

DP-RU & DP-RC, A Illustrative Solutions

Fall 2007

All Solutions apply to both the United States and Canada unless specifically stated

1.

Solution:

(a)

Possible objectives of an Asset / Liability study:

- Design a portfolio whose performance would serve to:
- Minimize cash contributions
- Minimize volatility of the funding surplus
- Allow for preservation of surplus

(b)

Characteristics

Should consider characteristics of:

Plan sponsor (NOC), the Hourly Plan, and NOC's industry when preparing asset / liability study, including:

- Sponsors tolerance for volatile pension costs given their profit margins
- Demographics of hourly plan population (active and inactive)
- Young workforce, few inactives – plan may be able to take on additional risk
- Actives hold 80% of plan liability – indicates longer term investment horizon
- Sponsors funding policy
 - Where does NOC contribute between the minimum and maximum allowable amounts
- Hourly Plan Provisions (features of the plan)
 - Liquidity requirements due to lump sums paid upon vested termination
 - NOC offers post retirement indexing – retirement benefits are tied to inflation
 - Indexing extends liability durations
- Cyclical nature of the industry may affect the investment strategy
- Is there a chance plan may be wound-up?
- Funded status of hourly plan may influence investment strategy

1. continued

(c)

Development of economic assumptions needed for asset/liability study

Split between asset (capital market) assumptions and liability assumptions

Asset Assumptions

- Need Expected return for each asset class
- Need variance/covariance matrix for asset classes under consideration
- Need capital market simulator for asset classes and other economic variables if doing stochastic study

Liability Assumptions

- Consider difference between valuation assumptions and projection assumptions
- Valuation assumptions are long term estimates
- Projection assumptions used to project results from one year to the next (plan experience)
- Need assumption for inflation
- Inflation assumption underlies other economic assumptions
- Inflation also important because of post retirement indexing in plan
- Need liability discount rate assumption
- View discount rate as rate of inflation plus real rate of return
- Should determine sensitivities of liability results to changes in assumptions

2. United States

Solution:

(a)

The SOA Code of Conduct

- Standards of Practice
 - Follow the applicable standards of practice – for demographic assumptions, this is ASOP 35.

ASOP 35

- Selection of Demographic and Other Noneconomic Assumptions
- Assumptions should meet standard individually, be consistent with the other assumptions and have a combined effect that is reasonable
- Should consider the following when selecting assumptions:
 - Purpose of measurement
 - Materiality of the assumption
 - Characteristic of the obligation
 - Characteristics of the covered group
 - Plan provisions that can have an effect on benefit timing
 - Contingent benefit amounts

Communication and Disclosure

- Assumptions used
- Changes in assumption
- Changes in circumstances
- Prescribed assumption
- Prescribed statement of actuarial opinions
- Deviations from standard

ASOP 27 (Selection of Economic Assumptions)

(b)

Retirement Assumptions

- Should be set considering early retirement options, social programs, and other ER benefits post retirement
- Flat rate is being used – should be moved to a table of rates
- Plan is running gains from retirement – gains getting larger – suggests that EEs are not retiring at 62 but tend to retire later

2. (b) continued – United States

Turnover

- Should determine based on industry, hazard level, work environment, and consider vesting provisions, early retirement and payment options.
- Again, significant gains on termination
- Gains from termination means more EEs are terminating than expected
- Table is based on NOC experience from 2 years in 86-88
- Very old – should be updated for the that today’s workforce is more mobile
- Make sure it should be a select and ultimate Table

Mortality

- Can use different pre-post mortality tables
- Different mortality for different groups and disabled lives
- Should consider mortality table improvements
- NOC is using 1983 GAM unisex mortality
- Consider Projection Scale AA
- Mortality is old, but they are running gains, which means people are dying faster than expected.
- Consider an updated pre-retirement mortality table like RP-2000 and the use of an older table for retired participants.
- Make sure unisex table is appropriate for population
- Consider blue collar versus white collar
- Optional form assumption – only 1 option
- Life if single or 60% S+S if married – so need no utilization assumption
- 80% married with three year differential is reasonable
- Expenses (Assume paid by company)
- There is a disability benefit but no disability table or disability mortality table
- Disability incidence depends on:
 - Level of benefits
 - Comp level
 - Hazardous conditions
 - Disability benefit
 - Plan administration
 - Demographics
- Disability mortality – for simplification – can use a multiplier of healthy mortality table
- Small group likely affected, so a recovery rate is not likely to be material.

2. Canada

Solution:

(a)

Discount rate

- By decreasing the discount rate the liabilities will increase
- The magnitude of the increase in liabilities depends on the duration of liabilities
- The building-block method for setting discount rate
 - Inflation
 - Risk free rate of return
 - Risk premium for each asset class
 - Margin for conservatism
- The expected return for each asset class will be the sum of inflation, risk free return and risk premium for that asset class
- The overall expected investment return will equal a weighted average of the individual expected returns for each asset class

Factors to consider when deciding on the degree of conservatism:

- The investment policy of the pension fund and the asset valuation method
- The characteristics of the liabilities
- Expenses paid from the fund

Mortality

- By replacing the GAM 83 table with any of the following 2 tables the liabilities will increase:
 1. UP94 static projected to 2015 with projection scale AA (this is the prescribed table to be used when calculating commuted values in Canada)
 2. UP94 generational
 3. RP2000
- The increase will be higher for males

Factors to consider when selecting the mortality table:

- Appropriateness of different tables before and after retirement
- Provisions for future mortality improvements
- Different assumptions for disabled lives

2. (a) continued - Canada

Retirement Age

- By reducing the retirement age assumption the liabilities will increase because the Salaried Plan has subsidized early retirement
- Currently a single assumed retirement age is used
- Better actuarial practice would be to use a retirement table
- There are no published standard retirement tables
- Selection of retirement rates can be based upon an analysis of historical plan experience (if relevant for the future) or an estimate of future retirement patterns (usually selected in conjunction with the plan sponsor).

Factors to consider when selecting the retirement age assumption:

- Plan design
- Availability of government benefits coverage (CPP, OAS)
- Availability of retiree medical benefits offered by the employer
- Early retirement windows
- Reductions in work force
- Financial strength of the company
- General health of the economy

Salary Scale

- By using a higher salary increase assumption the liabilities will increase because the actuarial cost method used to calculate the Salaried Plan liabilities is the Projected Unit Credit method.
- The building-block method for setting salary scale
 - Inflation
 - Productivity growth (the real general wage increase for the entire economy adjusted for industry, regional, employer specific factors)
 - Aging / merit
- The compensation increases for most employers have a strong age-based component
- Using a flat rate for the aging / merit component often skews results. To avoid this situation, an age based salary increase table can be used. The inflation component should be the same as the one used in the discount rate.

