size varies significantly by territory / occupancy, etc.

- Basic Group I *(Fire, lightning, explosion, vandalism, sprinkler leakage)*
- Basic Group II *(Windstorm, civil commotion, smoke, hail, aircraft, volcano, riot, sinkhole collapse, …)*
- Special Causes of Loss *(all other perils such as weight of ice/snow, additional causes of collapse, water damage, theft,…*

International Property
A. Non-Cat Excess Loss Estimates

First Loss Scale Illustration
Linking Amount of Insurance to Loss Size for Layering

% of AOI	% of Loss
0.0%	0.0%
10.0%	40.0%
20.0%	50.0%
25.0%	**60.0%**
30.0%	65.0%
40.0%	70.0%
50.0%	**75.0%**
60.0%	80.0%
70.0%	85.0%
80.0%	90.0%
90.0%	96.0%
100.0%	100.0%

AOI = $20,000,000 (insured value)

What is the charge for $5M excess of $5M?

• Layer attachment point: $5M / $20M = 25%; per scale, 60% of losses are less than or equal to 25% of AOI. Therefore, 60% of the total ground-up loss costs pays for losses related to the first $5M of building value

• Layer limit: $10M / $20M =50%; per scale, 75% of the ground-up losses pays the losses for the first $10M of building value

• Layer charge: would want to collect 15% (75.0%-60.0%) of the total ground-up expected loss costs for the $5M excess of $5M layer.

Therefore, if the total expected losses for this building was $40,000, then the amount for the excess layer would be $6,000 (15% x $40,000)

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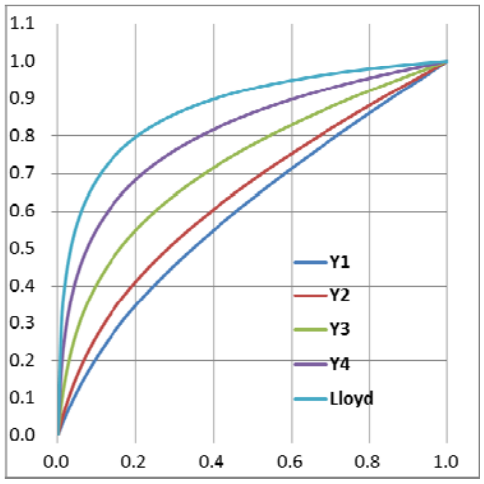
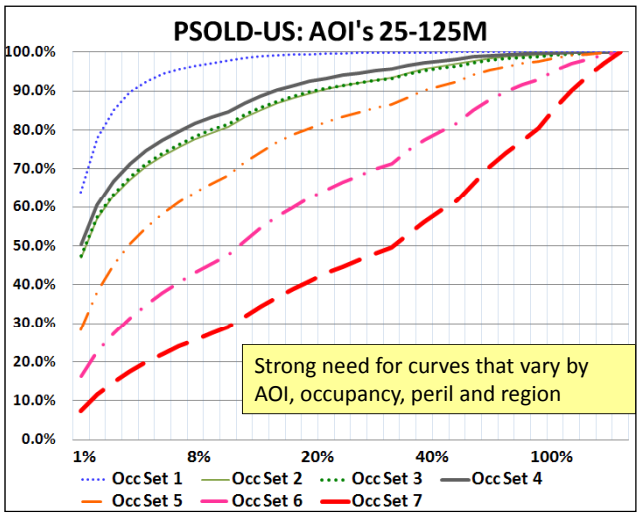
First Loss Scales Comparisons - Illustrative
Scales should vary by AOI, Occupancy, etc.



China Re-CPCR curve comparison MBBEFD (Swiss Re Y1-Y4 parametric approximation) Lloyd's empirical from unknown data source



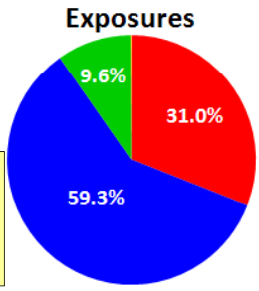
PSOLD uses over 3M individual linked losses and exposures to generate curves for 60 AOI bands, 38 occupancies, 4 sets of perils, 50 states, etc.

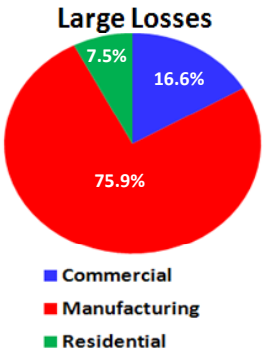
US NFPA Large Commercial Losses
Illustrating Importance of Type of Occupancy

US Large Fire Loss Experience by Occupancy (NFPA 20 years: 1991-2010)

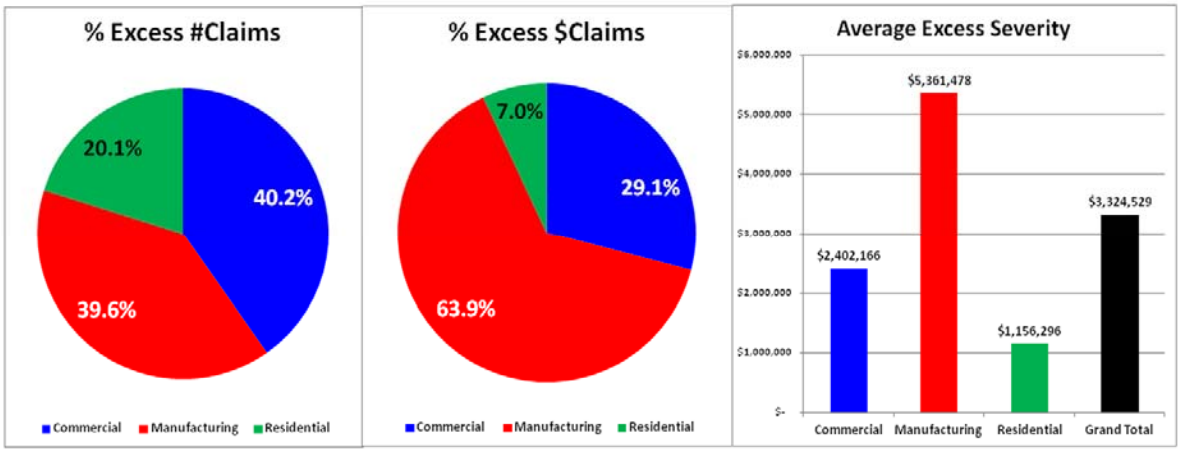
Row Labels	Sum of Estimated Loss (in $mm)	Count of Estimated Loss (in $mm)2	% Total Counts	US $XS Threshold 25mm	% XS Threshold
Commercial	2,727.6	33	16.6%	1,903	15.2%
Aircraft	409.9	9	4.5%	185	1.5%
Cafeteria	27.7	1	0.5%	3	0.0%
Casino	382.7	1	0.5%	358	2.9%
Casino/Hotel	46.7	1	0.5%	22	0.2%
College/University	69.1	2	1.0%	19	0.2%
Film/Movie Studio	44.1	1			
Hangar	50.4	1			
Hospital	71.6	1			
Hotel	76.3	2			
Hotel/Casino	115.9	1			
Office	921.8	6			
Office/Stores	231.4	1			
Residential/Commercial	124.6	1			
School	99.6	3			
Store	55.8	2	1.0%	6	0.0%
Manufacturing	14,053.3	151	75.9%	10,278	82.3%
Chemical Waste	33.4	1	0.5%	9	0.1%
Electric Sub-station	26.9	1	0.5%	2	0.0%
Lumber Yard	38.7	1	0.5%	14	0.1%
Mall	263.7	3	1.5%	189	1.5%
Manufacturing	8,700.8	80	40.2%	6,701	53.6%
Meat Prep Plant	56.3	1	0.5%	31	0.3%
Mill	31.0	1	0.5%	6	0.0%
Packing Plant	119.4	1	0.5%	94	0.8%
Pipeline	146.7	2	1.0%	97	0.8%
Plant	534.1	11	5.5%	259	2.1%
Power Plant	102.4	2	1.0%	52	0.4%
Ship	90.3	1	0.5%	65	0.5%
Special Property	385.1	8	4.0%	185	1.5%
Tractor Trailor	49.5	1	0.5%	25	0.2%
Truck	119.4	1	0.5%	94	0.8%
Warehouse	3,355.6	36	18.1%	2,456	19.7%
Residential	689.0	15	7.5%	314	2.5%
Apartment	456.6	9	4.5%	232	1.9%
Condo	33.1	1	0.5%	8	0.1%
Residential	199.3	5	2.5%	74	0.6%
Grand Total	17,469.9	199	100.0%	12,495	100.0%

