

Solution 1

As an actuary, first I must consider whether I am qualified to give advice

- Professional integrity
 - give known advice
- Qualification std
 - am I qualified to lead this discussion
- Std of practice apply
 - will go through more later
- Conflict of interest
 - should disclose to all parties
 - in this case, should let both parties know that I'm employed by the chairman
 - they must all agree and be comfortable in this
 - must act fairly
- Rates used to discount future cash flows
- Liabilities in funding valuations used to determine cash contributions to trust fund
- For accounting: discounted liabilities used to calculate pension expense on income statement
- The funding interest rate should be appropriate individually (stand-alone), and in aggregate with other assumptions
- can be derived in building block approach
 - risk free rate
 - inflation
 - risk premium
- or derived on cash flow approach
 - the discount rate that is consistent with a hypothetical bond portfolio with expected payment similar to the plan's payment
- usually there is a reasonable range of int rate assumption
 - can consider input from employer (ER)
 - some company would prefer to have more margin in case of adverse derivation
 - result is higher liability and greater contribution
 - if it is within reasonable range, we can make adjustment

Solution 1 (continued)

- under traditional approach
 - it must also in line with the underlying asset portfolio
 - it would include equity risk premium
 - also policy-driven margin included
 - is a long-term view
 - intend to level out contribution rate in the long-term
 - no credit risk included, i.e. probability of non-payment of benefit
- Though, there are recently another school of thought from finance economical principles.
 - the rate should base entirely on current market rate
 - no equity risk premium, (recognized when it is actually realized)
 - is intended to value liability accurately at any given time
 - with no policy driven margin
 - with credit risk
 - not a standard yet, but an interesting approach
- The funding rate should be based long-term view to avoid short-term volatility
- Increasing rate is possible if it is within reasonable range
- Or, if invested heavily in equities, then the expected ROR is higher, could argue for higher rate
- but must understand that the promised benefit is not changing. The total cost of the plan at the end is the same no matter where and when you find it
- changing rate would only affect short-term contributions
- if company is short of cash, then maybe a good way (given that the increase is reasonable)
- The interest rate for accounting purposes must be in line with the accounting standard.
- if in Canada, then it must be the high quality bond yield rate, (usually AA bonds)
- depending on the duration of the liability, the rate would be slightly different
- however, the increment would be small, say 0.25% range
- the interest rate for accounting purposes must be appropriate
- It can be different from funding rate as funding rate represents a long-term view, whereas, accounting rate kind of reflects the current market yield
- The accounting must be passed through the auditor too

Interested parties:

- consider increasing funding rates, the liability goes down
- improve surplus position
 - either less deficit, or more surplus
- Contribution requirement comes down

Solution 1 (continued)

Employee:

- want benefit security
- less secure, may affect morale
- on the other hand, improve surplus position could mean benefit improvement
- or surplus distribution, if wind-up or partial wind-up

Employer:

- want greater flexibility in contribution
- less contribution requirement
- can use the cash somewhere else
- better if after tax ROR better than pretax ROR in the fund
- less tax deductible contribution
- be careful of union/EE demanding benefit improvement if funded position improves

Shareholder:

- more liquid cash
- can improve business, or expansion, (possible acquisition)
- want the money to be best use
- want the value of the company improving
- love to see less compensation/operation expense

Government:

- want more income
- love to see more non-tax deductible
- also consider less secured benefits
 - may put pressure on government plan

Taxpayer:

- more tax coming from corporation
- better public service
- less likely to raise taxes

PBGC/PBGF

- want to see maximum security
- want the plans to be fully secure
- like to see more contribution to the plan

Retirees:

- want maximum security

Solution 1 (continued)

The accounting interest has no impact on some of these groups but affects

ER

- affect financial statement
- may affect their bonuses

Investor and Shareholder

- concerns only financial impact
- the accounting rates have big impact on the premium expenses.

Solution 2

- (a) The investment policy statement (IPS) include the following:
1. Purpose
 2. Plan overview and investment implication
 3. Investment beliefs
 4. Investment objective
 5. Investment manager instruction and mandate
 6. Investment manager objective
 7. Permitted investment constraint
 8. Derivative policy
 9. Relocating policy
 10. Asset mix and ranges

The plan overview and investment implication can help the CFO in his evaluation since it is important to know the nature of the liabilities to determine how asset should be invested.

Investment objective will also help → should qualify expected return on asset, should also incorporate risk tolerance of plan's sponsor. By regarding what were the expectation could help in his evaluation.

Investment manager objective → should explicitly qualify, should determine benchmarks and performance expectations.

