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Defined benefit pension valuations and the application of ASOP No. 56, Modeling

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Actuarial Standards of Practice (ASOPs) are guidelines that actuaries follow when performing their actuarial duties. Promulgated by the Actuarial Standards Board, they are the basis for which the actuarial work product is evaluated and utilized by intended users. These intended users may include other actuaries, clients, auditors, or government agencies.

ASOPs also provide actuaries with guidance on the disclosure requirements in communicating their results. Altogether, the intent of ASOPs is to demonstrate publicly that actuaries are bound professionally and are accountable for their work.

The newest standard, ASOP No. 56, *Modeling*, was released and went into effect October 1, 2020.[1] ASOP No. 56 provides direction to actuaries in all practice areas when performing actuarial services that require modeling. The standard addresses work related to designing, developing, selecting, modifying, using, reviewing, or evaluating models. Actuaries often invoke the use of models in their areas of specialty in identifying, managing, and quantifying risk.

While it is sometimes understood by clients, auditors, regulators, or other users of the actuary's work that the results are generated from models, the role of the actuary in the selection and application of the model may be undervalued. The user may not fully recognize the inherent risks in actuarial results that are based on model outputs. Actuaries are responsible for inputs to the model such as data and assumptions and must rely on their professional judgment in selecting, modifying, or developing the appropriate model to fit the purpose of the analysis. With the growing reliance on actuarial results to make financial decisions and the expansion of actuarial work in nontraditional industries, the use and focus of actuarial modeling has increased over the years, which has led to the need for the standard.

ASOP No. 56 allows the actuary to use professional judgment to determine whether full application of the ASOP is necessary. Generally, it's not applicable if the use of the model's results does not have a material financial effect or the results are not relied upon by the intended user. Under these circumstances, the actuary's work is not subject to ASOP No. 56 and the actuary should be prepared to provide a full explanation as to why this is the case. To help make this determination, the actuary should look to ASOP No. 1, *Introduction to Actuarial Standard of Practice*, Section 2.6.[2]

Modeling risk

Actuaries use different types of models in the measurement, management, and quantification of risk. The most common types are deterministic and stochastic models. Deterministic models refer to those in which the output or results are determined by initial parameter inputs such as data, assumptions, conditions, etc. Stochastic models, while similar to deterministic models in some ways, reflect some level of inherent randomness such that the initial parameter inputs result in a range of outputs.

Regardless of the type of model used, it is clear that the results of the model are highly dependent on the input parameters which are set by the actuary. Additionally, the model inputs and the appropriateness of the model will depend on the intended user and purpose. For this reason, modeling is a constant fixture in the daily work performed by actuaries; it is these analyses that would be subject to ASOP No. 56. Some examples of work performed by actuaries that involve modeling include, but are not limited to:

- Pension valuations
- Insurance product pricing
- Monte Carlo simulation models and regime-switching models used for financial reporting and generating interest rate scenarios
- Valuation of risk models
- Asset/liability modeling
- Modeling for developing hedge, credit risk, and capital management strategies

[1] Actuarial Standards Board (December 2019). Actuarial Standard of Practice No. 56: Modeling. Retrieved January 27, 2021, from http://www.actuarialstandardsboard.org/wp-content/uploads/2020/01/asop056_195.pdf.

[2] Actuarial Standards Board (December 2011). Introductory Actuarial Standard of Practice: Exposure Draft. Retrieved January 27, 2021, from http://www.actuarialstandardsboard.org/wp-content/uploads/2014/03/Introductory_exposure_draft_Feb_2012_updated.pdf.

While modeling can be found in most of the everyday work of actuaries and would require consideration of ASOP No. 56, some work associated with retirement plans, specifically individual benefit calculations and nondiscrimination testing required by certain Internal Revenue Service (IRS) rules, are exempt from the standard. To this end, the standard does not mandate a list of models and therefore it is the actuary's responsibility to assess whether the ASOP applies to the work performed with the use of models.

ASOP No. 56 notes that actuaries should be satisfied with the integrity of their own models as well as models developed by others, even if they are a member of the modeling team. Oftentimes, actuaries rely on models developed by a third party, whether internal or external, to perform their duties, or they use outputs from externally developed models as inputs to their own models. Examples of this would be a pension actuary relying on per capita claims costs, using trend and morbidity assumptions developed by a healthcare actuary as inputs for a retiree medical valuation, using a capital markets model developed by investment consultants to set inflation and expected rate of return assumptions, or more commonly using their own firm's pension valuation system developed by a third-party vendor. In these cases, the ASOP guides the actuary to make a reasonable attempt to understand how the model works, its strengths and weaknesses, and its limitations and sensitivities, coupled with a disclosure of the extent of their reliance on the third-party model.

