DP-RU Model Solutions
Fall 2012

1. **Learning Objectives:**

5. The candidate will be able to apply/synthesize the various methods used to value a pension plan or retiree health plan for various purposes.

6. The candidate will be able to analyze/synthesize factors that go into selection of actuarial assumptions.

7. The candidate will be able to analyze data for quality and appropriateness.

Learning Outcomes:

(6a) Evaluating actual experience, including comparisons to assumptions.

(6b) Adjust current assumptions, given past experience and future expectations in trends.

(6c) Evaluate appropriateness of current assumptions given the purpose.

(7a) Assess data quality.

(7b) Identify data needed.

(7c) Make appropriate assumptions where data cannot be provided.

Sources:

R-D130-09: ASOP 23 – Data Quality

R-D127-09: ASOP 6

Yamamoto Chapter 9

Commentary on Question:

In this question, candidates were asked to demonstrate that they understood and could identify the data elements required to prepare an actuarial valuation for a post retirement benefit plan and demonstrate their knowledge on data quality and the process for developing per capita claims cost experience for assumption purposes.

A well prepared candidate would be able to identify all required data for the valuation and for the per capita claims cost analysis.

1. Continued

The well prepared candidate would be able to outline how he/she would review the data to ensure its quality and appropriateness for a valuation. In addition, the well-prepared candidate would be able to outline the claims development process.

Solution:

(a) Identify the data elements needed to complete the January 1, 2013 actuarial valuation, including the development of the per capita claims cost assumption.

Commentary on Question:
This was a straightforward list-type question. Candidates generally did well on this section, as long as they noticed that the question was about the retiree health plan, and not the pension plan. For the first portion of part (a), credit was given for pension plan data elements listed, if they are also retiree health data elements. A good paper would have listed the important points – who data is needed for, the fact that the status of each participant is needed – in addition to listing the elements needed. For the second portion of part (a), the list we were expecting to see was sometimes embedded in the response to part (b), and credit was given in part (a) in that case. Here again, a good paper would have listed the important points – that actual claims and exposure data should be collected – in addition to listing the details of the claims/exposure to be collected (splits by age, gender, etc.)

The actuary should collect sufficient census data to make a reasonable estimate of the obligation:

- Need data on all current participants
- May need data on potential participants
- Status – active, retired, spouse, survivor of participant
- Age or date of birth
- Service or date of hire
- Gender
- Spouse date of birth
- Spouse gender
- Dependent date of birth
- Dependent gender

If pension data is provided, consider the appropriateness for use in the retiree health valuation, and make appropriate adjustments.

The actuary should collect sufficient data to calculate initial benefit costs for estimating the future health care obligations:

- Actual claims experience for the plan
- Exposure data
- Split by retiree vs. spouse vs. survivor

1. Continued

- Split by healthy vs. disabled
- Split by gender
- Split by age

(b) Describe the process and the considerations:

(i) To ensure data quality.

(ii) To determine the per capita claims cost assumption.

To ensure data quality, the actuary should consider:

- ASOP 23 Data Quality
- The scope of the assignment and the intended use of the data
- Is the data appropriate
- Is the data comprehensive
- Is the data reasonable and consistent
- Are there any material limitations of the data
- Cost and feasibility of obtaining additional data in a reasonable time frame
- Does the benefit gained from alternative data outweigh the time and/or cost to collect it

The actuary should document:

- Is the data of sufficient quality for the analysis
- The data requires enhancement before the analysis can be performed, and it is practical to wait for the enhancement
- Assumptions or adjustments can be made such that the data can be used
- If the data is so inadequate that the analysis cannot be performed
- The process followed to evaluate the data, including assumptions or adjustments made

The actuary should disclose the process followed when issuing communications about the analysis.

The process for determining the per capita claims cost assumption is;

- quantifying aggregate claims costs
  - Paid claims- usually get this
  - Incurred claims – best to use this
  - If incurred claims not available, may need to adjust paid claims
    - Simplified factor
    - Sophisticated lag analysis
- Quantifying a measure of exposure to risk (count of participants eligible for the plan during the claims period)

1. Continued

- Applying information from normative databases and/or premium rates if appropriate

To determine the per capita claims cost assumption, the actuary should consider:

- ASOP 6 Measuring Retiree Group Benefit Obligations
- Using multiple claims experience periods
- Credibility of plan experience
- Use of premium rates
- Impact of Medicare and other offsets
- Age-specific claims rates
- Adjustment for plan design changes

- Adjustment for administrative practices
- Adjustment for large individual claims
- Adjustment for trend
- Increases due to health care utilization, technology, or cost-shifting
- Use of different trends for hospital, professional, drugs, etc.
- Relationship of health care expenditures to GDP

The actuary should document the process followed with sufficient clarity for another qualified actuary to make an appraisal of the reasonableness of the work.

2. Learning Objectives:

8. The candidate will be able to evaluate the actuarial considerations in plan options and administration.

Sources:
"Embedded Options and Pension Plans" study note pp. 1-17

Commentary on Question:
In this question, candidates were asked to demonstrate their understanding of the features of embedded options in pension plans.

A well-prepared candidate would have been able to explain how the two categories of "embedded options" differ from one another, and articulate how the embedded options work under various types of retirement programs.

In addition, a successful candidate should be able to analyze (qualitatively and quantitatively) the financial implications of introducing an embedded option in a pension plan (e.g. introducing a post-retirement indexation minimum).

Solution:

(a) Describe the characteristics of the two (2) categories of pension plan embedded options.

Commentary on Question:
Candidates in general were able to answer this part properly and concisely. They needed to describe the key characteristics of the embedded options and it was not necessary to go into details about how to value them.

Category 1 Embedded Options:

- Key drive:
  - Options are driven primarily by employee behavior/election.
  - Economic factors may play a secondary role.
  - Economic factors are very difficult to isolate and their impact hard quantify (in terms of how they drive employee behavior).
  - Other factors may come into play (e.g. cultural norm, lifestyle, health conditions).
- What the options are:
  Category 1 options relate to options "granted" under specific terms of the plan.