Permitted investment constraint → could be set as minimum rating or minimum or maximum investment in a asset class.

Investment manager structure and mandate → what was the structure: style, term structure, inflation component, market cap bias.

The CFO could also use the performance attribution method to evaluate performance → if split between policy strategic decision asset allocation decision and securities selection decision. Can also use risk adjusted rate of return to assess performance (that is the best method)

Asset allocation (asset mix policy and ranges) is the most important part of IPS, affect 90% of the return.

Solution 2 (continued)

- (b) Risk adjusted rate of return:

$$R_p = \alpha + R_f + \beta (R_m - R_f)$$

$$\Rightarrow \alpha = (R_p - R_f) - \beta (R_m - R_f)$$

$$2003: \alpha = (0.2 - 0.04) - 0.9(0.21 - 0.04) = 0.7\%$$

$$2002: \alpha = (-0.03 - 0.05) - 0.85(-0.05 - 0.05) = 0.5\%$$

$$2001: \alpha = (0.02 - 0.04) - 0.8(0.01 - 0.04) = 0.4\%$$

- (c) Treynor measure: $T = \frac{R_p - R_f}{\beta}$

$$2003: \frac{0.2 - 0.04}{0.9} = 0.17$$

$$2002: \frac{-0.03 - 0.05}{0.85} = -0.094$$

$$2001: \frac{0.02 - 0.04}{0.8} = -0.025$$

- (d)
- Risk adjusted rate of return is the best method to determine performance.
 - A positive α indicate that the investment manager has beat the market
 - We can see that he has increased his performance from 2001 to 2003
 - The treynor measure suppose risk is systematic
 - Assume perfect diversification
 - It indicates the return per unit of risk
 - Here 2003 is clearly the best

In looking at β (the measure of risk) the fund is actually taking on less risk than the market as $\beta < 1$ in 2003

In order to truly evaluate the performance of the CFO should look at the Statement of Investment Policies & Procedures to see what the objectives are and if they have been met.

Solution 2 (continued)

To further analyze the performance I will use the performance attribution method

<u>Rate of return (%)</u>		<u>Weight %</u>		<u>Portfolio (%)</u>		
<u>Policy (benchmark)</u>	<u>Portfolio</u>	<u>Policy (target portfolio mix)</u>	<u>Portfolio</u>	<u>Policy</u>	<u>Allocated</u>	<u>Actual</u>
30	25	35	25	10.5	7.5	6.25
47	30	25	25	11.75	11.75	7.5
4	5	25	35	1	1.4	1.75
39	40	10	10	3.9	3.9	4
9	3	5	2	0.45	0.18	0.06
1	1	0	3	0	0.03	0.03
				27.6	24.76	19.59

loss of $27.6 - 24.76 = 2.84\%$ due to asset allocation decision
 and loss of $24.76 - 19.59 = 5.17\%$ due to securities selective decision

- (e) This is not a good position
- Should look at what are the objectives of the plan, the risk tolerance of the plan sponsor, plan policy etc...
 - The asset should be diversified to reduce risk which would not be the case with 100% in fixed income
 - Also need some liquidity to pay benefit payment and expense
 - The plan got post-retirement inflation so need to hedge inflation real estate good for this

The CFO should compare performance against the appropriate benchmarks and relative to similar portfolios. He should not look just at absolute returns.

The CFO should look at the fund performance over a full market cycle as oppose to just 3 years. The CFO is looking at past performance only and not the economic environment during period.

CFO needs to consider the asset mix relative to its liability structure. Need to do an asset/liability study.

Solution 3

- (a) Vesting: employee may leave before being vested and does not get any employer-provided value pension benefits

Loss of purchasing power: in final average DB plans, the benefit is based on pay at termination and not retirement. Not frequent for DB frozen pension to be indexed between termination and retirement.

If lump sum transfer allowed, employee might spend it instead of saving it until retirement.

DC plans are not as affected since entitled to full value of contributions at termination (unless employee is not vested). Can continue to earn investment returns until retirement.

Employees may lose post-retirement non-pension benefits

Career average plans and flat dollar plans: lose on potential future upgrades or flat benefit increases

Subsidized early retirement benefits may be lost in a DB plan

- (b) Allow lump sum transfer in DB and DC plans but on a locked-in basis only

Require DB benefit at termination to be indexed between termination and retirement

Establish portability clearinghouse to transfer money from one pension plan to another and ensure that benefit for service with prior employer will be based on pay at retirement. Will work well if plans are similar.

