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GENERAL INSURANCE PRICING SEMINAR

13 JUNE 2008, LONDON

Marine Hull Pricing

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Session Overview

- To show how data flows from insurer to reinsurer and the impact of assumptions made.

- Price an insurance portfolio
- Price a reinsurance portfolio
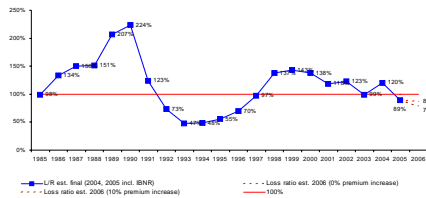- Look at the difference in loss cost by layer

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Exposure Pricing a Marine Hull Treaty - Assumptions

- The past is a good guide to the future…
    - Congested waters → more collisions & groundings?
    - Oil Prices, credit crunch? Margins thinner for operators, cost cutting?
- Quality of newbuilds the same as older ships?
- Larger vessels, Shift in manufacturing country?
- Cedant's pricing (target LR) is accurate ?
    - constant across all vessel types & sizes?
- Exposure Curve

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Marine Hull Market Cycle

2005 CEFOR Norwegian Marine Insurance Statistics – Part 3
As of 31 December 2005

Loss ratio in a long-term perspective

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Approach

- Build a fleet with known characteristics
- Use a known loss distribution and hence calculate FGU (from ground up) loss cost.
- Let an Insurer write these fleets with a deductible and a maximum line.
- Cede the portfolio to a reinsurer
- Exposure rate the ceded portfolio.
- Look at the errors in exposure rating

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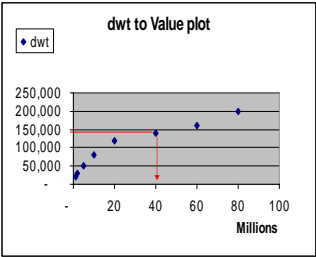making financial sense of the future

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Step 1 – Build a Fleet

- Assume each fleet has average of 10 vessels
  - Poisson distributed
- Randomly select a fleet size (# vessels)
- Randomly select vessels from a proprietary database
- Generate a value for each vessel
- Repeat to calculate 1,000 fleets

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Step 1 – Build a Fleet

- Take vessel size and look up its value

dwt to Value plot

ID	#	Type	DWT	Value
1	8	Bulker	1,846	1,918,144
1	8	Bulker	9,891	16,190,016
1	8	Bulker	75,311	111,648,640
1	8	Tanker	38,396	66,323,200
1	8	Bulker	35,315	61,611,776
1	8	Bulker	149,297	209,339,136
1	8	Passenger	500	2,419,008
1	8	Tanker	2,998	5,462,720
2	4	Tanker	105,745	154,585,344
2	4	Bulker	32,000	55,694,976
2	4	Bulker	45,090	71,373,120
2	4	Bulker	66,995	103,808,192
3	14	Bulker	45,862	71,662,080

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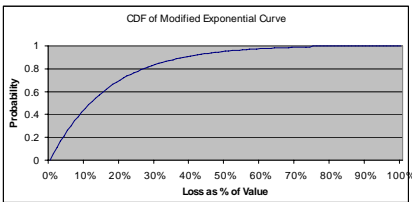making financial sense of the future

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Step 2 - Define Losses

- For this exercise everything is simplified
- Assume a known distribution for PA losses
  - exponential distribution on loss to value
- Particular Averages up to 75% of value
- loss frequencies are the right order of magnitude
  - Assume that probability of a loss is 20%
- Total Losses defined by frequency dependent on age and type

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Loss distribution

- Assume exponential distribution to 75% of the vessel value, total loss thereafter

CDF of Modified Exponential Curve

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Step 3 – Insure the fleet

- Randomly select a deductible from a sensible range
- Randomly select the Insurer's share of the Fleet subject to:
- Limit the Insurer's max written line to $50m

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Step 4 - Cede the portfolio to a Reinsurer

- Create a risk profile
  - For each fleet take the largest sum at risk (this defines the band) and allocate all the fleet premium to that band.

Band	Lower	Upper	Largest SI	Number of Vessels	Insurance Premium Charged
1	-	5,000,000	4,992,144	941	1.8
2	5,000,001	10,000,000	9,951,322	1,807	7.8
3	10,000,001	15,000,000	14,998,104	1,804	13.2
4	15,000,001	20,000,000	19,988,937	1,682	17.2
5	20,000,001	25,000,000	24,953,404	1,259	15.0
6	25,000,001	30,000,000	29,999,444	680	11.4
7	30,000,001	35,000,000	34,927,236	622	11.3
8	35,000,001	40,000,000	39,423,822	231	5.4
9	40,000,001	45,000,000	44,764,017	230	6.0
10	45,000,001	50,000,000	50,000,000	576	10.9
			Total	9,832	100.0

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Step 5 - Reinsurer estimates insurer's loss cost

- Constant Loss ratio across bands?

