

International Casualty Reinsurance Pricing Approaches

Ana Mata, PhD, ACAS

CARe Seminar

Boston, 4-5 June 2012

CAS - Antitrust Notice

The Casualty Actuarial Society is committed to adhering strictly to the letter and spirit of the antitrust laws. Seminars conducted under the auspices of the CAS are designed solely to provide a forum for the expression of various points of view on topics described in the programs or agendas for such meetings.

Under no circumstances shall CAS seminars be used as a means for competing companies or firms to reach any understanding – expressed or implied – that restricts competition or in any way impairs the ability of members to exercise independent business judgment regarding matters affecting competition.

It is the responsibility of all seminar participants to be aware of antitrust regulations, to prevent any written or verbal discussions that appear to violate these laws, and to adhere in every respect to the CAS antitrust compliance policy.

Ana Mata – Mini Bio

- **Truly international**
 - Born in Spain, grew up in Venezuela
 - PhD in Scotland, in UK for 15 years
 - Married to Indian
 - Live and work in London

- **Most career on Casualty/Financial Lines pricing**
 - Academic/Lecturer
 - Consultant in London
 - US Casualty treaty pricing actuary in Chicago
 - Insurance and reinsurance (US/Non-US) pricing actuary in London
 - Pricing consultant, software developer and trainer

Agenda

- **Comparison of methodologies US/UK/Europe**
- **Case study – Motor XOL**
 - Overview of pricing approaches
 - Current issues – Partial Payment Orders (PPO)
- **Other issues**
 - Currencies – global treaties
 - Sources of claims inflation – does one size fit all?
 - Stacking of limits – data limitations
 - ALAE adjustments
 - Lloyd’s underwriting *minimum* standards

Data issues

Item	USA	UK	Europe
Limits profile	Banded profile or individual risk download	Banded profile by attachment and limit (lowest attachment and total limit stacked) OR full risk download with a stacked code	Unlimited coverages, profile banded by limit offered
Gross triangles	Often provides if not Schedule P used	Some provide gross incurred triangles most don't. Upon request may provide plan loss ratio or ULRs for last 5 years.	Rarely provided, if at all paid triangles. May provide plan gross loss ratio.
Rate changes	Standard in submission or easy to get, rate filings, etc.	Better in most recent years, but calculations not standard, often questionable.	Rarely provided or based on anecdotal evidence.
Historic premium, which premium?	Often premium subject to treaty or a good proxy (EP for LOD and WP for RAD)	Gross or net of commission? Written or earned depending on Lloyd's non-Lloyd's market.	Most treaties 1/1, not an issue, but could be EP for RAD
Individual claims progression	Could include Indemnity and ALAE, could include policy limits and deductibles, paid and O/S.	ALAE not split, but often treaties are inclusive of ALAE. Limits by claims rarely provided. Indemnity paid and O/S, but ALAE just paid.	ALAE not split, but often treaties are inclusive of ALAE. Limits by claims rarely provided. Indemnity paid and O/S, but ALAE just paid.
ILFs	Some cedant's may share this information, particularly medmal writers. Rely on ISO curves.	Everyone struggles for curves, so may not share due to lack of them. Power curves commonly used, some very old 5PP ISO 1997 still being used.	May not even have them or may be using the power curves too.