Require lump sum transfer to be locked-in like in Canada

Allow employees to buy-back past service

Allow and encourage reciprocal transfer agreement

Allow and encourage Hybrid plan design such as pension equity, cash balance, DC with a floor DB

Immediate or more rapid vesting

Solution 3 (continued)

Establish government sponsored pension plan

Establish a standard for the calculations of lump sum transfer values at termination

- (c) Locked-in lump sum will ensure that benefits received at termination are not spent before retirement

Pre-retirement indexation protects employee from erosion of benefit due to inflation prior to retirement

Allowing lump sum transfers will give employee the chance to earn investment returns over and above the inflation

Portability clearinghouse and reciprocal transfer agreement ensure that all service is based on pay at retirement. Protects against inflation and productivity increase before retirement.

Earlier vesting will ensure that more mobile workers are entitled to a benefit at termination.

DC plans and Hybrid plans pay a higher termination benefits than regular DB plan

A standard for calculated DB lump sum transfer values will ensure consistencies and fairness between plans

- (d) If these policies are adapted by the Govt, then NOC will have to adapt its plans to comply with the new policies

Portability clearinghouse and reciprocal transfer agreement will increase the administration complexity

Plan document will have to be amended and changes would have to be communicated to employees

Will likely increase turnover since termination benefit would be better

Solution 3 (continued)

May need to review investment policy since more liquidity needs

Earlier vesting and pre-retirement indexation would increase funding and accounting liabilities resulting in an increase in cash contributions and pension expense.

Increase plan benefit cost as more members are vested

Solution 4

(a) Problems with Current System

- Accounting conceals risk and volatility and anticipates unearned risk premiums
- Pensions are mispriced in negotiations and compensation decisions
- Participants bear creditor risk they can't evaluate or diversify
- Assumption selection process influences investment decisions
- Does not incorporate FE principles
- Transfers risk to future generations
- Hypothetical gains conceal real economic losses
- Conceals risk by smoothing
- Extended amortization

FE Model

- \$ million of equities has same value as \$ million cash or bonds
- fair trade of assets occurs at market price
- all parties entitled to full current information on market price of assets and liabilities
- liabilities valued like assets traded index/liquid market
- rewards earned/risks become by individuals, not institutions

Debt model is inadequate for pensions because

- duration not found in market
- benefit payments are not known in advance
- no market for pension liabilities other than for retirees or terminating plans
- sponsors concerned about costs not liabilities
- if pensions considered debt then so are other contingent payments

Traditional model vs. FE model

Traditional: anticipates risk premium

- contains margin
- designed to level contributions over time

FE: based on current market rates

- contains discount for probability of non-payment
- consistent with return of reference portfolio
- designed to accurately value plan at specified time

Solution 4 (continued)

- (b) Move to a FE approach
- Liabilities valued using unit credit
 - assets valued at market value
 - expected return on assets replace with actual investment gain or loss
 - remove corridor
 - shorter amortization periods for gain and losses and prior service costs, or immediate recognition
 - Application of rigor/discipline in selection of assumption
 - Liabilities should be valued at rates to match the assets
 - pensions resemble debt and should be valued that way
 - use discount rate applicable to debt of similar creditworthiness
 - No salary scale used, but might include contractually determined future salaries
 - Show sensitivity of results to assumption changes
 - The operating cost of a defined benefit plan is the value of newly earned benefits
 - The financing cost of the plan is the decrease in accrued benefit surplus, before contribution and newly earned benefits

Solution 5

(a) Exec has security that benefit will be there

Exec not taxed on benefit accruals until benefit is funded

Employer can invest assets internally while exec is active, more flexibility with cash prior to termination

LS would preserve benefit if exec in poor health

LS gives the exec more flexibility

not funded until termination, susceptible to bankruptcy risk and employer's refusal to pay prior to termination

no security prior to retirement

Employer can't deduct vested accruals until benefits funded

Employer still has to recognize an expense each year

No asset return offset or lower liability that will eventually be moved

potential for large payments in short amount of time if multiple execs retire at same time

takes assets out of employers hands after retirement

what happens if you purchase too much coverage for employee?

issues with lump sum

longevity risk for employee

employee may squander

employer susceptible to adverse selection

Solution 5 (continued)

(b) Lump-sum option

$$\text{After-tax SRP benefit} = (1 - 40\%) \times (100,000) = 60,000$$

$$\text{Lump-sum value} = 60,000 \times \text{after-tax annuity factor} = 60,000 \times 13.5 = 810,000$$

$$\text{Gross-up pymt to account for immediate taxes} = \frac{810,000}{1 - 40\%} = 1,350,000$$