Very different Exposure and Large Loss distributions for Commercial & Manufacturing; Mfg with 31% of exposures, but 76% of the large losses (151 out of 199 >25M)





New Imperial College IICI-Lloyd's LCR Dataset
Shows similar Occupancy Importance



Threshold: All Claims >= $0M
n= 3,080

- Insurance Intellectual Capital Initiative (IICI) – Large Commercial Risks (LCR)
- New dataset from Syndicate submissions shows similar major Occupancy group distributions as NFPA and PSOLD
- Occupancy split by North America vs. Rest of the World also similar

Source: International Congress of Actuaries (Wash DC – April 2014 – Enrico Biffis-Imperial)

Netherlands FPA Data Collection
Sample Large Data to be Aggregated

N/VRE

Grote branden eerste kwartaal 2012

Ramingen van branden groter dan 1 miljoen Euro

Datum	Plaats	Soort bedrijf	Bedrag
januari			
1	Velsen	Buurtcentrum	€ 1.500.000,00
2	Nijmegen	Voetbalstadion	€ 2.000.000,00
6	Leek	Handel in bouwmaterialen	€ 1.000.000,00
8	Gorinchem	Bedrijfsverzamelgebouw	€ 2.500.000,00
8	Pijnacker	Bedrijfsverzamelgebouw	€ 2.000.000,00
8	Vriezenveen	Horeca	€ 1.500.000,00
8	Kwintsheul	Supermarkt	€ 2.000.000,00
13	Oirschot	Fabrikant tuin/decomaterialen	€ 1.500.000,00
16	Vianen	Bedrijfspand	€ 3.000.000,00
21	Roermond	Producent verpakkingsmateriaal	€ 4.000.000,00
24	Waalwijk	Diverse bedrijfspanden	€ 1.000.000,00
26	Zutpen	Bakkerij	€ 3.000.000,00
Totaal			**€ 25.000.000,00**
februari			
1	Ravenstein	Woonboerderij	€ 1.000.000,00
3	Tolbert	Partycentrum	€ 4.000.000,00
7	Ter Apel	Fabriekshal aardappelverwerking	€ 8.000.000,00
8	Grijpskerk	Bedrijfsverzamelgebouw	€ 2.000.000,00
11	Giesbeek	Bad en keukenhandel	€ 1.000.000,00
17	Lichtenvoorde	Bedrijfsverzamelgebouw	€ 1.500.000,00
24	Echt	Cosmeticabedrijf	€ 1.500.000,00
24	Enschede	Parketvloerenbedrijf	€ 4.000.000,00
24	Rotterdam	Laboratorium	€ 1.000.000,00
25	Steenwijk	Biomassacentrale / opslaghal	€ 6.000.000,00
Totaal			**€ 30.000.000,00**

Large Netherlands Claims by Major Occupancy Type
Similar to US and IICI-Lloyd's Distributions

PSOLD - International

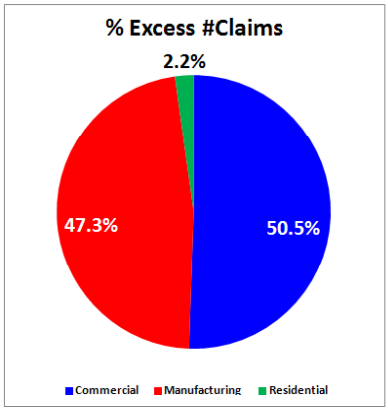
Netherlands Cross-Country Data Validation

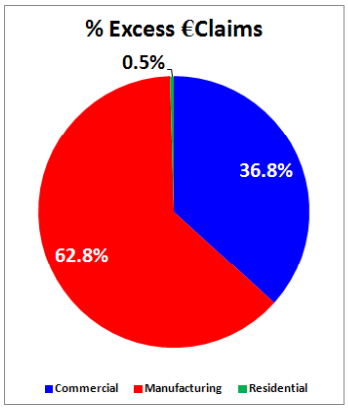
Source: N/VRE (Fire Protection Association Data)

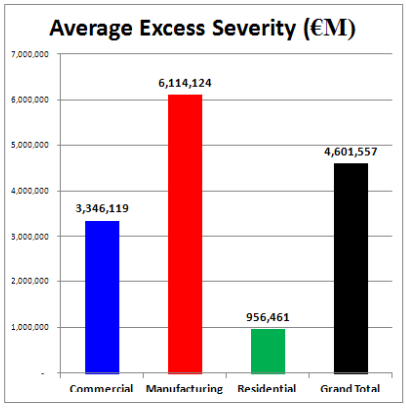
Threshold (All) 2.5 in million Euro

Values

Row Labels	Sum of #Claims > Threshold	Sum of €Claims > Threshold (M)	Sum of €Claims Excess of Threshold (M)	Average Loss	Average Excess Loss
Commercial	92	538	308	5,846,119	3,346,119
Manufacturing	86	741	526	8,614,124	6,114,124
Residential	4	14	4	3,456,461	956,461
Grand Total	182	1,292	837	7,101,557	4,601,557







Derivation of US First Loss Scales
Significant policy counts with claims by AOI for curve fits

Amount of Insurance (US$)	PSOLD-2014 Cumulative Claim Counts by AOI: Net of Deductible	PSOLD-2014 Cumulative Claim Counts by AOI: Gross of Deductible
Ground-Up	2,779,081	4,827,815
1,000,000	706,326	1,534,418
5,000,000	197,346	541,264
10,000,000	112,851	336,902
25,000,000	50,618	167,250
50,000,000	30,098	100,565
75,000,000	22,710	74,417
100,000,000	18,682	60,192
150,000,000	12,406	38,964
200,000,000	9,648	29,654

For first loss scale curve fits, underlying policies and linked claims are put into 60 AOI bands, 38 occupancies, etc.

Further claim count splits by occupancy and sample curve fit for 3 AOI bands are shown in the next slides.

The above claim counts are total number of claims regardless of size, linked to the underlying AOI
All policies and claims from 1991 to 2012; AOI's and claims are trended to 2013 for 2014 PSOLD
All occupancies, states, non-cat perils combined (excluding both minor and major cat)
Gross of deductible counts for ground-up curves use ISO's underlying deductible distributions

Derivation of US Scales – Sample Occupancy Volumes

Large occupancy average severity differences by subclass

New PSOLD RG #	PSOLD RG name	Count of CSP	Sum of 20-year Total Claim Count	Relativity High/Low 20 yr	Relativity High/Low 5 yr
1	Apartment/Condo under 10 units	7	72,360	1.00	1.00
2	Apartment/Condo over 10 units	8	76,568	1.64	1.74
6	Hotels and Motels - With Restaurant	4	11,871	2.19	1.91
7	Hotels and Motels - Other	7	58,438	1.00	1.00
15	Other Mercantiles - Retail/Wholesale	4	79,980	1.81	1.78
16	Other Mercantiles - Other	17	440,504	1.00	1.00
25	Agricultural - Greenhouses	1	3,177	1.00	1.00
26	Agricultural - Grain Elevators	6	2,982	6.75	5.75
27	Food Processing - Other	7	16,221	1.00	1.00
28	Food Processing - Severe	3	1,324	1.98	2.82
31	Light Manufacturing - Printing	1	14,274	1.00	1.00
32	Light Manufacturing - Other	5	12,551	2.00	2.48
33	Heavy Manufacturing - Wood	4	23,910	1.48	1.73
34	Heavy Manufacturing - Other	7	32,300	1.00	1.00
36	Highly Protected Risks - Low	17	4,453	1.00	1.00
37	Highly Protected Risks - Medium	15	7,950	2.47	1.66
38	Highly Protected Risks - Heavy	46	4,703	8.28	5.41
Grand Total		230	2,520,239		

Underlying average severities in the 38 occupancy groups range from 9k (Billboards) to over 500k (Petrochemical Plants)

Significant credible differences in average severities of losses between subgroups within occupancy; e.g. the average severity of grain elevators is 5 to 7 times higher than greenhouses

Consistent with indications from other US and International large claim accumulation attempts such as with IICI-Lloyd's (e.g. Hotels with and without restaurants) and various FPA data.

