# Mack/Murphy Unchained

CLRS 2018
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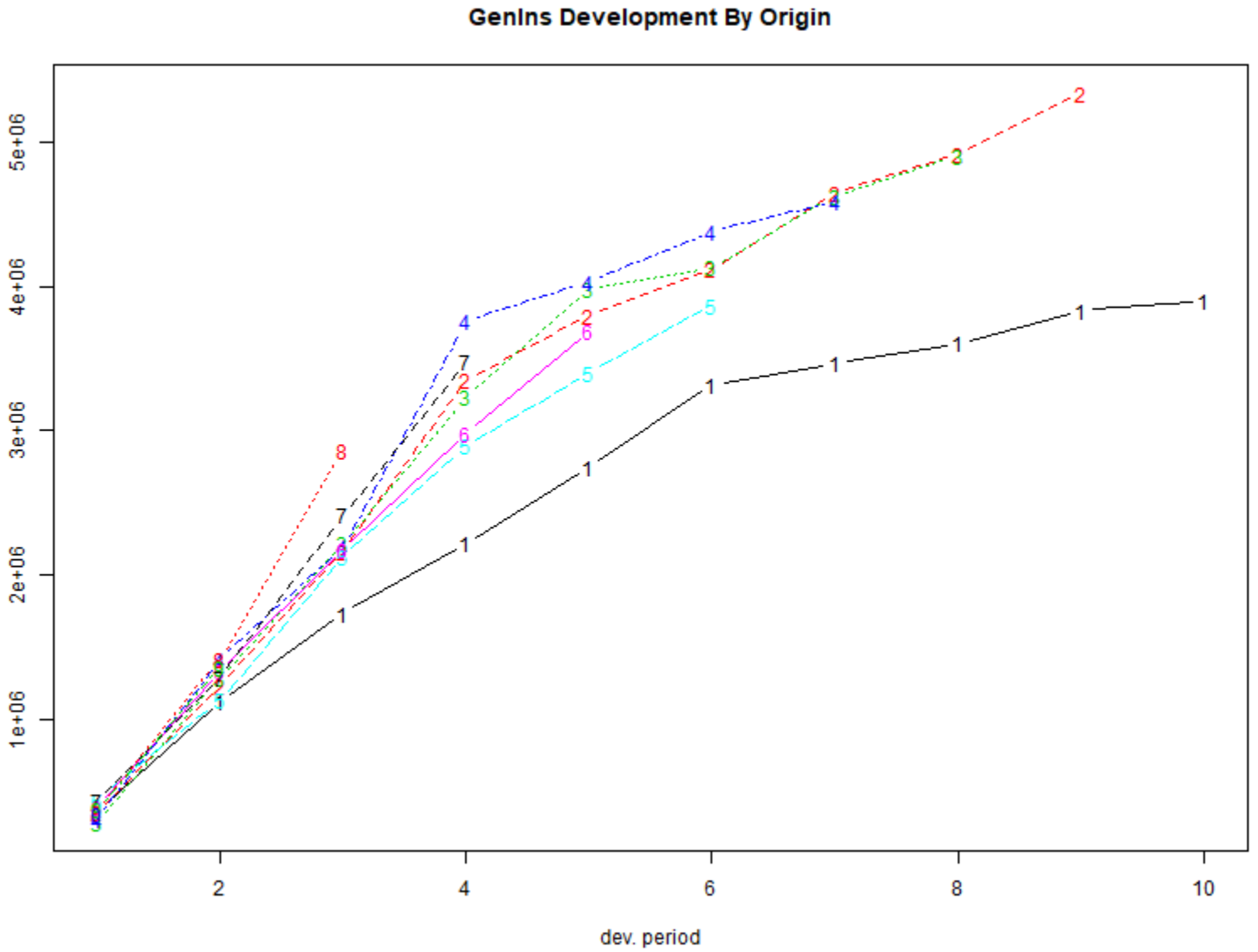
Trinostics