Insured annuity option

Annual payments from insured annuity are split in two

- taxable part

- tax-free part

We want after tax payment of 60,000 so the annual amount that should be purchased (A) is determined as follows:

$$\text{purchase price} = 10 \times A$$

$$\text{tax-free annual payment} = \frac{10 \times A}{20}$$

$$\text{after-tax annual payment} = 60,000$$

$$\Rightarrow 60,000 = A - 40\% \left(A - \frac{10A}{20} \right)$$

$$= A - 40\% \times \frac{A}{2}$$

$$= 80\%A$$

$$\Rightarrow A = 75,000$$

$$\text{purchase price} = 75,000 \times 10 = 750,000$$

$$\text{Gross-up payment} = \frac{750,000}{1 - 40\%} = 1,250,000$$

Cost differential:

It will cost 100,000 more if Pat chooses lump sum

Solution 6

- (a) Group A: all employees with age 55 and 5 years of service by 1/1/05 and <20 years at 1/1/04

Group B: all employees not in A,C, or D

Group C: all employees with less than 30 years of service at retirement and at least 20 years of service at 1/1/2004

Group D: all employees with at least 30 years of service at retirement and at least 20 years of service at 1/1/2004

Assumption: All age/svc cells are (uniformly) evenly distributed across all

Group A: Boundaries: <20 years at 1/1/04 so all in 5-10, 10-15, <5 and 80% of 15-20
 ≥ 54 and ≥ 4 so all in >65, 55-65 and 20% of 45-55 excluding 80% of <5 column

45-55, >5: $190 \times 20\% \times 20\%$	5-10: $194 \times 20\%$
55-65, <5: $108 \times 20\%$	5-10: 50
>65, <5: $3 \times 20\%$	5-10: 5
=29.8	=93.8
10-15: $205 \times 20\%$	15-20: $370 \times 80\% \times 20\%$
10-15: 60	15-20: $55 \times 80\%$
10-15: 10	15-20: $5 \times 80\%$
=111	=107.2

Group A Count = 341.8

Group C&D combined: all ≥ 20 years at 1/1/04

<u>15-20</u>	<u>>20</u>	
$16 \times 20\%$		
$224 \times 20\%$	258	
$370 \times 20\%$	768	
$55 \times 20\%$	365	
$5 \times 20\%$	8	
=134	=1399	so total 1533

Break out C&D based on svc at retirement

Solution 6 (continued)

Valuation assumption is age 62 for retirement
(not supported by plan experience, ie. large gains, but use for this purpose as conservative estimate)

25-35 now, with 20+ years, assume all have 30 years at retirement
35-45 now, with 20+ years, assume all have 30 years at retirement
45-55 now, with at least 20 years, assume 90% have 30 years at retirement
55-65 now, with 20+ years, assume 60% have 30 years at retirement
>65 now, with 20+ years, assume 20% have 30 years at retirement

$$\text{Group D Count: } (16 \times 20\%) + (224 \times 20\% + 258) + (370 \times 20\% + 768) \times 90 \\ + (55 \times 20\% + 365) \times 60\% + (5 \times 20\% + 8) \times 20\% = 1291.2$$

$$\text{Group C Count} = 1533 - 1291.2 = 241.8$$

$$\text{Group B Count} = 4293 - 341.8 - 1533 = 2418.2$$

(b) Curtailment = significant reduction in future service

Group A: This is not a curtailment of benefits for the portion that does not retire by 1/1/05. Based on valuation retirement assumption, not many will retire.

Group B: This is a curtailment of benefits for all in this group

Group C: The plan amendment that reduces benefits for group C would create a negative unrecognized prior service cost. I am assuming that the curtailment would be recognized first, as the PSC would not reflect the group that is curtailed.

Group D: No special accounting since no change for this group

The curtailment noted above would result in a gain in the APBO (don't know accrual method, so can't estimate) that would be partially offset by unrecognized losses. There is no PSC, so nothing to be recognized.

Solution 6 (continued)

- (c) NOC would have to recognize a large gain the first year and would see decreased expense for following years for the retiree medical plan.

