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Feature Articles

It's About Time: An Examination of Loss Reserve Development Time Horizons

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A rich bo anagement in the pr estimates. This stud ment horizons years of devel estimation error pare and contrast ommon practice ent patterns priate develop er than the current t lines of business ent horizons are necessary to establish insurers' ultimate liability, relatively short-term

development horizons may be more appropriate when attempting to identify deliberate manipulations or to assess solvency risk, where the short-term variations are the primary object of interest. Ultimately, this article investigates the degree to which methodology originally developed for estimating loss reserve errors is appropriate today, in particular, relative to current data availability.

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Notes

1 An insurer's earnings are based (at least partially) on the losses the insurer reports. Increases (decreases) in loss reserves, therefore, decrease (increase) an insurer's earnings during the reporting period. We would consider any intentional altering of reserves to affect insurer earnings to be "earnings management."

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5 For m al accident year (AY y remaining reserves ule P. For some sh urety, accident ent years of history a nes can be derived all lines.

6 Researchers have often used different scaling variables (premiums, reserves, incurred losses) to measure the relative amount of error between insurers. In our multivariate tests, we will scale by the developed reserve for our tests on the individual lines of business and by total assets for our tests on aggregate reserves.

7 Anderson used a one-year development, though, subsequently, most research has utilized a longer development horizon.

8 Schedule P has been completely redesigned since the time that Anderson conducted his study and now includes much greater reporting detail, more lines of business, and a full 10 years of development history (originally, Schedule P included only five years of development). Even with all the reporting changes, these two basic approaches—the AYD and the CYD—continue to appear in the literature today. Moreover, the one-year and two-year CYD measures are now incorporated into Schedule P Part 2 for each of the major lines of business.

9 Subsequent researchers have often labeled development from AY to AY + 4 as “five-year development” because there is some loss development during the accident year itself. However, Forbes specifically defined loss reserve development in the statement year as “no development” and referred to development from AY to AY + 4 as four- year development (Forbes 1970, 531). We consistently use the terminology of Forbes and Anderso ent horizon as the n fer to the develop

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12 These on either the AYD or C

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article for parsimony, but interested readers can contact the authors for an illustrative case.

14 The hypothesis is written such that rejecting the null would be in support of the Forbes Standard.

15 For the CYD calculation, the reserves are summed for each accident year within a calendar year; that is, the t subscript represents the sum of all reserves set in year t.

16 There are data limitations to the KFS study, particularly related to the lack of consistency in defining the ultimate losses; that is, instead of using AYt + 9 for ultimate losses, KFS were forced to use the latest year available. That means that for certain accident years, the "ultimate" developed reserves were established as early as AYt + 3. The KFS data set was also relatively small, with between 48 and 67 observations in each of the 10 available accident years from 1977 to 1987. Additionally, only three of those accident years (1977, 1978, and 1979) had a full 10 years of loss history, and hence we see the relaxation of the definition of "ultimate" in their research. Therefore, each of the other accident years in their study (1980–1987) had fewer than 10 years of development, and the ultimate losses were probably misstated. By contrast, we examine thousands of observations (depending on the line of business), and each of our 10 accident years is fully developed to AYt + 9.

17 KFS c ne as well as all indivi

18 Thou lson 2003; Grace ar y different and inclu ed when included results are also an $1 millio

19 We n ll lines of business observat .

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21 Tables 2a and 2b report the mean paid to incurred ratios (and conduct statistical test on their difference relative to 97%). The results presented here are similar when conducting similar tests on the median paid to incurred ratio in that all lines except four take more than five years to develop to 97% or greater of “ultimate.” The four exceptions include three previously discussed (homeowners, private passenger automobile liability, and miscellaneous short tailed lines) as well as the combined line. In this case, the median paid to incurred ratio for the combined lines is statistically greater than 97% after five years of development. This last result will give some solace to those using a five-year reserve error period; however, we note that this relies on the median, and consistent differences still exist across lines.

22 Again, most of the extant literature examines reserve errors on an aggregated basis.

23 As an alternative measure of accuracy, we computed the proportion of insurer-year observations in each development year that reported developed accident year reserves that fell within 1% (or within 5%) of the ultimate developed reserve. In untabulated results (available from the authors), very few insurer-year observations achieve the 1% standard of accuracy for any given line of business or for their aggregate results. In fact, only 36% of insurer-year observations show a reserve within 1% of the final reported reserve by year 5. Even with the looser standard of having the estimate fall within 5% of the ultimate requires a significant development horizon, and that the accuracy

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25 Howe tly different from zer ean change in th h is signific n reserves. Therefor ay be that three ye t the reserves urely subjecti ditionally, if the purp , the bulk of

the errors show up relatively quickly. Arguably, a one-, two-, or three-year horizon is sufficient to detect deliberate manipulations.

26 While we do not use the reserve error metric in Grace and Leverty (2012), we use their model as an overview of commonly cited reserve error-based incentives. See Barth and Eckles (2018) for a further discussion on the reserve error used in Grace and Leverty (2012).

27 We define the following lines as long-tailed: farm multiperil, homeowners, commercial, medical malpractice, workers compensation, products liability, auto liability, and other liability. This is consistent with the definition found in Hoyt and McCullough (2010), Eckles and Halek (2010), and Carson, Eastman, and Eckles (2018).

28 The Wald test allows testing the significance of coefficients across models. See Judge et al. (1985) for further discussion.

29 We appreciate an anonymous reviewer for this observation.