(b)

CIA, Rules of Professional Conduct

A member shall ensure that professional services performed by or under the direction of the member meet applicable standards of practice

2. (b) continued - Canada

CIA Consolidated Standards of Practice (CSOP)

- *General Section – Assumptions*
 - The assumptions should in the aggregate be appropriate
 - An appropriate assumption is a best estimate assumption modified to make provisions for adverse deviations
 - Provisions for adverse deviations should not be included if the related work requires an unbiased calculation
 - A provision for adverse deviations in a calculation is a bias which may affect two conflicting interests (in this case NOC and CRA, shareholders). The actuary needs to strike a balance.
 - A provision for adverse deviations would not exceed the amount needed to fully offset the effect of adverse deviations which are plausible in usual operations.
 - The actuary should select each needed assumption except for those which are stipulated by the terms of the engagement. If the actuary does not take responsibility for an assumption the actuary should so report

- *Pension Plans Section – Assumptions*
 - Use a salary scale assumption for going-concern valuations of plans having an earnings-related formula
 - Assumptions used to value the liabilities should be consistent with the asset valuation method selected
 - Make provisions for any expenses that are expected to be paid from the plan's assets

- *Statement of Principles on Revised Actuarial Standards of Practice for Reporting on Pension Plan Funding*
 - In general, each actuarial assumption should be independently reasonable
 - “Independently reasonable” means that the assumption is a best-estimate assumption or differs from a best-estimate assumption by an appropriate margin for adverse deviation
 - However, an assumption that is not independently reasonable may be used if:
 - The assumption is prescribed by law
 - The assumption has no material impact on the results of the work
 - The assumption is an appropriate approximation
 - The assumption is a model assumption that reasonably represents reality

2. (b) continued - Canada

- *The actuary is responsible for all aspects of his or her work and performs it in accordance with accepted actuarial practice*
- *The actuary shall act honestly, with integrity and competence, and in a manner to fulfill the profession's responsibility to the public and to uphold the reputation of the actuarial profession*
 - The actuary should not use unreasonable assumptions to obtain the results desired by the client. Doing so would harm the reputation of the actuarial profession.
 - In NOC's case, the actuary has a responsibility not only to the plan members (who will benefit if NOC resumes contributions) but also to NOC's shareholders (who may prefer that the funds are invested to grow the business) and the government (who relies on the actuary to determine a reasonable level of tax-sheltered contributions).
- *It is the professional responsibility of the member not to be associated with anything which the member knows or should know is false or misleading*
 - In this case, using excessive margins for adverse deviations when setting the assumptions will be misleading
 - The 1.1.2007 valuation shows gains on investments, salary, mortality and retirement. This leaves little room to make the current assumptions more conservative

3. Canada

Solution:

(a)

Salaried Plan Only

Information Required for Funding Valuation

1. Membership data
2. Asset data
3. Plan provisions / including future amendments
4. Prior valuation report
(Includes prior assumptions, methods, etc.)
5. Other info

1. Membership data

- Can be provided by plan administrator (either third party or sponsor)
- If third party may require additional information from plan sponsor
- Required info:

a. Active members

- Age or date of birth
- Date of hire or continuous (eligibility or membership) service
- Credited service (pensionable service)
- Earnings history (basic pay only)
 - Require at least last 60 months
 - May use all of historical if readily available
 - Indication if it is annualized or not
 - Indicator if disabled
- May also require prior valuation data for reconciliation and to also verify consistency and reasonableness of data
- Indication as to the level of checks and audit of the data that is already done
- Any possible issues with the data.

b. Deferred members

- Date of birth
- Accrued pension
- Normal retirement date
- Date of termination

3. (a) continued - Canada

c. Retirees / Beneficiaries

- Date of birth
- Date of retirement
- Pension in pay
- Form of pension (life only or J/S 60%)
- Spouse date of birth if applicable
- Retiree/Spouse status (deceased or not)

2. Asset data

- May come from the trustee or plan sponsor or both
- Should include Market Value at valuation data
- Should have reconciliation from prior year valuation
- Require cash flow data
- Also receive asset portfolio mix from sponsor/trustee or investment manager
- May also want the target asset mix or a copy of the statement of Investment Policies
- Asks for outstanding amounts
- Also require prior actuarial value of assets and how it was developed
- This may come from the prior value report or the plan sponsor

3. Plan Provisions

- From the plan sponsor, generally in the form of the plan ext
- Also should be in prior value report

4. Prior Valuation Report

- From plan sponsor or prior actuary (firm)
- Should include all relevant information such as assumptions, data summaries, assets / liabilities, etc.
- Required for gains/loss analysis and other reconciliations

5. Other miscellaneous info as required

- From prior actuary (firm)
- Required to cooperate under standards of practice
- Plan sponsor may assist

3. continued - Canada

(b)

Quality Checks:

Membership Data

- Based on level of checks done by the provider
- Required to assure data is reasonable and relevant for the valuation purposes
- Not required to audit the data, however may be included in the scope of work
- Assuming data is audited by client and is clean I would:
 - Verify DOB's and DOH's are reasonable
 - Ie: ages and SVC are within limits (nobody under 18 or over 70, etc.)
 - Compare increases in earnings
 - Identify significant changes
 - Verify average age is reasonable compared to prior year (about the same)
 - Verify average svc is reasonable compared to prior year (about the same)
 - Increase in credited svc by member is ≤ 1
 - Average credited svc is about the same as prior year
 - Verify average earnings increase is reasonable (ie less than AIW due to new entrants generally being less than retired members)
 - Check pensions have not changed
 - Check pension DOBs, etc., are okay and average ages are reasonable
 - Verify deferred pensions and averages for age etc. Are stable
 - Perform a membership reconciliation
 - Verify forms of pensions haven't changed

Asset Data

- Check contributions and benefit payments are reasonable and consistent with membership data
- Perform asset reconciliation
- Compare rate of return to the benchmark return
- Verify outstanding amounts are contributed
- Ensure no contributions or loan payments have been made twice

3. United States

Solution:

(a)

Info from NOC or Prior Actuary

- Data used in prior val
- Test lives
- Details of liabilities, NC and expected benefit payments

- Plan documents and other documentation
- Government filings

Info Needed – Trustee or NOC

- Asset statement as of the end of the prior year including breakouts and details of transactions, cash flow, and expenses paid for trust

Info needed from Administrator or NOC

- Benefit registry

Information needed – provided by NOC or prior actuary

Active Records:

- Identifier for reconciliation of prior data
- DOB – Marital status if used
- DOH – Service
- Salary used in valuation (base pay only)
- Salary used for projection
- Breaks in service
- Sex
- DOT
- DOR
- Date of Disability
- Other relevant information for val (allocations, projections, etc.)
- Amount of lump sum paid if so for reconciliation

3. (a) continued – United States

Inactive:

- Identifier
 - DOB
 - DOH
 - Ben Dob
 - Date of Ret or term or disability
 - Benefit, form
 - Date of death if beneficiary
 - Other relevant information
-
- Prescribed assumptions and methods
 - Plan provisions and changes since prior valuation
 - Prior valuation report
 - Details of assumptions used in prior val and basis
 - Details and description of funding methods used in prior val

Would use ASOP as a guide

Actuary should make determination:

- Reasonable for use
- Appropriate and comprehensive for use
- Time, expensive and feasibility of collected better data
- Benefits of collecting better data based on the time and expenses to collect
- Sampling techniques

Actuary not required to:

- Come up with additional data to ensure the quality of the data
- Audit the data

