Analysis of RAA loss data

CLRS Concurrent Session

Thursday, September 10, 2015

Load the ChainLadder package and view the RAA triangle.

```
library(ChainLadder)
RAA
```

```
##       dev
## origin    1     2     3     4     5     6     7     8     9    10
##   1981 5012  8269 10907 11805 13539 16181 18009 18608 18662 18834
##   1982  106  4285  5396 10666 13782 15599 15496 16169 16704    NA
##   1983 3410  8992 13873 16141 18735 22214 22863 23466    NA    NA
##   1984 5655 11555 15766 21266 23425 26083 27067    NA    NA    NA
##   1985 1092  9565 15836 22169 25955 26180    NA    NA    NA    NA
##   1986 1513  6445 11702 12935 15852    NA    NA    NA    NA    NA
##   1987  557  4020 10946 12314    NA    NA    NA    NA    NA    NA
##   1988 1351  6947 13112    NA    NA    NA    NA    NA    NA    NA
##   1989 3133  5395    NA    NA    NA    NA    NA    NA    NA    NA
##   1990 2063    NA    NA    NA    NA    NA    NA    NA    NA    NA
```

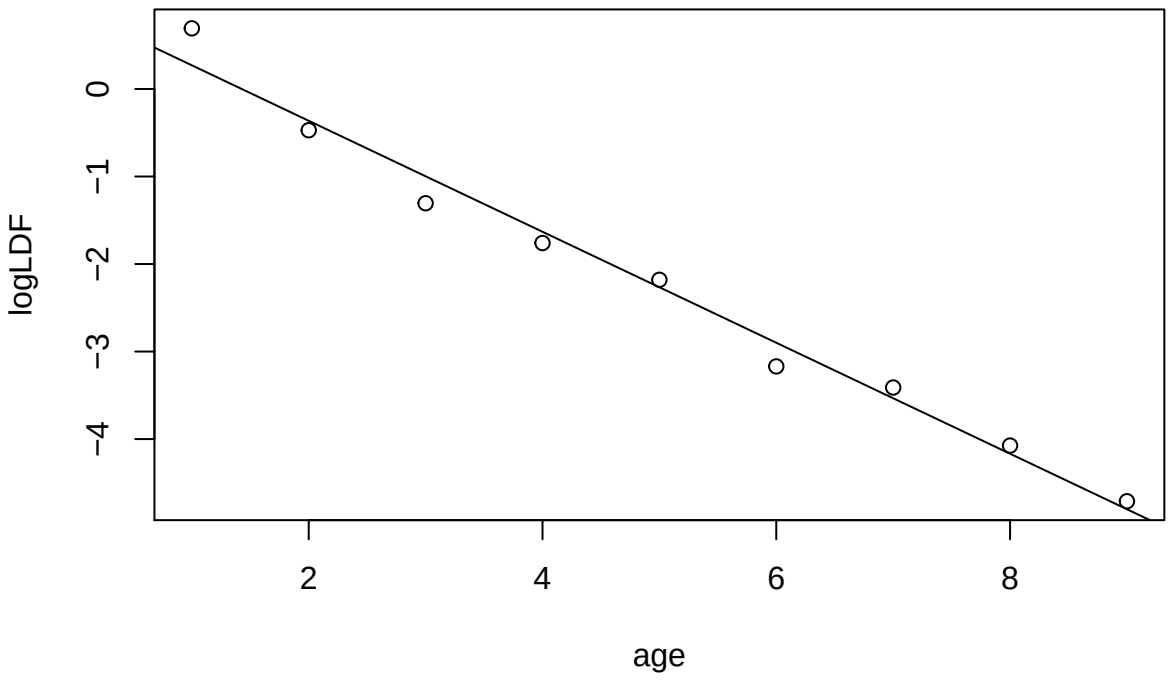
Form the triangle of age-to-age factors and initially select the weighted average link ratios.

```
##       dev
## origin    1-2   2-3   3-4   4-5   5-6   6-7   7-8   8-9  9-10
##   1981  1.650 1.319 1.082 1.147 1.195 1.113 1.033 1.003 1.009
##   1982 40.425 1.259 1.977 1.292 1.132 0.993 1.043 1.033    NA
##   1983  2.637 1.543 1.163 1.161 1.186 1.029 1.026    NA    NA
##   1984  2.043 1.364 1.349 1.102 1.113 1.038    NA    NA    NA
##   1985  8.759 1.656 1.400 1.171 1.009    NA    NA    NA    NA
##   1986  4.260 1.816 1.105 1.226    NA    NA    NA    NA    NA
##   1987  7.217 2.723 1.125    NA    NA    NA    NA    NA    NA
##   1988  5.142 1.887    NA    NA    NA    NA    NA    NA    NA
##   1989  1.722    NA    NA    NA    NA    NA    NA    NA    NA
##   smpl  8.206 1.696 1.315 1.183 1.127 1.043 1.034 1.018 1.009
##   vwtd  2.999 1.624 1.271 1.172 1.113 1.042 1.033 1.017 1.009
```

```
##   1-2   2-3   3-4   4-5   5-6   6-7   7-8   8-9  9-10
## 2.999 1.624 1.271 1.172 1.113 1.042 1.033 1.017 1.009
```

Analyze tail

The average link ratios seem to follow a pattern.




```
##
## Call:
## lm(formula = logLDF ~ age)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.30799 -0.12857  0.08537  0.09332  0.42221
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.90448    0.17662   5.121  0.00137 **
## age         -0.63404    0.03139 -20.201 1.82e-07 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.2431 on 7 degrees of freedom
## Multiple R-squared:  0.9831, Adjusted R-squared:  0.9807
## F-statistic: 408.1 on 1 and 7 DF,  p-value: 1.825e-07
```

Assuming the pattern continues, what magnitude of tail is implied? Investigate the next 10 years versus the next 100 years.

Over the next 100 years, the tail would be 1.009309. We use this as our estimated tail factor.

In addition, select the simple average link ratio for the 1-2 period. Here is the cumulative loss development pattern:

```
##          9-10    8-9    7-8    6-7    5-6    4-5    3-4    2-3    1-2
##  1.009  1.018  1.036  1.070  1.115  1.241  1.454  1.848  3.002 24.632
```

Project to ultimate

```
##      Latest    CDF Ultimate
## 1981  18834  1.009    19004
## 1982  16704  1.018    17005
## 1983  23466  1.036    24311
## 1984  27067  1.070    28962
## 1985  26180  1.115    29191
## 1986  15852  1.241    19672
## 1987  12314  1.454    17905
## 1988  13112  1.848    24231
## 1989   5395  3.002    16196
## 1990   2063 24.632    50816
## Sum  160987     NA   247293
```