![Society of Actuaries logo](SOCIETY OF ACTUARIES)

Article from
Retirement Section News
September 2019
Issue 99

New Research on Estimating Annuity Market Pricing in the U.S. and Canada

By Victor Modugno

The Society of Actuaries (SOA) recently published "Annuity Market Pricing Approaches," a report sponsored by the Retirement Section Research Committee. It examines the Canadian Institute of Actuaries (CIA) methodology of developing solvency valuation assumptions, compares it to methods used in the U.S., and considers if it could be used in other markets, such as U.S. group annuities or individual annuities. The report is available on the SOA website *https://www.soa.org/resources/ research-reports/2019/annuity-market-pricing/*. This report contains references and sources of data used in this article.

The CIA issues guidance in the form of an educational note on assumptions for group annuity pricing for hypothetical wind-up and solvency valuations. The CIA obtains annuity buyout quotes quarterly from seven insurers on three hypothetical groups with low, medium and high duration liabilities. For annuities with cost-of-living adjustments (COLAs), four companies provide quotes. The average of the best three quotes is used. The interest rates are derived from these quotes using projected Canadian pension mortality. These interest rates are then expressed as a spread over yields on government of Canada marketable bonds with maturities over 10 years. For consumer price index (CPI)-indexed annuities, one spread is used for all durations. This spread, which is currently negative, is applied to yields on the benchmark government of Canada real-return long-term bonds.

In applying this guidance, the actuary calculates the duration of the liability by the change in value for a one basis point change in rates at 3 percent. This duration is then compared to the durations of the hypothetical groups. If it falls in between, linear interpolation is used to determine the spread. This spread is added to the government bond rate on the date of valuation and projected Canadian pension mortality is used. The other assumptions are left up to the actuary, subject to standards of practice. The educational note is not binding, but deviations would need to be justified.

Unlike Canada, there are no educational notes on solvency valuations with quarterly rate updates in the United States. The most analogous, formally documented guidance available to all U.S. pension actuaries is Code of Federal Regulations Part 4044. CFR 4044 prescribes an approach for calculating, in limited situations, liabilities of terminating private-sector single-employer-defined benefit plans. CFR 4044 mandates not only interest and mortality but also expense and early retirement assumptions. Under the CIA method, the expenses and other assumptions are those used for the hypothetical groups.

To calculate CFR 4044 rates, the PBGC collects 14 sample male annuity rates for a range of ages (30 to 80) from participating insurers quarterly. In recent years, three to six insurers have participated. Outliers (generally rates 12.5 percent greater or less than the average at age 65) are eliminated. The interest rate is then extracted from these average annuity rates using the UP-94 mortality table with a static projection to the current year plus 10 using scale AA. The rates are fitted to a select and ultimate rate where the rate changes in 20 or 25 years. In recent years, there has been very little difference between select and ultimate rates. An average of these rates and the previous quarter's rates are used to produce interest rates. This rate, along with the same mortality basis and PBGC expense and early retirement assumptions, is used in annuity valuations for the next quarter.

> Unlike Canada, there are no educational notes on solvency valuations with quarterly rate updates in the United States.

Starting in 2017, the PBGC is using a yield curve for the valuation of its liabilities. The PBGC changed the mortality to RP-2014 with generational projection MP-2016. The information available on the yield curve is from the PBGC's 2017 actuarial report: "PBGC used forward yield curve interest factors which were derived from a recalibration based on the prices from the two most recent ACLI [American Council of Life Insurers] surveys (March 31, 2017, and June 30, 2017) to value PBGC's liabilities. The interest factors so determined for the September 30, 2017, valuation vary annually from 1.54% in year 1 to 2.44% in year 31 and beyond." A proposal to revise Reg. 4044 to use this methodology is under consideration, possibly for next year.

The CFR 4044 interest rates to be used for July 1, 2018, to Sept. 30, 2018, were based on the average of rates calibrated to ACLI annuity price surveys received for Dec. 31, 2017, and March 31, 2018. Thus, the rates lag the market by six months on average. This lag is a shortcoming for this method's applicability to approximate current annuity prices. If there had been a significant change in interest rates during that period, the asset and liability values would be out of whack. A plan invested in a matched portfolio of high-grade bonds could develop spurious surplus or deficit. The Canadian method's lag is only a quarter's credit spreads, which would be minimal compared to possible changes in interest rates. The asset and liability valuations are close. The PBGC method has some advantages in using net rates and then adding expenses and early retirement subsidies, customizing the cost to the plan's characteristics. The elimination of outliers from the average, although rarely done, is another advantage.