Checks actuaries should make:

- Data definitions
- Reasonableness of individual data elements
- Check against prior data

Actuary must make one of the following determination

- Data is appropriate for use
- Data need adjustments or assumption for use
- Determine level of previous review of data and, if necessary, make additional reconciliations
- Data is not sufficient and actuary must request new data

3. continued – United States

(b)

- Match prior actuaries valuation within a reasonable level
- Use checks prescribed by ASOP
- Check for changes in data
 - Pay changes reasonable
 - Pay does not include overtime or bonuses
 - Change in dates
 - Decrements (death) and reasonableness
 - Change in benefits
 - Changes in service
 - Missing date
- Check changes in assets
 - Mislabeled transaction
 - Reasonableness of transaction
 - Return
 - Changes in and levels of asset categories for assumption setting
 - Expenses and benefits parts reasonable
- Changes in plan design
- Changes in assumption
- Reasonableness in assumptions

4. United States

Solution:

(a)

Defined contribution plan defined:

- Individual participant accounts are maintained credited with contributions, interest, forfeiture allocation;
- Unlike in DB where investment risk is born by ER, investment risk is born by participants

Tax Qualified Status (US)

- In US plans have to qualified either of three types (different qualification rules apply to different types)
- Pension plan (DB and some DC plans)
- Profit sharing Plans (DC plans)
- Stock Bonus Plan (DC plans)

Money Purchase Plans

- Qualified as pension DC plans, more like DB plans
- Primary objective to provide retirement benefits
- Subject to definitely determinable benefits: ER contribution are based on fixed formula
- Other DB like qualification requirements: must provide annuity option of payment, as well as LS
- Must provide QJSA and QPSA like pension DB plans
- Subject to minimum funding requirements, similar to DB
- Only post tax EE contribution are allowed, so typically such plan has no EE contributions
- No in-service distributions are allowed
- Loans are typically not offered under these plans
- As in case of pension DB plans, investment in ER securities is restricted

Profit Sharing Plans

- DC plans with neither benefit nor contribution definitely determinable
- ER contributions must be recurring and substantial
- Often discretionary ER contributions based on profits or other financial metrics; some have non-discretionary ER contributions
- Typical PS plan's objective is capital accumulation, sharing company's success with EEs
- Typical PS plan does not have EE contributions

4. (a) continued – United States

Savings (or thrift) plans

- Capital accumulation vehicles – main objective to accumulate savings, objective range from tax efficient capital accumulation vehicles to supplemental benefit plans
- Can be qualified as PS or MP, must state in plan document-different qualification rules would apply
- Typically PS, with EE contributions (pre-tax via CODA or after-tax)
- Often ER contributions matching EE
- Also ER contribution can be automatic (e.g. % of pay, flat \$) of based on profits / other ER financial metrics)
- Often in-service distributions are allowed, loans
- No annuity distribution requirements, no QJSA, QPSA – but annuities can be offered if desired
- No restrictions on investment in ER securities

Stock Bonus Plans

- Similar to Profit sharing plans but benefits are distributed in employer securities

Employee Stock Ownership (ESOPs)

- DC plan mostly invest in ER securities

Hybrid DC plans: e.g. Target Plans

- Target plans must be qualified as MP (DC pension plans) and meet appropriate qualifications requirements
- Mimic Defined Benefit Plan benefit accumulation patterns, but it is a DC plan
- ER contribution is determined to meet certain targeted benefit and certain assumptions
- Benefit is not guaranteed, actual provided determined by account balances

(b)

Advantages of MP as compared to savings plan with ER match

- NOC salaried workforce currently has DB plan, a new Money Purchase plan will be like DB plan – added perceived security for NOC employees
- Can mimic DB accruals with contributions related to age and service in target plan – helpful to NOC where average age of salaried EEs is a little over 40
- As pension plan and subject to minimum requirement provides plan participants with added security regarding plan contributions

4. (b) continued – United States

- For younger NOC employees maybe viewed as more valuable than DB because of available LS and ease of communication
- NOC experiencing high turnover among salaried workforce-money purchase plan might do better job retaining employees
- Annuity option is available to protect against longevity risk, as well as J&S options – valuable for older NOC employees

Disadvantages of MP compared to savings with ER match

- Don't encourage savings EE and or stress EE responsibilities for their retirement security; as EE contributions are only available on after tax basis; in savings plan ER match gives additional incentive to EE to save
- Not as tax efficient capital accumulation vehicle as savings plans that are more flexible with achieving savings objectives other than retirement
- No pre-tax EE contribution in MP can be viewed as disadvantage compared to 401(k) arrangement when EE can contribute
- NOC competes for its workforce with other companies: matched 401(k) plan might do a better job of attracting new hires
- Some pension plan requirements (J&S) can lead to complex and cumbersome administrations compared to savings plan – matched 401(k) plan easier to administer
- Restricted investment in ER securities does not allow using this tool to promote productivity and employee identification with ER
- EE might appreciate savings plan better as they are more involved and see their money grow with ER match
- EE might appreciate availability of in-service distribution and loans in matched 401(k), but not in MP

(c)

EE contributions

- Typically includes pre-tax elective deferrals CODA or 401(k) arrangement, EE often have a choice of a level
- Level of EE contributions can vary with service: e.g. years 1-2: 3%, years 3-4: 4%, years 5-7: 5%, years 8+: 6%
- “Negative election” provision often helps increasing levels of EE participation
- Can allow post tax contributions as well

4. (c) continued – United States

ER contributions

- In savings plans typically non-discretionary, defined by formula
- Often a match: defined as percentage of EE contributions, with possible cap (e.g. 50% of the first 6%)
- Can also have automatic percentage of compensation, or flat dollar (e.g. 3% of comp)
- Can be based on age, or service or point (age + service)
- Can be percent of profits or other financial metric of employer

Plan design often tailored to objective of the plan

- Attract and retain: liberal vesting provisions, minimum eligibility, definitely formula
- Defer compensation on tax advantaged basis: maximum allowable contributions, loans and in service distributions
- Encourage savings: higher matching percentage; automatic enrollment
- Supplement retirement plan: restrict loans, offer annuities
- Foster sense of company identification: purchase, contributions of ER securities
- Accumulate funds for other purposes: liberal vesting, loans, in service distributions

Consideration on transition for NOC employee

- Grandfather, allow choice between plans, etc.