# ChainLadder sample GL triangle 'GenIns' (in thousands)

| origin | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 358 | 1,125 | 1,735 | 2,218 | 2,746 | 3,320 | 3,466 | 3,606 | 3,834 | 3,901 |
| 2 | 352 | 1,236 | 2,170 | 3,353 | 3,799 | 4,120 | 4,648 | 4,914 | 5,339 | |
| 3 | 291 | 1,292 | 2,219 | 3,235 | 3,986 | 4,133 | 4,629 | 4,909 | | |
| 4 | 311 | 1,419 | 2,195 | 3,757 | 4,030 | 4,382 | 4,588 | | | |
| 5 | 443 | 1,136 | 2,128 | 2,898 | 3,403 | 3,873 | | | | |
| 6 | 396 | 1,333 | 2,181 | 2,986 | 3,692 | | | | | |
| 7 | 441 | 1,288 | 2,420 | 3,483 | | | | | | |
| 8 | 359 | 1,421 | 2,864 | | | | | | | |
| 9 | 377 | 1,363 | | | | | | | | |
| 10 | 344 | | | | | | | | | |

| origin | 1-2 | 2-3 | 3-4 | 4-5 | 5-6 | 6-7 | 7-8 | 8-9 | 9-10 |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 3.143 | 1.543 | 1.278 | 1.238 | 1.209 | 1.044 | 1.04 | 1.063 | 1.018 |
| 2 | 3.511 | 1.755 | 1.545 | 1.133 | 1.084 | 1.128 | 1.057 | 1.086 | |
| 3 | 4.448 | 1.717 | 1.458 | 1.232 | 1.037 | 1.12 | 1.061 | | |
| 4 | 4.568 | 1.547 | 1.712 | 1.073 | 1.087 | 1.047 | | | |
| 5 | 2.564 | 1.873 | 1.362 | 1.174 | 1.138 | | | | |
| 6 | 3.366 | 1.636 | 1.369 | 1.236 | | | | | |
| 7 | 2.923 | 1.878 | 1.439 | | | | | | |
| 8 | 3.953 | 2.016 | | | | | | | |
| 9 | 3.619 | | | | | | | | |