Turning to other approaches, the FTSE Pension Discount Curve and Liability Index (formerly Citi Pension Liability Index and Citi Pension Discount Curve) is calculated based on a universe of AA-rated corporate bonds from the FTSE U.S. Broad Investment-Grade Bond Index (USBIG) and the yields of the Treasury model curve. This index was developed for accounting standards.

The Treasury HQM corporate bond yield curve was constructed to calculate Current Liability for single employer pension plans and remains in use to calculate the full yield curve funding target liability under PPA. It contains bonds of the three highest ratings—AAA, AA and A. Most of the bonds are A, making this a slightly lower credit than the FTSE.

There are consultants that have indexes and other information on group annuity pricing. Mercer publishes pension discount yield curve and index rates in the United States monthly. Aon publishes analysis of insurer pricing, Aon Annuity Tracker. Brentwood Asset Management's website has current interest rates for various types of group annuities.

Figure 1 compares FTSE Pension Discount and HQM on June 29, 2018, with CFR 4044 rates (PBGC rates). A Treasury yield curve is included for comparison. The anomaly of PBGC rates pricing through Treasuries may be partially due to the lag in rates. The rates on June 29, 2018, are based upon the average of survey rates between March 31, 2018, and Dec. 31, 2017. On Jan. 2, 2018, the 10-year treasury yielded 2.46 percent, which is below the PBGC rate of 2.53 percent. Difference in mortality assumptions between the insurers and PBGC is also a factor. Mortality improvement has been much higher than predicted by scale AA. Thus, the PBGC mortality rates are higher than current mortality at important ages.

If the CIA methodology for approximating group annuity prices were to be employed in the U.S., it would be most effective if many insurers participate in the quarterly survey.

Figure 1
Yield Curves, June 29, 2018
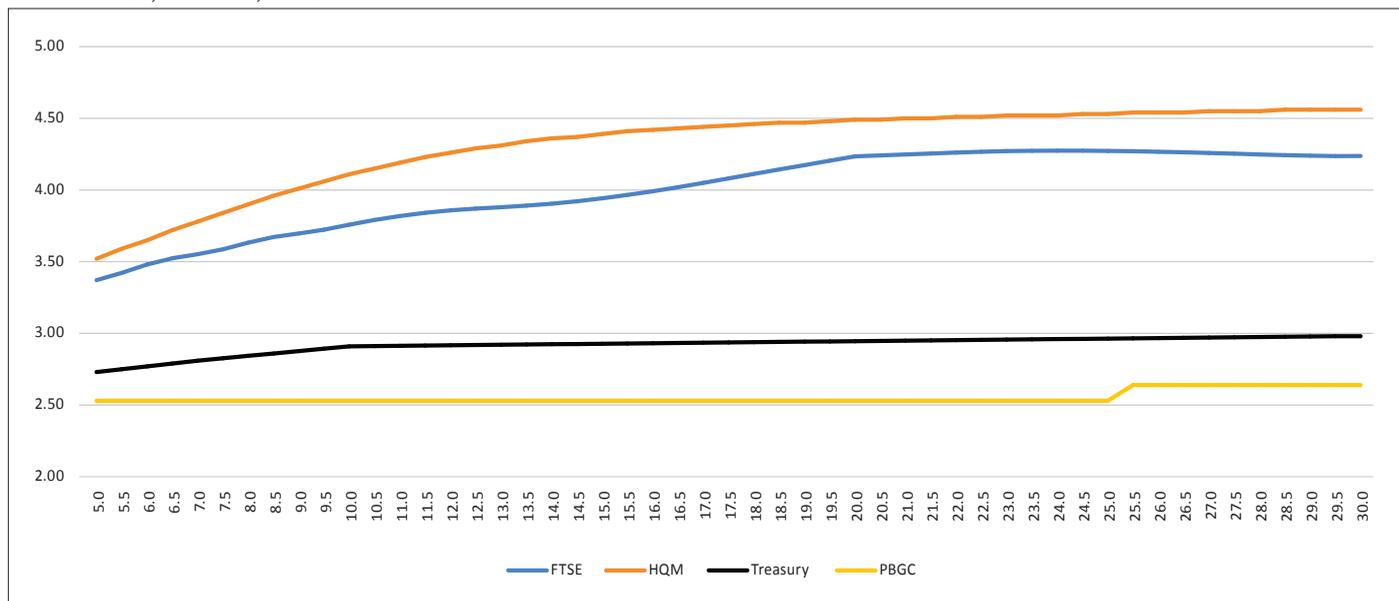
For public plans, which often have CPI annuities, there is no required calculation of plan termination liability and the accounting standard uses assumed returns on investments. The interest rate for plan termination liabilities would likely be close to zero, as in Canada.