PSOLD - Sample Excess Loss Curve Fitting

Empirical vs. Fitted – Three Sample AOI Bands

	Avg AOI		Avg AOI		Avg AOI	
Mean	1,368,552		27,255,431		136,185,954	
Loss Size	Empirical	Fitted	Empirical	Fitted	Empirical	Fitted
500,000	0.0172178	0.0171748	0.0176866	0.0215390	0.0222923	0.0234397
600,000	0.0150256	0.0142887	0.0143784	0.0187130	0.0208845	0.0201597
800,000	0.0109457	0.0103353	0.0129809	0.0148345	0.0168243	0.0157731
1,000,000	0.0080962	0.0078440	0.0104765	0.0122890	0.0132677	0.0129889
1,500,000	0.0020511	0.0045626	0.0082228	0.0085986	0.0096213	0.0091371
2,000,000	0.0003422	0.0030018	0.0055385	0.0065622	0.0074156	0.0071112
2,500,000	0.0000129	0.0021048	0.0042232	0.0052358	0.0056390	0.0058152
3,000,000	0.0000000	0.0015378	0.0039346	0.0042981	0.0052654	0.0049014
4,000,000	0.0000000	0.0009013	0.0025593	0.0030694	0.0041492	0.0036959
5,000,000	0.0000000	0.0000000	0.0018377	0.0023086	0.0032391	0.0029362
6,000,000	0.0000000	0.0000000	0.0010690	0.0017950	0.0029111	0.0024114
8,000,000	0.0000000	0.0000000	0.0003996	0.0011570	0.0027151	0.0017330
10,000,000	0.0000000	0.0000000	0.0002325	0.0007939	0.0024732	0.0013206
15,000,000	0.0000000	0.0000000	0.0000694	0.0003805	0.0016055	0.0007901
20,000,000	0.0000000	0.0000000	0.0000000	0.0002214	0.0015689	0.0005421
25,000,000	0.0000000	0.0000000	0.0000000	0.0001420	0.0008368	0.0003992
30,000,000	0.0000000	0.0000000	0.0000000	0.0000960	0.0008368	0.0003075
40,000,000	0.0000000	0.0000000	0.0000000	0.0000487	0.0001046	0.0002010
50,000,000	0.0000000	0.0000000	0.0000000	0.0000278	0.0001046	0.0001442
60,000,000	0.0000000	0.0000000	0.0000000	0.0000174	0.0001046	0.0001097
80,000,000	0.0000000	0.0000000	0.0000000	0.0000081	0.0000000	0.0000700
100,000,000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000481
250,000,000		0.0000000		0.0000000		0.0000072

Sample 2010 PSOLD Curve Fit: All years, excl all cat, Buildings+contents+time element, 300% AOI cap

This exhibit shows three sample AOI curve fits for bands 1-1.5M, 25-30M, and 125-150M. Empirical claim distribution are copared to fitted from our 10 parameter mixed exponentials. The resulting claim volumes and fitted distributins are included in PSOLD.

Note that as part of the smoothing / fitting technique that for these three examples, claims are distributed up to the default cap of 3x the AOI band. For example in the 25-30M AOI band, the empirical claims go to a high of 15M, while the fitted values are spread to a high of about 80M.

The accumulation of all these curve fits is shown on the next slides, which show an all-industry application of the curves.

Macro Validation of US First Loss Scales

Good comparison of NFPA Large Claims to All-Industry Application

Threshold (M)	NFPA Large Claims 2014	PSOLD Large Claims 2014 (300% Cap)	PSOLD Large Claims 2014 (100% Cap)
500	3	0.5	0.2
400	5	1.5	0.7
250	11	7.7	4.6
200	15	13.3	8.7
150	19	23.0	16.5
100	37	45.5	36.4
80	50	61.1	52.2
50	95	113.4	96.2
25	196	360.1	270.4

Good all-industry validation of large claims from 25M to 200M, and perhaps 250M if accept potential protection improvements in the last 20 years

For example, over the last 20 years, there were 37 Fire claims (trended) above 100M, while all-industry validation would produce 45.5 claims (36.4 if cap all claims at 100% of AOI in PSOLD)

The most severe occupancies of severe manufacturing/petroleum and HPR-heavy account for almost 2/3rds of the largest claims

Actual claims from National Fire Protection Association largest claims from 1991-2012
- trended to 2014, but not developed beyond 1st report; does not include indirect losses such as Time Element (BI)
- does not include potential protection improvement credits (9 of the 13 >=200mm are from 1990s-trended)

PSOLD: using all AOI bands (60), rating groups (38) and states combined; using 34B prem and 52.7% non-cat LR
Includes Severe Manufacturing/Petroleum & Highly Protected Risks-Heavy (52 CSP Classes; PSOLD RGs-35,38)
Large claim counts shown including and excluding claims above the AOIs (due to e.g. TE)

US to International Property Risk Excess Loss Factors

PSOLD International: COPE Assessment Matrix (for illustration only)

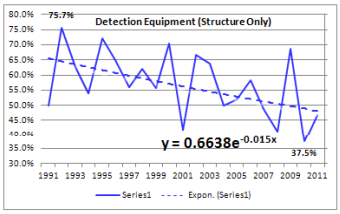
		Commercial / Industrial US	Country A	Country B	Country C	Country D	Country E	Country F	Country G
Construction	C		H	M	L		M	M	M
Occupancy	O		L	H		M		H	L
Protection	P			M	M	M	H	M	H
Exposure (e.g. industrial facilities)	E			M	L	H			L
Amount of Insurance	A		M			M	L	H	M
Replacement Costs	R		M	L	H	L	L	H	M
Miscellaneous	M			M		L		H	
Total Indicated (before validation)				H		M	L	L	H

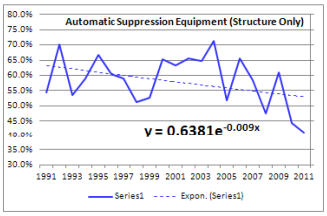
Impact Key (compared to US)	
Direction	Worse
	Better
	No difference
Magnitude	H = High
	M = Moderate
	L = Low

1. With US as base, compare each COPE+ attribute
2. Tally up expected impacts and qualitatively weigh them by COPE+ attribute
3. See how compares to actual large loss experience
4. Use same procedure for Ground-up Loss Costs, but include Frequency component – COPE+FARM

NFPA US Large Loss Data Collection
Protection Trends: Detection / Suppression Trends