Overview of methodology differences

Method	Sub-item	USA	UK	Europe
Experience	Claims trending	Often constant trend. Average loss method from avg loss date of past to average loss date of future.	Wide variations: Avg loss date, CY, differentiate between closed and open claims.	Trends by year. Calendar year for incremental payments and outstanding from year end.
	Layer indexation	Not an issue	Apply average index factor to all trended claims, apply own payment pattern to each closed claim.	Apply average index factor to all trended claims, derive a credit to experience based on the curve fitted.
	Claims development	Create excess triangle of trended losses seems preferred approach. Apply excess LDFs to aggregate losses in layer.	Wide variations: trend, layer, create excess triangle, excess LDFs vs. Trend, develop open claims, layer and aggregate. IBNR from claim count pattern.	Individual claims development applied to open claims in order to fit curves for "exposure rating". May also create excess triangles.
Exposure	Trending parameters	Standard to trend parameters for parametric curves. Each curve has an effective date.	Some do but most don't. Tables of ILFs untrended and power curves scale invariant.	Curve fitted each time for specific accounts. Power curves are scale invariante, inflation does not matter.
	ALAE included or not? Adjustments?	Clear understanding of indemnity only vs indemnity plus ALAE curves and appropriate adjustments done.	Some adjust for ALAE but most don't. Main adjustment need to policy limit, but often missed. Power curves: do they include or exclude ALAE??	Curve follows data presentation. Power curves: do they include or exclude ALAE??
	Limits profile vs. unlimited coverages	Standard methodology taking into account limits profile if available.	Depends on data presentation: aggregate banded profile vs individual policies with stack code.	Fit a curve to cedant's data and use frequency/severity approach. Rare use of "limits profile" approach
Mixed/Hybrid		1) Experience rate (loss cost %) low credible layer, use curve to extrapolate burn cost		
		2) Experience rate frequency at low reference attachment, use curve to extrapolate frequency and severity from curve.		
		3) Experience rate (loss cost %) from lowest attachment all programme, then use the curve to split between layers.		
		4) Hybrid method*		
Aggregate loss distributions		1) Lognormal or gamma approximation fitting mean and CV		
		2) Poisson model with total or partial severity		
		3) Model for frequency and severity then combine using simulation, recursive algorithm or Fast Fourier Transform		

*Buchanan, J and Angelina, M. The Hybrid Reinsurance Pricing Method: A Practitioner's guide. To Appear in Variance.

Motor XOL – Background

- UK Motor – third party liability is unlimited
- Rating – standard GLMs techniques, but gender rating in discussion
- Legal system – tort system based on negligence
- Medical costs – public healthcare reimbursed by motor insurers
- Settlements – lump sum settlement most common in the past, 2003 Partial Payment Order imposed by courts
 - Main current issue!

Motor XOL – A case study

Programme

- £2M xs £3M
- £5M xs £5M
- 15M xs £10M
- Unlimited xs £25M
- Full indexation clause

Data received

- Premium and exposures historically
- Policies profiles
 - ❖ Age, gender, usage, type of vehicle
- Claims greater than £100k with development
 - ❖ Discounted/undiscounted?
 - ❖ Reserving practices?
- Large claim status report

Motor XOL – A case study

Overview of indexation clause

- Also known as stability clause
- Only to bodily injury claims
- Treaty limit and attachment are adjusted
 - Depending on payment pattern of EACH claim
 - According to an official wage index published by the government, in the UK

“Average earnings index, Series LNMQ – (whole economy, seasonally adjusted), appearing in the Office for National Statistics’ *“Monthly Digest of Statistics”*, published by The Stationery Office.

- Key assumptions in pricing:
 - future wage inflation
 - future payment pattern

Motor XOL – A case study

Overview of indexation clause

- Three main types of indexation:
 - Full indexation – from treaty inception
 - Severe inflation clause (SIC) – excess inflation from when cumulative index reaches agreed threshold
 - Franchise – from treaty inception only when cumulative index reaches agreed threshold
- Adjusted incremental payment = paid amount /cumulative inflation from inception
- Adjustment = actual paid/(sum adjusted payment)

Motor XOL – A case study

Overview of indexation clause

% BI	100.00%
Future wage inflation	3.00%
SIC	20%
Franchise	20%
Treaty effective date	01/07/2012

From inception	% Paid	Inc_%Paid	Paid_Date	Cum_index	Fully indexed Adjusted_Payment	Franchise Adjusted_Payment	SIC Adjusted_Payment
0.50	0.20%	0.20%	30/09/2012	1.00742	0.0019	0.0020	0.0020
1.50	4.32%	4.12%	01/07/2013	1.03000	0.0400	0.0412	0.0412
2.50	13.46%	9.14%	01/07/2014	1.06090	0.0862	0.0914	0.0914
3.50	24.55%	11.09%	01/07/2015	1.09273	0.1015	0.1109	0.1109
4.50	43.30%	18.75%	01/07/2016	1.12551	0.1666	0.1875	0.1875
5.50	65.12%	21.82%	01/07/2017	1.15927	0.1882	0.2182	0.2182
6.50	79.79%	14.67%	01/07/2018	1.19405	0.1229	0.1467	0.1467
7.50	90.91%	11.12%	01/07/2019	1.22987	0.0904	0.0904	0.1085
8.50	93.18%	2.27%	01/07/2020	1.26677	0.0179	0.0179	0.0215
9.50	95.45%	2.27%	01/07/2021	1.30477	0.0174	0.0174	0.0209
10.50	97.73%	2.27%	01/07/2022	1.34392	0.0169	0.0169	0.0203
11.50	100.00%	2.27%	01/07/2023	1.38423	0.0164	0.0164	0.0197
Avg_index_factor					1.1542	1.0449	1.0113

