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The Art of Asset Adequacy Testing

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At the time that this article is expected to appear in print, most actuaries who work on the annual Asset Adequacy Testing (AAT) will be well into the exercise. It is curious how this exercise got its name, the "asset" part, as the testing process is more about testing adequacy of actuarial reserves. At a simplified level, the test is a modeling exercise that starts the actuarial model with the assets equal to formulaic reserves and projects policy cash flows including taxes. Various metrics of the projection are studied, like interim balance sheet on an economic and on an accounting basis, and the present value of market value of surplus. This exercise is intended to compare formulaic reserves to the economic reserve based on the comprehensive projection of assets and liabilities.

Below is a recommended actuarial guidance reading list (by far not exhaustive) for someone starting the AAT exercise. We suggest reviewing ASOPs 23 and 41 in addition to the items on this list.

Actuarial Opinion and Memorandum (AOM) Regulation
This regulation was adopted in April of 2010. VM-30 has similar information in terms of defining the role of the appointed actuary and recommended language for the AOM. The highlight of the AOM Regulation is Section 7 which describes requirements of the actuarial memorandum. The section is broken out to cover discussion of actuarial reserves, liability assumptions, asset assumptions, and modeling methodology.

ASOP 7: Analysis of Life, Health, Property/Casualty Insurer Cash Flows
The highlight of ASOP 7 is Section 3.4 which details that the projection of asset cash flows requires consideration of asset characteristics (e.g., sensitivity to economic factors) and investment strategy with regard to reinvestments and disinvestments. Another interesting section is 3.5.1(e), which requires projection of cash flows to consider "the ability of the policyholder or other party to exercise options under the policy that have an effect on policy cash flows." We understand this section to imply that projections should assume highly efficient policyholder behavior, a principle that will be meaningful later on in this article.

ASOP 22: Statement of Opinion Based on Asset Adequacy Analysis of Actuaries for Life and Health Insurers
The highlights of this ASOP are in Section 3.3.2 which describes analysis methods, including gross premium valuation and conservatism methods, and Section 3.3.3 which covers assumptions. Section 3.4.2 has important language when describing what "moderately adverse" is **not**: "To hold reserves or other liabilities as great as to withstand any conceivable circumstances, no matter how adverse, would usually imply an excessive level of reserves or liabilities."
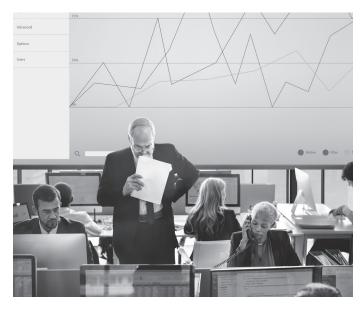
Asset Adequacy Practice Note—August 2014
This practice note was produced by the American Academy of Actuaries and updated for the results of the SOA survey of 184 companies. The topics of interest discussed in this article will be based on the methodology choices in AAT modeling that are not well prescribed. The practice note will be referenced where relevant.

IMPORTANT METHODOLOGY CHOICES

Projection of Taxes
Q45 of the above practice note addresses disinvestment modeling. The guidance covers priority of sales and borrowing. It is acceptable to assume, as long as disinvestment strategy supports this, that sales of more liquid instruments would occur first, without a need to liquidate less liquid assets like real estate. The guidance, however, stops short of discussing tax leverage in the assumption of real estate sales. Assuming a simplified example of a real estate fund growing at 5 percent (from growth and reinvestment of income) and depreciated at 2 percent, there will be a 15 percent difference between MV and Tax BV of that asset in two years, which will grow to a 41 percent difference in five years. This works just like your

401(k) only with leverage from depreciation; the longer you defer the sale of real estate the longer you get to capitalize on tax-free growth and depreciation.

The last paragraph of the response to this question deals with the issue of arbitrage of the borrowing rate and notes that the borrowing rates should be consistent with the market rate. The potential arbitrage occurs when the model borrows at a rate lower than the portfolio rate.