NFPA US - Analysis of Fire Protection Equipment - 21 Year

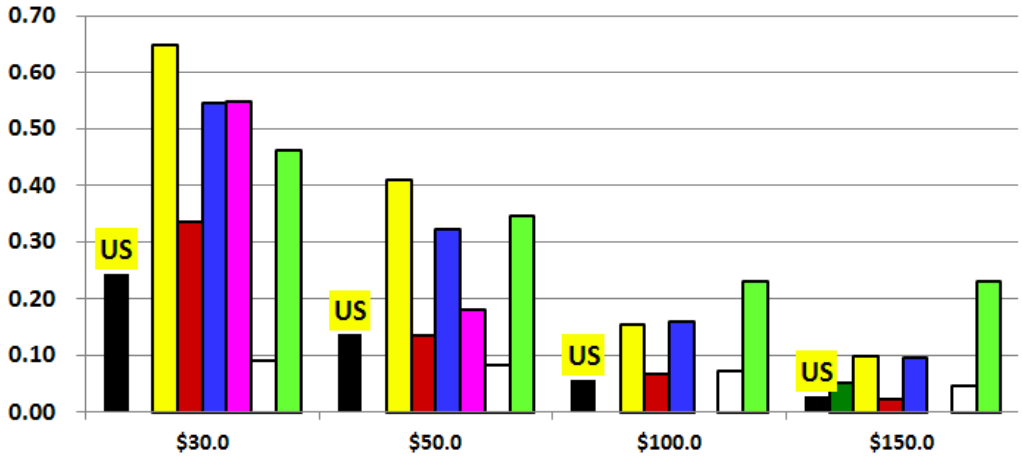




Threshold (mm)			Loss Type				Detection Equipment (Structure Only)			Automatic Suppression Equipment (Structure Only)		
	Loss Ye	Total Los	Structu	Outside of Structu	Vehic	Wildfi	None	Some Typ	Unknow	None	Some Type	Unknown
10	2011	22	17	1	1	3	7	8	2	7	10	0
10	2010	17	15	1	0	1	3	5	7	4	5	6
10	2009	24	19	0	2	3	11	5	3	11	7	1
10	2008	35	31	0	0	4	7	10	14	10	11	10
5	2007	71	59	0	2	10	20	21	18	28	20	11
5	2006	45	38	0	3	4	14	10	14	19	10	9
5	2005	38	37	0	1	0	14	13	10	14	13	10
5	2004	46	41	2	3	0	16	16	9	25	10	6
5	2003	46	41	0	1	4	21	12	8	22	12	7
5	2002	46	41	0	1	4	24	12	5	23	12	6
5	2001	52	49	0	1	2	18	25	6	26	15	8
5	2000	61	55	0	0	6	31	13	11	32	17	6
5	1999	66	56	1	4	5	20	16	20	19	17	20
5	1998	55	50	0	4	1	23	14	13	19	18	13
5	1997	56	50	0	4	2	23	18	9	23	16	11
5	1996	59	52	1	4	2	26	14	12	26	17	9
5	1995	43	42	0	0	1	26	10	6	26	13	3
5	1994	54	43	0	5	6	20	17	6	23	16	4
5	1993	54	45	0	4	5	25	15	5	23	20	2
5	1992	52	44	0	2	6	28	9	7	26	11	7
5	1991	47	39	0	4	4	17	17	5	19	16	4
	Total	989	864	6	46	73	394	280	190	425	286	153
	% Total	N/A	87.4%	0.6%	4.7%	7.4%	58.5%	41.5%	N/A	59.8%	40.2%	N/A

Note: Total losses from 1991-2007 >$5m and >$10m for 2008+
Note: 2001 excludes WTC
Source: ISO analysis of National Fire Protection Association data - Fire Loss in the United States Reports from 1991 to current

Cross-Country Comparison of Large Claims
of Large Claims per $B of Total Industry Premium - Illustrative



- **Using US as the base, compare # of large claims per $B of total commercial property premium in excess of various thresholds. Shown are thresholds ranging from $30M to $150M**
- **Although varies significantly by country, the number of large claims on average is 40-50% higher than the US for these largest claims**
- **Protection/ sprinkler differences may account for a significant portion of the US vs. non-US experience**

International Property
B. Non-Cat Ground-up Losses

Calculating Ground-Up Non-Cat Loss Costs (Illustrative)

- **Non-Cat Loss = Base LC x**
- **Territorial Multiplier x**
- **Deductible Factor x**
- **Limit of Insurance Factor x**
- **(Limit of Insurance / 100) x**
- **Protection Factor x**
- **Sprinklered Relativity**

Parameter	Building Value	Contents Value
Base loss cost (for specific occupancy/ construction combination)	0.175	0.220
Territorial Multiplier	1.150	1.150
Deductible Factor	0.870	0.730
Limit of Insurance Factor	0.600	0.750
Limit of Insurance	$42.5M	$9M
Subtotal	$44,647	$12,467
Protection Factor	1.00	1.00
Sprinklered Relativity	0.85	0.85
Loss Estimate	$37,950	$10,597
Basic Group 1: Fire et al (building & contents)	**$48,547**	

Portability to Australia (Illustrative) - NonCat Ground-Up Loss Costs and Layering

San Francisco, California

Bunbury, Australia

ISO Class Loss Costs from ISO Portal Database		
Amount of Insurance	$10,000,000	AU $10,000,000
Deductible	$2,500	AU $2,500
Occupancy	Restaurants and bars	Restaurants and bars
Construction Type	Noncombustible	Noncombustible
PPC	5	5 (equivalent)
Sprinklered Status	Sprinklered	Sprinklered
Combined Loss Cost Factor – Pre-COPE	0.250	0.250
Country Validations/Customizations		
Portfolio COPE Scalar	1.000	0.900
Account Experience Scalar	1.000	0.800
Expected Scaled Loss Costs	$25,000	AU $18,000
PSOLD % of Loss (vary by AOI, occupancy, region, and so forth)		
25% of AOI	60.0%	50.0%
50% of AOI	75.0%	75.0%
75% of AOI	87.5%	90.0%
Layer Loss Costs 2.5M xs 2.5M	$3,750	AU $4,500

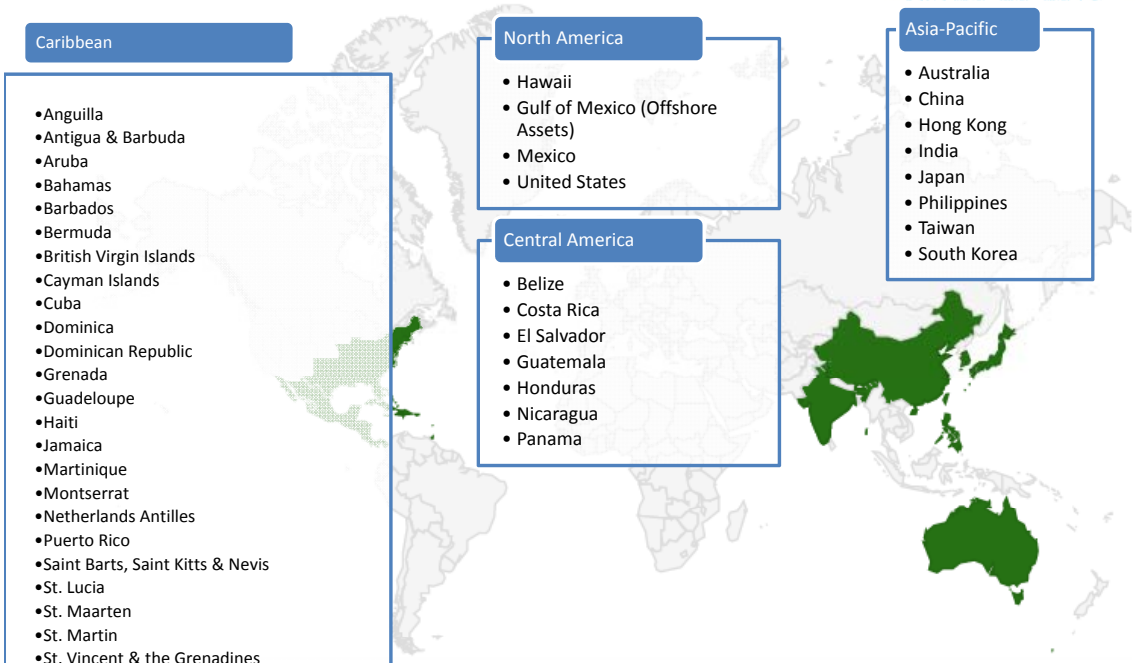
Adjusting Ground-up Loss Costs by Region and Peril Component – NL (Illustrative)