Defined benefit pension valuations and application of ASOP No. 56

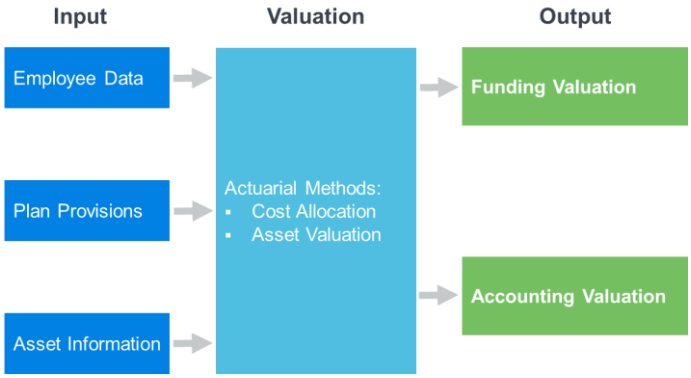
To understand the role of modeling and how the standard may apply, defined benefit pension valuations serve as a good example and will be used for this paper. A pension actuary's primary function is to perform periodic pension valuations that may be accompanied with federal or state government statutory filings, documentation, and certifications. As background, actuarial valuation calculations result in projections or forecasts of the expected cash flows of plan members' benefits. Most actuarial valuations follow a valuation process and use a model or software that was developed by others. Typically, the actuary would enter various inputs such as data, assumptions, assets, etc. in order to estimate the pension plan's benefit obligation and asset value at different points in time with different measurements. The estimated assets and liabilities are the main outputs of the model and are then used to determine funding and accounting costs or balance sheet position, or to satisfy reporting requirements.

The actuarial valuation process can be classified in three main steps below:

- Valuation inputs
  - Employee data
  - Actuarial assumptions
  - Plan provisions
  - Asset information
- Valuation model run
  - Cost allocation
  - Asset valuation
- Valuation model output
  - Funding valuation
  - Accounting valuation

There may be additional outputs depending on the type of pension valuation being performed. Figure 1 illustrates a general overview of the main inputs and outputs of modeling in a typical pension valuation.

FIGURE 1: MODELING IN A TYPICAL PENSION VALUATION



During the valuation process, actuaries will typically use multiple models. ASOP No. 56 will generally apply to each of these models, whether they are simple or complex. Therefore, it is important to go through the various components of ASOP No. 56 to see how a pension actuary can comply.

First, ASOP No. 56 notes that any model used needs to fit the intended purpose of the assignment. One of the purposes for a pension actuary is to calculate the plan's contribution requirements based on the valuation results. To determine the valuation results, the primary model is a pension valuation system. This calculates the plan's liabilities. Together with the plan's assets and specific funding policy, the contribution requirements can be calculated. Besides the primary purpose

of the model, there may be other uses of the model's output such as inputs for an asset/liability modeling study. In this case, the study may require the actuary to adjust inputs such as data or assumptions to generate cash flows that align with the intended investment strategy as appropriate for the asset/liability model. Ultimately, the actuary needs to be aware of each way the model's results will be used to ensure its setup is appropriate for each purpose.

The actuary needs to make sure the model is in line with the intended purpose. For pension actuaries, using a valuation system (whether from a third party or created in-house) will ensure this is the case as these types of valuation systems are created purely for the purpose of calculating a pension plan's liabilities and costs. Each year, the actuary needs to review the inputs for reasonableness and accuracy. Inputs to the model include the employee data, assumptions, and benefit provisions. Review of the data is covered separately by ASOP No. 23 (*Data Quality)*.[3] Assumptions and methods are discussed separately in ASOP No. 27 (*Selection of Economic Assumptions for Measuring Pension Obligations*),[4] ASOP No. 35 (*Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations*),[5] and ASOP No. 44 (*Selection and Use of Asset Valuation Methods for Pension Valuations*).[6] Once the data is reviewed and the assumptions are set based on guidance from the other ASOPs, there shouldn't be much, if any, additional work to satisfy this component of ASOP No. 56.

Outside of the pension valuation system that calculates liabilities and costs, additional models may be used as part of the valuation process. They can include setting the assumptions that go into the model that calculates liabilities, such as setting the expected return on assets assumption or demographic assumptions. It is up to the actuary's professional judgment to determine whether ASOP No. 56 is applicable to any of these pieces. For example, an experience study to set demographic assumptions may or may not be covered by ASOP No. 56 depending on the methods used to set the assumptions. See the American Academy of Actuaries Pension Committee's Practice Note *Modeling—for Pension Actuaries* for additional details on types of models where ASOP No. 56 may or may not apply.[7]

Once the actuary has determined what components of the pension valuation process are applicable to ASOP No. 56, the next step is to review and understand each model's setup. When checking the pension valuation system model, the actuary needs to review how the inputs flow through, make sure that the assumptions match as expected, and see that the calculations are consistent with the plan's specific benefits and provisions. Does the actuary understand the processes and calculations of the models? The actuary also needs to review the structure of the model based on the purpose of the calculations.