Motor XOL – A case study

Pricing approach

- Pricing approach
 - Heavy reliance on experience
 - Payment patterns
 - Reserving practices
 - No exposure rating due to unlimited policies
 - Mixed/hybrid method – requires a curve
 - Curve fitted to data from multiple cedants – (industry benchmark)
 - Start by deriving indexation factor
 - Experience rate indexed layer

Motor XOL – A case study

Common pricing methods

- Mixture of experience and a curve
 - Select a reference attachment – often 1M or as low as possible
 - Experience rate 1M xs 1M and extrapolate burning cost using the curve
 - Experience rate frequency xs 1M
 - Extrapolate frequency using curve
 - Use severity directly from the curve
 - Experience rate unlimited xs of 1M and use the curve to split burn cost

Motor XOL – A case study

Common pricing methods

- Curve: Pareto (1.45; 1,000,000)
- Assumed claims inflation = 3% wage inflation and 3% social inflation (6% total)
 - BI awards study 2007 – 9.5% average claims inflation
 - Small claims vs. large claims
- Avg index factor = 1.1542
- Experience rated losses and counts
 - £1M xs £1M
 - Unlimited xs £1M

Motor XOL – A case study

Summary of results

Layer	Exposure			
	Frequency	Severity	Burn cost	Probability xs layer
Unlimited xs 1M	0.23150	2,433,601	56.34%	100.00%
1M xs 1M	0.23150	684,667	15.85%	100.00%
1M xs 2M	0.08474	852,298	7.22%	36.60%
2M xs 3M	0.04707	1,574,200	7.41%	20.33%
5M xs 5M	0.02244	3,423,331	7.68%	9.69%
15M xs 10M	0.00821	8,633,661	7.09%	3.55%
Unlimited xs 25M	0.00218	50,945,055	11.08%	0.94%
Total treaty			33.27%	

- Gross LR = 85%
- All results for indexed layer
- Freq = #claims/mill premium

Layer	Experience			Mixed 1		Mixed 2			Mixed 3	
	Frequency	Severity	Burn cost	% 1M xs 1M	Burn cost	Frequency	Severity	Burn cost	Unlimited xs 1M	Burn cost
Unlimited xs 1M	0.06105	1,712,463	10.45%							
1M xs 1M	0.06105	734,123	4.48%							
1M xs 2M										
2M xs 3M				46.751%	2.0953%	0.01241	1,574,200	1.9541%	13.153%	1.3750%
5M xs 5M				48.473%	2.1725%	0.00592	3,423,331	2.0258%	13.637%	1.4257%
15M xs 10M				44.744%	2.0054%	0.00217	8,633,661	1.8693%	12.588%	1.3160%
Unlimited xs 25M				69.924%	3.1339%	0.00057	50,945,055	2.9288%	19.672%	2.0566%
					9.4070%			8.7780%		6.1734%

Motor XOL – A case study

Significant differences in results

- Market results tend to vary widely
 - Inflation assumptions
 - Indexation approach
 - Pricing methodology
 - Curves
- Changes from Lump Sum settlements and PPOs add a new dimension
 - Historic patterns mostly based on Lump Sum
 - Future pattern a mixture of LS and PPO

Motor XOL – A case study

What are the issues around PPOs?

- Lump sum: non-economic damages plus discounted future medical cost and cost of care based on life expectancy.
- Courts Act 2003 gave court power to impose rest-of-life structured settlement
 - Originally to be indexed with RPI
- PPOs did not take off until a few appeals in 2008 (e.g. *Thompstone v Tameside*)
 - Avg earnings index for loss of earnings
 - ASHE 6115 for cost of care