Band	Lower	Upper	Largest SI	Number of Vessels	Insurance Premium Charged	Loss Ratio	Loss Cost
1	-	5,000,000	4,992,144	941	1.8	75%	1.3
2	5,000,001	10,000,000	9,951,322	1,807	7.8	75%	5.9
3	10,000,001	15,000,000	14,998,104	1,804	13.2	75%	9.9
4	15,000,001	20,000,000	19,988,937	1,682	17.2	75%	12.9
5	20,000,001	25,000,000	24,953,404	1,259	15.0	75%	11.3
6	25,000,001	30,000,000	29,999,444	680	11.4	75%	8.5
7	30,000,001	35,000,000	34,927,236	622	11.3	75%	8.5
8	35,000,001	40,000,000	39,423,822	231	5.4	75%	4.0
9	40,000,001	45,000,000	44,764,017	230	6.0	75%	4.5
10	45,000,001	50,000,000	50,000,000	576	10.9	75%	8.2
			Total	9,832	100.0		75.0

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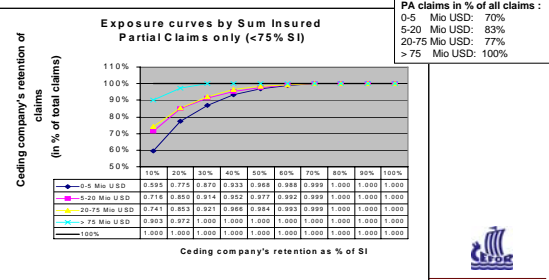## Step 6 – Reinsurer allocates loss cost to layers
- choose an exposure curve

- Own Data ?
- Publicly available data?
- Property curve?

- Change curve depending on size of vessel
  - or age of vessel?

Publicly available exposure curve

2007 CEFOR Nordic Marine Insurance Statistics – Part 9
As of 31 December 2007

Exposure curves by Sum Insured
Partial Claims only (<75% SI)

Ceding company's retention of claims (in % of total claims)

	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
0-5 Mio USD	0.595	0.775	0.870	0.933	0.968	0.988	0.999	1.000	1.000	1.000
5-20 Mio USD	0.716	0.850	0.914	0.952	0.977	0.992	0.999	1.000	1.000	1.000
20-75 Mio USD	0.741	0.853	0.921	0.966	0.984	0.993	1.000	1.000	1.000	1.000
>75 Mio USD	0.903	0.972	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
100%	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Ceding company's retention as % of SI

PA claims in % of all claims :
0-5 Mio USD: 70%
5-20 Mio USD: 83%
20-75 Mio USD: 77%
> 75 Mio USD: 100%

http://www.cefor.no/statistics/documents/2005%20CEFOR%20The%20NoMIS%20report.ppt
Slide 46

Apply bands to curves to allocate losses

- Look at error in calculating the loss cost
- Curves which get to 100% too soon are problematic
- Even the assumed curve has error
  - because of fleet aggregation

layer 0 to 50m	0 to 5m	5 to 10m	10 to 15m	15 to 20m	20 to 25m	25 to 30m	30 to 35m	35 to 40m	40 to 45m	45 to 50m	Sum layers 0 to 50m
True Loss Cost	55.48	12.57	4.00	1.54	0.68	0.37	0.18	0.09	0.06	0.03	75.00
Medium Vessel	63.51	7.27	2.63	1.02	0.36	0.14	0.06	0.01	-	-	75.00
Small Vessel	56.99	11.10	4.11	1.69	0.71	0.28	0.11	0.01	-	-	75.00
Assumed curve	57.26	11.00	3.56	1.52	0.75	0.41	0.24	0.13	0.08	0.06	75.00
Error											
Medium Vessel	14%	-42%	-34%	-34%	-46%	-62%	-65%	-90%	-100%	-100%	
Small Vessel	3%	-12%	3%	10%	5%	-23%	-38%	-90%	-100%	-100%	
Assumed curve	3%	-12%	-11%	-2%	10%	10%	33%	39%	47%	126%	

Can we overcome the Problems?

- Write across the program
  - but what about the cedant's retention?
- Increase the cedant loss ratio assumption
  - but this is probably not enough looking at the errors
  - especially at the top end

- Ask Cedants for more complete data

- Opportunity to profit if you can spot the inconsistencies

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Can we overcome the Problems?
...continued

- Cedent's loss cost ?
- Bands decided by largest vessel
- How many fleets, how many vessels?
- How many vessels per band?
- distribution of vessel values within a fleet

- Try splitting bands into individual vessels…

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Allocate loss cost to assumed vessel distribution

- Not accurate
- Just moves the problem

layer 0 to 50m	0 to 5m	5 to 10m	10 to 15m	15 to 20m	20 to 25m	25 to 30m	30 to 35m	35 to 40m	40 to 45m	45 to 50m	Sum layers 0 to 50m
True Loss Cost	55.48	12.57	4.00	1.54	0.68	0.37	0.18	0.09	0.06	0.03	75.00
Assumed curve	57.26	11.00	3.56	1.52	0.75	0.41	0.24	0.13	0.08	0.06	75.00
Assumed curve, SI weight	58.23	11.36	3.41	1.20	0.47	0.20	0.08	0.03	0.01	0.00	75.00
Assumed curve, Size & rate	63.50	8.17	2.10	0.71	0.28	0.13	0.06	0.03	0.01	0.01	75.00
Error											
Assumed curve	3%	-12%	-11%	-2%	10%	10%	33%	39%	47%	126%	
Spread over 10 bands by SI	5%	-10%	-15%	-22%	-30%	-47%	-55%	-67%	-79%	-86%	
Spread over 10 bands by size and rate	14%	-35%	-48%	-54%	-58%	-64%	-66%	-70%	-77%	-73%	

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Further complications

- When creating risk profile is the Increased Value (IV) added to the H&M for each vessel?
- What if insurer discloses hasn't added but that these are included in the policy list?
  - Move loss cost up the bands
  - Assume x% of vessels have IV of 25%, 40% ???
- What if insurer doesn't disclose whether IV included or not?
  - Better to find out before, know your data
  - Make an assumption

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Final Thoughts

- Do you capture enough data to create your own exposure curves?
  - Claim data
  - Exposure data
  - Can be very difficult to obtain

- For your spare time…
  - Read up on exposure curves
  - work out how adjust your exposure rating
  - Cargo issue,one figure for ship capacity? look up Emma Maersk on Wikipedia & compare to Seaway
    http://en.wikipedia.org/wiki/Emma_Maersk

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