	Proxy State Group		Region Scalar
Netherlands - L	US Low States	00095	0.85
Netherlands - M	US Countrywide	00099	0.95
Netherlands - H	US High States	00097	1.10
Netherlands - S	US Very High States	00098	1.25

	Minimum Loss Cost	US & Intl Peril Scalar
BG1 (Fire, Lightning, Sprnklr Lkg)	0	1.25
BG2 (Wind, WCSHAVERS)	0	0.25
SCL (Water Dmg, Collapse, Theft)	0	0.50

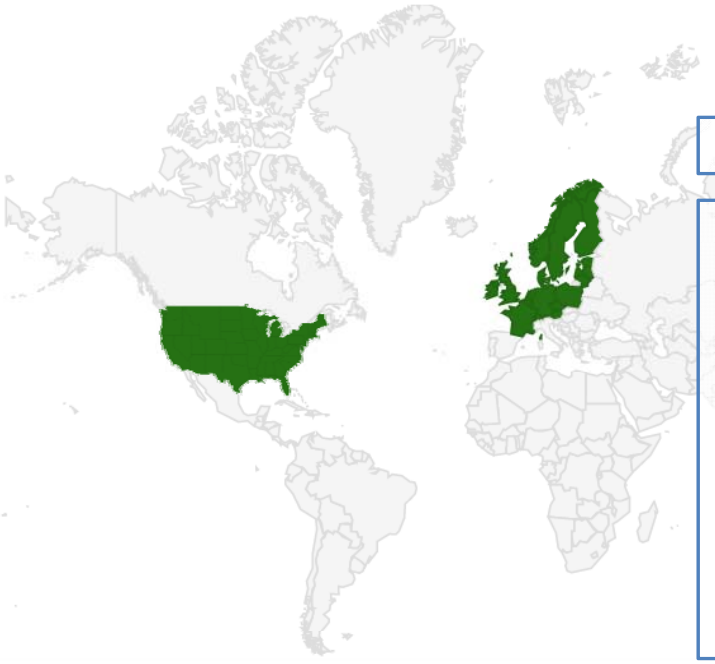
International Property
C. Cat Loss Estimates

Modeled Tropical Cyclone Locations



Source: AIR Touchstone™

Modeled Extratropical Cyclones Locations



North America

- United States

Europe

- Austria
- Belgium
- Czech Republic
- Denmark
- Estonia
- Finland
- France
- Germany
- Ireland
- Latvia
- Lithuania
- Luxembourg
- Netherlands
- Norway
- Poland
- Sweden
- Switzerland
- United Kingdom*

** Includes coastal storm surge flooding*

Source: AIR Touchstone™

International Property
D. Bringing it All Together

Netherlands Case Study – White Paper
Include Ground-up, Excess and Cat Components

- **Case Study**
  - 1000 Netherlands exposures split between Commercial and Industrial (banded profile)
- **Ground-up Loss Costs**
  - Use NL ground-up loss cost factors that have been adjusted for Fire, Wind, and other cause of loss factors from US or other source
  - Include construction, occupancy, protection (location or region) and other exposure selections – either identified or judgmental
- **Excess Pricing**
  - Use selected size of loss curves, adapted to country specific circumstances using COPE+ methodology
- **Cat Pricing**
  - Incorporate cat model results, generated using the same individual exposure information as with the Ground-up Loss Costs
- **Combined Results**
  - Total ground-up and excess layer cat and noncat results in aggregate and by exposure

Case Study – Netherlands Banded Profile (Illustrative)

Commercial				
Sum Insured (EUR)		Total Sum Insured	Number	Premium
-	500,000	58,904,000	290	172,642
500,001	1,000,000	75,591,000	108	180,483
1,000,001	2,000,000	174,873,000	122	332,542
2,000,001	5,000,000	287,917,000	92	447,804
5,000,001	7,500,000	150,015,000	24	209,515
7,500,001	10,000,000	103,247,000	12	130,705
10,000,001	12,500,000	168,046,000	15	170,971
12,500,001	15,000,000	273,308,000	20	254,471
15,000,001	20,000,000	449,610,000	26	416,152
20,000,001	25,000,000	287,708,000	13	177,028
25,000,001	50,000,000	818,160,000	24	401,052
50,000,001	100,000,000	265,495,000	4	106,635
Total		3,112,874,000	750	3,000,000

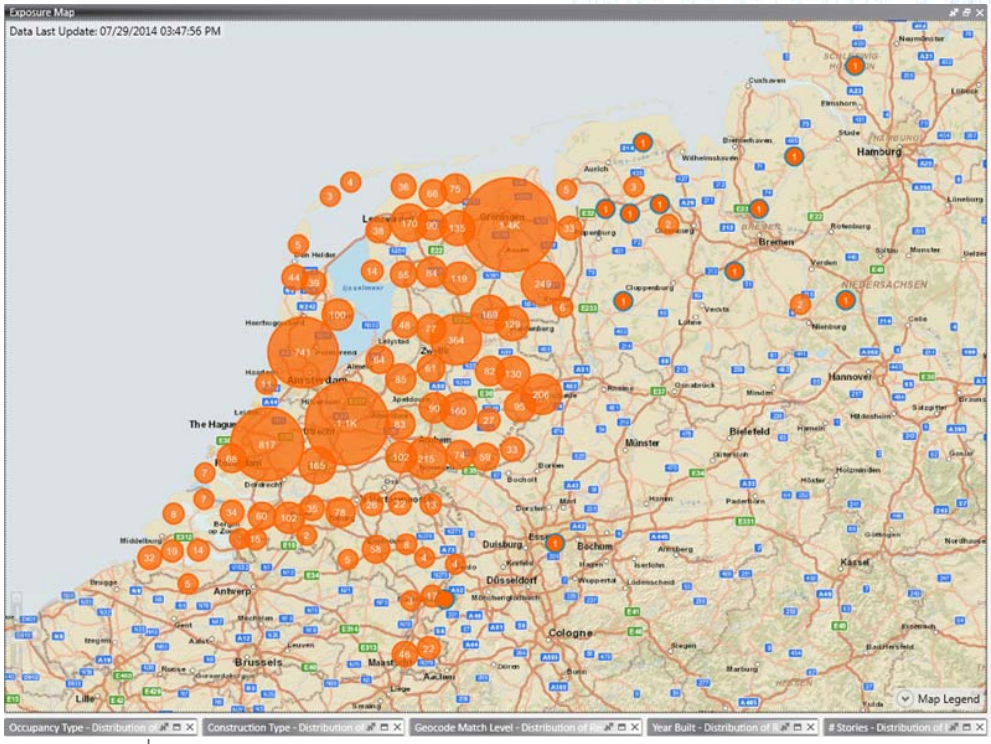
Industrial				
Sum Insured (EUR)		Total Sum Insured	Number	Premium
-	500,000	15,744,000	82	50,236
500,001	1,000,000	30,373,000	41	79,046
1,000,001	2,000,000	34,853,000	24	69,499
2,000,001	5,000,000	157,877,000	40	208,191
5,000,001	7,500,000	191,957,000	31	218,303
7,500,001	10,000,000	115,248,000	13	125,692
10,000,001	12,500,000	56,236,000	5	60,856
12,500,001	15,000,000	81,742,000	6	65,495
15,000,001	20,000,000	37,532,000	2	24,933
20,000,001	25,000,000	43,364,000	2	25,836
25,000,001	50,000,000	82,110,000	3	43,547
50,000,001	100,000,000	69,258,000	1	28,366
Total		916,294,000	250	1,000,000

Total Comm'l + Industrial	4,029,168,000	1,000	4,000,000

Note: Sum insureds are total of Building + Contents + Time Element (Business Interruption) - per policy

Source: compiled from AIR Cede file

Netherlands – Geospatial Exposure



Ground-Up Non-cat Loss Costs – NL (Illustrative)

Company	White Paper-NL Case Study
Program	Offices / Light Mnfg
Inception Date	1/1/2015
Comment	Initial non-cat - before adj. for exper.