Regulatory requirement impact design as well

- Non discrimination requirement: age discrimination, ADP/ACP, coverage-consider safe harbor
- Contribution and applicable compensation limits
- Vesting, eligibility, etc. requirements (e.g. 100% vesting upon death, retirement or disability, 100% vesting of EE contributions, vesting schedules for ER contributions)

Distributions

- Typically cash, account balance if paid out in a lump sum
- Can offer annuities but typically do not
- In-service distribution may be permitted, with or without penalties
- Loans/loan provisions/hardship requirements

4. (c) continued – United States

Investment Options

- Typically EEs are offered a choice, can direct their contributions
- Should EE direct ER match?
- Life cycle funds/balanced fund options
- Comply with ERISA 404(c): safe harbor for shifting responsibilities to participants
- Option to invest in ER securities

4. Canada

Solution:

(a)

- Conversion of DB to DC plan (reason):
 - DC is advantage of OC / why converting
 - Stability of cost
 - Ee bear letter risk, risk transferred to employees
 - Ee will appreciate the plan
 - Easier in communication and administration
 - Less government compliance than DB
 - Avoid financial commitment and actuarial complexities of DB plan
 - Admin, legal and consulting fee
 - Members may not fully understand the value of DB
 - Simple to communicate
 - Stability of contribution, stability of pension expense
 - Attract young and mobile employees (better fit)
 - Reflect the plan design adopted by competitors
 - Flexibility in contribution amount for certain designs (i.e. profit sharing plans)

(b)

- **DC plan (deferral plans)**
 - Group RRSP
 - Thrift saving plan
 - PSP
 - Subject to Pension Legislation
 - Locked in
 - No cash lump sum at retirement
 - Contribution limits are lay by one year
 - Assets are protected from creditor
 - EE + ER contributions are defined
 - May be fully ER-paid or required EE contributions
 - Contributions may be fixed % of salary, fixed dollar amount, specified amount per year of service/hour worked
 - Employee contributions that are forfeited usually used to ↓ER's cost
 - Ultimate benefit at retirement based on account balance which not known in advance

4. (b) continued - Canada

- **Hybrid Plan**
 - Cash balance
 - PEP
 - Flow effect
 - Flexible Plan
 - Gain Shared
 - Shared cost
 - Life cycle Pension
 - New comparability PSP
 - Age wtg PSP
 - Min balance
 - Target benefit plan
 - MEP

- **Types of MPP**
 - DC RPP
 - DPSP
 - Group RRSP

- **Group RRSP**
 - *Advantages*
 - ER contribute on behalf of EE, EEs can contribute
 - Flexible in EE tax and retirement planning
 - EE can divert fund to spouse's RRSP.

 - *Advantages over DC plan*
 - Flexibility in eligibility
 - Flexibility in contribution
 - Can split the income

 - *Disadvantage over DC plan*
 - ER may not be able to determine the individual RRSP room
 - ER contributions are reportable as income to EE
 - Contributions attract payroll taxes
 - CPP/QPP
 - WC/EI/Provincial health car
 - There is no contributor for EE who are on unpaid leave / LOA / disability
 - May increase cost of other benefits
 - Immediate vesting of employer contributions

4. (b) continued - Canada

- **Thrift Plan**
 - Contributions are deductible to ER and taxable income to EE
 - Some companies encourage EEs to hold stock in company and become shareholders

- **PSP**
 - Conts expressed as % of profits, % of covered payroll
 - Contributions based on profit, linked to profitability of co.
 - Contributions / benefits are either discretionary or determined in advance but allocation must have definite formula / registered arrangement
 - They are deductible
 - Contributions are allocated to employee based on compensation and or service
 - Investment return and forfeitures are allocated based on account balance
 - Must be established and operated for exclusive benefit of EEs

 - *Advantage*
 - Provide a sense of partnership
 - ↑ productivity
 - ↑ morale

 - *Disadvantage*
 - Benefits are uncertain and depend on
 - Firm's profit / performance
 - Rate for purchasing annuities
 - Cash lump sum or can purchase annuity at retirement

- **Bonus Stock Extra Plan / ESOP**
 - Provides Benefits similar to PSP but benefits are distributed in company stock

 - *DPSP*
 - ER contributions not permitted

 - *EPSP*
 - cash withdrawals while in svc allowed
 - Main Disadvantages:
 - Taxation
 - EEs pay tax on all amounts allocated to their accounts

4. (b) continued - Canada

- Target Benefit Plan – ER contributions are actuarially determined as those necessary to achieve targeted benefit
- Age-weighted PSP – apply age factors to allocate contributions to older members
- Floor offset plan – DB portion establishes minimum level of benefits if DC benefit does not exceed DB benefit

(c)

Consider DC formula:

- ER competitive position with respect to contribution level
 - ER competitive position with respect to cost
 - Relative important of pensions to other forms of compensation
1. Graded by age/svc
 - If grade by age: NOC will attract mid career people to join the company
 - If graded by service – NOC is encouraging a career employment. It is like mimicking the DB plan
 2. Uniform
 - A uniform rate means NOC will be providing benefits to everyone disregarding whether they are saving for their retirement or not near their replacement ratio
 3. Based on company performance
 - Their design can increase productivity of the company
 - However, if the performance isn't well, ee will not have adequate income for retirement and have unhappy employees
 4. Matching
 - NOC can send a message to their employees that it is a joint responsibility to save for retirement and not just employer's
 - May consider different forms of matching contributions
 5. Combination of the above
 - Desire to endure current DB members not significantly disadvantaged by new DC design
 - Will change from DB to DC be imposed or voluntary?
 - Will some/all be given choice of DB or DC for future svc?
 - Will some/all be given choice of DB or C for past svc?

4. continued - Canada

(d)

If past service is to be converted:

- Need to communicate to the employee the objective for the change
- What will happen and how will it affect them
- They'll need good education to make their decision and be able to contribute and invest their money appropriately
- May not be able to force conversion

NOC may consider the following:

- Members remain in DB plan and new hires in DC plan if concern about the cost of conversion (in interest rates)
- Accounting implication
- Past service to conversion and new plan in DC.
- If want to get rid of DB responsibility quickly
- If want to provide flexibility to members, let them choose between DB and DC
- If want to maintain the replacement ratio for those closer to retirement, offer them with grandfather plan
- Not all the DB benefits are reflected at conversion date
 - Including the benefits
 - Including ancillaries already earned

When deciding to calculate LS, should be considering the following:

- DB accrued at the conversion date can't be reduced
- Provide a LS at least the value determined under the CIA std. (interest rate)
- Since the benefits are earning related, must use projection in the salary and take consideration of the withdrawal assumption
- Should include all benefits including:
 - Death benefits
 - Min er contr.
 - Guaranteed indexation
 - Ancillary benefits

When converting the ancillary benefit, NOC should

- Provide full ancillary benefit to employee if they are eligible
- If employee is not eligible, should calculate the value, taking into account the possibility of being eligible

4. (d) continued - Canada

If there's deficit in the plan, NOC may

- Provide the full benefit to employees and then contribute to make up the shortfall
- Provide full benefit test ratio of the plan and fund the shortfall no more than 5 years

Consider the employees when converting

- Provide grandfather benefit in DB formula if close to retirement
- Provide additional transition credits if close to retirement

- Accounting duplications
- Curtailment since future years will be DC
- Settlement accounting may apply
- Consider documentation and tax implications
- File amendment and conversion report outlining funding impact
- Statutory notice required prior to conversion
- Conversion subject to approval by pension authorities
- Max transfer rules apply
- Proper communication of change in plan design is important to success of conversion
- If offer DB/DC choice – Employer responsibility to ensure employees understand the choice

5. United States

Solution:

Types of objectives for a SERP plan:

1. Restore base plan benefits lost due to pay of benefits limits
2. Provide additional benefits to base plan
3. Protect benefits lost due to mid career transfer
4. Recognize elements of pay not reflected in base plan
 - Incentive pay
 - Deferred comp
 - May want to include bonuses which are not included in base plan since they seem to be a significant part of those employees salary
5. A uniform supplemental umbrella for exec. transfers create
6. Golden Handcuffs – *strict eligibility*
 - Do they want these employees to stick around for a long time?
7. Incomplete provisions
8. Golden Handshakes – *Encourage early retirement*
 - Do they want to encourage them to retire early?
 - If so, can use a svc cap or unreduced ER at 62 like base plan
9. Uniform treatment of one off contracts

Plan provisions need to consider

1. Eligibility requirements – *will they let anyone else in plan later?*
 - Ways to limit eligibility
 - Base on job description
 - Base on eligibility of incentive pay
 - Restrict to only those elected by board or compensation committee
 - Avoid using pay threshold unless index
2. Definition of compensation
 - Elements to include – base and bonus
 - Would probably want to include bonus since significant
 - Averaging period – sometimes use shorter period to make average higher
3. Benefit structure – *based on base plan?*
 - To make up for pay limits?
 - Completely different design?
 - Target replacement ratio? (Usually tt-60 for exec)
 - Want a DB or DC plan?
4. Retirement ages – *need to consider objectives*
 - Do want to encourage early retirement or want to retain until 65
5. Service – *can include svc from hire or only svc while on executive*

5. continued – United States

6. Death Benefit – *current SERP does not have*
 - Could make same as base plan
7. Disability Benefits:
 - Same as Base
 - Allow continued svc accruals
 - Treat as early retire w/o reduction
 - Credit svc as if worked until NRIA
8. Vesting – *Again need to consider what is objective of plan*

Need to consider assumptions to use

(the following may want to use different than base plan)

- Salary growth
- Turnover
- Retirement

Considerations when designing plan to meet target ben. %

- Length of svc
- Accrual rate (same as base, front-loaded / back-loaded)
- Income sources (base plan, ss, savings)
- Determine elements of comp. To include
- Averaging period
- Normal retirement age

Adv. of unfunded DB plan:

- Easier to administer
- Easier to explain
- More flexibility in plan design
- Not as much difference between DB/DC if unfunded

Adv. Of DC plan regardless of funded status

- Easier to understand
- Easier to coordinate with company stock
- Imputed rate of return tied to company performance
- Easier to deal with design issues for mid career executive

Tax considerations

- Benefit tax and deducted when paid in unfunded plan
- SERP payments not subject to early withdrawal/penalties

5. continued – United States

Want to attract new executive hires; consider ways to protect them:

- Short svc eligibility requirements
- Recognize svc with prior employer
- Generous accruals in first few years of svc
- Additional DC contributions

If security will help attract, possible methods:

- Rabbi trust
- Secular trust
- COLI (Corp. owned life insurance)

5. Canada

Solution:

Plan design consideration for the SERP

Purpose of the SERP

- Restore benefit lost due to ITA limits
- Attract mid career hires
- Provide uniform treatment (is, no individual contracts)
- Provide more generous benefit than allowed under registered plan
- Include other elements of comp

Eligibility

- Specific members (in this case just COO, CEO and CFO)
- Anyone affected by the limits
- Those over specific pay grade

Service

- Include service since plan inception
- Include service only when eligible for SERP
- Include service with previous employer – might be an idea in this case to help to new CDO accrue enough relevant benefit

Compensation

- Same as under registered plan – note that NOC's registered plan does not include bonus in the definition of comp
- All three members have significant bonuses so could be included in the SERP
- What averaging period to use

Form of Benefit

- DB or DC
- Same as under registered plan
- Stock incentives could be provided instead
- What accrual rate
- Could be specified % by earnings at retirement

Ancillary Benefits

- Early retirement
- Does NOC want executives to retire at certain age?
- Indexation – currently not provided
- Should try to provide as much as possible from RPP to save on cost

5. continued - Canada

Form of Payment

- Lump sum is more secure since benefit not funded

Vesting – Golden Handcuffs

- Want to provide vesting only at retirement
- Want to ensure executives stay with NOC for a certain length of time
- Lose benefits if leave early

NRA

- Usually the same as registered plan

Change of Control Provisions

Death benefits

- Currently not provided in the RPP

EE Conts.

- Are executives expected to pay a portion of benefits?

Retiree Allowance

Non Compete provisions

Documentation

- Should document all for benefit of company and employee

6.

Solution:

(a)

Below are the descriptions of components of a global benefits policy

- Determining company's objective and defining global philosophy

Global benefits best practices are

- Determine objectives and have a well documented policy
- Maintain a clear global governance model
- Design a global benefits strategy and implement

W's philosophies on

- **Costs**
 - Preferred level of employee cost sharing
 - How costs should be budgeted / reported
 - Desired funding levels / investment types
- **Total employee remuneration**
 - Overall level of competitiveness for each element of pay
 - Tax effectiveness and state of business also covered
- **Employee communication**
 - What info is available and how often
- **Definition of competitive practice**
 - May differ from country to country
 - May have different standards for different groups of employees
- **Uniformity of treatment**
 - Many countries allow differentiation between groups of employees
- **Mergers and acquisitions**
 - Integrate immediately with corporate program
 - Gradually integrate
 - Maintain current arrangement
- Local country's tax legislations
- Local country tax rates, benefits available

6. continued

(b)

Issues that multinational benefits consultants face

- **Method of funding pension**
 - Use of financing vehicle will depend on local laws and taxes
- **Issues of multinational pooling**
 - Assists in cost control / management of insurance arrangements
 - Available to companies with insurance coverage in more than one country
- **Labor laws, tax laws, and other legal factors**
 - Including termination indemnities and pension legislation
- **Social security and mandatory employee benefits**
 - Major impact on provisions of employer sponsored plans
 - Many countries introducing supplementary plans
- **Expatriates benefits need to be adequate**

7.

Solution:

(a)

1. Portfolio

$$\begin{aligned} \mathbf{2005} \quad & 0.11 \times 0.51 + 0.17 \times 0.09 + \\ & 0.03 \times 0.38 + 0.02 \times 0.02 = 0.0832 \end{aligned}$$

$$\begin{aligned} \mathbf{2006} \quad & 0.21 \times 0.57 + 0.1 \times 0.11 + \\ & 0.04 \times 0.3 + 0.02 \times 0.02 = 0.1431 \end{aligned}$$

$$\mathbf{Total} \quad (1 + 0.0832) \times (1 + 0.1431) - 1 = 0.2382 \quad (1 + 0.2382)^{0.5} - 1 = 0.1127$$

2. Benchmark

$$\begin{aligned} \mathbf{2005} \quad & 0.13 \times 0.5 + 0.16 \times 0.15 + \\ & 0.07 \times 0.35 + 0.03 \times 0 = 0.1135 \end{aligned}$$

$$\begin{aligned} \mathbf{2006} \quad & 0.15 \times 0.5 + 0.07 \times 0.15 + \\ & 0.05 \times 0.35 + 0.01 \times 0 = 0.103 \end{aligned}$$

$$\mathbf{Total} \quad (1 + 0.1135) \times (1 + 0.103) - 1 = 0.2282 \quad (1 + 0.2282)^{0.5} - 1 = 0.1082$$