Unlike group annuities, there is no need for guidance to estimate prices for individual annuities. In the United States and Canada, there are several websites where quotes can be obtained for individual annuities. Indeed, the problem is too much data. There are many websites, companies and annuity types in this market. Given that an exact price of an annuity can be easily determined, why use an estimation method?

A group annuity pricing survey like the ones done in connection with the SOA's 2001 papers on 30-year Treasury rates and DB plans was completed. Sixteen insurers were identified as currently active in the U.S. group annuity closeout market, compared to 11 in the 2001 survey. Ten agreed to participate, the same number as in the 2001 survey. These ten included the major companies in this market. The following is a summary of these responses.

- Mortality assumptions. In the 2001 survey, eight companies used variants of the GAM while two used the RP. The mortality improvement was scale AA. In this survey, no companies used GAM for pricing and only one company used scale AA for mortality improvement. Many companies used internally developed mortality assumptions, which were closer to the RP-2014. Three companies used the RP. Most companies used the MP-2017 or variants of this scale for improvement. A couple of companies used Social Security Administration (SSA) data to develop mortality improvement assumptions. Only one company had assumptions that were close to the Reg. 4044 bases (UP-94 projected 34 years using scale AA). Most said their assumptions were closer to the PBGC Annual Report basis (RP-2014 projected generationally using MP-2016). Unlike the 2001 survey, most companies are underwriting mortality using different assumptions based upon industry, ZIP code, collar and annuity size. Many companies would use plan-specific mortality data if credible.

- Interest assumptions. Seven companies use a yield curve for pricing, while two use rates that vary by duration. Five use rates from investments, which in one case was compared to an index rate. Three use indices and the remaining two use yield on an assumed investment portfolio.

- Expense assumptions. None of the companies had different expenses for buy-ins, but many do only buyouts. Three companies had assumptions that were like the PBGC's. The others that gave details used per life charges, percent of premium or interest rate reductions to reflect expenses.

- Early retirement assumptions. In the current low interest rate environment, subsidized early retirement factors have become much less important. Indeed, in some cases, the subsidies are negative (i.e., result in gains). One company mentioned that they were more concerned about late retirement increases than early retirement. Of the eight companies pricing early retirement subsidies, three used assumed retirement ages, while five used retirement scales. Six companies considered plan experience in choosing early retirement assumptions.

- Optional forms, including lump sums. Most companies would price these based upon experience. Some would decline cases with too many lump sums or other subsidized options that could not be modeled.

- Special circumstances. Size (too big or too small) was given as a reason to decline by many companies. Administrative complexity, too many lump sums or other optional forms that were difficult to model, disability benefits if not based on Social Security, COLAs and too many deferred were reasons for declination. Of companies indicating a minimum size requirement, the lowest was $20 million.

A model of insurer pricing was built based upon the foregoing survey, NAIC risk-based capital requirements, assumed expenses and return on capital/profit charges. For an investment strategy, a duration matched portfolio of NAIC 1 (A or higher) rated publicly traded bonds was chosen as represented by the ICE Bank of America Merrill Lynch Corporate A bonds 15+ (C8A3). This has an effective duration of 14, which is representative of a buyout with both retired and non-retired lives.

Redundancies are applied to NAIC capital charges giving a total required surplus of 3 percent. The target after tax return on this surplus is 10 percent, and surplus earns 4 percent pre-tax, and the tax rate is 21 percent. The required spread rounds to 0.30 percent. We have added 0.20 percent for overhead and investment management expenses, 0.05 percent for asset defaults and 0.10 percent for administrative expenses, giving a total spread of 0.65 percent off the A bond rate. We have ignored surplus and tax strain, which are no longer an issue. For mortality, the RP-2014 was projected using MP-2017 generationally.