Total Exposure Info	
Total AOI	4,029,168,000
# of Exposures	1,000
Average Exposure	4,029,168
Largest Exposure	76,854,000

Total Premium & Loss Cost Info		
		ELR
Total	2,405,108	60.1%
Total / AOI	0.060	

PSOLD Country - Region	Description/Record Index	BUILDING Amount of Insurance ($)	CONTENT Amount of Insurance ($)	TIME ELEMENT Amount of Insurance ($)	CSP Class Code	Portfolio GULC Scalar	IRV Class Based Total Loss Costs	ELR (IRV GULC/ Actual Prem)
Netherlands - M	1_C2259-9301	56,924,000	13,300,000	6,630,000	0702	0.95	19,047	59.4%
Netherlands - M	2_C3750-7951	53,983,000	12,610,000	6,290,000	0702	0.95	18,062	59.4%
Netherlands - M	3_C3426-7735	53,256,000	12,440,000	-	0702	0.95	13,981	59.4%
Netherlands - M	4_C7517-3371	44,842,000	-	5,220,000	0702	0.95	12,219	59.4%
Netherlands - M	5_C2293-9402	37,272,000	-	-	0702	0.95	8,963	59.4%
Netherlands - H	6_C518-9501	36,360,000	8,490,000	4,240,000	0702	1.10	16,346	59.4%
Netherlands - M	7_C4040-3771	36,026,000	8,420,000	4,200,000	0702	0.95	12,056	59.4%
Netherlands - L	8_C7463-2964	34,728,000	8,110,000	-	0702	0.85	5,188	59.4%
Netherlands - M	9_C2098-9411	33,477,000	-	3,900,000	0702	0.95	8,475	59.4%
Netherlands - M	10_C934-7822	31,884,000	-	-	0702	0.95	7,299	59.4%
Netherlands - M	11_C382-7971	31,381,000	7,330,000	3,660,000	0702	0.95	10,500	59.4%
Netherlands - L	12_C5748-1601	30,294,000	7,080,000	3,530,000	0702	0.85	5,869	59.4%
Netherlands - M	13_C385-7981	28,272,000	6,610,000	-	0702	0.95	11,300	59.4%
Netherlands - M	14_C389-7991	28,052,000	-	3,270,000	0702	0.95	9,590	59.4%
Netherlands - M	15_C2292-9402	27,945,000	-	-	0702	0.95	8,279	59.4%
Netherlands - M	751_I1277-7951	49,508,000	13,820,000	5,930,000	0520	0.95	17,699	62.4%
Netherlands - M	752_I282-7783	21,753,000	6,070,000	2,600,000	0520	0.95	9,496	62.4%
Netherlands - M	753_I1359-3061	20,161,000	5,630,000	-	0520	0.95	7,244	62.4%
Netherlands - M	754_I1339-3771	19,625,000	-	2,350,000	0520	0.95	5,206	62.4%
Netherlands - M	755_I1124-7902	18,753,000	-	-	0520	0.95	6,530	62.4%

- Individual exposures assigned to LMH region based on postal code; construction/ sprinkler usage was selected based upon building size; occupancies selected: offices and light manufacturing for commercial and industrial – sensitivity testing
- Includes Peril scalars to adjust for expected Fire, Wind, other causes of loss differentials for US vs. Netherlands
- Include additional country/region scalars as needed to balance back to credible actual expected loss ratio (vs. 60.1% indicated LR)

Source: ISO Rapid Valuator –International with ISO-Portal

Ground-Up Non-cat Loss Costs – NL (Illustrative) Results by Peril

			Proportion to PSOLD				Total
			Fire et al BG1	Wind et al BG2	Special COL	TE (BI)	Attritional (non-cat)
		Peril Scalars:	125%	25%	50%	100%	84.7%
1000	$ 3,296,838,000	Total after Peril Scaling:	$ 1,778,864	$ 176,541	$ 259,922	$ 189,781	$ 2,405,108
		Total before Peril Scaling:	$ 1,423,091	$ 706,163	$ 519,815	$ 189,781	$ 2,838,850

Description/ Record Index	Building AOI	State / Region	BG1 Loss Cost	BG2 Loss Cost	SCL Loss Cost	*TE Loss Cost 15% (BG1+BG2)*	Total Loss Cost
1_C2259-9301	56,924,000	Netherlands - M	$ 11,940	$ 1,190	$ 2,753	$ 3,164	$ 19,047
2_C3750-7951	53,983,000	Netherlands - M	$ 11,323	$ 1,129	$ 2,611	$ 3,000	$ 18,062
3_C3426-7735	53,256,000	Netherlands - M	$ 10,719	$ 987	$ 2,275	$ -	$ 13,981
4_C7517-3371	44,842,000	Netherlands - M	$ 7,246	$ 949	$ 2,070	$ 1,954	$ 12,219
5_C2293-9402	37,272,000	Netherlands - M	$ 6,023	$ 932	$ 2,008	$ -	$ 8,963
6_C518-9501	36,360,000	Netherlands - H	$ 9,470	$ 1,399	$ 2,900	$ 2,577	$ 16,346
7_C4040-3771	36,026,000	Netherlands - M	$ 7,557	$ 753	$ 1,742	$ 2,002	$ 12,056
8_C7463-2964	34,728,000	Netherlands - L	$ 3,390	$ 442	$ 1,355	$ -	$ 5,188
9_C2098-9411	33,477,000	Netherlands - M	$ 5,217	$ 580	$ 1,288	$ 1,391	$ 8,475
10_C934-7822	31,884,000	Netherlands - M	$ 5,152	$ 675	$ 1,472	$ -	$ 7,299
11_C382-7971	31,381,000	Netherlands - M	$ 6,582	$ 656	$ 1,518	$ 1,744	$ 10,500
12_C5748-1601	30,294,000	Netherlands - L	$ 3,031	$ 515	$ 1,488	$ 835	$ 5,869

Source: ISO Rapid Valuator –International with ISO-Portal

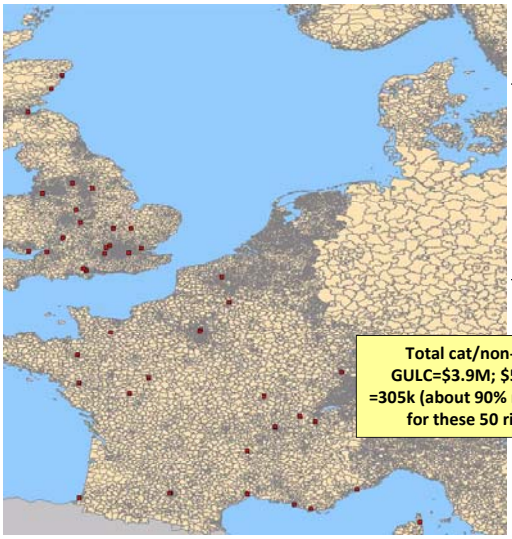
Ground-up and Excess Layer Distribution – Non-cat

		Layer %	40.2%	12.6%	7.4%	9.4%	12.2%	9.2%	5.3%	3.7%
		Return Period		1.15	2.30	3.45	5.62	12.88	41.60	150.51
1000	$3,296,838,000	$ 2,405,118	$ 966,170	$ 303,679	$177,602	$226,231	$ 293,996	$220,878	$127,096	$ 89,467