2. Continued

Category 2 Embedded Options:

- Key drive:
  - Options are driven primarily by underlying economic variables, such as:
    - Interest rate
    - Market performance
    - Inflation rate

- What the options are:
  Category 2 options are either:
  - Entire plan types (e.g. in case of floor-offset plan); or
  - Distinct provisions of a plan which can be viewed as equivalent to options/derivatives that trade in capital markets. Behavior of these provisions can be replicated by options or other financial instruments.
- Misc:
  - Characterized by dynamics of "asymmetry."

(b) Describe the embedded options under each of the following retirement programs:

(i) A floor-offset plan.

(ii) A defined benefit pension plan with cost of living adjustments based on the change in the Consumer Price Index (CPI), with a floor of 1% and a cap of 6% per year.

(iii) A defined benefit pension plan with cost of living adjustments that provides pension increases if the prior year's rate of return on plan assets exceeds a "hurdle rate" of 8% per year.

Commentary on Question:
Most candidates managed to explain how each type of retirement programs worked. However, some failed to address how the embedded options work in the context of the types of plans specified. Again, it was not necessary to provide the details on how to value the options.

It was also valid to explain how the embedded options worked in terms of financial derivatives, in which case, the candidate should have specified the holder/underwriter of the option (whether it is the employer or the plan participant) and the financial variable in consideration (e.g. fund rate of return, inflation… etc).

2. Continued

(i) A floor-offset plan

- A floor-offset plan consists of a DB and a DC plan components.
- The DB plan acts as a floor (i.e. establish the minimum guaranteed pension).
- The DC plan acts as 'base plan.'
- Upon benefit payment:
  - If the DC balance provides a benefit that is greater than DB floor, the participant receives the full DC balance and no benefit is paid from the DB plan.
  - Otherwise, the participant receives the full DC balance and the DB plan makes up the difference.
- The cost of the embedded option is the value of the DB minimum guarantee in excess of the DC balance upon benefit payment.
- The investment return on the DC plan is solely driven by economic variables.
- When the DC plan underperforms, plan sponsor needs to make up the difference (i.e. additional cost is incurred). This could happen:
  - Under adverse economic/financial conditions
  - When the market performance is poor
  - When bad investment decisions are made

(ii) A DB plan with COLA dependent on the change in CPI, with a floor of 1% and a cap of 6%

- After retirement/termination, plan benefit increase (or cost living adjustment) is granted each year based on the change in CPI over the year.
- Each year, the pension increase cannot be lower than 1% and cannot exceed 6%.
- The applicable index (CPI) is driven by inflation and is dependent on the economic phenomena.
- Additional cost is incurred to the plan sponsor when the CPI change generates a benefit increase of less than 1%. In this case, the employer needs to make additional contribution to provide for a 1% benefit increase.
- There will be savings for the plan sponsor when the CPI change generates a benefit increase of more than 6%. The resulting cost to the sponsor is limited by the 6% cap.

2. Continued

(iii) A DB pension plan with COLA that provides pension increases if the prior year's rate of return on plan assets exceeds a 'hurdle rate' of 8%

- After retirement/termination, plan benefit increase (or cost of living adjustment) is each year if the plan rate of return is greater than a pre-specified rate of return (i.e. the hurdle rate) of 8%.
- If the plan rate of return is less than 8%, the increase for that year is 0. If the plan rate of return is more than 8%, the increase for that year is the return in excess of 8%.
- The plan rate of return is solely driven by the underlying economic climate.
- When the plan rate of return exceeds 8%, the plan sponsor shares the success with the plan participants. This could happen:
  - Under favorable economic/financial conditions.
  - Market performance is great.
  - When good investment decisions are made.
- The cost of embedded option is related to the actual rate of return on assets. Even if the long term expected return is less than 8% p.a., there will be years when the return exceeds 8%.
- To correctly capture the cost of the embedded option, there should be a value assigned to the conditional indexing to reflect the fact that the return in some years will be above 8%.

(c) Determine the additional cost to the employer of the embedded options as of January 1, 2012 for the plan.

Commentary on Question:
Candidates in general did very well in this part. A handful of candidates mistakenly determined the additional pension, not the additional cost, due to the embedded option.

- DB floor annual pension = 1% × final year's earnings × years of service
  - Employee A: DB floor annual pension = 1% × \$60,000 × 5 = \$3,000
  - Employee B: DB floor annual pension = 1% × \$90,000 × 20 = \$18,000
- Value of DB Pension = annual pension × $\ddot{a}_{65}^{(12)}$
  - Employee A: value of DB pension = \$3,000 × $\ddot{a}_{65}^{(12)}$ = \$3,000 × 15 = \$45,000
  - Employee B: value of DB pension = \$18,000 × $\ddot{a}_{65}^{(12)}$ = \$18,000 × 15 = \$270,000
- Cost of embedded option = Max(\$0,Value of DB floor - DC balance):
  - Employee A: cost = Max(\$0,\$45,000 - \$50,000) = \$0
  - Employee B: cost = Max(\$0,\$270,000 - \$185,000) = \$85,000
- Total cost to the Employer is sum of cost for each employee:

= \$0 + \$85,000 = <u>\$85,000</u>

2. Continued

Alternatively, candidates may answer the question by comparing the equivalent pension instead.

- DB floor annual pension = 1% × final year's earnings × years of service
  - Employee A: DB floor annual pension = 1% × \$60,000 × 5 = \$3,000
  - Employee B: DB floor annual pension = 1% × \$90,000 × 20 = \$18,000
- Actuarial equivalence of DC Pension = DC balance ÷ $\ddot{a}_{65}^{(12)}$
  - Employee A: equivalent DC pension = \$50,000 ÷ $\ddot{a}_{65}^{(12)}$ = \$50,000 ÷ 15 = \$3,333.33
  - Employee B: equivalent DC pension = \$185,000 ÷ $\ddot{a}_{65}^{(12)}$ = \$185,000 ÷ 15 = \$12,333.33
- Cost of embedded option = Max(\$0, DB floor - DC equivalent pension) ×$\ddot{a}_{65}^{(12)}$:
  - Employee A: cost = Max(\$0,\$3,000 - \$3,333.33) × $\ddot{a}_{65}^{(12)}$ = \$0 × 15 = \$0
  - Employee B: cost = Max(\$0,\$18,000 - \$12,333.33) × $\ddot{a}_{65}^{(12)}$ = \$5,666.67 × 15 = \$85,000
- Total cost to the employer is sum of cost for each employee:
  = \$0 + \$85,000 = <u>\$85,000</u>

(d) You are the actuary for a company that sponsors a defined benefit pension plan that provides annual post-retirement indexing of 50% of the increase in CPI during the previous calendar year.