Figure 2 compares the model company's pricing rate (ICE A–.65%) to the PBGC rates (PBGC rate 1 for the first 20 or 25 years, PBGC rate 2 for years thereafter) and the FTSE AA yield on June 29, 2018. Treasury yields are there for comparison. As expected, the model pricing rate is inside the AA rate (averaging .45% lower). However, it's higher than the PBGC rates, averaging 1.2% percent higher than the PBGC initial rate. This is due in part to the lag in the PBGC rates. These rates are the average from two to three quarters ago. During periods of rising interest rates, PBGC rates will lag the current market. Another reason is that the insurers participating in the survey may be using more conservative mortality assumptions.

Figure 2
Rate Comparison
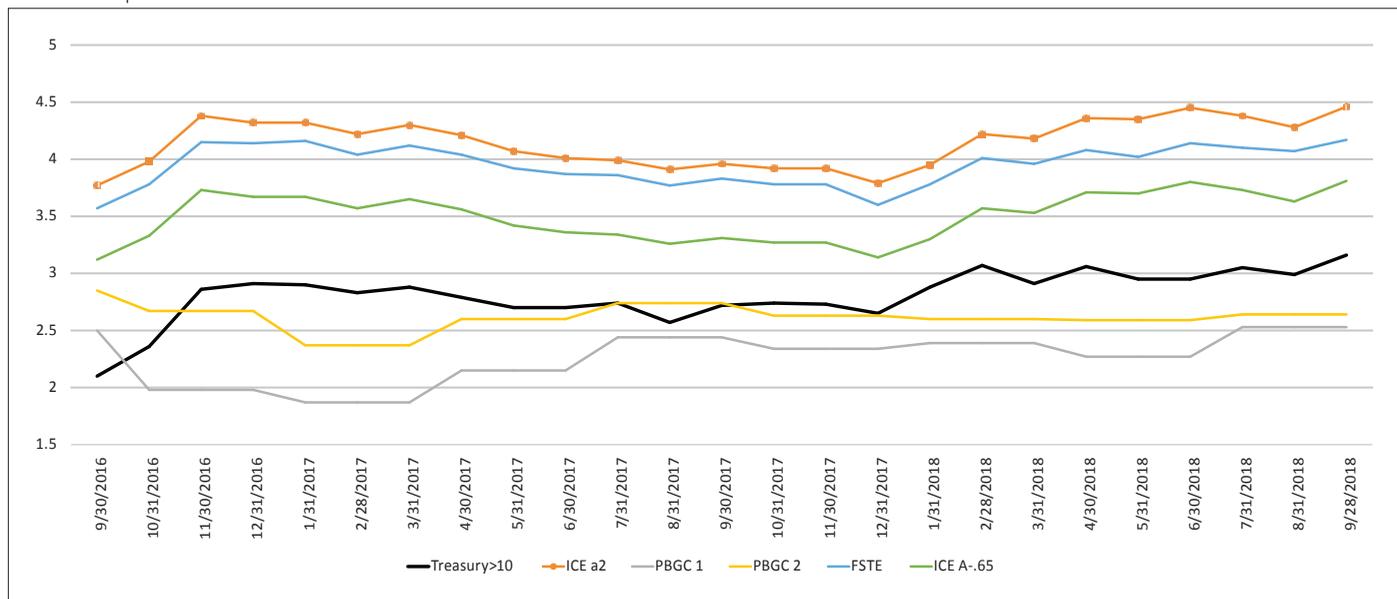
Encouraging more insurers to participate in the ACLI/PBGC survey could lead to a more robust approach.

To examine this, the cost for $1,000 per month for life for a healthy male annuitant age 65 was calculated on the PBGC and model company basis. The PBGC basis is UP-94 projected scale AA static 34 years at 2.53 percent for 25 years and 2.64 percent thereafter. The effect of the 11 basis points higher rate after 25 years adds about 1 basis point to the initial rate or 2.54 percent, which gives a cost of $182,490. The rate for the model was developed by interpolating C8A3 (15+ years) with duration 14 and C7A3 (10 to 15 years) with duration 9 to match the liability duration of 10, giving 4.3 percent. The model uses RP-2014vMP-2017 at 3.65 percent, giving a cost of $169,490. The price difference of 7.5 percent equivalent to 0.75% percent in interest rate at duration 10. This leaves 0.36 percent attributable to mortality. The PBGC rates are based upon an average of the rates on March 31, 2018, and Dec. 31, 2017. Using the average of the model rates on those dates gives a net rate of 3.11 percent, 0.54 percent lower, making the lag the more important factor.