Motor XOL – A case study

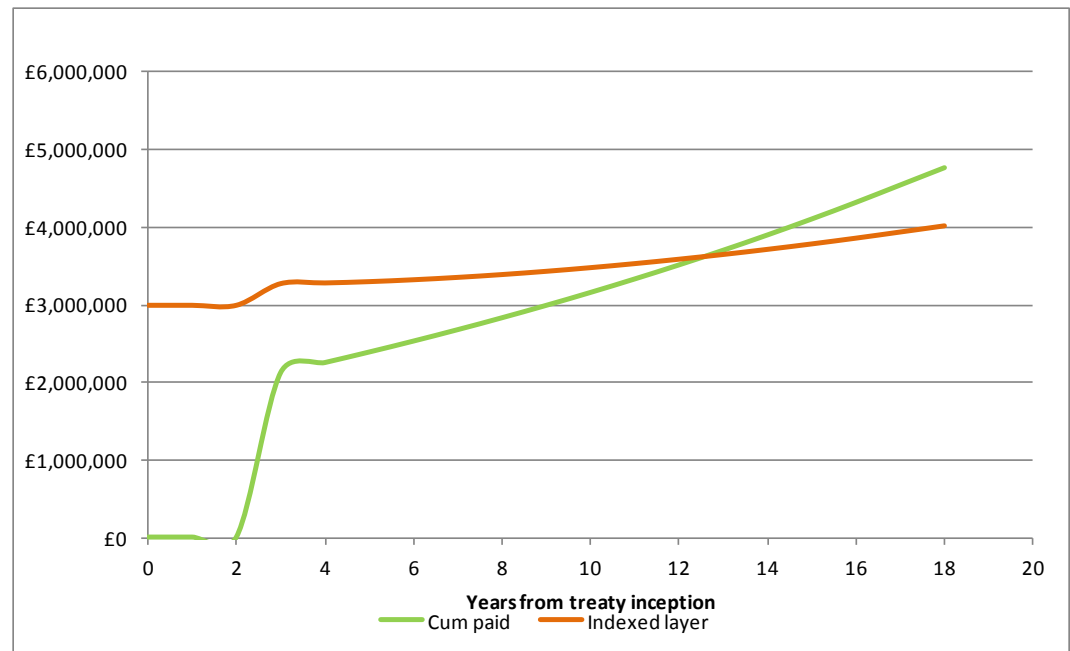
References for background

- Simply Google: PPOs
- Periodic Payment Order – Issues and Implications for Reinsurance, 14 October 2011, Guy Carpenter, www.GCCapitalIdeas.com
- PPOs – be afraid, be very afraid, GIRO working party 2010, 2011. www.actuaries.org.uk
- PPO study, Report from the IUA Casualty Treaty Group, Nov 2011, www.iua.co.uk

Motor XOL – A case study

PPO issues

Treaty effective date	01/07/2008	
Settlement	01/07/2011	
Lump sum	2,000,000	
Life expectancy	15	
Loss of earnings/year	50,000	3.00%
Cost of care/year	75,000	5.00%
Interest rate		2.50%
RI Attachment	3,000,000	
Lump sum settlement	3,875,000	
PPO	4,782,948	
Indexed attachment	3,278,181	(3 years)
Indexed attachment	4,024,733	(18 yrs)
Ultimate recovery	758,215	
Buyers needs to fund	1,024,733	
Discounted reserve at 1/7/2011	4,276,797	



Motor XOL – A case study

Issues for buyers and sellers

Cedants

- Interest rates – reserve uncertainty
- PPO indexation
- Mortality risk
- Ultimate IBNR ceded
- Funding between excess and indexed excess
- Would the reinsurer be there?

Reinsurer

- Interest rates – reserve uncertainty
- PPO indexation = layer indexation
- Longer tail – admin/expenses
- Mortality risk
- How to price the future when the past is uncertain
- Capital allocation for ROE

Motor XOL – A case study

Pricing vs. Reserving

Pricing - Assumptions

- Proportion of LS vs. PPOs
 - Payment and incurred patterns
- Future wage index and ASHE (constant)
- Constant index factor
- Discounted vs. undiscounted loss pick
- Capital charge
 - LS – reserve risk
 - PPO – mortality risk

Reserving - Actuals

Actuarial or Claims?