For actuarial valuation purposes, the current CPI increase assumption is 2.5% per year.

During collective bargaining negotiations, the union requested amending the plan to provide minimum post-retirement indexing of 0.5% per year, arguing that there is no additional cost to the company.

Evaluate the union's argument.

Commentary on Question:
Most candidates correctly explained there were additional costs associated with the union's proposed minimum guarantee, however only few candidates reflected on the impact of the increased liabilities.

- There is real probability of additional cost to the company.
  There is cost associated with the proposed minimum guarantee in the years when CPI is less than 1%.
  No additional cost otherwise.
- This is because when CPI is less than 1%, the benefit increase is:
  - < 0.5% under the current plan

2. Continued

  - = 0.5% under the proposed plan (i.e. the increase is higher than under the current plan).
- During low inflationary period, the proposed guarantee will have the most value and create the most additional cost to the plan sponsor.
- The cost of the proposed guarantee will need to be captured when valuing the plan.
- Current valuation assumes a fixed CPI increase of 2.5% p.a. However, if a CPI assumption of more than 1% is used, the proposed guarantee will be shown to have no value (i.e. asymmetric effect).
  The 2.5% valuation assumption represents long term average expectation of CPI increase, which includes years higher than 2.5% and years lower than 2.5%.
- When the additional cost associated with the proposed guarantee is captured, the plan liabilities will increase. Hence:
  - From funding perspective, this plan change will increase the funding requirements.
  - For accounting, this plan change will:
    - Increase the PBO, and impact the funded status (reduce surplus or increase deficit)
    - Increase the pension expense
    - Impact the adjustment in retained earnings
    - Affect the balance sheet and company financials.
  - Cashflow implication: the actual benefit payments will be higher under the proposed plan in the years when CPI is less than 1% (see above).
- Misc:
  - Admin: This plan change adds to admin complexity. Costs more admin fees.

3. Learning Objectives:

6. The candidate will be able to analyze/synthesize factors that go into selection of actuarial assumptions.

Learning Outcomes:

(6a) Evaluating actual experience, including comparisons to assumptions.

(6c) Evaluate appropriateness of current assumptions given the purpose.

(6e) Describe and apply the building of economic assumptions.

(6f) Assess and explain the effect that the assumptions selected had on valuation results.

Sources:

Yamamoto Ch 9 pp 256 – 278

R-D112-10: 2009 Selection of Actuarial Assumptions, Mercer

R-D614-11: CSOP 3100-3500, December, 2010

R-D130-09: ASOP 23 – Data Quality

Commentary on Question:

This question is broken up into 4 parts. Part (a) of the question asks the candidate to demonstrate their understanding of the steps required in an experience study (Learning Outcome 6(a)). A well prepared candidate will be able to list the major steps in an experience study with some additional discussion on the data collection process.

Part (b) asks the candidate to demonstrate their understanding of important factors to consider while performing an experience study (Learning Outcome 6(a)). A well prepared candidate will discuss types of assumptions analyzed, data considerations, assumptions specific to subgroups, external factors that may impact the experience study, plan provisions, format of assumptions and credibility of results.

Part (c)asks the candidate to demonstrate their understanding how the three types of assumptions affect a pension valuation (Learning Outcome 6(f)). A well prepared candidate will be able to comment on how the assumption change impacts the pension liabilities on a going concern and solvency basis, as well as normal cost and gains and losses from the valuation. A well prepared candidate should also be able to give a brief summary of the quantitative impact on the liabilities from these assumption changes.

Part (d) asks the candidate to demonstrate their understanding how assumptions have different impact for a pension plan versus retiree medical plan (Learning Outcome 6(f)). A well prepared candidate should recognize and explain that termination and retirement scale has a bigger impact on retiree medical plans.

3. Continued

Solution:

(a) List the steps to perform an experience study for pension and retiree medical plans.

The steps to perform an experience study are as follows:

Step 1. Identify the assumptions to be reviewed
Step 2. Collect data
Determine time period to be reviewed
Determine which of data fields are required (salary, DOB, service etc)
Step 3. Review data for reasonableness and quality (ASOP 23)
Step 4. Compare actual experience versus assumptions
Step 5. Analyze results
Should analyze results in combination with liabilities gains/losses in past valuations
Should adjust for any special events during study period
Step 6. Present results and make recommendations as appropriate
May go back to client and request more data if original data provided not adequate

(b) Describe the considerations when performing an experience study for the following assumptions for NOC's defined benefit pension and retiree medical plans:

(i) Retirement
(ii) Turnover
(iii) Mortality
(iv) Trend rates

(i) Retirement

Considerations for when performing an experience study for the retirement assumptions are as follows:

- Amount of data required
  - Plan is relatively young but enough experience to be credible
- Types of retirement assumptions to be used
  - Current assumption is single age of 62
  - Single age versus table: if actual retirements are occurring at different ages, may be more appropriate to use table
- Consider using different retirement assumptions for different groups
  - Active members versus deferred vested members
    - Deferred vested members are entitled to actuarial equivalent benefits; different incentives to retire
  - Open group versus closed group

3. Continued

- Consider how plan provision may impact retirement assumptions
  - Early retirement subsidy may encourage early retirements
- Consider how special events may impact retirement assumptions
  - Were there any early retirement windows
  - Are any special events expected to continue into the future
- Consider how external factors may impact retirement assumptions (this point applies to all four assumptions)
  - Current economic conditions
  - Financial strengths of the company
- Consider how eligibility for retiree medical plan affect retirement
- Retirement assumptions have larger impact on retiree medical plan than pension plan
- Consider how Retirement assumptions is related to termination assumption
  - Typically retirements aren't assumed to occur till after termination rates end
- Consider how results of the experience study tie back to the gains/losses from the valuation results (this point applies to all four assumptions)

