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CLFM Estimates

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Users are demanding something be done! ☺

- Apr 8, 2009
  Hi,
  I am using the latest version of Chainladder in R 2.8.1 and have found it to be an excellent package indeed. There are occasions when the development factor may need to be selected as different from the output of the linear model … Is there a place in the MackChainLadder code where different development factors may be used?
  Thanks and Regards

- Feb 27, 2013
  I agree with this proposal. We often have to choose specific coefficients. Could it be an option in the input of the functions bootchainladder and MackChainLadder?
  Thank you in advance,

WC Indemnity Paid Dollars

Paid Indemnity Loss Development ($millions)												
	Age (months)											
Acc Year	12	24	36	48	60	72	84	96	108	120	…	372
1979											…	410
1980											…	490
…				…	…	…	…	…	…	…		
2001			2,454	3,244	3,715	4,001	4,205	4,348	4,452	4,528		
2002		1,438	2,563	3,306	3,726	4,006	4,190	4,320	4,406	4,486		
2003	434	1,464	2,482	3,100	3,497	3,749	3,910	4,028	4,132	4,227		
2004	392	1,142	1,738	2,148	2,397	2,573	2,699	2,809	2,908			
2005	322	880	1,331	1,644	1,843	1,988	2,108	2,207				
2006	311	890	1,370	1,683	1,911	2,083	2,224					
2007	320	929	1,438	1,791	2,042	2,230						
2008	322	942	1,486	1,888	2,171							
2009	287	881	1,424	1,822								
2010	292	921	1,500									
2011	299	956										
2012	325											

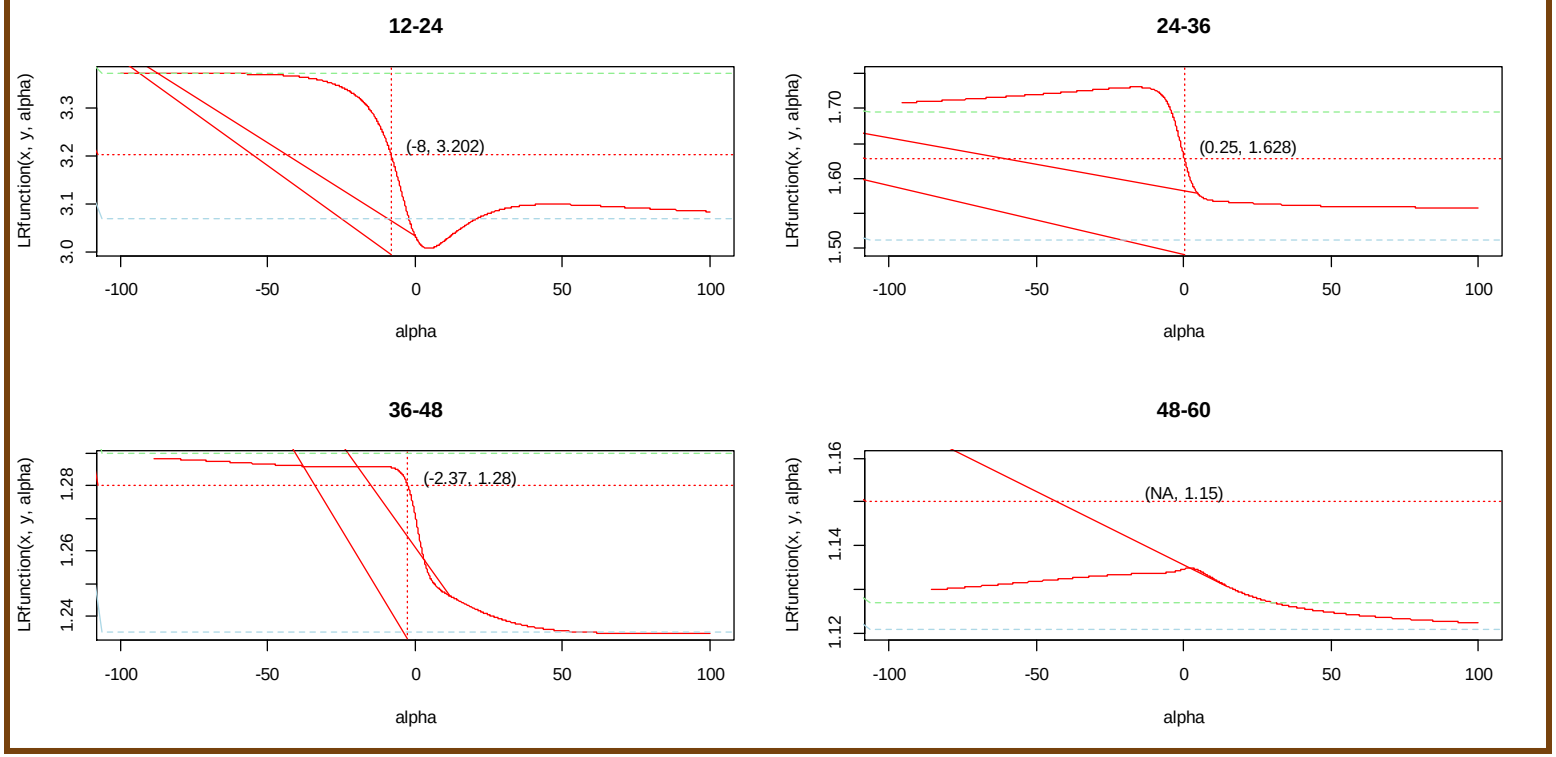
- “Equivalent” industry data evaluated 12/31/2012
- The green shaded cell in each column is the observation with the minimum beginning value in that development period
- The blue shaded cell is the maximum beginning value