3. Difference (Portfolio minus Benchmark)

$$\mathbf{2005} \quad 0.0832 - 0.1135 = -0.0303$$

$$\mathbf{2006} \quad 0.1431 - 0.103 = 0.0401$$

$$\mathbf{Total} \quad 0.2382 - 0.2282 = 0.01$$

	2005	2006	Total
Portfolio minus Actual Benchmark	8.32%	14.31%	23.82%
	11.35%	10.30%	22.82%
Difference with Benchmark	-3.03%	4.01%	1.00%

(b)

Sources of Macro Analysis

- Net Contributions
- Risk Free
- Asset Category
- Benchmark
- Active Management
- Allocation Effects

7. (b) continued

	2005	2006
Net Contributions	0.0%	0.0%

Risk Free | 3.0% | 1.0% | Risk free from Benchmark

Asset Category Sum of $w_i \times (\text{return Benchmark} - r_f)$ using policy allocation weights

	8.35%	9.30%
--	-------	-------

$$(0.13 - 0.03) \times 0.5 + (0.16 - 0.03) \times 0.15 + (0.07 - 0.03) \times 0.35 + (0.03 - 0.03) \times 0 = 0.0835 \text{ for 2005}$$

$$(0.15 - 0.01) \times 0.5 + (0.07 - 0.01) \times 0.15 + (0.05 - 0.01) \times 0.35 + (0.01 - 0.01) \times 0 = 0.0930 \text{ for 2006}$$

Benchmark | 0.00% | 0.00% | Only one manager per asset category

Active Sum of $w_i \times (\text{return fund} - \text{return benchmark})$ Actual and Policy allocation are both acceptable

-2.25%	3.10%	⇒ policy allocation
-2.47%	3.47%	⇒ actual allocation

$$(0.11 - 0.13) \times 0.5 + (0.17 - 0.16) \times 0.15 + (0.03 - 0.07) \times 0.35 + (0.02 - 0.03) \times 0 = -0.0225 \text{ for 2005 (policy)}$$

$$(0.21 - 0.15) \times 0.5 + (0.10 - 0.07) \times 0.15 + (0.04 - 0.05) \times 0.35 + (0.02 - 0.01) \times 0 = 0.031 \text{ for 2006 (policy)}$$

$$(0.11 - 0.13) \times 0.51 + (0.17 - 0.16) \times 0.09 + (0.03 - 0.07) \times 0.38 + (0.02 - 0.03) \times 0.02 = -0.0247 \text{ for 2005 (actual)}$$

$$(0.21 - 0.15) \times 0.57 + (0.10 - 0.07) \times 0.11 + (0.04 - 0.05) \times 0.30 + (0.02 - 0.01) \times 0.02 = 0.0347 \text{ for 2006 (actual)}$$

Allocation Balancing item (total return for portfolio minus individual components above)

-0.78%	0.91%	Active management based on policy
-0.56%	0.54%	Active management based on actual

$$0.0832 - 0.03 - 0.0835 - (-0.0225) = -0.0078 \text{ for 2005 (policy)}$$

$$0.1431 - 0.01 - 0.0930 - 0.031 = 0.0091 \text{ for 2006 (policy)}$$

$$0.0832 - 0.03 - 0.0835 - (-0.0247) = -0.0056 \text{ for 2005 (actual)}$$

$$0.1431 - 0.01 - 0.093 - 0.0347 = 0.0054 \text{ for 2006 (actual)}$$

7. (b) continued

Allocation (cont.)

Other Approach

$$0.13 \times (0.51 - 0.50) + 0.16 \times (0.09 - 0.15) + 0.07 \times (0.38 - 0.35) + 0.03 \times (0.02 - 0) = -0.0056 \text{ for 2005 (actual)}$$

$$0.15 \times (0.57 - 0.50) + 0.07 \times (0.11 - 0.15) + 0.05 \times (0.30 - 0.35) + 0.01 \times (0.02 - 0) = 0.0054 \text{ for 2006 (actual)}$$

$$0.11 \times (0.51 - 0.50) + 0.17 \times (0.09 - 0.15) + 0.03 \times (0.38 - 0.35) + 0.02 \times (0.02 - 0) = -0.0078 \text{ for 2005 (policy)}$$

$$0.21 \times (0.57 - 0.50) + 0.10 \times (0.11 - 0.15) + 0.04 \times (0.30 - 0.35) + 0.02 \times (0.02 - 0) = 0.0091 \text{ for 2006 (policy)}$$

Explanation

In 2005, at the portfolio level, the manager picked securities that earned less than the benchmark. This bad year was increased by taking a more aggressive position in bonds than the policy and having worse return than the index.

In 2006, the impact is positive by a better selection on different securities. This was achieved by taking a stronger position in stock in 2006 and beating the index and by reducing the exposure to bonds since lower return.

8. United States

Solution:

(a)

Characteristics of Hybrid Plans:

- Reduces early termination penalties compared to traditional DB
 - Value is more evenly distributed
 - More valuable to early leavers
 - Less valuable to career employees
- Facilitates communication and portability
 - Many provide LS options
 - Easier to understand and better appreciated
 - Helps attract younger, more mobile employees
- Employer retains investment risk
 - Unlike DC but more similar to DB
- Early retirement subsidies not provided but can be added
 - DC plans don't incorporate ER subsidies that may help with work flow issues – encouraging employees to retire early
 - DB plan typically do include
 - Can include or exclude w/ Hybrid
- Most provide a LS option
 - Must also provide annuity option
 - Employees like LS option – although can be provided with any DB
- Accrual rates can be based on age and or service
 - Can be designed to mirror DB accruals
 - Can be used to reward mid career hires
 - Control that cannot really be achieved by a DC plan
- Members who convert to a hybrid around age 50 get worse of both worlds
 - If start in DB get low initial accruals and hybrid accounts typically more flat so get lower later accruals as well

8. continued – United States

(b)

Cash Balance Plan Characteristics

- Investment return – borne by employer
- Pay credits – can vary by age and/or service
 - Service graded pay credits reward length of service
 - Age graded pay credits reward mid career hires
 - Can be integrated with Social Security
- Interest credits
 - Can be based on index or fixed
 - Can provide ad hoc increases if feel rate has not been appropriate front loaded or back loaded
- Form of Benefit
 - Expressed as a LS
 - Usually offer LS option but must also offer annuity

Advantages of CB Plan

- More control of costs than FAP since basically an indexed career average plan
- Communicates easily
- Employees like LS option
- Provides QJSA, spousal consent and PBGC protection
- Benefit is portable
- May help attract mobile and younger employees

Disadvantages of CB

- Not as attractive to mid career hires – less time to accumulate benefits
- Overall cost relative to FAP may increase if higher turnover
- No pre- or post- retirement inflation protection

PEP Characteristics

- Provide an accrual each year of a percentage of final average earnings-
Add up all accruals and apply to final average pay
- Expressed as a LS
- Most use a graded schedule of PEP credits – steeper grading than CB

8. (b) continued – United States

Advantages over traditional DB

- Short term employees can accumulate a more significant benefit
- Easier to understand