(ii) Turnover

Considerations for when performing an experience study for the retirement assumptions are as follows:

- Types of turnover assumptions to be used
  - Age based table or service based table
  - Select and ultimate table
- Consider using different turnover assumptions for different groups
  - Gender
  - Salaried versus hourly workers
- Consider how plan provision may impact turnover assumptions
  - Vesting provision: low turnover before vesting eligibility
- Consider how special events may impact turnover assumptions
  - Were there any workforce reductions and are any expected in the future

(iii) Mortality

Considerations for when performing an experience study for the mortality assumptions are as follows:

- Amount of data required
  - Plan does not have enough data to develop own table
  - Should use published table such as UP1994 or RP2000
- Adjustments to the published table
  - Mortality improvements: static table versus generational improvements

3. Continued

  - Collar adjustments: blue and white collar
- Consider using different retirement assumptions for different groups
  - Healthy lives versus disabled lives
  - Different mortality table for pre and post retirements
- Mortality assumptions have larger impact on retiree medical plan if there are benefits related to mortality such as life insurance benefits

(iv) Trend rates

Considerations for when performing an experience study for the trend assumptions are as follows:

- Only used for the retiree medical plan
- Consider how past conditions (medical advances) affected data used in the study
- Consider how future medical advances will affect assumption
- Types of assumptions to be used: select and ultimate

(c) Describe, in words, the impact of each assumption change to the January 1, 2012 pension valuation results for the Full-Time Salaried Pension Plan.

(i) Salary scale

- Increasing the salary scale assumptions for under age 35 would increase the going concern liability since it is valued using projected unit credit method.
- Increasing salary scale assumption would also increase the normal cost.
- There is no impact on the solvency liability .
- Members under age 35 would have less service therefore lower liabilities. Changing this assumption would have a small impact on the total liabilities.
- The percent increase to normal cost would be higher than the percent increase in total liabilities.
- Numerical example on impact on an individual's liabilities: e.g. for someone aged 30, increasing the salary scale from 4% to 6% for 5 years (till age 35) will be around 10%.
- If there were historical salary gain in past valuations, then the gain will be reduced for the next valuation by increasing the salary scale assumption.

(ii) Turnover

- Changing the turnover assumptions would lower the going concern liability and normal cost.
  - Some members will not reach vesting.

3. Continued

- Some members will not get to remain in plan till eligible for subsidized early retirement.
- Changing the turnover assumptions would have no impact on the solvency liability.
- If there were historical termination gains in past valuations, then the gain will be reduced for the next valuation.

(iii) Retirement

- Current assumption is 100% retirement at age 62 which is the unreduced age.
- Changing the assumed retirement age from 62 to 64 would lower the going concern liability.
  - Members are not taking advantage of the unreduced early retirement subsidy.
- Changing the retirement age would decrease normal cost for those under age 62.
- Change the retirement age would increase normal cost for those between age 62 and 64 (where previously normal cost for them was zero).
- Gains and losses from retirements do not occur until the earliest assumed retirement age. May not see impact of assumption change till later in the future.

(d) Describe, in words, the difference in sensitivity of the liabilities to the above assumption changes between the Full-Time Salaried Pension Plan and the Full-Time Salaried and Union Retiree Health Benefit Program.

(i) Salary scale

- The retiree medical plan benefits are unrelated to the salary assumption, therefore the liabilities for the retiree medical plan are not sensitive at all to the salary scale.

(ii) Turnover

- The liabilities of the retiree medical plan are much more sensitive to the turnover assumption.
  - Terminated members (vested) are still entitled to their benefits in a pension plan.
  - Members must reach 55&10 in order to receive benefits from the retiree medical plan; therefore if any members terminated before meeting those requirements would not get any benefits.

3. Continued

(iii) Retirement

- The liabilities of the retiree medical plan are much more sensitive to the retirement assumption.
- Retirees under age 65 receive a much bigger benefit (therefore higher liabilities) than retirees over age 65.
  - Retirees under age 65 receive benefits for longer period.
  - There is government carve-out in pre 65 retiree medical benefits (such as Medicare in the US).

4. Learning Objectives:

1. The candidate will be able to analyze different types of registered/qualified defined benefit and defined contribution plans, as well as retiree health plans.

8. The candidate will be able to evaluate the actuarial considerations in plan options and administration.

Sources:
RD-145-12: Legal and Research Summary Sheet: Phased Retirement, Georgetown Law

Commentary on Question:
In this question, candidates were asked to demonstrate their understanding of various types of phased retirement arrangements and how they would benefit the employee and employer and what challenges are faced under each arrangement.

A well prepared candidate will described employee benefits, employer benefits and employee/employer challenges for all three arrangements. The well prepared candidate will also demonstrated their understanding of the differences between the various phased retirement methods.

In general, candidates did poorly on this question. Candidates that performed the best on this question looked beyond just the pension plan implications of a phased retirement and were clearly familiar with the Georgetown Law: Legal and Research Summary Sheet on phased retirement from the syllabus material.

Solution:
Describe the benefits and the challenges of each arrangement from both the employees' and employer's perspective.

PARTICIPANT A: elected to commence partial pension payments and is continuing to work for your client on a part-time basis

Commentary on Participant A
On average, candidates scored best on their responses for Participant A. Most candidates identified that pension calculations could be complicated under this type of arrangement, that the employer would benefit from retaining an experienced employee and that there would be an administrative burden associated with this arrangement. However, only a small group of candidates identified some implications beyond the pension plan implications, such as the employee possibly being eligible for employer sponsored benefits and other legal implications.

4. Continued

Employee Benefits

- The employee can work less, while their lost employment income is replaced with partial retirement income.
- The employee may still be eligible for employer sponsored benefits, depending on the amount of reduction in their work schedule.

Employer Benefits

- Similar to participants B & C, the employer is retaining talent by continuing to employ the experienced employee and will continue to benefit from their expertise and knowledge without having any additional training expenses.
- The employer is also able to postpone searching for new talent.
- This arrangement gives the employer an opportunity to extend the labor force participation of their older workers.

