6TH CAPACITY BUILDING SEMINAR ON RETIREMENT BENEFITS

GURGAON

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ANALYSIS OF ACTUARIAL GAINS & LOSSES

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Institute of Actuaries of India

OVERVIEW

- LOOK AT INDAS19
- WHY TO DO GAIN\LOSS ANALYSIS?
- GAIN\LOSS DUE TO ASSUMPTION CHANGE

ANALYSIS OF ACTUARIAL GAINS & LOSSES
WHAT DOES INDAS19 SAYS

Actuarial gains and losses **are changes in the present value of the defined benefit obligation resulting from:**

(a) experience adjustments (the effects of differences between the previous actuarial assumptions and what has actually occurred); and

(b) the effects of changes in actuarial assumptions.

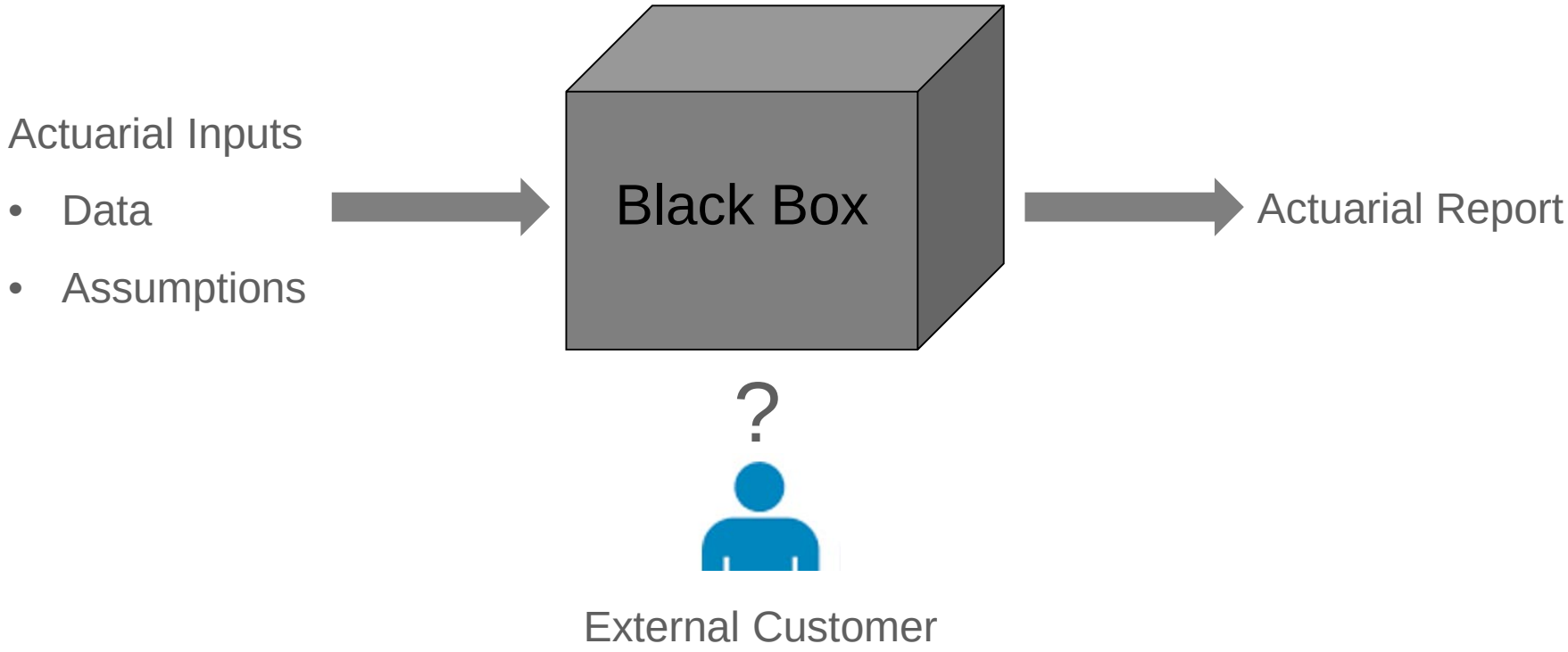
Disclosure Reconciliation
DBO at end of prior year
+ Service Cost
+ Interest Expense
- Benefit payments from plan
+/- Gains\Losses
DBO at end of current year

Due to assumption changes

- Demographic
- Financial

Due to Experience

ANALYSIS OF ACTUARIAL GAINS & LOSSES
WHY TO DO IT?



- A detailed actuarial Gains\Losses analysis can help us answer lot of customer queries with reasonable confidence & accuracy.

ANALYSIS OF ACTUARIAL GAINS & LOSSES
WHY TO DO IT?

- Segregate underlying multiple reasons of Gains\Losses
- Indicates reasonableness of individual assumptions – APS 27
- Prove consistency of coding (calculations) year over year
- Uncover calculations problems
- Uncover data errors

ANALYSIS OF ACTUARIAL GAINS & LOSSES
GAINS & LOSSES DUE TO ASSUMPTION CHANGES

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Demographic assumption changes

- Assumptions that impact timing of future cash-flows
- Like
  - Decrements – e.g. Retirement
  - Leave availment rate
  - Form of payment (Pension)

Financial assumption changes

- Assumptions that impact amount of future cash-flows
- Like
  - Salary increase
  - Future increase in Gratuity limit
  - Medical inflation rate

- Determination of change in PBO due to an assumption change is straight forward.
- But what about scenario when multiple assumptions need a change:
  - Does order of assumption change runs materially impact change in PBO amount?