The CIA's quarterly guidance in the form of an educational note on group annuity pricing for solvency valuations provides an excellent approximation to group annuity prices in Canada. It could work in the United States, assuming sufficient insurer participation. Currently less than half of the insurers in this market provide sample indicative rates to ACLI for the PBGC survey. Without sufficient insurer participation, the CIA method of pricing three hypothetical annuity quotes will not work in the U.S. This also points to a potential future problem in Canada—decline in participation over long time periods. Back in the 1980s, there were efforts to encourage insurers to participate in the PBGC survey and participation was better.

Encouraging more insurers to participate in the ACLI/PBGC survey could lead to a more robust approach. Perhaps a website can be set up where rates could be entered by participating companies. A study comparing actual pricing on closeouts to PBGC pricing completed in 2000 could be repeated to validate PBGC methodology.

There is no need for an estimation of individual annuity prices in either the United States or Canada since these are readily available on websites. The same companies that treat sample indicative group annuity rates as closely guarded secrets publish on the internet exact buyable quotes for any age or benefit for individual annuities. The mortality and expenses may be different, but the underlying investments for individual and group annuities should be the same. A method of using individual annuity rates downloaded from the internet to estimate group annuity pricing could be developed using historical individual annuity quotes. The stickiness of individual annuity quotes needs to be factored into the algorithm. This could be a future SOA research project. ■

Victor Modugno, FSA, MAAA, is a consulting actuary in Huntington Beach, Calif. He can be contacted at *vicmodugno@verizon.net*.

LIVING *to* 100
SOCIETY OF ACTUARIES
INTERNATIONAL SYMPOSIUM

Jan. 13–15, 2020
Orlando, Florida

Register Today

Registration for the 2020 Living to 100 Symposium is now open. This prestigious event brings together thought leaders from around the world to share ideas and knowledge on increasing lifespans. Expert presenters will explore the latest longevity trends, share research results and discuss implications of a growing senior population.

New this year are teaching sessions that will provide practical pointers to help actuaries measure and forecast mortality at advanced ages.

Symposium speakers include:

- Steve Horvath, Professor of Human Genetics and Biostatistics for the David Geffen School of Medicine at University of California, Los Angeles
- Jacquelyn B. James, Director of the Boston College Center on Aging & Work and the Sloan Research Network on Aging & Work
- Ronnie Klein, FSA, MAAA, Director of the Global Ageing program at The Geneva Association
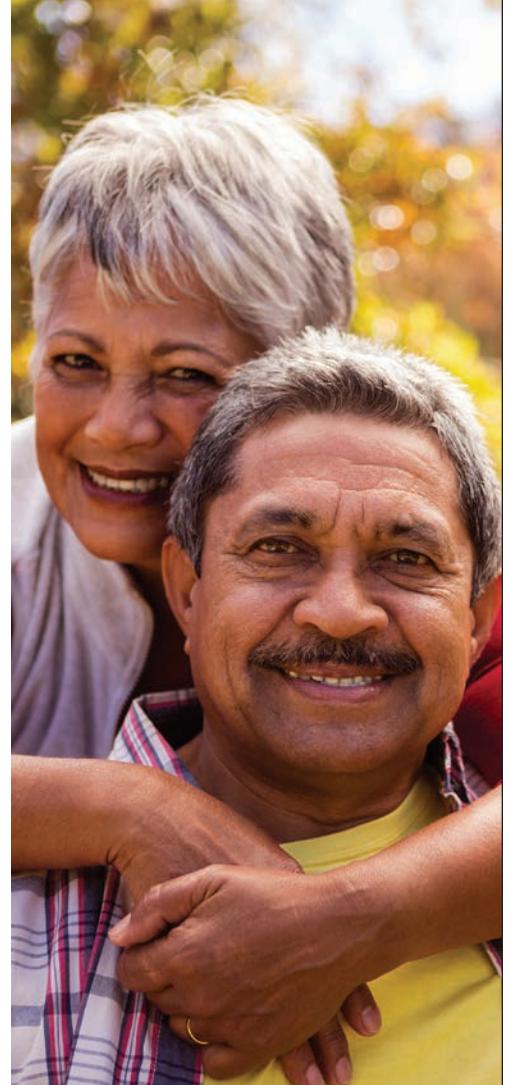
Visit *LivingTo100.SOA.org* for more information