Forecasting & Futurism 4th Annual Contest Submission

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On Actuarial Wisdom

This essay responds to the Forecasting and Futurism contest to “develop a technique that advances actuarial science predictions and forecasting.” As highlighted in the contest rules, the proposed technique could include several different approaches including advancing an “interesting application of an established technique.” This will be the basis of my proposed technique – an explicit discussion of an approach that has long been used by experienced actuaries with a deep knowledge of data, models, and of the real life consequences of predictions. In the absence of a more formal term, I will call this technique Actuarial Wisdom (AW).

Actuarial Wisdom (AW): The Big Picture

In broad terms, AW involves a series of steps and considerations that an experienced actuaries will employ to develop a prediction. In developing this prediction, an actuary employing actuarial wisdom (AEAW) is not necessarily intent on using complex models or an extensive data set to develop a response to a business question. Instead, an AEAW looks to most effectively use all available information – including data, quantitative tools and models, as well as several qualitative factors to develop a transparent process that leads to the best possible answer for their organization.

Although this technique is implicitly used by experienced actuaries through all our specialties, it rarely receives the focus that comes with other techniques associated with “big data” or with many of the modeling techniques highlighted in the contest proposal including predictive modeling, genetic algorithms, agent based models, or hidden markov models. Unfortunately, AW lacks the appeal of these other techniques because its inherent simplicity does not have the implied sophistication associated with complex models or large data sets.

In response to this interest in greater sophistication, throughout our profession as well as other technical fields (economists and data scientists), the sales pitch to senior managers has focused on the importance of using increasingly large data sets and more complex models without consideration, in many cases, to the limits of the data or the importance in using qualitative factors to improve the decision making process. Although this approach is very much in keeping with the increasing availability of data, it is far different than the techniques used historically to drive decision making when less data was available and the computing power was less powerful. Without the support of data and complex models, business leaders and actuaries would use qualitative factors and AW to educate decisions. In an effort to balance our profession’s interest in using more computing power and data to drive complex models, this proposal will highlight the advantages of using AW to drive predictions and sound decision making.

Actuarial Wisdom: The Specifics
Although the specifics can vary among experienced actuaries, the following list highlights many of the techniques used by AEAW to improve decision making.

**Understand the underlying system and the potential usefulness of data and complex modeling.** Unlike many analysts who reflexively believe that more data and greater complexity will produce a more accurate prediction, an AEAW will consider whether the underlying system is complex or simple and whether the system is changing or stable relative to its historical experience.  

In a simple example, if one were attempting to develop a mortality table, a large data set with more complex modeling could reasonably be employed to estimate its components and be useful in developing life insurance rates. In this case, the system (mortality) and the variables contributing to mortality are largely known (gender and age, for example) and dramatic changes from the historical period to the prediction period are unlikely. This example is in contrast to the experience that many health actuaries are confronting in our ACA filings. With no historical experience and a highly complex incentive system to participate in the exchange (tax penalties, complex subsidy rules, availability of transitional policies), the use of detailed data and complex modeling are much less useful.

As an illustration, the following chart describes examples of different systems and the relative usefulness of employing complex models.

<table>
<thead>
<tr>
<th>System Description</th>
<th>Stable System with little historical change and significant historical data</th>
<th>Changing System with little or no historical information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple System with a few known causal variables</td>
<td>Mortality Tables (Complex models can be more useful)</td>
<td>Changes in mortality caused by an external event – disease or war, for example.</td>
</tr>
<tr>
<td>Complex System with numerous and potentially unknown causal variables</td>
<td>Healthcare cost predictions prior to the ACA and the financial crisis.</td>
<td>ACA Rate Filings (Complex models are much less useful)</td>
</tr>
</tbody>
</table>

Consistent with the above framework, an AEAW will understand the underlying system and then apply a prediction technique that is appropriate for the particular system.

**Consider the outcome of a prediction rather than focus solely on the prediction itself.** As one of the most important risk managers at an insurance company, an AEAW knows that the outcome of a prediction is more important than the prediction itself. If, for example, a small variance in a prediction will lead to an extremely adverse financial outcome – the risk of this prediction should be considered in a much different light than a prediction that will not have a material impact on an organization’s overall results.

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1 This model is based, in part, on the four quadrant model introduced by Nassim Taleb. His approach helped formalize a framework that AEAW implicitly use on a day to day basis.
Look for multiple data points to confirm or disprove a prediction. Throughout my career, I have seen many people fall in love with a story or prediction based on the results from a single data point. The problem is that this simple story can often be disproven or questioned by reviewing additional sources of data or consulting alternative viewpoints. Like many of our activities, an AEAW must consider the contrary position and look for evidence that disproves a story or prediction with the same interest as finding a data point that confirms a desired story.

Consider the risk management implications with more complex models. While more complex models and large data sets hold the promise for more accurate results, an AEAW also knows that the additional complexity comes at a cost—a much greater likelihood that the model could produce a significant error with either the underlying data or the models. As a result, an AEAW will include this risk management problem when considering the tradeoff between a complex model and a more simple approach.

