Cal Actuarial League Thirteenth Case Competition

Team 3

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Retirement Task

The client is on a defined benefit plan, and currently offers a Final Average Pay plan, which is where the client receives a fixed monthly amount for their lifetime. The company cites rising PBGC premiums and plan contributions as financial concerns. The Pension Benefit Guaranty Corporation (PBGC) is a government agency created with the goal to protect participants of private-sector defined plans when the plans are terminated without sufficient funds to pay all benefits. PBGC premium rates are set by law. Since 2019, changes in premium rates have been due to indexation, meaning that they only change due to changes in inflation and, hence, they change automatically over time. They can also change when Congress passes new legislation affecting premiums. PBGC premiums have been getting a lot of attention lately because of the significant scheduled and historical PBGC Premium increases. Contributions to a defined benefit pension plan are based on a formula. They are determined by considering the following factors: the employee's life expectancy and normal retirement age, possible changes to interest rates, annual retirement benefit amount, and the potential for employee turnover.

De-risking Options

There are a couple of alternatives the company can use to reduce the risks brought on by a defined benefit plan. One popular tool is a Lump Sum Window for Terminated Vested Participants (TVs), in which participants are offered the option to receive a lump sum (instead of monthly annuities). Benefits of this are that the company can permanently reduce its pension liabilities and future administrative costs, which include but are not limited to plan

administration and PBGC premiums. Furthermore, the sponsor transfers longevity risk to the participant.The flip side, however, is that there might be potential settlement accounting charges and considerable short term administration costs such as one-time actuarial and legal costs because benefits need to be approved as fair and accurate. Another alternative is the Buyout for retirees, which is the purchase of annuity contracts from an insurance company to pay all future annuity payments for retirees. This tool is useful because it removes the obligations of participants' future pension concerns from the sponsor, and reduces investment risk and longevity risk. However, it introduces potential settlement accounting charges and generally costs more than offering a lump sum payout because the insurer would take a margin. Finally, there is the option for an Annuity Buy In, which is similar to a buy-out option, except that the plan sponsor maintains the assets and liabilities on the balance sheet. The sponsor continues to pay the monthly benefits, but is reimbursed by the insurance company. Longevity risk and investment risk is transferred to the insurer but other expenses such as PBGC premiums and annual notices are not transferred. The benefit of a buy-in, as compared to a buy-out, is that the risks can be reduced without an immediate, current-year effect on reported earnings. Moreover, a buy-in is not categorized as a settlement, so there is no accounting settlement charge. However, due to no reduction in short-term expenses, a buy-in is perhaps optimal as a temporary solution, and can be converted into a buy-out into a buyout with well-planned timing and measures. Another popular risk management strategy to consider is liability-driven investment (LDI). LDI manages investment risks by closely matching a bond portfolio to the liability cash flow, reducing the volatility of pension funded status. It reduces or mitigates the impact of market fluctuations on closely followed metrics of corporate health, such as earnings and cash flow. However, some long-duration bonds are in short supply, and there are uncertainties in the bond rate environment.

Methodology and Assumptions

For an optimal Annuity Buy-Out for Retirees, we recommend a buyout on a proportion of retirees, specifically the x%of the retirees with the lowest benefits. To sort the data of TVs and Retirees accordingly, we made a Pivot Table with 'Status' and 'Code' as the rows, and 'Monthly Benefit' as values. Then, we sorted the monthly benefits in ascending order. We chose to group the retirees by the smallest benefits -- rather than age or any other factor -- because retirees with smaller benefits have been associated with shorter lifespans, which could lead to favorable pricing from insurers. It could also limit size to avoid settlement accounting, and leaves some retirees in plan, which is helpful if planning for plan termination in near future. To illustrate the potential benefits of the two options, we calculated the PBGC savings for the TV and Retiree population for the year 2020, assuming that there is a take rate of 50% for terminally vested participants and that 50% of the retirees are chosen for the buyout. COUNTIF was used to calculate the numbers of TVs and retirees respectively, as well as to clean the data in case there were any invalid entries. We have no information on the opening balance of plan assets, so we cannot determine their fair value and, hence, the sponsor's funded status is not known. So, we assume that there are no unfunded vested assets, and only applied the PBGC premium flat rate of $83. This yields the savings in the form of PBGC premiums as $82917 with a 50% take rate for TVs and a 50% proportion of retirees. In the unlikely case that everyone is taken off the defined benefit plan, the savings would be $166000. The 50% as a proportion for the retirees was rather random, and to determine what the optimal proportion would be more specifically for the company's plan, we first calculated how much a lump-sum payout would cost with a 50% take rate. First, to calculate the present value of the monthly annuities, we made a function in VBA that takes in the participant's age and monthly benefit, and uses a FOR LOOP iterating from the

participant's current age (or if they are younger than 65, the starting age was taken as 65 using an IF statement) to age 120. Within the loop, for each age level, the present value of the monthly benefits to be paid is calculated for that particular year using the sum of this geometric series:

$$p \times v^{(12(i-age))+1} + p \times v^{(12(i-age))+2} + \ldots + p \times v^{(12(i-age))+12}$$

Where p is the monthly benefit, v $= \frac{1}{1+\frac{discount\ rate}{12}}$ and i = age level in the loop.