Link Ratios

Acc Year	24/12	36/24	48/36	60/48	72/60	84/72	96/84	108/96	120/108
2001			1.322	1.145	1.077	1.051	1.034	1.024	1.017
2002		1.782	1.290	1.127	1.075	1.046	1.031	1.020	1.018
2003	3.370	1.696	1.249	1.128	1.072	1.043	1.030	1.026	1.023
2004	2.914	1.522	1.236	1.116	1.073	1.049	1.041	1.035	
2005	2.734	1.512	1.235	1.121	1.079	1.060	1.047		
2006	2.866	1.539	1.229	1.135	1.090	1.068			
2007	2.905	1.547	1.246	1.140	1.092				
2008	2.927	1.577	1.271	1.150					
2009	3.069	1.616	1.280						
2010	3.154	1.628							
2011	3.202								
Selected	3.202	1.628	1.280	1.150	1.092	1.068	1.047	1.035	1.019

- The industry committee's decision is to select the most recent factor
- The green cell in each column is the link ratio corresponding to the observation with the minimum beginning value
- The blue cell is corresponds to the observation with the maximum beginning value

Link Ratio Function
First Four Development Periods



- Red horizontal dotted line: selected value
- Red vertical dotted line: value of alpha such that LRfunction(alpha) = selected vale
- Asymptotes are at the link ratios of the AY with the minimum and maximum beginning values
  - Link ratios between asymptotes termed “reasonable” in paper
  - A less restrictive definition appears possible – an unsolved problem at this time

Estimate the development of unpaid loss as of 48 months using the R ChainLadder package

```
> triangle
      12   24   36   48
2001  NA   NA 2454 3244
2002  NA 1438 2563 3306
2003 434 1464 2482 3100
2004 392 1142 1738 2148
2005 322  880 1331 1644
2006 311  890 1370 1683
2007 320  929 1438 1791
2008 322  942 1486 1888
2009 287  881 1424 1822
2010 292  921 1500   NA
2011 299  956   NA   NA
2012 325   NA   NA   NA

> library(ChainLadder)
> delta <- CLFMdelta(Triangle = triangle,
+     selected = c(3.202, 1.628, 1.28))
> MackChainLadder(triangle,
+     alpha = 2 - delta,
+     est.sigma = "Mack",
+     mse.method = "Independence")
```

	Latest	Dev.To.Date	Ultimate	IBNR	Mack.S.E	CV(IBNR)
2001	3,244	1.000	3,244	0	0.0	NaN
2002	3,306	1.000	3,306	0	0.0	NaN
2003	3,100	1.000	3,100	0	0.0	NaN
2004	2,148	1.000	2,148	0	0.0	NaN
2005	1,644	1.000	1,644	0	0.0	NaN
2006	1,683	1.000	1,683	0	0.0	NaN
2007	1,791	1.000	1,791	0	0.0	NaN
2008	1,888	1.000	1,888	0	0.0	NaN
2009	1,822	1.000	1,822	0	0.0	NaN
2010	1,500	0.781	1,920	420	97.2	0.231
2011	956	0.480	1,992	1,036	171.1	0.165
2012	325	0.150	2,168	1,843	342.7	0.186

	Totals
Latest:	23,407.00
Dev:	0.88
Ultimate:	26,706.60
IBNR:	3,299.60
Mack S.E.:	402.17
CV(IBNR):	0.12

$$\frac{1}{3.202 \cdot 1.628 \cdot 1.28} = 0.150$$

$$Coefficient\ of\ Variation = 0.12$$

- Note that the default Mack Method using weighted average link ratios results in a CV of 0.09, which is 25% less than the CV indicated by the actual selected factors
- As of this writing, ChainLadder's S.E. calculation
  - limits alpha to the range [-4, 8]
  - does not yet reflect the PSI function adjustment

Questions for the audience

- What is the difference between the Chain Ladder method and the Loss Development method?
- [per 2nd poster on slide 1]
  Is it appropriate to carry out the England and Verrall bootstrap method given a triangle and an arbitrary set of selected link ratios? Why or why not?

Thanks

- To my co-authors Manolis and Ali for being the brains behind this paper
- To the many reviewers for their time, patience, and dedication to our Society