Advantage over CB

- Easier to provided target replacement ratio at retirement
- Stronger golden handcuffs affect
 - Benefit based on FAP
 - Pay credits more steeply graded
- Better rewards fast trackers
- No explicit interest credit to administer

Disadvantages of PEP

- Less cost control than a career average plan or CB
- Overall cost relative to FAP may increase if higher turnover

Floor Offset Plan Characteristics

- 2 Separate plans
- DB Floor plan and DC base plan
- If annuitized DC is less than Floor DB plan makes up different
- If DC is greater than DB then member only gets DC balance

Valuation issues

- Almost always need to create an imputed account
- Need special assumptions to project future account balance

Advantages of Floor Plan

- Can correct for
 - Lower profits
 - Poor investment returns
 - DC accumulation shortage due to early retirement
- Provides employees with upside potential without downside risk
- Sponsor can easily build in subsidies (i.e. ER)
- QJSA and spousal consent rules apply
- Provides security for older longer-service employees and meaningful benefit to younger shorter-service employees

8. (b) continued – United States

Disadvantages of Floor Plan

- Difficult to communicate and administer (all DC and DB administration)
- Need to pay DB insurance premium (PBDC) even if DC more valuable
- Employees may maintain a riskier portfolio – because of DB Floor

(c)

Wear away issues that may arise when converting to hybrid

- New plan less valuable than old plan and opening balance determined as if always in new plan – common with PEP
- Conversion interest rates higher for initial balance than PV of accrued benefit in old plan
- New plan doesn't offer provisions in old plan – no ongoing early ret. Subsidies or value of early ret. Subsidies not included in initial balance
- Variations in interest rates can create a perceived wear away

Ways to protect employee benefits in transition

- Grandfather employees based on age and svc. In old plan if near retirement (could create an HR issue if exclude some people who want to be included)
- Provide additional transition credits to employees near retirement – may be more difficult to explain, understand and administer
- Allow employee choice between new and old plan – make sure to provide good communication so select the best benefit for them and avoid potential issues
- Provide a transition benefit
- Enhance DC formula
- Use a lower interest rate when determining initial balance (will create a higher opening balance)

Communication should include

- Reason for the change
- What will happen
- How they will be effected

8. Canada

Solution:

(a)

General Description

- Tax deferred contribution / tax deductible contributions on a voluntary basis without increasing the PS

Objectives

- Purchase ancillary benefits
- Ancillary benefit do not count against member's PA
- Tax deductible contributions to be used to increase the value of pension
- Higher pensions accumulated at little or no additional cost to employer
- Greater flexibility and choice for plan members
- Increase employee awareness and appreciation for pensions

Types

- Front End
- Predetermined contributions for predetermined ancillary benefits
- Less flexibility since options and contributions are pre-determined
- Back End
- Flexible contributions for ancillary benefits to be selected at retirement
- Contributions made to individual accounts which grow with investment return through the career

(b)

Final average earnings

- Indexation
- Reducing the averaging period

Early retirement reductions

- Unreduced at 60, 30 or 80 points

Bridge benefit

- Temporary pensions payable until member receives government benefits

Survivor benefits

- Better guarantee period
- Better form of spousal pension

8. (b) continued - Canada

Indexation

- Pre retirement – increases with wage inflation
- Post retirement – increases with general inflation

(c)

Flex account balance may only be used to purchase ancillary benefits
50% rule cannot apply to flex account

If flex account balance exceeds the value of all ancillary benefits at termination or retirement, the excess is forfeited

- Typically account balances are tested regularly to ensure no forfeiture at termination / retirement
- Some plan sponsors pay the forfeited amount outside the plan

Maximum annual contributions

- Min (70% of PA + 10000 or 9% of earnings) minus member required contributions to the basic plan provisions

9. Canada

Solution:

(a)

Special payments starting January 1, 2007:

Solvency deficiency of \$14,570,000 to be amortized over a maximum period of 5 years using an annual rate of 4.75% (active member discount rate).

Factor: 4.47

Annual amortization payments payable monthly: \$3,258,827

Projection to January 1, 2008

Liabilities should be adjusted for any change in discount rate. Assumed no change in discount rate. Also assumed no retirements during projection period. Assumed all cash flows at beginning of year for simplicity.

Liability Projection

$$\begin{aligned} & (\text{Active liability} + \text{NC} - \text{lump sums}) \times 1.0475 + (\text{pensioner liability} + \\ & \text{pension payments}) \times 1.045 = (\$806,000,000 + \$52,000,000 - \\ & \$6,500,000) \times 1.0475 + (\$167,000,000 - \$14,000,000) \times 1.045 = \\ & \$1,051,831,000 \end{aligned}$$

Asset Projection

$$\begin{aligned} & (\text{asset beginning of year} + \text{GC NC} + 2007 \text{ special payments} - \text{lump sums} - \\ & \text{pension payments}) \times 1.04 = (\$959,430,000 + \$41,799,000 + \$3,258,827 - \\ & \$6,500,000 - \$14,000,000) \times 1.04 = \$1,023,347,000 \end{aligned}$$

Even though there is a pension surplus as of 1/1/2007, must contribute GC NC and special payments because of solvency deficiency.

Must include present value of special payments:

Present value of next 4 years of \$3,258,827 special payments using active discount rate of 4.75%

Factor: 3.66

Value: \$11,919,994

9. (a) continued - Canada

Financial position as at 1/1/2008

Assets – wind-up expensive + present value of special payments – liabilities =
\$1,023,347,000 - \$1,000,000 + \$11,919,994 - \$1,051,831 = (\$17,563,916)

This deficiency must be amortized over a maximum of 5 years using same factor
calculated above:

$$\frac{\$17,563,916}{4.47} = \$3,928,467$$

Total special payments for 2008: \$3,928,467 + \$3,258,827 = \$7,187,294

Projection to 1/1/2009

Liability projection

$$\begin{aligned} & (\text{Active liability} + \text{NC} - \text{lump sums}) \times 1.0475 + (\text{pensioner liability} + \\ & \text{pension payments}) \times 1.045 \\ & = (\$891,846,000 + \$52,000,000 - \$6,500,000) + (\$159,885,000 - \\ & \$14,000,000) \\ & = \$1,134,425,000 \end{aligned}$$

Asset projection

$$\begin{aligned} & (\text{Asset beginning of year} + \text{GC NC} + 2008 \text{ special payments} - \text{lump sums} \\ & - \text{pension payments}) \times 1.15 \\ & = (\$1,023,347 + \$41,799,000 + \$7,187,294 - \$6,500,000 - \$14,000,000) \\ & = \$1,209,609,000 \text{ less } \$1,000,000 \text{ expense} \\ & = \$1,208,609,000 \end{aligned}$$

Normally, would include present value of special payments (3 years remaining of 2007 schedule and 4 years remaining of 2008 schedule). However, not necessary since already in a surplus position and therefore special payments can be eliminated.