For example, if the work includes doing projections for future years, what assumptions does the model make as it rolls forward the assets and liabilities from year to year? In a pension valuation, the actuary may be projecting results to show the client the potential impact of a change in funding policy, regulations, plan provisions, or workforce. These impacts will likely require adjustments to the baseline model used to calculate valuation results. For instance, if evaluating a proposed plan change, assumptions may need to be made regarding future participant behavior. Once the actuary knows the intended purpose of the projection, the necessary adjustments can be made and the reasonableness of the model's projection results assessed. Based on the specific changes made to the model, the actuary can compare the impact on the baseline model versus the projection model and see whether it is in line with expectations. To satisfy ASOP No. 56, the actuary will need to review and adjust the model to ensure it is in line with the intended purpose, checking that the assumptions, inputs, and plan provisions are appropriate.

Once the model's inputs, purpose, and structure are reviewed, the actuary needs to check the output for reasonableness. This includes checking individual calculations independently. These steps are typically part of the pension valuation process already: reviewing detailed calculations for individual sample participants, reconciling data and liabilities versus the output from the prior valuation's model with a gain/loss analysis, and testing variations of key assumptions and volatility of various inputs—this last component may be covered by ASOP No. 51, *Assessment and Disclosure of Risk Associated with Measuring Pension Obligations and Determining Pension Plan Contributions*.[8]

[3] Actuarial Standards Board (November 2015). Exposure Draft: Proposed Revision of Actuarial Standard of Practice No. 23: Data Quality. Retrieved January 27, 2021, from http://www.actuarialstandardsboard.org/wp-content/uploads/2015/11/ASOP-No.-23-revision_exposure-draft_nov-2015.pdf.

[4] Actuarial Standards Board (January 2011). Proposed Revision of Actuarial Standard of Practice No. 27: Selection of Economic Assumptions for Measuring Pension Obligations. Retrieved January 27, 2021, from http://www.actuarialstandardsboard.org/wp-content/uploads/2014/03/asop27revision_exposure_2011_updated.pdf.

[5] Actuarial Standards Board (September 2013). Exposure Draft: Proposed Revision of Actuarial Standard of Practice No. 35: Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations. Retrieved January 27, 2021, from http://www.actuarialstandardsboard.org/wp-content/uploads/2014/06/asop35_september_2013.pdf.

[6] Actuarial Standards Board (August 2006). Fourth Exposure Draft: Proposed Actuarial Standard of Practice: Selection and Use of Asset Valuation Methods for Pension Valuations. Retrieved January 27, 2021, from http://www.actuarialstandardsboard.org/wp-content/uploads/2014/03/pension_dec06_44_PED.pdf.

[7] American Academy of Actuaries (October 2020). Exposure Draft: Modeling—for Pension Actuaries. Retrieved January 27, 2021, from https://www.actuary.org/sites/default/files/2020-10/Exposure_Draft_Practice_Note_ASOP_No56.pdf.

[8] Actuarial Standards Board (September 2017). Actuarial Standard of Practice No. 51: Assessment and Disclosure of Risk Associated With Measuring Pension Obligations and Determining Pension Plan Contributions. Retrieved January 27, 2021, from http://www.actuarialstandardsboard.org/wp-content/uploads/2017/10/asop051_188.pdf.

Finally, the actuary needs to disclose the intended purpose of the model, any material inconsistencies or unreasonable output, and any other material limitations of the model. If the actuary has a limited understanding of models developed by others that they are relying on, additional disclosures should be included—disclosing that they are using them and to what extent. When adding additional disclosure to the report, the actuary should also refer to ASOP No. 41 on *Actuarial Communications*.[9]

Conclusion

Defined benefit pension valuations represent one instance of the application of ASOP No. 56. Its use would be embedded in similar processes in other areas of actuarial practice. It is incumbent on the actuary to use judgment in applying ASOP No. 56 to everyday work with models, where applicable. Most pension actuaries are likely following all or most of the standard's requirements already and may just need to add some additional disclosure to their work products to fully comply with this standard.

Caveats and limitations

Kerry Forrester and Julie Smith are consulting actuaries at Milliman, members of the American Academy of Actuaries, and meet the qualification standards of the Academy to render the actuarial opinion contained herein. To the best of our knowledge and belief, this information is complete and accurate and has been prepared in accordance with generally recognized and accepted actuarial principles and practices.

The material in this report represents the opinion of the authors and is not representative of the view of Milliman. As such, Milliman is not advocating for, or endorsing, any specific views contained in this paper.

This paper is intended to summarize requirements of ASOP No. 56, *Modeling*, as it pertains to pension actuaries. This information may not be appropriate, and should not be used, for other purposes. We do not intend this information to benefit, and assume no duty of liability to, any third party that receives this work product. Any third-party recipient of this report that desires professional guidance should not rely upon Milliman's work product, but should engage qualified professionals for advice appropriate to its specific needs.

[9] Actuarial Standards Board (December 2009). Second Exposure Draft: Actuarial Standard of Practice No. 41: Actuarial Communications. Retrieved January 27, 2021, from http://www.actuarialstandardsboard.org/wp-content/uploads/2014/03/asop41_secondexposure.pdf.

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