Challenges for both employee and employer

- As this employee has retired under a phased retirement arrangement where they are receiving partial pension payments and are continuing to work, it will be more complicated to calculate this employee's final pension benefit when they choose to fully retire.
- The reduction in hours due to part-time employment status could impact accruals under the plan and could equate to a reduction in final pension for final average DB plans.
- The impact on spousal survivor benefits and early retirement subsidies must be considered. Any employer sponsored life and disability insurance based on compensation could be reduced.
- The reduction in hours due to part-time employment status could also impact the employee's eligibility for employer-sponsored health care and other employee benefit plans.
- The impact on eligibility for government sponsored benefits must also be considered. For example, Medicare as a Secondary Payor rules are unclear as to whether the employer sponsored health care plan or Medicare would be the primary plan for individuals over age 65, if the employee is eligible for retiree health care coverage instead of active health care coverage.
- One of the main legal issues relating to phased retirement is under what circumstances an individual may access pension or retirement funds to supplement part-time income. For example, current US tax laws do not permit a distribution from a pension plan before full termination, age 62 or reaching the plan's normal retirement age. Furthermore, employee elective deferrals under Code Section 401(k) may not be distributed before termination of employment or age 59 & 1/2.
- Employers may be exposed to potential lawsuits that result from a formal phased retirement program.
- Additional pension plan administrative burden and/or additional HR burden may result from a formal phased retirement program.

4. Continued

PARTICIPANT B: Elected to commence full pension payments and is continuing to work for your client on a full-time basis

Commentary on Responses for Participant B
Most candidates identified that the employer would benefit from retaining an experienced employee and that there would be administrative burden associated with this arrangement. However, only a small group of candidates identified that the employee would be eligible for the same employer sponsor benefits that are available to other full-time employees and there would be a possibility that the employee's pension benefits could be suspended while working full time.

Employee Benefits
- The employee is still eligible for all employee benefits available to other full-time employees.

Employer Benefits
- Similar to participants A & C, the employer is retaining talent by continuing to employ the experienced employee and will continue to benefit from their expertise and knowledge without having any additional training expenses.
- The employer is also able to postpone searching for new talent.
- This arrangement also gives the employer an opportunity to extend the labor force participation of their older workers.

Challenges for both employee and employer
- This is a less flexible phased retirement arrangement.
- It is possible that pension benefits may be suspended while working full time.
- If the employee is over age 65 then employer's active health care plan will be primary plan over Medicare
- Employers may be exposed to potential lawsuits that result from a formal phased retirement program
- Additional pension plan administrative burden and/or additional HR burden may result from a formal phased retirement program.

PARTICIPANT C: Elected to commence full pension payments and has been hired by your client as an independent contractor.

Commentary on responses for Participant C
Most candidates identified that the employer would benefit from retaining an experienced employee and that there would be administrative burden associated with this arrangement. However, only a small group of candidates identified that the employee's pension benefit would most likely not be suspended, that the employee has to deal with their own employment taxes and that the employer has the luxury of retaining the employee on a "need-to-have basis."

4. Continued

Employee Benefits

- Employee's pension benefit is most likely not suspended due to contract employment status

Employer Benefits

- Similar to participants A & B, the employer is retaining talent by continuing to employ the experienced employee and will continue to benefit from their expertise and knowledge without having any additional training expenses.
- The employer is also able to postpone searching for new talent.
- This arrangement also gives the employer an opportunity to extend the labor force participation of their older workers.
- Employer is not responsible for employee's employment taxes due to contract employment status.
- Able to retain employee talent and experience on a "need-to-have" basis (also have the flexibility to negotiate terms of a contract).

Challenges for both employee and employer

- Employee is not eligible for employer sponsored benefits due to contract employment status.
- Employee is responsible for all employment taxes.
- Tax laws may be unclear. For example, it may be unclear as to when or whether such arrangement is a termination of employment for purposes of receiving a pension or retirement benefit.
- Health coverage may not be bridged until Medicare eligibility.
- Must meet certain requirements to be considered an independent contractor and not an employee.
- Employers may be exposed to potential lawsuits that result from a formal phased retirement program.
- Additional pension plan administrative burden and/or additional HR burden may result from a formal phased retirement program.

5. Learning Objectives:

2. The candidate will be able to understand how the regulatory environment affects plan design and understand how to apply relevant restrictions.

5. The candidate will be able to apply/synthesize the various methods used to value a pension plan or retiree health plan for various purposes.

9. The candidate will be able to understand principles and rationale behind regulation.

Learning Outcomes:

(2a) Explain and apply the regulatory limits placed on types of plans that can be offered.

(5a) Differentiate between the various purposes for valuing pension plans:
- (i) Budgeting
- (ii) Funding
- (iii) Accounting
- (iv) Solvency
- (v) Termination/wind up
- (vi) Economic value

(9b) Describe the principles and motivations behind legislated restrictions.

Sources:

The Impact of the Financial Crisis on Defined Benefit Plans and the Need for Counter-Cyclical Funding Regulations, OECD B

Commentary on Question:

In this question, candidates were asked to demonstrate their knowledge of OECD country responses to the recent financial crisis and OECD recommendations for counter-cyclical funding regulations.

A well prepared candidate was expected to know strategies used by OECD countries in the recent financial crisis and describe how three OECD counter-cyclical regulatory concepts affect sustainability and security of defined benefit plans.

Solution:

(a) Identify four temporary regulatory changes Organization for Economic Co-operation and Development (OECD) countries have used to address defined benefit funding challenges as a result of recent financial crises. References to specific countries are not required.

5. Continued

Commentary on Question:
For part (a), many candidates identified an increase in the amortization period, but relatively few candidates identified the many other changes described in the OECD study note. No credit was given for recent US regulatory changes that were not described in a syllabus reading.

(1) Increased recovery period from 5 to 10 years for federally regulated plans; several provinces extended similar relief.

(2) Temporarily lifted requirement to use market interest rates to compute pension liabilities; also submit quarterly reports instead of supervisory traffic light.

(3) Secured solvency requirements without forced sales of securities in weak market.

(4) Gave additional time to prepare funding proposals and longer recovery periods; plus voluntary employer guarantees in approving funding proposals.