(b)

Must first determine the new going concern financial position of the Plan:

Surplus of \$171,841,000 less additional liabilities of \$200,000,000 =
(\$28,159,000)

9. (b) continued - Canada

This unfunded liability must be amortized over a maximum period of 15 years using the going concern discount rate of 6.5%:

Factor: 9.73

Annual special payments: \$2,893,900

To determine solvency deficiency, must include present value of next 5 years of going concern special payments. Use active rate of 4.75%:

Factor: 4.47

Present value of special payments: \$12,938,300

Solvency financial position:

Deficiency at 1/1/2007 of \$14,570,000 + additional liability of \$250,000,000 – present value of special payments of \$12,938,300 = \$251,631,700

Solvency deficiency must be amortized over a maximum of 5 years

Factor using 4.75%: 4.47

Amortization payments: \$56,281,700

Total contributions for 2007:

Going concern special payments: \$2,893,900
+
Solvency special payments: \$56,283,700
+
Current service cost: \$41,799,000
+
Current service cost for new group: \$15,000,000
= \$115,974,600

The company may also be required to make additional payments in order to pay the full commuted value for terminating members.

10. Canada

Solution:

(a)

Input Data and Assumptions

	2005	2006	2007
MV	772,639	860,847	959,430
Cont	39,789	0	
Benefits	20,500	20,500	
	19,289		
Assumed Interest Rate (i)	6.50%		

Calculate Expected Market Value of Assets Based on previous year

1 Expected MV of assets at Jan. 1, 2006 based on Jan 1, 2005 MV

Expected MV at Jan 1, 2006 =

$$\text{MV @ 1.1.2005} \times (1+i) + (\text{Contributions} - \text{Benefit Payments}) \times \left(1 + \frac{i}{2}\right) =$$
$$772,639 \times 1.065 + 19,289 \times 1.0325 = 842,776$$

2 Expected MV of assets at Jan. 1, 2007 based on Jan 1, 2006 MV

Expected MV at Jan 1, 2007 =

$$\text{MV @ 1.1.2006} \times (1+i) + (\text{Contributions} - \text{Benefit Payments}) \times \left(1 + \frac{i}{2}\right) =$$
$$860,847 \times 1.065 + -20,500 \times 1.0325 = 895,636$$

Gain or (Loss)

Gain or (Loss) in 2005

Actual MV of assets at Jan 1, 2006 – Expected MV at Jan 1, 2006 =

$$860,847 - 842,776 = 18,071$$

10. (a) continued - Canada

Gain or (Loss) in 2006

$$\begin{aligned} \text{Actual MV of assets at Jan 1, 2007} - \text{Expected MV at Jan 1, 2007} &= \\ 959,430 - 895,636 &= 63,794 \end{aligned}$$

$$\begin{aligned} \text{Unrecognized portion Gain / (Loss)} &= \frac{1}{3} \text{ of Gain / (Loss) in 2005} + \frac{2}{3} \text{ of Gain / (Loss) in 2006} \\ &= \frac{1}{3} \times 18,071 + \frac{2}{3} \times 63,794 \\ &= 48,552.99 \end{aligned}$$

Calculate Smoothed Market Value of assets at January 1, 2007

Smoothed Market Value of Assets at Jan

$$\begin{aligned} &= \text{actual MV at Jan 1, 2007} - \text{Unrecognized portion Gain / (Loss)} \\ &= 959,430 - 48,553 \\ &= 910,877 \end{aligned}$$

(b)

Advantages of using smoothed asset valuation method vs. market value method

- Remove impermanent fluctuations in security prices, driven by speculators or short horizon investors, if it is believed that such volatility is not reflected in pension liability and is irrelevant to long term planning for retirement benefits
- Moderate volatility in asset values and generate smooth pattern of contribution rates

Disadvantages of using smoothed asset valuation method vs. market value method

- Excessive smoothing will not be accepted, particularly as the plan sponsor financial planning tends to be over short term and will be influenced by the market conditions
- Arbitrary smoothing (actuaries use different methods) may not be easy to understand for users (accountants, financial managers, and shareholders)
- Not objective for determining solvency
- Artificial funded/unfunded liability and contribution rates

10. (b) continued - Canada

- Using actuarial cost method involving a spreading of actuarial gains and losses may be more efficient than amortization of gains and losses through a smoothed market value of assets in the sense that more stable contribution rates and funding levels may be achieved

11. Canada

Solution:

(a)

Interest assumption, use bond rates with 2 months lag from month of termination
 ⇒ February 2007 bond rates.

Series	Name	Feb Rate		Annualized
B14070	7 Year GOC	3.98%	i_7	0.04020
B14072	Long term GOC	4.09%	i_L	0.04132
B14031	Long term real GOC	1.75%	r_L	0.01758

$$r_7 = r_L \times \frac{i_7}{i_L} = 0.01710$$

Non-indexed

$$i_{1-10} = i_7 + 0.5\% = 0.04520 \quad \text{rounded nearest 0.25\%} = 4.50\%$$

$$i_{10+} = i_L + 0.5 \times (i_L - i_7) + 0.50\% = 0.04688 \quad \text{rounded to 4.75\%}$$

Fully indexed

$$r_{1-10} = r_7 + 0.50\% = 0.02210 \quad \text{rounded to 2.25\%}$$

$$r_{10+} = r_L + 0.5 \times (r_L - r_7) + 0.50\% = 0.02282 \quad \text{rounded to 2.25\%}$$

Calculate implied CPI to get 75% CPI rates

1st 10 years:

$$\begin{aligned} \text{Implicit CPI 1}^{\text{st}} \text{ 10 years} &= \frac{(1+i_{1-10})}{(1+r_{1-10})} - 1 && \text{before rounding} \\ &= \frac{1.0452}{1.0221} - 1 \\ &= 0.02260 \end{aligned}$$

75% of deemed CPI – 0.01695

Geometrically reduce non indexed rate:

$$\frac{1.04520}{1.01695} - 1 = 0.02778 \quad \text{rounded to 2.75\%}$$

11. (a) continued - Canada

Thereafter:

$$\text{Ultimate deemed CPI} = \frac{(1+i_{10+})}{(1+r_{10+})} - 1 = 0.02352$$

75% of ultimate CPI = 0.01764

Geometrically reduce non indexed rate:

$$\frac{1.04688}{1.01764} - 1 = 0.02873 \quad \text{rounded to 2.75\%}$$

Therefore partially indexed rates:

1 st ten years	⇒	4.50%
Next 5 years	⇒	4.75%
Thereafter	⇒	2.75%

(b)

Other assumptions used other than interest rates required:

Valuation date

- Equal to date of termination
- Need to specify period after which recalculation is required

Married assumption

- Contingency that member would be married at retirement age

Proportion married and Spouse age

- Since Joint and Survivor form, need to survivor benefit
- Need spouse's age, based upon unisex percentage of group

Mortality assumption

- Prescribed table is UP94 projected to 2015 using scale AA
- Use unisex percentage of group to calculate a blended unisex table

Benefit entitlement

- Need to reflect full benefit entitlement

Retirement age

- Need to reflect subsidized early retirement

11. (b) continued - Canada

Accrued Pension

- Need to calculate pension earned to date projected to be paid at retirement
- Need DB limit at retirement and Highest Average Indexed Compensation