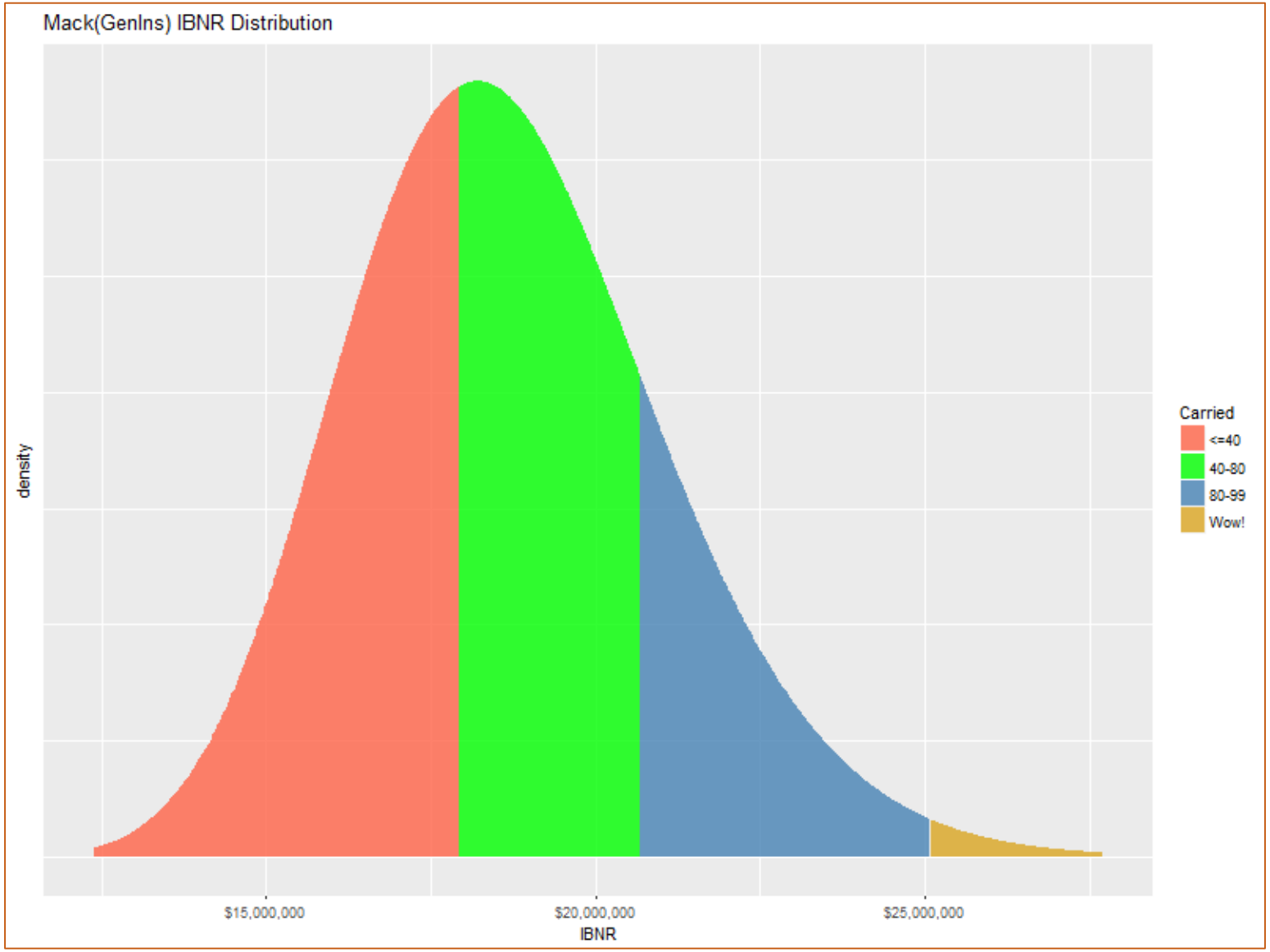
# plot(GenIns)


GenIns Development By Origin
5e+06
4e+06
3e+06
2e+06
1e+06
2
4
6
8
10
dev. period

# ChainLadder::MackChainLadder(GenIns)

| origin | Latest | Dev.To.Date | Ultimate | IBNR | Mack.S.E | CV(IBNR) |
|---|---|---|---|---|---|---|
| 1 | 3,901 | 100.0% | 3,901 | 0 | 0 | |
| 2 | 5,339 | 98.3% | 5,434 | 95 | 72 | 75.9% |
| 3 | 4,909 | 91.3% | 5,379 | 470 | 119 | 25.4% |
| 4 | 4,588 | 86.6% | 5,298 | 710 | 132 | 18.5% |
| 5 | 3,873 | 79.7% | 4,858 | 985 | 261 | 26.5% |
| 6 | 3,692 | 72.2% | 5,111 | 1,419 | 410 | 28.9% |
| 7 | 3,483 | 61.5% | 5,661 | 2,178 | 558 | 25.6% |
| 8 | 2,864 | 42.2% | 6,785 | 3,920 | 875 | 22.3% |
| 9 | 1,363 | 24.2% | 5,642 | 4,279 | 971 | 22.7% |
| 10 | 344 | 6.9% | 4,970 | 4,626 | 1,363 | 29.5% |
| sum | 34,358 | | 53,039 | 18,681 | 2,441 | 13.1% |