(b) For the following three (3) counter-cyclical regulatory concepts, describe how each improves both the sustainability and security of defined benefit plans in the future:

(i) Avoid excessive reliance on current market values for purposes of determining contributions (i.e. permit smoothing techniques).

Commentary on Question:
Part (b)(i) responses focused more on sustainability than security.

Sustainability
Smoothing discount rates reduces volatility and maintains predictability, improving sustainability of DB plans in future.

Market discount rate for liabilities increases volatility of contributions.

Security
This reduction in volatility from smoothing discount rates also improves security of DB plans in future.

Use smoothed rates to avoid rush changes in funding and investment strategies that may be counterproductive in the long run.

5. Continued

Basing contributions on day-day market fluctuations is counterproductive for 3 pension funding goals - long term viability, stability and security.

However, smoothing has limitations. If smoothing period is too long, minimum contributions can be too low, which led to significant US plan terminations.

(ii) Allow appropriate levels of over-funding in good economic times via more flexible tax ceilings.

Commentary on Question:
For part (b)(ii), many candidate responses described the buffer shown in the model solution below, but relatively few other responses based on a syllabus reading were received.

Sustainability
Can act as buffer in bad times when liabilities rise due to lower discount rates and asset values plunge.

Maximum contribution ceilings can be smoothed over several years to allow greater management of cash flows by the plan sponsor.

Security
Increased funding levels directly increase DB plan security.

Governments should consider raising maximum level of surplus before contributions must be suspended.

Can also introduce smoothing into maximum limit, e.g. by setting maximum equal to specified % above smoothed minimum funding requirement.

Can leave surplus in fund to build contingency reserve to offset future experience losses, subject to limits.

(iii) Flexible funding rules that reflect overall volatility of funding valuations.

Commentary on Question:
Part (b)(iii) responses also focused more on sustainability than security.

5. Continued

Sustainability
Recovery periods to eliminate DB funding deficits should reflect overall volatility of funding levels, which improves sustainability.

Should structure funding rules to not put undue pressure on plan sponsors when their profitability/continuity is in jeopardy.

Use longer recovery period if little smoothing in computing funding level, or shorter period if smoothing is used.

Security
Flexibility in funding rules can be complemented with other enhancements to member security, e.g. insurance against plan sponsor bankruptcy or giving plan members priority creditor status.

Contingent assets can be used - these transfer from the sponsor to the scheme under certain conditions.

Canada permits letters of credit up to 15% of plan assets and employers would not be required to remit cash amounts to the fund.

6. Learning Objectives:

1. The candidate will be able to analyze different types of registered/qualified defined benefit and defined contribution plans, as well as retiree health plans.

10. The candidate will be able to analyze the relationship of plan investments with plan design and valuations.

Learning Outcomes:

(1d) Given a plan type, explain the relevance and range of plan features including the following:
- (i) Plan eligibility requirements
- (ii) Benefit eligibility requirements, accrual, vest and phased retirement
- (iii) Benefit/contribution formula
- (iv) Payment options and associated adjustments to the amount of benefit
- (v) Ancillary benefits
- (vi) Benefit subsidies and their value, vested or non-vested
- (vii) Participant investment options
- (viii) Required and optional employee contributions
- (ix) Phased retirement and DROP plans

(10a) Evaluate the interaction of plan investments and:
- Plan design,
- Plan funding,
- Valuation assumptions, and
- Valuation methods.

Sources:

Green DB Vanguard Note

McGill Chapter 10 and Chapter 12

Allen Chapter 21

MS JACF Risk Allocation Note

Commentary on Question:

In this question, candidates were asked to demonstrate methods and design to reduce pension cost volatility, other than freezing pension plans. A well prepared candidate addressed alternative designs such as a Retirement Shares Plan and articulated ways to reduce volatility from a plan design perspective.

6. Continued

Solution:

(a) Describe how eliminating the following current plan provisions could help achieve the CFOs objectives:

(i) Lump sums.

(ii) Early retirement.

(i) Lump sums *[Most candidates got credit for the first 4 bullet points which state what effect lump sum volatility have on a plan, but did offer alternative solutions like "Applying dollar limit" below nor what effect lump sums have on the benefits that can be offered]*

- Lump sums can cause benefit volatility (not predictable)
- Cash flow volatility limits investment options
- Lump sums may decrease funded status
- Lump sums may increase funding requirements
- Apply dollar limit to lump sum payments
- Lump sums reduces amount of retirement income a plan can provide to others
- Mandatory annuities allow more benefit to be paid out of the plan

(ii) Early retirement *[Most candidates received points for 2nd and 3rd bullets below. Candidates missed opportunity to discuss how early retirement affects employer's operations]*

- Ideal age for retirement may change and may need experienced employees longer
  - Demographic changes
- Early retirement provisions add uncertainty to costs
- Restrict early retirement subsidy
- Volatility arises from uncertainty of the period over which payments will be made
- Plan may not benefit from participants dying before benefit begins (survivorship)
- Work force management issues

(b) The CFO's concern about volatility relate to the following risks:

- Investment;
- Interest rate; and
- Longevity.

6. Continued

Explain how the design features of each of the following two defined benefit pension plans could address each of the above risks:

(i) Retirement Shares Plan (RSP).

(ii) Cash balance plan.

(i) Retirement Shares Plan (RSP) *[Most candidates got most of the points below related to RSPs]*

- Investment Risk
  - For funding purposes, plan is assumed to earn share interest rate (SIR)
  - If actual asset return is lower or exceeds SIR, benefits are adjusted higher or lower
  - This transfers investment risk and reward to employees
- Interest Rate Risk
  - Since benefits linked to asset performance, there is direct match of assets and liabilities
  - Change in interest rates will not produce unfunded liabilities or surpluses
- Longevity Risk
  - RSP provides monthly benefit like a traditional DB plan
    - Thus plan retains longevity risk
  - Demographic changes do not produce volatility like interest rate and investment return experience
  - Sponsors can more easily manage demographic risk

(ii) Cash Balance Plan *[Candidates missed opportunity to discuss how mitigate investment risk and interest rate risk, such as tying interest crediting rate with investment return in the trust, or possibly immunizing liabilities or tying discount rate to interest crediting rate]*

- Investment Risk
  - Assets return less/more than expected – contributions are greater/less than expected
  - Typical cash balance plan will have investment risk since final cash balance is a defined benefit
    - Unless the interest crediting rate is tied to the investment return in the pension trust
  - Cash balance plan has a shorter payment duration
- Interest Rate Risk
  - Discount rate below interest crediting rate results in liability that is more than the account balance
  - Interest rate changes can cause volatility in required contributions

6. Continued

- Can reduce volatility by tying the discount rate to the interest crediting rate
- Invest in fixed income assets that match the duration of the plan (immunize)

- Longevity Risk
  - Cash balance plan typically pays in a lump sum form
    - Thus longevity risk is eliminated

7. Learning Objectives:

3. The candidate will be able to analyze plans designed for executives or the highly paid

Learning Outcomes:

(3a) Given a specific context, apply principles and features of executive deferred compensation retirement plans.