They may see increased withdrawal if younger employees see medical benefit as valuable and competitor is still offering benefit

Solution 7

(a) Asset Return

- will depend on asset mix
- look at expected rate of return of invested asset

Discount rate

- rates upon which liabilities could effectively be settled
- generally consider high quality bonds
- plan sponsor responsible for the selection
- governed by FAS87((US)/CICA3461(Canada))
- need auditor approval

$$\text{PBO } 1/1/05 = (560,919 + 27,169)(1.06) - 11,258(1.06)^5 = 611,782$$

$$\text{Assets } 1/1/05 = (380,679 + 33,000 - 11,258 + 31,324) = 433,745$$

$$31,324 = 380,679 \times .08 + (33,000 - 11,258) \times .04$$

1/1/2005

	Expected 1/1/05
PBO	(611,782)
MV	433,745
FS	(178,037)
PSC	27,240 = 37,077 - 3,837
G/L	107,015
(A)/P	(43,782) = (40,856) - 35,926 + 33,000

$$\text{Exp MVA } 1/1/05 = 380,679 + 31,324 + 33,000 - 11,258 = 433,745$$

$$\text{Exp PBO } 1/1/05 = (5560,919) - 27,169(1.06) - 11,258(1.06)^5 = 611,782$$

$$\text{Exp SC } 1/1/05 = 27,169 \times 1.06 = 28,799$$

$$\text{IC} = 28,999(0.6) + 611,782(.06) - 12,100 \left(\frac{.06}{2} \right) = 38,072$$

Solution 7 (continued)

Amort PSC for 2005 = 3837

$$\text{Amort G/L} = \frac{107,015 - 10\% \text{ or } Ax(611,782,433,745)}{11.5} = 3986$$

2005 expense:

SC=	28,799
IC=	38,072
ERA=	(35,736)
PSC=	3,837
G/L=	<u>3,986</u>
	38,958

(c) Increase in discount rate

affect Sc, IC & loss amort

decrease in discount rate: reverse

change in EROA assumption

consider difference of actual assets vs. expected

- EROA will change
- amortization/loss may also change

Solution 8

- (a) Focus is on what are the plan sponsor objectives with the plan

Review fundamental issues of plan design:

- Legislative requirements and barriers
- Financial issues – what is the cost of the program?
- Human resource issues – is the purpose to retain employees?
- Adequacy of retirement benefits – what replacement ratio would be acceptable?
- Demographics of plan population (current and projected)
- Integration of government benefits

Discuss various alternative pension plan designs

Prepare costings of various designs and outline impact on contributions and expense

- consider impact on employee satisfaction and workforce planning

Present results to client

Implementation:

- employee communications
- consider minimizing administration costs

- (b) Need to understand why employees are leaving early. Reviewing actuarial report we can see that there have been retirement gains for last 4 years, therefore retirees are retiring after 62.

Reviewing medical plan expense shows that plan is costly and that increasing eligibility age for health benefits may result in considerable cost savings.

Other options to reduce early retirement cost would include:

- increase early retirement reduction from 3% per year to 6% per year
- increase unreduced age from 62 to 65
- the above two options would not only reduce the cost of early retirement, but would also reduce the incidence of early retirement
- increase limit for early retirement eligibility (either service or age)
- phased retirement
- backloading benefits (higher accrual in later years)

Solution 8 (continued)

- (c) The PA system is only affected by the benefit accrual rate, not ancillary benefits
The current system is $9 \times \text{accrual} - \600

Since NOC accrual is based on 2% formula, member's are already maximizing their PA and leaving little room for members to contribute to their PPA.

To maximize the PPA contribution room and minimize the PA, we should lower the accrual rate and increase ancillary benefits.

Non-retirement age benefits that could be enhanced or introduced include:

- survivor benefits
- indexing
- DC plan
- Flexible pension plan

Solution 9

- (a) All the risk is shifted to the individual in a defined contribution scheme. Including ancillary benefits that are basically funded by the individual.

There is also a risk that individuals will invest in less risky assets and not get close to the expected return.

Asset management firms need to be regulated with regard to available investments as well as fees/

DC schemes have higher expenses as illustrated by Chile's program.

Other issues with DC schemes include no wealth redistribution meaning the government needs to guarantee a minimum benefit.

There are also issues with how the transition will be funded if there is a legacy program. Will the current generation pay for two generations of benefits. If the plan is prefunded the prefunding might be raided.

- (b) Suggested modifications to the proposal include adding:

- a minimum benefit
- the ability for companies to contract out if they provide a comparable plan
- an insurance component for ancillary benefits
- investment options with lifestyle funds

Asset management firms and Annuity firms need to be regulated.

Earlier and later retirement should be allowed and phased withdrawal should be allowed as well.

Inflation protected annuities should be mandated in retirement

- (c) Under the current plan the labor cost will have increased and this proposal will drop the overall cost of the retirement program to be in line with original cost.

There will be winners and losers and transition has not been addressed.

Since defined contribution plans do not integrate well with defined benefit plans the CFO should consider an offset plan. The defined benefit plan could remain in place with the addition of an offset from the social security benefit based on an expected return.