Deferred Tax Considerations

In the event that AAT reserves are established or released, the statutory income statement will reflect the movement of AAT reserves. Because the AAT reserves are not tax deductible, there is potential for AAT reserves to impact the tax efficiency of the income statement without recognizing a deferred tax liability or asset (DTL/DTA) to offset this impact. The DTL/DTA serves the purpose of maintaining an effective tax rate of 35 percent. Per NAIC guidance, the DTL/DTA on the balance sheet should not reflect discounting.

Margins on Best-Estimate Mortality Assumptions

In the interest of assessing the economics of the formulaic reserve for AAT purposes, it is natural for the company to defer to its best-estimate assumptions which presumably capture the true economic risk of the liabilities. However, best-estimate assumptions are commonly used in AAT along with the corresponding margins used in the economic reserve. This immediately raises a question with regard to the appropriate level of margins to which the actuary must apply judgment.

A company subject to the regulation of two jurisdictions (e.g., United States and Canada) may find itself with conflicting guidance with regard to the establishment of margins on its liability assumptions. For example, the Canadian Institute of Actuaries (CIA) indicates that margins should be defined in terms of the curtate life expectancy within a particular range whereas principle-based reserves (PBR) (most recent guidance on margins for mortality in the United States) will specify margins on the basis of a credibility analysis, with weaker credibility requiring higher margins all else equal.

Per the CIA: *"The low and high margins for adverse deviations for the mortality rate per 1,000 are respectively an addition of 3.75 and 15, each divided by the best estimate curtate expectation of life at the life insured's projected attained age."*[1]

In contrast, for new business issued under PBR, the margins on the best-estimate mortality assumptions are determined based on the credibility of the experience data based on attained age only. The actuary may choose between the Buhlmann method and the Limited Fluctuation Credibility Theory (LFCT) with a confidence level of 95 percent and error margin no greater

than 5 percent. Lower credibility driven by higher expected variance in the sample distribution leads to higher margins. Credibility is quantified using a ratio idiosyncratic to the credibility method, but which generally captures the quotient of number of actual observations against the number of observations required for full credibility, not to exceed one.

The margins for the CIA $(9/e_x)$ vs. the PBR approach (Buhlmann method with 90 percent credibility) are shown in Table 1 for a 45-year-old male non-smoker at issue.

Table 1

Attained Age	Duration	2015 VBT q_x	e_x	CIA % Increase	PBR % Increase
45	1	0.35	39.63	64.89%	7.30%
46	2	0.49	38.64	47.53%	7.30%
47	3	0.63	37.66	37.93%	7.30%
48	4	0.77	36.68	31.86%	7.20%
49	5	0.84	35.71	30.00%	7.20%
50	6	0.94	34.74	27.56%	7.10%
51	7	1.10	33.78	24.22%	7.10%
52	8	1.29	32.81	21.26%	7.00%
53	9	1.47	31.86	19.22%	7.00%
54	10	1.65	30.90	17.65%	6.90%
55	11	1.88	29.95	15.98%	6.90%
56	12	2.16	29.01	14.36%	6.80%
57	13	2.49	28.07	12.88%	6.80%
58	14	2.82	27.14	11.76%	6.60%
59	15	3.22	26.22	10.66%	6.60%
60	16	3.74	25.30	9.51%	6.50%
61	17	4.33	24.40	8.52%	6.50%
62	18	4.84	23.51	7.91%	6.40%
63	19	5.25	22.62	7.58%	6.40%
64	20	5.72	21.74	7.24%	6.20%
65	21	6.27	20.86	6.88%	6.20%
66	22	7.15	20.00	6.30%	6.10%
67	23	8.11	19.14	5.80%	6.10%
68	24	9.13	18.30	5.39%	5.90%
69	25	10.21	17.46	5.05%	5.90%
70	26	11.47	16.64	4.71%	5.70%
71	27	12.86	15.84	4.42%	5.70%
72	28	14.52	15.04	4.12%	5.60%
73	29	16.46	14.27	3.83%	5.60%
74	30	18.67	13.50	3.57%	5.40%

There is very little guidance on the choice of starting assets.

