

# Practical Application of “It’s About Time: An Examination of Loss Reserve Development Time Horizons” to Health IBNR Reserves

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I have been an actuary at Aetna since 1988, almost all of that as a valuation actuary in group health benefits or some closely related financial reporting department. A lot of things have changed in health insurance financial reporting in the third-of-a-century I’ve been picking IBNR (incurred but not reported) reserves, but one of them hasn’t. Getting IBNRs “right” during a financial close is still the Holy Grail of valuation; and having significant favorable or unfavorable development emerge on a picked reserve is the worst nightmare, and the most professionally damaging event for valuation actuaries, which can occur during the course of a working day, month, or quarter.

So, imagine the reading pleasure which was in store for me in 2019 when I opened the North American Actuarial Journal, and came across a gem of a paper “It’s About Time: An Examination of Loss Reserve Development Time Horizons” by Professors Barth, Eastman, and Eckles.<sup>1</sup> They were using Property/Casualty (P&C) data and lines of business, not strictly health (although, interestingly, P&C companies are allowed to write health insurance). But there were still gems to be found in this veritable diamond mine of decades of IBNR runout for health actuaries, too.

Some quick background, for those unfamiliar with IBNR actuary-world: why would a health actuary even proceed with reading an article on P&C IBNR reserves? Especially since health reserves complete in 60 to 90 days, with an extreme tail going out no further than 3-4 years; while P&C reserves can complete in 10 years or more (and, in the case of, say, asbestos liability reserves, 3 to 5 decades)? A couple of reasons. Although the time horizons are quite different, the underlying arithmetic of the respective reserve triangles are remarkably similar. Chain-ladder type methods are used in the 3/4th’s oldest accident years/date-of-service months, with little if any human judgment applied during the financial close; and then actuarial judgement, and methods, relied on almost exclusively for the

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<sup>1</sup> Barth, Michael M., Evan M. Eastman and David L. Eckles. 2019 February 8. “It’s About Time: An Examination of Loss Reserve Development Time Horizons.” *North American Actuarial Journal*. <https://www.tandfonline.com/doi/full/10.1080/10920277.2018.1538804> or <https://doi.org/10.1080/10920277.2018.1538804>.

1/4th most recent accident years/date-of-service months. And, if anyone ever “solves” the problem of accurately estimating IBNR for the recent/incomplete periods: well, the better in me says it will be the P&C actuaries who get there first—they’ve exhibited relentless statistical curiosity in figuring out how to pick the “right” reserve, and I’ve long experienced intellectual fulfillment in studying their methods. This particular Barth et al. paper was no exception.

The authors of this paper are, in theory, investigating and discussing a very narrow topic: should P&C regulators give three years for financial statement accident-year incurred amounts to develop before considering the result credible for purposes of evaluating regulatory action or, are more years than that needed? Their thesis and their conclusions are admittedly not readily transferrable to applications beyond the scope of the paper. But from a research perspective, and from an actuarial perspective, they deliver to readers, and for posterity, an unexpected bonus by curating, summarizing, and publishing the full output of the statistical model they prepared to address their thesis. Searching for, and finding, potential universal truths of IBNR reserving and runout is an effort richly rewarded to the health actuary with the energy to plunge into this well-organized research paper.

What makes this paper such a timeless (and perhaps underappreciated) gem?

1. Start with the sheer audacity. The authors compile and analyze data for EVERY licensed P&C player in the U.S. across decades of published financial results across EVERY classification category (company size, company strength, company financial results, etc.) over a continuous 20-year period of time. The authors are looking at a particular thesis (time horizon of credibility of P&C reserve runout), but their output is general and flexible enough to be of interest more broadly to those involved with IBNR reserves. In this way, the general readership can benefit from the data collection and collation undertaken by the authors for their narrower purpose.
2. Secondly, the use of multiple linear regression. There’s a whole tool chest of data analytics tools out there for quantitative professionals: from traditional statistical tools with theoretical derivations to econometric hybrid tools used to perform economic experiments, to machine learning tools harnessing powerful data mining analytics. Those of us interested in discovering unexpected predictive correlations and inter-relationships that will win the trust of senior management face a constant juggling act of using statistical tools which are simple enough to concisely explain and understand, but complex enough to convey sufficient sophistication. Multiple linear regression, and especially in a form that studies the properties of the derived coefficients (as opposed to focusing on the solved dependent variable), strikes that perfect balance. Even non-statistically inclined finance professionals can inherently understand multiple linear regression and accept output derived from it.