(3b) Given a specific context, apply principles and features of supplemental retirement plans

Sources:

Morneau Sobeco Chapter 11 page 267-273

Allen Chapter 14 page 253-259

Commentary on Question:

In this question, candidates were asked to demonstrate their knowledge on:

(a) How a Restoration Plan and a plan that provides a fixed percentage of final pay at retirement can help the client achieve the objectives of cost containment, benefit adequacy and attraction/retention.

(b) Calculate the replacement ratio for each member from two different plan designs.

(c) Evaluate each plan design from part (b) based on the client's objectives.

A well prepared U.S. candidate would compare and contrast the similarities and differences between a pure Restoration Plan versus a target benefit plan based on the final average pay from the perspective of cost containment, benefit adequacy and attraction/retention in part (a), calculate the ratios properly in part (b) and analyze them in part (c).

Solution:

(a) Compare and contrast how the following two Supplemental Executive Retirement Plan (SERP) designs could address your client's objectives in cost containment, benefit adequacy and attraction/retention:
(i) A plan that restores benefits above government limits.
(ii) A plan that provides a fixed percentage of final pay at retirement.

Commentary on Question:

Candidates generally did well on this section.

7. Continued

1. Cost Consideration – Restoration Plan
A Restoration Plan could have higher costs since it covers the entire employee group. Cost containment would depend on the salary level of the employee group. Profile and demographics of the plan participants also affects cost. If a plan has lots of middle management who are over the IRS limits with regularity, it may increase costs of the Restoration Plan.

2. Cost Consideration – SERP
A plan that provides a fixed percentage of final pay at retirement (SERP) has more flexibility in its plan design. Plan sponsor can define a narrower eligibility group to limit the number of participants (e.g., top executives), this will lower the cost.

The costs will depend on the generosity of the SERP design, as well as the underlying DB plan. If the SERP design is very generous and the offsetting underlying DB Plan's provisions are less generous, this will also increase the SERP cost. Sponsors need to bear this in mind when designing the provisions of the true SERP plan

Profile and demographics of the participants of the Plan also affects cost - executive heavy organization will show a greater cost in a true SERP which are typically more expensive than regular excess plan.

3. Benefit Adequacy – Restoration Plan
Will be directly related to the adequacy of the underlying qualified plan.

4. Benefit Adequacy – SERP Plan
In general, the plan provisions in the SERP Plan are very flexible in designing a plan that provides rich provisions. Some of the available measures are:

- Different pay definition, such as including incentive/variable pay
- Higher accrual percentage
- Shorter average period for final average earning plans
- Offer more generous early retirement subsidies
- Offer more generous pension form subsidy, such as Normal Form of Pension = 100JS
- Offer multiple years of credited service for each year of employment

5. Retention/Attraction – Restoration Plan
In general, Restoration Plan would have similar impact as those of the underlying DB plan in attracting/retaining employees.

7. Continued

6. Retention/Attraction – SERP Plan
Due to its flexibility in plan design, SERP plan can be designed to target specific retention/attraction needs of an organization, some of the measures are:

- Implement more strict or cliff vesting/eligibility requirement to retain top executives
- Recognize service with a prior employer to encourage mid-career recruiting
- Non-compete provision in vesting requirement to discourage top-talent turnover to competitors
- Provide richer pension benefits accrual to attract mid-career recruiting

(b) Calculate the replacement ratio at their Normal Retirement Age assuming they are fully vested.

Commentary on Question:
This was a calculation question and most candidates did well on this section. Some of the common mistakes made are:

- Calculated the wrong final average earnings (earnings needed to be increased by one year's salary scale to be current).
- In calculating the replacement ratio for member A and B, candidates were not consistent in the final salary (whether to include bonus or not). Replacement ratios need to be consistent in order to be comparable.

Earnings calculations were not strictly required to find the replacement ratios. However, they have been included since all candidates used them.

1. Member A

Base Salary for the period of Jan 1, 2012 to Dec 31, 2012 (age 55) = $500,000 x 1.05 = $525, 000

Member's NRD is age 62, to calculate the final average earnings, need salary at ages 59, 60 and 61
Base Salary for age 59 = $525,000 x 1.05 ^ 4 = $638,141
Base Salary for age 60 = $525,000 x 1.05 ^ 5 = $670,048
Base Salary for age 61 = $525,000 x 1.05 ^ 6 = $703,550

Final average earnings (FAE) at age 62 = (salary at age 59 + salary at age 60 + salary at age 61)/3 = ($638,141 + $670,048 + $703,550)/3
= $670,580

Credited service accrued at age 62 = 8 + (62-55) = 15

Accrued pension at age 62 = 4% x FAE x min (10, 15) + 7% x FAE x max (15-10, 0) = $502,935

7. Continued

Replacement Ratio at age 62 = accrued pension at age 62/ total salary at age 61
= $502,935/($703,550 x 1.2)
= 60%

2. Member B

Base Salary for the period of Jan 1, 2012 to Dec 31, 2012 (age 50) = $250,000 x 1.04 = $260, 000
Total Salary (with bonus) at age 50 = $260,000 x 1.01 = $286, 000