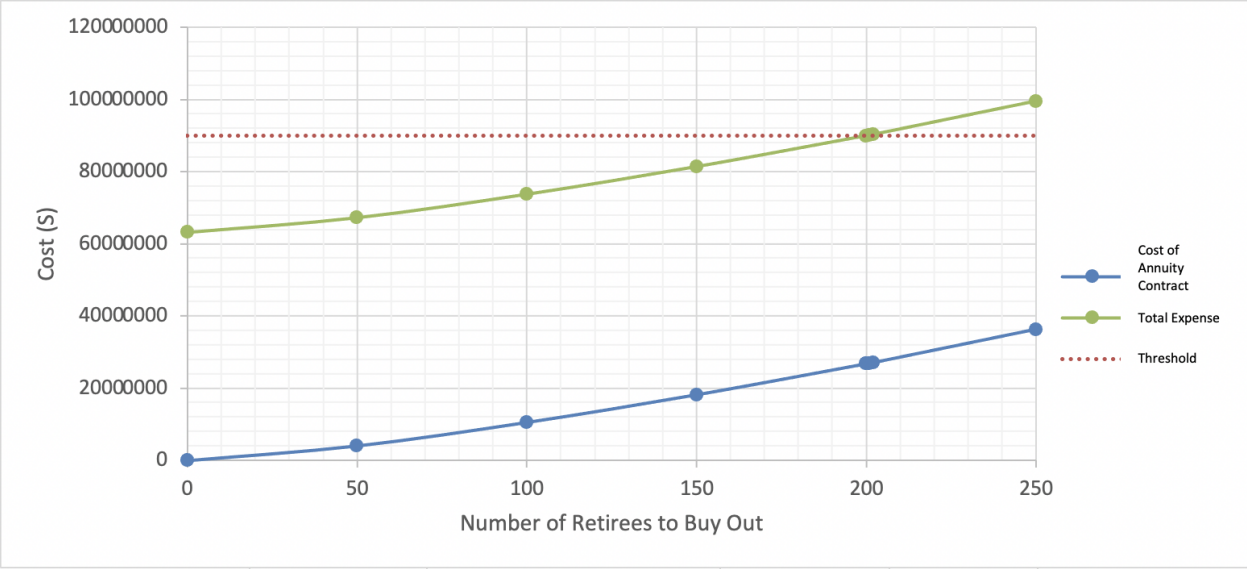
Then, to account for life expectancy, we multiplied this sum of monthly benefits for the year with the probability that the person is alive by the end of that particular age level. For instance, the probability of someone who is exactly 40 living to exactly 100 is equal to:

$$1 - qx(40) \times 1 - qx(41) \times \ldots \times 1 - qx(100).$$

For the sake of simplicity while coding, we assumed that everyone is born on the 1st of January and they can only die at the end of the year. We created a similar function to calculate the cost of an annuity buyout contract except there was no IF statement because the starting age is always the current age for retirees. Then we found the expected value of the cost of a lump sum payment with a 50% take rate, using the formula:

$$\sum_{i=1}^{919} \frac{1}{2} \times M(i)$$

Where M(i) is the monthly benefit for the particular TV. Finally, to optimize the proportion of retirees to buy out in order to save on settlement accounting expenses, the total cost of the Lump Sum Payout and the Annuity Buy Out contracts must be less than the sum of the Interest Cost and the Service Cost of the company. Thus, we conclude that 18.59% (201 retirees out of 1081) of the retirees can be selected for the Annuity Buy Out, along with a 50% take rate for a Lump Sum Payout TVs and the company can save on settlement accounting charges.



Conclusion

We recommend the lump sum window for terminated-vested participants and annuity buyout for retirees because of the PBGC savings and the overall risk reduction discussed heretofore; however, these de-risking tools have little impact on active participants. To address this, we think that spin-off termination is helpful for active participants. It settles liability for participants to reduce plan expenses and volatility. A spin-off termination also allows the plan sponsor to terminate the most cost-effective portion of the plan by splitting a single plan into two separate plans: an ongoing pension plan and another undergoing a plan termination. The terminating plan can be structured to include a specific portion of the original plan (e.g. participants with smaller benefits), and thus the termination can be accomplished for a fraction of the cost.

Health and Benefits

What are shelf rates and why do insurance carriers use them?

The shelf rates refer to the offering of a plan and the factors that are used to create those plans, such as zip code, employee elective contributions, and the plan design. These factors are used to determine the price of the premium by rating the riskiness of certain characteristics.