Let me get specific at this point on the value of the paper. Barth and his co-authors generate a regression coefficient for large companies vs small companies, as measured by admitted assets. I propose that a safe leap can be made that this is a proxy for whether the lags themselves are large or small.<sup>2</sup> If larger lags were easier to make a reserve pick on, they would have less prior period development, and therefore a smaller coefficient. But in fact, the opposite is the case—smaller lags generated smaller development.

In terms of directly applying the paper, we did not, and will not, attempt to validate, or re-produce, any of the published results, nor our hypotheses of what is suggested by them. To start with, even if we wanted to, I’m not sure we could. The authors take advantage of Schedule P’s being readily, electronically, available in a consistent

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<sup>2</sup> For purposes of this essay, “large” and “small” are relative terms referring to the amount of business represented in the lags, whether measured in dollars, claims counts, membership, etc.

format over a prolonged period of continuous time. In the real world of a health insurance enterprise, we are constantly experiencing systems migrations, changes in file naming structure, and mergers/sales/integrations with other enterprises—we're lucky if we're even able to generate a 5-year body of continuous data, never mind 20 years.

Using the assumptions described above, the hypothesis we took away is that if you are working at a large national health plan and delegate reserve picking responsibility to market actuaries, the actuaries in smaller markets have no cause for complaint for an expectation that their reserve picking be as accurate as their peers in large markets. And what we did do is communicate this hypothesis to our small health plan reserving actuaries and let them know that they're not at a career disadvantage compared to their colleagues overseeing larger health plans. But they'll need to "take our word for it" from the Barth paper—we have no intention of proving or disproving it with our company-specific data. Again, the value of this paper is floating hypotheses—not proving them "beyond a reasonable doubt."

I've been trying to keep this discussion to concepts rather than actual output and numbers, but it's useful to highlight specific data in the paper. Let's first contemplate Figure 2 on Page 16. The first Multivariable Analysis independent variable is "Size," further explained by the authors to be "[t]he natural log of assets." Important lesson here: log-transforms are a powerful tool in the statistical modeler's toolbox. There are many contexts in health insurance where large paid or large claims in backlog can, if unaddressed, distort model accuracy, and yet (almost magically) disappear as a distraction simply by transforming the distribution logarithmically. In my view, you'll know you're a professional modeler when you find yourself, as a matter of course, log-transforming highly dispersed data.

Now, let's proceed to Table 9 on page 23 of the pdf version of Barth et al. Observe the asterisk in the SUM column of the "Size" row. The asterisk visual is customary in the Finance and Econometrics professions to illustrate 90th, 95th, and 99th-percentile significance of regression coefficients—when you see asterisks, pay attention to those rows and columns; there's something significant there deserving your attention. Company asset size (and, by my admittedly leap-of-faith inference, lag size) "drives" reserve accuracy. But in which direction? Let's look at the derived coefficient. It's 0.0022. Negative-0.0022. Hardly any impact on reserve accuracy, with 90% statistical confidence. This further supports my hypothesis that an actuary picking a reserve in a small reserve lag will be just as accurate, in hindsight, as the actuary with the "luxury" of much more data in the triangle.

Summing it up, an important part of the practicality of this paper is the opportunity to deliberate upon a "complete" data set. Someone else already did the not-fun part: compiling the data, running the model, and printing tables of output. The reader gets to do the analysis part. That's our favorite part, the value-add part, of our work life, right? Well, here's your chance for the "enrichment" part of your life.

At my company, shortly after publication of the Barth et al article, we had a lively discussion of "take-aways" for our enterprise. Large-vs-small IBNR lags: which prove to be more accurate over time? (The Barth output generated a counterintuitive result). We had observed that medical malpractice insurance had been consistently developing favorable results over the experience period: if and when those results "turned," what might it mean for hospital/physician reimbursement, and therefore group medical trend? So much food for thought. And such good mind exercise to review multiple linear regression output in such an unexpected context. If you ask me, the Barth et al paper is truly an undiscovered gem of actuarial research, and a motivator to "get busy" and find other practical applications of regression and statistics.

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