# Safety Levels of GenIns Carried IBNR

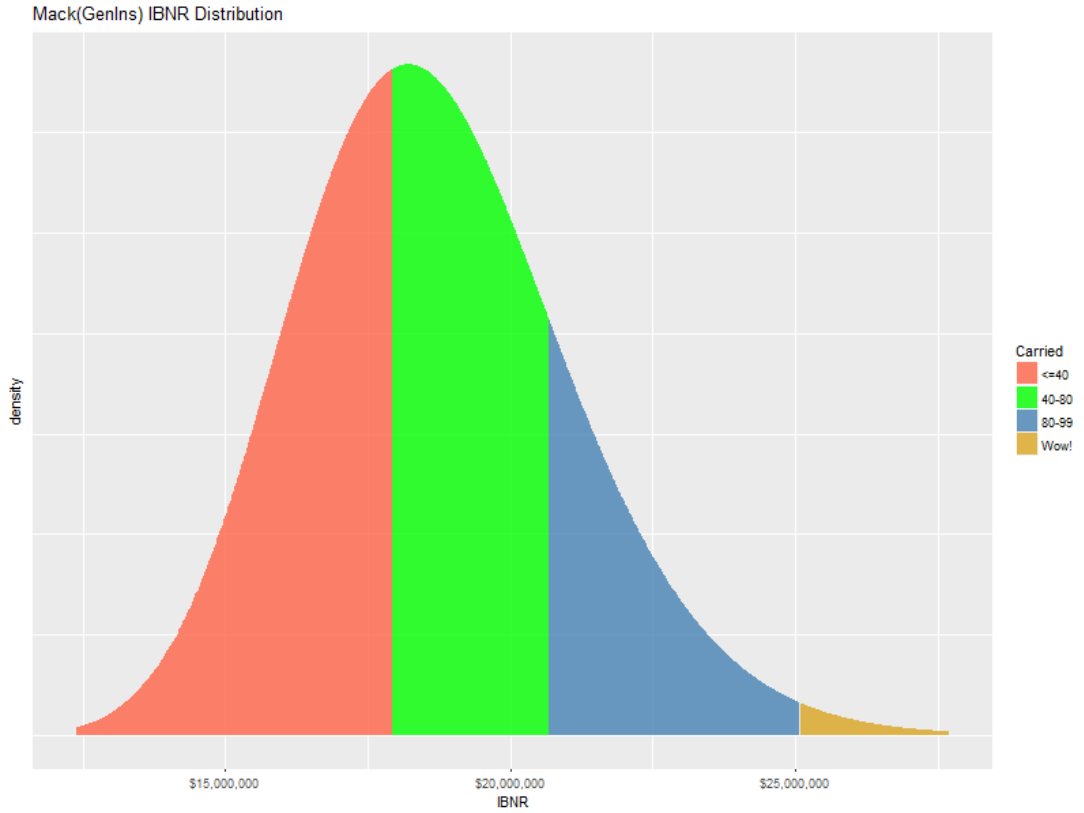


# GenIns at the Claim Level

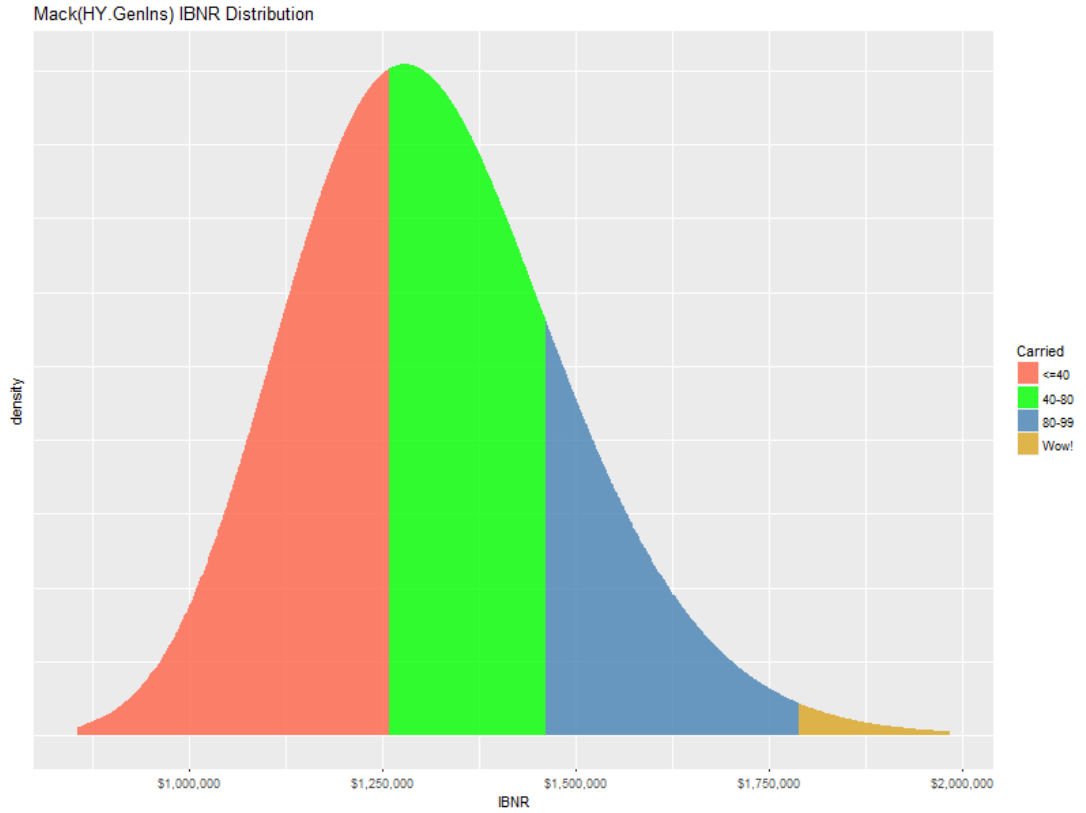
- Hai You generated simulations of over 5000 synthetic claims whose accident year aggregation is “close to” GenIns
  - We pegged the 13% cv as the measurement of similarity
- Claim-characteristic choices included:
  - Frequency distribution
  - Severity distribution
  - Distribution for the number of payments per claim
  - Report lag and payment lag
- The purpose of this exercise was to compare the Mack results on the aggregated triangle versus the claim detail

# IBNR distributions have same shape

## Original GenIns




## Aggregated triangle from Hai data



# GenIns at the Claim Level: Claim detail sample in triangle format

| | Latest | Ultimate | IBNR | Mack.S.E | CV(IBNR) |
|---|---|---|---|---|---|
| GenIns | 34,358 | 53,039 | 18,681 | 2,441 | 13.1% |
| HY.GenIns | 32,556 | 47,866 | 15,310 | 2,127 | 13.9% |
| HY detail | 32,556 | 40,909 | 8,353 | 695 | 8.3% |

3304
3305
4330
5538
5
6
6

**Wo! What happened?**

**Could it be the development factors?**

# To be continued … ☺

```
> attr(ata(GenIns), "vwtd")
     1-2      2-3      3-4      4-5      5-6      6-7      7-8      8-9     9-10
3.490607 1.747333 1.457413 1.173852 1.103824 1.086269 1.053874 1.076555 1.017725
> attr(ata(HY.GenIns), "vwtd")
   12-24    24-36    36-48    48-60    60-72    72-84    84-96   96-108  108-120
3.412879 1.608162 1.293365 1.181609 1.118462 1.082687 1.062238 1.044175 1.046972
> attr(ata(dat), "vwtd")
   12-24    24-36    36-48    48-60    60-72    72-84    84-96   96-108  108-120
1.287861 1.205773 1.150838 1.120326 1.086169 1.066163 1.052599 1.040253 1.042831
```

- Then I'll show the x-y graph of the data points and all will become clear
- I'll keep you posted, Hai