		PSOLD Input	PSOLD Outputs - Attritional							
Description/ Record Index	Building AOI	PSOLD-Attritional Expected Loss	Base - 500 XS 0 XS Loss	Sub1 - 500 XS 500 XS Loss	Sub2 - 500 XS 1,000 XS Loss	Sub3 - 1,000 XS 1,500 XS Loss	Layer1 - 2,500 XS 2,500 XS Loss	Layer2 - 5,000 XS 5,000 XS Loss	Layer3 - 10,000 XS 10,000 XS Loss	LAyer4 - 180,000 XS 20,000 XS Loss
1_C2259-9301	56,924,000	$ 19,047	$ 1,848	$ 954	$ 720	$ 1,151	$ 2,110	$ 2,771	$ 3,211	$ 6,282
2_C3750-7951	53,983,000	$ 18,062	$ 1,752	$ 905	$ 683	$ 1,092	$ 2,001	$ 2,628	$ 3,045	$ 5,957
3_C3426-7735	53,256,000	$ 13,981	$ 1,356	$ 701	$ 529	$ 845	$ 1,549	$ 2,034	$ 2,357	$ 4,611
4_C7517-3371	44,842,000	$ 12,219	$ 1,622	$ 817	$ 600	$ 920	$ 1,558	$ 1,829	$ 1,917	$ 2,956
5_C2293-9402	37,272,000	$ 8,963	$ 1,417	$ 707	$ 512	$ 767	$ 1,238	$ 1,347	$ 1,305	$ 1,671
6_C518-9501	36,360,000	$ 16,346	$ 2,170	$ 1,093	$ 802	$ 1,231	$ 2,084	$ 2,447	$ 2,565	$ 3,955
7_C4040-3771	36,026,000	$ 12,056	$ 1,600	$ 806	$ 592	$ 908	$ 1,537	$ 1,805	$ 1,892	$ 2,917
8_C7463-2964	34,728,000	$ 5,188	$ 689	$ 347	$ 255	$ 391	$ 662	$ 777	$ 814	$ 1,255
9_C2098-9411	33,477,000	$ 8,475	$ 1,340	$ 668	$ 484	$ 725	$ 1,171	$ 1,273	$ 1,234	$ 1,580
10_C934-7822	31,884,000	$ 7,299	$ 1,154	$ 576	$ 417	$ 624	$ 1,008	$ 1,097	$ 1,063	$ 1,361
100_C6999-2636	9,292,000	$ 2,543	$ 733	$ 340	$ 234	$ 325	$ 447	$ 343	$ 121	$ -
101_C1-3842	162,000	$ 403	$ 403	$ -	$ -	$ -	$ -	$ -	$ -	$ -
102_C2-6221	238,000	$ 550	$ 525	$ 25	$ -	$ -	$ -	$ -	$ -	$ -
103_C3-7941	549,000	$ 954	$ 755	$ 156	$ 43	$ -	$ -	$ -	$ -	$ -
104_C4-7961	1,584,000	$ 1,742	$ 1,112	$ 292	$ 141	$ 150	$ 47	$ -	$ -	$ -
996_I304-7918	302,000	$ 630	$ 567	$ 63	$ -	$ -	$ -	$ -	$ -	$ -
997_I305-7925	90,000	$ 257	$ 257	$ -	$ -	$ -	$ -	$ -	$ -	$ -
998_I306-7926	199,000	$ 429	$ 410	$ 19	$ -	$ -	$ -	$ -	$ -	$ -
999_I307-7941	231,000	$ 363	$ 351	$ 12	$ -	$ -	$ -	$ -	$ -	$ -
1000_I310-8401	65,000	$ 109	$ 109	$ -	$ -	$ -	$ -	$ -	$ -	$ -

Source: ISO PSOLD and IRV-International – capping losses at 150% of AOI

Case Study 2: 50 European Locations



Total cat/non-cat GULC=$3.9M; $5x5M =305k (about 90% non-cat) for these 50 risks

Cat / Non-Cat Inputs

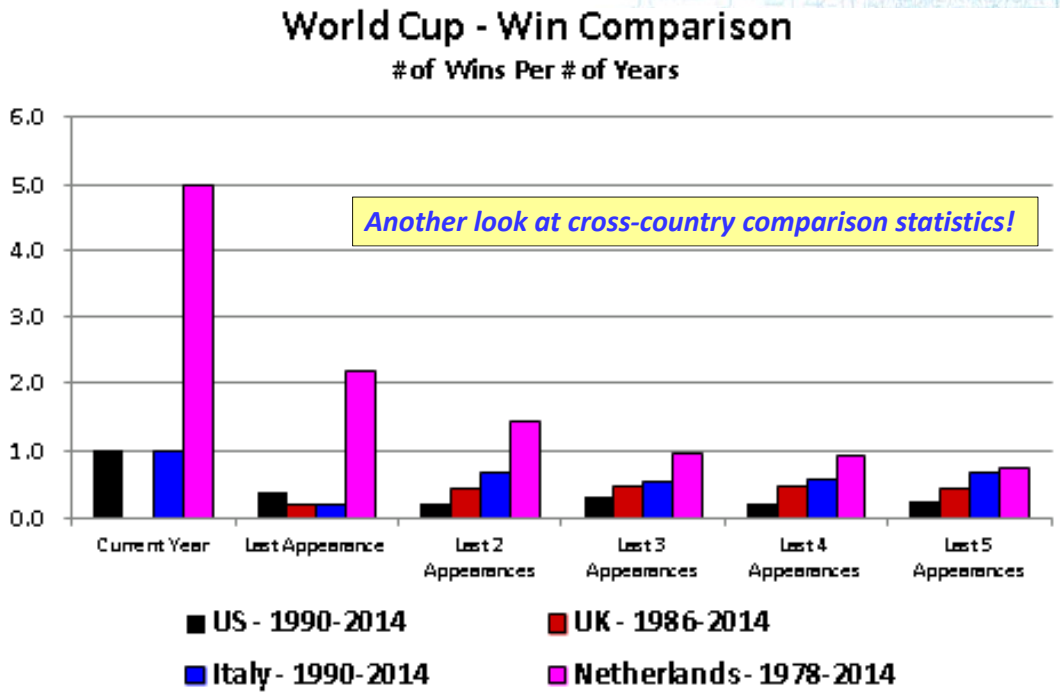
Loc ID	Country	City	Region (Prot)	Cresta	Stories	YearBuilt	Construction Desc	Total Value
33	FR	Paris	A	75009	5	1988	Reinforced Concrete	5,873,617
69	FR	Toulon	B	83000	12	1984	Light Metal	7,067,592
1	FR	Biarritz	C	64200	8	1987	Steel	11,979,678
35	UK	Cheltenham	A	GL52 8SF	2	1989	Precast Concrete	14,394,014
64	UK	Edinburgh	B	EH9 3JL	9	1986	Reinforced Concrete	24,049,661
61	UK	Montrose	C	D10 9SL	7	1982	Light Metal	36,282,526
3	FR	Le Puy	A	43000	5	1985	Reinforced Masonry	37,006,477
70	FR	Limonest	B	69760	10	1984	Reinforced Concrete	37,097,538
68	FR	Marseille	C	13005	17	1987	Unknown	37,299,874
67	UK	Cardiff	A	CF4 7YJ	8	1981	Reinforced Concrete	37,532,053
							Total - 50 Hotels	2,645,540,948

Cat / Non-Cat Results

	Cat Expected Losses		NonCat Expected Losses		Combined	
Loc ID	Total (GroundUp)	5xs5	Total (GroundUp)	5xs5	Total	5xs5
33	245	24	25,000	190	25,245	214
69	869	72	12,075	373	12,944	445
1	865	89	14,140	1,102	15,005	1,191
35	1,777	120	12,425	866	14,202	986
64	3,525	153	7,210	724	10,735	877
61	19,576	1,004	11,655	1,302	31,231	2,306
3	1,064	94	27,510	1,193	28,574	1,286
70	755	71	32,235	1,612	32,990	1,683
68	2,746	213	43,505	3,826	46,251	4,039
67	3,812	260	43,680	3,363	47,492	3,622
	334,008	24,004	3,566,510	281,113	3,900,518	305,117

Source: Verisk Cat/Non-cat Integrated Solution (Tripod)
cat: AIR Touchstone™
non-cat: ISO Rapid Valuator with Portal and PSOLD™-International