Understand the risk tolerance of the organization. As an AEAW understands, it is often difficult for senior leaders to fully articulate an exact risk tolerance acceptable for an organization. In these cases, the AEAW must make a qualitative judgment that considers a quantitative understanding of the risk along with a qualitative understanding of the organization’s risk tolerance. This certainly isn’t easy, but it represents one of the most important qualitative tasks for an AEAW.

Understand the incentives of those providing a prediction. Although not often discussed, predictions can often come with imbedded biases that need to be considered when reviewing a prediction. Young actuaries, for example, will often try to inappropriately use complex models or formulas simple because it is more intellectually interesting than using a simple model. These actuaries are also more likely to show an interesting result rather than present an ambiguous or a more uncertain result. Although these tendencies are not inherently a problem in developing a given prediction within an actuarial team, these approaches need to be tempered with an AEAW to consider other factors that may be less interesting or certain, but are very important in the decision making process. As those with AW have learned, the energy and drive of young actuaries can be a great asset, but this enthusiasm needs to be tempered with a broader understanding of all the approaches necessary to reach the best possible decision.

Ensure a transparent process to discuss key assumptions, exogenous model factors, and the potential variability in predicted results. Because key assumptions are important to the ultimate outcome of a prediction, an AEAW will ensure complete transparency and a help facilitate a wide discussion of these assumptions throughout the organization. This transparency and discussion will help ensure a diverse range of viewpoints are considered in the process and no insight is lost in developing the key assumptions. In addition, an AEAW will not just consider the known model factors, but will also make allowances and ensure a broader discussion among other factors that are not explicitly included in the model, but could materialize in the future. As we have seen with the extension of the transitional plans into the ACA, these unknown factors could have a profound impact on the ultimate results.

In addition to highlighting the most important assumptions, an AEAW will also emphasize the variability associated with a prediction. Some best practices include:
• Show predictions as a distribution rather than a single point estimate. The potential volatility needs to be emphasized and the analyst should highlight the relative volatility in comparison to other point estimates.

• Set appropriate expectations regarding the potential accuracy of the prediction and maintain this position through the entire process.

In addition to the above specific actions, throughout the entire prediction process, an AEAW will approach prediction with a significant amount of humility. For those who have been practicing for a long time, they have seen adverse financial events – higher than expected trend, a volatile financial market – and will make allowances for adverse events in their predictions throughout the estimation process including highlighting the potential risks in making a particular decision. In many cases, these approaches will not be popular, but it is a foundational trait among those AEAW.

**Actuarial Wisdom and the Judging Criteria**

To highlight the usefulness of AW, in the discussion below, I highlight how AW can be applied relative to the specific judging criterial

**How useful is the technique to the actuarial profession?** AW is highly useful – it can be used across all specialties in the actuarial profession and as an important complement to any prediction technique including everything from complex modeling to more simple approaches. In addition, AW as a prediction technique is particularly important for actuarial students who spend years learning technical models and skills, but much less time learning AW – a skill that most actuaries learn on the job through years of experience.

**How understandable is the approach (to an actuarial audience)?** Without the burden of complex formulas or modeling techniques, AW is an approach that could be understood by all actuaries.

**How easy would it be for another actuary to reproduce your work?** AW is certainly reproducible, but the challenge is actually having the day-to-day discipline to ensure that it is consistently applied in the decision making process. AW needs to be kept top of mind to ensure its effectiveness.

**How sophisticated is the technique (or extension) developed?** In order to answer this question, I turned to the dictionary for the definition of “sophisticated” – a few definitions were given:

1. Worldly – wise, not naïve. *Sophisticated travelers*
2. Appealing to cultivated taste. *Sophisticated music*
3. Complex; intricate. *A sophisticated electronic control system*

I think the judging criteria largely depends on the definition of sophisticated. Because the goal of AW is to show wisdom by looking at all available information and not naively rely solely on complex models or large data sets to drive decision making, I think the first definition is very much consistent with AW. In
addition, consistent with the second definition, AW requires a certain degree of cultivation that is developed over a number of years working as an actuary. On the other hand, the 3rd definition would likely favor a more complex modeling approach.

**How flexible is your technique? Could it easily be applied to other applications?** The beauty of AW is that it could be applied to any actuarial subspecialty as well as aspects of your personal life. Like other forms of wisdom, AW has an incredibly wide range of applications.

**How creative is your approach?** To the extent that many AW considerations are not explicitly discussed in developing predictions or in communicating results, I believe the AW technique is very creative.

**Conclusion**

As a profession, I do not think that we emphasize enough the wisdom that we gain from spending years attempting to make accurate predictions regarding the future. Because we are often in the “hot seat” to make important predictions, we intuitively learn many techniques outside of data and modeling that are important in developing the best possible predictions. As many of us know, models and data can be more or less useful and it is important to develop techniques that provide the appropriate balance between the qualitative factors and the quantitative metrics. We have also learned many of the techniques necessary to manage an effective decision making process including how to communicate, how to focus on key assumptions, and how to set appropriate expectations.

In my own actuarial career, as I consider the inevitable tradeoff between models with greater complexity and AW, I am reminded of a quote from the well-known economist and philosopher, Friedrich Hayek: “I prefer true but imperfect knowledge, even if it leave much undetermined and unpredictable, to a pretense of exact knowledge that is likely to be false.”