- Actual cases of LS vs. PPOs
- Claim by claim indexation
- Discounted PPOs reserves: annual review present value of O/S
 - Actual and forecasted indices and interest rates
 - Remaining life expectancy



Miscellaneous pricing issues

The rationale behind power curves

- Basic limit = B, pure premium P(B)
- Pure premium for limit 2B = $P(B) \cdot (1+r)$, e.g. $r=20\%$
- Pure premium for limit 4B = $P(B) \cdot (1+r)(1+r)$
- **Riebesell's rule becomes ILF formula:**

$$ILF(Limit) = (Limit / 1M)^\alpha \quad 0.25 \leq \alpha \leq 0.75$$

- Main issue (for me!)
 - Inflation and currency independent
 - Exposure result may fall behind experience

Global treaties- dealing with currencies

- Typical programme:
 - 1st layer: 1M xs 1M GBP/USD/CAD/EUR or 2M xs 2M AUD/NZD or 100M xs 100M JPY
 - 2nd layer: 3M xs 2M GBP/USD/CAD/EUR or 6M xs 4M AUD/NZD or 300M xs 200M JPY
- Any other unnamed currency in USD
- Mixture of currencies from
 - Benchmarks: curves/LDFs
 - Data in original currency? - Ideal
 - Treaty
 - Exchange rates – year on year difficult to reconcile

Global treaties- dealing with currencies

- Select a rating currency – all results to this
- Named currencies rate in original currency then convert to selected rating currency
- Unnamed currencies rate in USD then convert to rating currency
- Add across
- Can rating models cope with this? Many don't
- Not an issue in the USA

Sources of claims inflation

- No sources of claims inflation other than economic inflation and wage indices
- Wide range of assumptions in market
 - Motor: 6% - 9.5%
 - GL: 4% - 9.5%
 - EL: 6% - 12%
 - Medmal: 2% - 8%
 - E&O/PI: 2% - 6%
 - D&O/FI: 5% - 10%
- Very profitable accounts may look quite bad after inflation, do we believe this?

Exposure rating – results depend on data

- Policy limit profile (actual limits or range)
 - Limits written with premium written by limit size
 - If excess policies, matrix by policy limit and attachment
- Details of each risk including share, attachment, limit and premium

Share	Limit	Attachment	Share of premium
50%	£10M	0	£400,000
50%	£10M	£10M	£125,000
10%	£50M	£50M	£15,000
	£15M	0	£540,000

Solvency II – “Potential” New Regulation

- On-going since 2000
- “Going live” date moved several times latest 1/1/2014
- Integrated risk management approach – ERM
- Minimum Capital Requirements vs. Solvency Capital Requirements
 - Internal model approach
 - Prescribed formula
- Generated lots of jobs for actuaries!
- Significant changes for the industry

Lloyd's Underwriting Minimum Standards

Traditional underwriting

Look at the policy, mentally rate it, and agree to write it or not.



WHY ME?

WHY THIS?

WHY NOW?

WHAT NOW?

Underwriting today

Modelling each risk: putting information through a rating model to calculate technical pricing

Rate monitoring

Trying to allocate a loss ratio to each policy

Produce Lloyd's technical or benchmark pricing

Prepare next year's plan (quarterly)

Inconsistencies throughout the market

- What is technical or benchmark price?
 - Loss cost
 - Break-even premium
 - Premium with a target loss cost
 - Premium to achieve business plan
- Often benchmark = achieved price due to back filling of models
- What does rate change mean? Should I include claims experience?

Rate Change vs. Loss Ratio Trend

- Rate monitoring includes:
 - Change in exposure %
 - Change in limits %
 - Change in excess/attachment %
 - Change in T&C %
 - Claims inflation %
 - Other %
- Often not linked to pricing factors
- Generate inconsistencies between Rate Change and Loss Ratio

Working with what we have

- Communication plays important role
 - Understand limitations
 - Overcome actuarial over confidence
 - Communicate uncertainties and assumptions
- Better listeners
 - Listen to clients, brokers and underwriters
- See the big picture
 - Pricing aside - is this a good treaty to write?
 - Facts vs assumptions

Legal notice

Copyright © 2012 by MatBlas Limited. All rights reserved

No part of this publication may be reproduced or modified or use for commercial purposes without prior written permission by MatBlas Limited.

Disclaimer: All worked examples shown in this note were derived from hypothetical assumptions based on general acquired knowledge through work experience only and do not reflect any company's rates, rating factors, benchmark factors, loss experience or reporting processes. Any similarity between these examples and any (re)insurance company is coincidental only.

Although all the information presented is based on general acquired professional knowledge, MatBlas Ltd does not accept any responsibility for the accuracy or comprehensiveness of the information. Under no circumstances shall MatBlas or its employees be liable for the use of and reliance on any part of the information provided in this presentation.