Appendix



Imperial College
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Some New Insights into Large Commercial Risks

Enrico Biffis

Imperial College London

CAS Seminar on Reinsurance

New York City
May 22, 2014

Extracts from full CARe-5/2014 and GIRO-9/2014 Presentation

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OVERVIEW

A new data source: **Imperial-IICI dataset**

- Insurance Intellectual Capital Initiative (IICI)
  - Bronek Masojada (Hiscox), James Slaughter (Liberty Mutual), Rob Caton (Hiscox)
  - Lloyd's of London
- Focus on Large Commercial Risks (LCR)
  - Commercial Property, On-shore Energy; non-natural hazards

Implications for **reserving** and capital **modeling** (joint work with Davide Benedetti, Erik Chavez [Imperial]; with Andreas Milidonis [Nanyang] for Asia-Pacific region)

- Tail risk estimation
- Benchmarking exercise (market loss curves & scaling factors)

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TAIL RISK

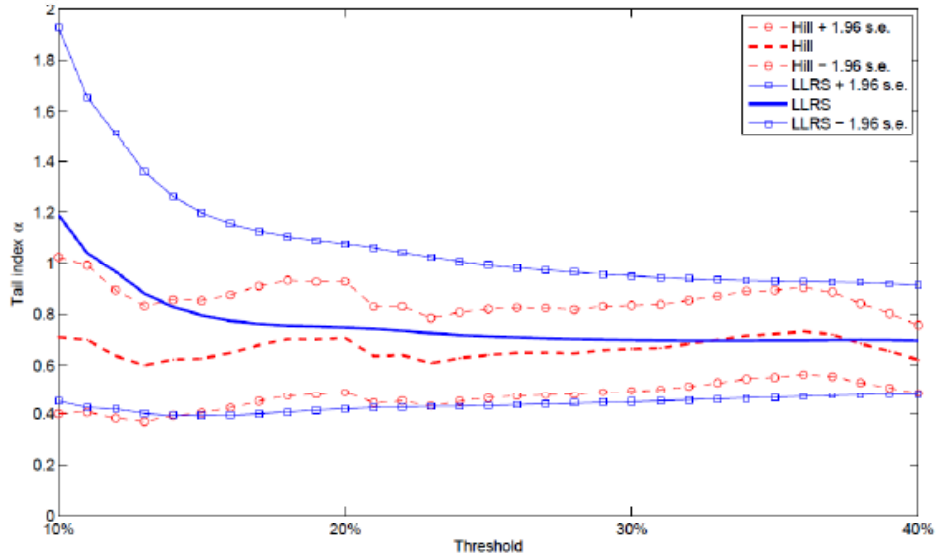
Tail index (α) estimation: $\mathbb{P}(Z > z) \sim Cz^{-\alpha}$

- Existence of **centered moments** (mean, variance, etc.)
  - Mean/Variance finite if and only if $\alpha > 1$ ($\alpha > 2$)
- Extent of **diversification** benefits for quantile-based risk measures
  - Retain fractions $w_1, \ldots, w_n$ of risks $X_1, \ldots, X_n$
  - Resulting aggregate risk $Z_{(w_1,\ldots,w_n)} = \sum_i w_i X_i$
  - $VaR_p(Z_{(1,0,\ldots,0)}) < VaR_p(Z_{(\frac{1}{n},\ldots,\frac{1}{n})})$ for $\alpha \in (0,1), p \in (0, 1/2)$, for stable distributions (e.g., Ibragimov, 2009)

What do we find for LCR?

- Heavy tails & significant heterogeneity across occupancy type

OCCUPANCY LEVEL 2 - Chemicals, Metals, Mines



NEXT STEPS

New data source for LCR

- Robust estimation of **tail risk**
- **Comparing** claim costs across occupancy/TIV bands/location

Lessons from Imperial-IICI data collection, validation, and analysis

- Link between claims and exposures crucial: Systematic storage of claims & exposures information (policy schedules & claims narratives in digital, compatible format) should be a priority
- Macro-validation (e.g., Fire Protection Agencies) & micro-validation (e.g., syndicate level) of data important for *structural* understanding of risk
- Gains from data aggregation HUGE - **please contribute!**

John W. Buchanan

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John Buchanan, FCAS, MAAA, is a principal in charge of ISO's Excess and Reinsurance Division. He has over 30 years of experience as a front-line pricing actuary and consultant in the US, London, and other international reinsurance marketplaces.

In John's career, he has conceptualized, developed and implemented extensive benchmarking and modeling services for various reinsurers, excess carriers, and industry groups. He has pioneered extensive work to extend information gathered in mature benchmarking markets, and extending that information to other International markets making use of local and customized knowledge. He was a frontline sign-off actuary for many domestic and international lines of business. While a consultant, he was also the main contact for many years for the Reinsurance Association of America and the Reinsurance Research Council of Canada as well as having worked extensively with the London and European reinsurance market through the Casualty Actuaries in Reinsurance in London.

John's professional accomplishments in the property area also include being heavily involved with many international meteorological groups including NOAA, UK-Met, GLOBE, ACRE, and as chairperson of the CAS Climate Change Student Outreach subcommittee. He is in charge of the reinsurance educational tracks at the annual CARe conference, and previously at the CAS Ratemaking Seminar. He has also been a moderator and panelist at dozens of industry seminars on the topic of domestic and international reinsurance pricing, the underwriting cycle, international benchmarking, etc.

Prior to joining Verisk, John was a Senior Vice President at Platinum Underwriters (previously St. Paul Reinsurance), a Principal at Tillinghast (now Towers Watson), and a Senior Consultant at KPMG, Peat Marwick. He also has competed as an amateur in the Global Salsa Championships, and is determined to write the book "The Mathematician's Guide to Salsa Dancing".

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Enrico Biffis is an Associate Professor of Actuarial Finance at Imperial College Business School, a fellow of the Pensions Institute London, a member of the Munich Risk and Insurance Center at LMU Munich, and an editor of ASTIN Bulletin – The Journal of the International Actuarial Association. His area of expertise is asset-liability management, with emphasis on risk analysis and market consistent valuation for the insurance and pensions industry, as well as optimal risk transfers for catastrophe and long term risks.

His research has attracted funding from leading insurers and governmental organizations, and has been published in the Journal of Risk and Insurance, Insurance: Mathematics and Economics, North American Actuarial Journal, Scandinavian Actuarial Journal, among others. Enrico has also worked with industry bodies on the benchmarking of stochastic asset models, and the impact of Dodd-Frank/EMIR regulation on OTC derivative markets.

Enrico is a regular speaker at academic and industry events, including Risk Theory Society (American Risk and Insurance Association), Risk Minds Insurance, and Global Derivatives. Enrico holds a BSc and MSc in Statistics, a MSc in Actuarial Management, and a PhD in Mathematics for Economic Decisions. Prior to joining Imperial College London in 2007, Enrico held positions at Bocconi Milan, Association of British Insurers, and Cass Business School.

Gratefully acknowledge contributions by Enrico to the CAS International seminars - JWB

Dave Sandeman

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Dave is the executive director responsible for leading the Content & Operations side of Axco in London. The Content includes the Axco Market Reports on over 180 countries as well as the Statistical Data covering the economic and Insurance Market data across, P&C as well as Life and Health and EB. The Operations side incorporates the on-going development and generation of new delivery tools and systems which allow clients to access extract and manipulate the required narrative and unique data sets developing within Axco Analytics service.

Dave joined Axco in 2009, following a career where he has enjoyed exposure to various roles, from Commercial and Corporate Underwriting and Marketing, within Insurance and Reinsurance environments, through to Risk Financing and Financial Risk projects, and Captive Design and Management, incorporating developing new and unique cross border solutions for clients across Life and Non-Life, as well as the Health and PA sectors of the industry.

Gratefully acknowledge contributions by Dave to the CAS International seminars - JWB

Questions