This is an example of a shelf-rated dental plan

Arkansas Blue Cross Dental | Small Group PPO Plus for Groups Size 2-25

	Essential 1000	Value 1000	Elite 1000	Elite 1500	Elite 2000
Calendar-Year Aggregate Maximum (per individual)	**In | Out** $1,000 | $1,000	**In | Out** $1,000 | $1,000	**In | Out** $1,000 | $1,000	**In | Out** $1,500 | $1,000	**In | Out** $2,000 | $1,500
Deductible (ind. / 3 or more family)	n/a	$50/$150	$50/$150	$50/$150	$50/150
Rollover Benefit	Yes	Yes	Yes	Yes	Yes
Waiting Period	No waiting periods.				
Network	Arkansas Blue Cross Dental Select PPO Plus				
Diagnostic & Preventive Services (not subject to deductible) **In-network | Out-of-Network** (plan pays)					
Exams	100% | 80%	100% | 90%	100% | 90%	100% | 90%	100% | 90%
Radiographic Images (X-rays)					
Fluoride Treatment					
Prophylaxis (cleaning)					
Sealants					
Minor (basic) **Restorative Services**					
Fillings	n/a	80% | 70%	80% | 70%	80% | 70%	80% | 70%
Extractions	n/a				
Non-Surgical Periodontics	n/a	50% | 40%*			
Endodontics (root canals)	n/a				
Oral Surgery	n/a				
Anesthesia	n/a				
Major Restorative Services					
Surgical Periodontics	n/a	50% | 40%	50% | 40%	50% | 40%	50% | 40%
Inlays, Onlays, Crowns	n/a				
Partials and Dentures	n/a				
Implants	n/a				
Orthodontic Services (limited to covered individuals through age 18; not subject to deductible)					
Diagnostic, Active, Retention Treatment	n/a	50% | 40% $1,000 lifetime max	50% | 40% $1,000 lifetime max	50% | 40% $1,000 lifetime max	50% | 40% $1,000 lifetime max

All plans have in-network and out-of-network benefits. Please see a plan's benefit summary for a full listing of benefits.

* Listed under major restorative services for this plan

Insurance carriers tend to use shelf rates because it allows the customer to easily choose the most appropriate choice between different plans and maximize their benefit to them. Another key benefit of a shelf-rated plan is that they offer the same level of benefits whether you are inside-network or go outside-network, so a client can visit any dentist without having to pay an outrageous amount. However, there are a couple of drawbacks, one being the difficulty to satisfy the special requirements for each individual customer. This is where custom rates can be very beneficial, especially since we are only working within the small group segment. Another drawback is that typically shelf-rated plans offer a lifetime deductible, so this means that a person has to pay a fixed amount, one time in order for plan benefits to begin. This does not allow

Projected Loss Ratio 2021

Based on the current shelf rates and the claims incurred in 12 months, the projected loss ratio for 2021 is 63%. We took the claims incurred from the member experience data, took the sum of all them, and disregarded any NA values. This was done by using the SUMIF function to sum up all of the claims if they were not equal to NA. Then we also took the sum of shelf rate annual premiums. We calculated the loss ratio by dividing total claims by total premiums. We decided on this formula because the dental industry is exempt from the provision of the Affordable Care Act where loss ratios must be above 80%We made the assumption that there were no adjustment expenses to account for when calculating the loss ratio.

Adding Additional Factors to the Standard Model

The assumption we made is that the shelf rate includes three factors: zip code, contribution, and plan design. In order to add the factor “group size” onto the standard model, we first sorted the data in the “Member Experience” sheet so that the group numbers were in increasing order. Then we were able to identify the number of people in each group. Using the COUNTIF() function, we were able to figure out the amount of members in each specific group and recorded them in the “Group Metrics” sheet under Group Size. Using a nested IF() statement, we converted the raw member count in each group so that it matched with the categories in the calculator in the first sheet. We used a FOR loop in VBA in order to automate the process of putting each individual characteristic of each member in the premium calculator. This allowed us to see the change in the premiums when adding on the factor “SIC Code”. We need to figure out how to nest another FOR loop so that the rest of the values in the calculator could stay the same while we input different zip codes since there are members with several different zip codes in each group. Converting the output of the calculator to an annual premium, we then could quantify the benefit that these two additional factors have over the standard model. We could use the new premiums to calculate a new loss ratio for 2021 in order to identify any positive changes.

In order to generate age factors to add to the standard model, we first copied the data from the Member experience onto a new sheet in order to not disrupt the VBA code. We then sorted the data this time by DOB, so that the youngest members were first, and the oldest members were last. By looking at the claims data, the general trend we noticed was that the claims were low for younger members, and much higher for older members. We would then have to determine the factor for each age group so then we could adjust premiums accordingly. The higher the claims

incurred, the more risky that person would be, so the factor would need to be higher for the older members.

Adding Variables to a Model

When adding more variables to the standard model, we are able to predict any changes in premiums based upon different factors more accurately. By doing so, we could improve the loss ratio. We would suggest adding more variables as the main benefit would be that the data could be judged against more aspects, and would make it a more comprehensive model. However, when we add more variables we must be careful to make sure that the factor is adjusted so that the accuracy of the model is preserved. Some factors may not contribute much to the model, but can skew the final result.