Member's NRD is age 65, to calculate the final average earnings, need total salary at ages 60 to 64
Total Salary (incl. bonus) for age 60 = $286,000 x 1.04 ^ 10 = $423,350
Total Salary (incl. bonus) for age 61 = $525,000 x 1.04 ^ 11 = $440,284
Total Salary (incl. bonus) for age 62 = $525,000 x 1.04 ^ 12 = $457,895
Total Salary (incl. bonus) for age 63 = $525,000 x 1.04 ^ 13 = $476,211
Total Salary (incl. bonus) for age 64 = $525,000 x 1.04 ^ 14 = $495,259

Final average earnings (FAE) at age 65 = (sum of salary from age 60 to 64)/5
= ($423,350+$440,284+$457,895+$476,211+$495,259)/5
= $458,600

Credited service accrued at age 65 = 12 + (65-50) = 27

Accrued pension at age 65 = 2% x FAE5 x = $247,644

Replacement Ratio at age 65 = accrued pension at age 65/ total salary at age 64
= $247,644/$495,259
= 50%

(c) Evaluate each plan design in (b) based on your client's objectives of cost containment, benefit adequacy and attraction/retention.

Commentary on Question (c):
Candidates generally did well on this section.

1. Cost Consideration
   - Plan A has an overall generous plan design, thus may be more costly than Plan B, even though plan B has a more generous pensionable earnings definition.
   - Plan A has very generous accrual rate which is more than the 2% maximum accrual rate for a RPP.
   - Plan A has an earlier Normal Retirement Date than Plan B, so Plan A has a longer payout period and higher early retirement subsidies, which makes the plan more costly.

7. Continued

- Plan A has a shorter averaging period for final average earnings, which generally leads to a higher FAE, which leads to a higher benefit accrual/cost.
- Plan B has a more generous pensionable earnings definition - for any member who has a significant bonus pay, Plan B will be more costly.

2. Benefit Adequacy
   - Plan A has more generous plan provisions, thus Plan A would offer better pension benefits to members.
   - In the calculation in part (b), Plan A offers higher replacement ratio than B.
   - However if bonus represents a significant portion of the total pay, Plan A may not provide adequate replacement ratio.

3. Attraction/Retention
   - Plan A has more generous plan provisions, thus it provides more incentive to retain and attract employees, especially the accrual rate jumps to 7% after 10 years of service.
   - Plan A is especially more attractive to older employees who may have a shorter further service time to retirement. Plan A offers faster benefit accrual for such members. (i.e. appealing to mid-career hires).
   - Plan B includes bonus in its pensionable earnings definition. Plan B is more attractive for employees who have a significant portion of total pay as variable pay.

8. Learning Objectives:

6. The candidate will be able to analyze/synthesize the factors that go into selection of actuarial assumptions.

Learning Outcomes:

(6c) Evaluate appropriateness of current assumptions given the purpose

Sources:

RD -114 – 07 Introduction to duration for pension actuaries

Commentary on Question:

In this question, a well prepared candidate would have calculated the duration properly, estimated the revised liability for a change in discount rate and understood the limitations of duration to estimate the liability.

There were three possible ways to arrive at the correct duration for part (a). The first possible method is to use first principles and solve for the negative of the first derivative of the liability with respect to the interest rate divided by the liability. The second and simpler way to approximate the duration is to determine the liability at interest rate (i + 0.0001). The third possible method is to use the Modified duration formula.

A summary of the differences between Macaulay and modified duration from Wikipedia: Note that the Macaulay duration formula calculates the weighted average maturity of cash flows. Macaulay duration and modified duration are both termed "duration" and have the same (or close to the same) numerical value, but it is important to keep in mind the conceptual distinctions between them. Macaulay duration is a time measure with units in years, and really makes sense only for an instrument with fixed cash flows.

Modified duration, on the other hand, is a derivative (rate of change) or price sensitivity and measures the percentage rate of change of price with respect to yield. The concept of modified duration can be applied to interest-rate sensitive instruments with non-fixed cash flows, and can thus be applied to a wider range of instruments than can Macaulay duration. From a pension actuaries' perspective, the modified duration is almost always used in day to day practice and the first principles definition is what is shown on the syllabus. Candidates were not given full marks if they used the Macaulay duration.

Part (b) was relatively well done, but many candidates did not show their work.

For part (c), many candidates stated that duration would not be appropriate for estimating a liability with a large change in rates. The study note states that duration is more accurate for small changes in interest rates, but is silent on its accuracy for larger changes in rates. There could be instances where duration is used as a back of the envelope check on actual liabilities. In this case, duration could be an appropriate way of estimating the liability but should be used with a high degree of uncertainty.

8. Continued

Solution:

(a) Calculate the duration. Show all work.

The duration of a liability is the negative of the first derivative of the liability with respect to change in the assumed interest rate, divided by the liability.
An appropriate approximation is to compare the present value with the present value calculated at i + 0.01%.

Present Value =
200 X (1.01)^-5 + 300 X (1.02)^-9 + 500 X (1.03)^-12 + 600 X (1.04)^-16 = 1,112.355
Present Value i + 0.01% =
200 X (1.0101)^-5 +300 X (1.0201)^-9 + 500 X (1.0301)^-12 + 600 X (1.0401)^-16 = 1,111.138
Duration = -(Change in PV/change in DR)/PV
= -((1,111.138 – 1,112.355)/0.0001)/1,112.355
= 10.94

(b) A pension plan has a liability of $100,000,000 with a duration of 8. Calculate the estimated liability after a 50 basis points increase in the discount rate, using duration techniques.

The change in liability is inversely proportional to the duration times change in interest rate
Estimated change in liability = -100,000,000 x 8 x 0.005 = -4,000,000
Estimated liability = 100,000,000 – 4,000,000 = 96,000,000

(c) Discuss the appropriateness of estimating the revised liability, using duration for a 200 basis point change in the discount rate.

Duration is only an approximation and is more accurate for small changes in the discount rate. However, duration may still be appropriate if used as a back of the envelope check, but should be used with a high degree of uncertainty. Other issues with duration are that interest rates do not change continuously, but in increments of 10 and 25 bps; and duration does not capture convexity. The actuary should also consider the extent to which other variables used in the calculation of the liability are assumed to change as the interest rate changes. (i.e. salary scale, or lump sum).