Dynamic Lapse Function

Q71 in the practice note addresses dynamic lapse modeling. The considerations are product, policy duration, level of surrender charges, market and many others. Dynamic lapse functions are required for annuities by New York's Special Consideration Letter. They should be used for life products as well to be conservative, although the actuary has discretion in deciding whether to do so. According to a survey by the Academy, roughly three-quarters of appointed actuaries used dynamic lapse assumptions for at least one of the tested products.

Dynamic lapse assumptions have been studied at length for annuities products, but have a number of specific considerations for life products. Dynamic behavior for life products is reduced to the extent that the block has matured, some of the business has migrated to less preferred risk classes, the new select and ultimate COI structure is of higher cost, and new surrender charges will begin. All of the block will age and therefore will have higher COI charges. Because of all these reasons, a liabilities portfolio would be very unlikely to respond to higher interest rates, even under severe shock. The sensitivity would come from a shock economic scenario (e.g., a recession in which policyholders access cash values or stop paying premiums).

Starting Assets

There is very little guidance on the choice of starting assets. Q14 describes allocations among lines, with most companies using formal segmentation. The methodology question in application of these techniques is whether the starting assets should be trued-up to the actuarial reserves using pro-rata or with cash. Most actuarial models have a switch that would allow either approach to be modeled. In the current interest rate environment, a model that trues up with cash will most likely have lower yield than the model that trues up pro-rata.

Another methodology question related to starting assets is what assets should be used if the model needs more assets. This could happen because of either a need to set up additional AAT reserves or because the asset segment is managed on an economic basis and holds assets lower than the statutory reserve. The most common approach is to use a pro-rata in-

crease in the portfolio (assuming there are sufficient assets in other segments or surplus). Another approach is to use assets from surplus or other segments directly. Although sounding like first-principles, the latter approch could distort the ALM balance of the portfolio. Another way to think about this issue is what assets your company would actually manage to in that segment if you needed more assets.

Borrowing in the Model

It is a natural consequence that at least some instances of AAT will produce periods of negative surplus. In these cases, a modeling decision must be made about how to capture the source of funding for the shortfall. For example, if AAT is being performed on one asset segment then it is possible to assume that shortfalls in the projection may be funded by borrowing from another asset segment. The effect, however, should be for the borrowing segment to absorb the impact of the borrowing and to leave any other segments whole. Hence, a borrowing rate must be assumed to compensate the lending segment for the assets borrowed to cover the shortfall.

The purpose of borrowing is not to create leverage. Rather than a primary strategy to take advantage of surplus rates higher than a borrowing rate, borrowing should be seen as a secondary strategy meant to cover negative interim surplus.

Interim Negative Surplus

The question of interim results is discussed in Q92, with most companies considering interim results important. The Regulatory Asset Adequacy Issues Summary (RAAIS), mandated to be filed in some states, requires commentary on interim negatives. The response to the question in the practice note points to most companies looking at book value surplus in examining interim results. There is a methodology choice on how assets that have significant difference in book value and market value should be considered. For example, real estate funds can develop significant differences in market value that was modeled to grow over time and book value that was projected to depreciate over time. One approach is to assume that in the case of a shortfall in assets, these assets could be liquidated for cash and cash reinvested; in effect this approach transforms market value gains into book value.

CONCLUSION

This article went through a number of methodology choices that actuaries face when conducting AAT work. The anchor in these decisions is whether the outcome makes sense from first principles. For example, in the example above on interim values and real estate, if the company's investment strategy or the economic scenario would call for borrowing first before sales of real estate then the modeling of trading of real estate would not be appropriate. There are many standards and regulations to guide actuarial work on cash flow testing. Another example

of guidance is the NY Special Considerations Letter. This is the letter from NYDFS that usually comes out at the end of October and prescribes various approaches for cash flow testing in NY domiciled companies. The abundance of guidance still leaves a lot of room for actuaries to make methodology choices. There is only one guidance at the end of the day and that is common sense. ■

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ENDNOTE

1 *https://www.cia-ica.ca/docs/default-source/2005/205007e.pdf?sfvrsn=0*

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