ANALYSIS OF ACTUARIAL GAINS & LOSSES
GAINS & LOSSES DUE TO ASSUMPTION CHANGES

- Standard Gratuity plan with no limit on payable Gratuity benefit.

Prior year assumptions -

- Salary rate – 10% p.a.
- Attrition rate – 20% p.a.
- Retirement age – 65
- Discount rate – 8% p.a.

This year assumptions -

- Salary rate – 8% p.a.
- Attrition rate – 10% p.a.
- Retirement age – 65
- Discount rate – 8% p.a.

- In which of the following order of runs, do you expect the demographic assumption change to be larger:
  - Order 1 – Salary Rate, Attrition Rate
  - Order 2 – Attrition rate, Salary Rate
- Lets consider a sample employee
  - Salary – 25,000; Age – 30 years; Service – 5 years

ANALYSIS OF ACTUARIAL GAINS & LOSSES
GAINS & LOSSES DUE TO ASSUMPTION CHANGES

- Lets look at an example.

Description	Sample Employee
Salary	25,000
Age, Service	30, 5
Exp. Duration	5
a. Liability	~ 79,000
Order 1	
b. Liability post change in Salary rate	TBD
c. Liability post change in attrition rate	TBD
Order 2	
b. Liability post change in attrition rate	TBD
c. Liability post change in Salary rate	TBD

*Liability = 15 / 26 * Salary * Service * ((1+Sal. Rate) / 1.08)^(Duration)

Prior year assumptions -

- Salary rate – 10% p.a.
- Attrition rate – 20% p.a.
- Retirement age – 65
- Discount rate – 8% p.a.

This year assumptions -

- Salary rate – 8% p.a.
- Attrition rate – 10% p.a.
- Retirement age – 65
- Discount rate – 8% p.a.

ANALYSIS OF ACTUARIAL GAINS & LOSSES
GAINS & LOSSES DUE TO ASSUMPTION CHANGES

- Lets look at an example.

Description	Sample Employee
Salary	25,000
Age, Service	30, 5
Exp. Duration	5
a. Liability	~ 79,000
Order 1	
b. Liability post change in Salary rate	~ 72,000
c. Liability post change in attrition rate	~ 72,000
Order 2	
b. Liability post change in attrition rate	~ 87,000
c. Liability post change in attrition rate	~ 72,000

Change in financial assumption = (7,000)

Change in Demographic assumption =(Nil)

Change in Demographic assumption = 8,000

Change in financial assumption =(15,000)

*Liability = 15 / 26 * Salary * Service * ((1+Sal. Rate) / 1.08)^(Duration)

EXPERIENCE GAIN\LOSS

- WHAT IT IS?
- SALARY GAIN\LOSS
- DECREMENT GAIN\LOSS
- INVESTMENT GAIN\LOSS

ANALYSIS OF EXPERIENCE GAINS & LOSSES
WHAT IS IT?

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- Gain loss is the difference between expected results and the actual results.
- Gain loss analysis reconciles the plan's asset or liability from the prior year to the current year.
- As actuarial estimates are based on assumptions, gain loss arising is an indicator of deviation of plan's actual experience vs. assumptions made.
- A detailed gain loss analysis (by source) is about determining & quantifying possible causes of this deviation.

Last year's (LY) Valuation

- LY Active Liability
- LY Inactive Liability

This year's (TY) Expected Valuation

- TY Expected Active Liability
- TY Expected Inactive Liability

This year's Actual Valuation

- TY Active Liability
- TY Inactive Liability

ANALYSIS OF EXPERIENCE GAINS & LOSSES
WHAT IS IT?

Last year's (LY) Valuation

at 1/1/20XX-1

PBO_{LY}, NC_{LY}, BP_{LY}

This year's (TY) Expected Valuation

at 1/1/20XX

PBO_{Exp}

This year's Valuation

at 1/1/20XX

PBO_{TY}

Gain \ Loss

$$PBO_{Exp} = (PBO_{LY} + NC_{LY})(1 + i) - BP_{LY}(1 + i * 0.5)$$

i → Discount rate used in last valuation

Above formula can vary from simple interest to compound interest.

- Salary Increases
- Terminations, Retirements, Mortality
- Leave availment & encashment
- New entrants, Data changes
- Benefit payments & timing
- Asset return
- Contribution amounts & timing

Asset related

ANALYSIS OF EXPERIENCE GAINS & LOSSES
WHAT IS IT?

$PBO_{Exp} = (PBO_{LY} + NC_{LY})(1 + i) - BP_{LY}(1 + i * 0.5)$

Disclosure Reconciliation	Related items of Exp. Liability
DBO at end of prior year	PBO_{LY}
+ Current Service Cost	$NC_{LY} * (1 + i)$
+ Interest Expense	$PBO_{LY} * i - BP_{LY} * 0.5 * i$
- Benefit payments from plan	BP_{LY}
+/- Gains\Losses	-
DBO at end of current year	PBO_{Exp}

- Concept of expected liability consistent with accounting reconciliation.
- There will be no gain or loss if everything works as per our assumption.

ANALYSIS OF EXPERIENCE GAINS & LOSSES
GAIN\LOSS DUE TO SALARY

- One of the most commonly used assumption where actual experience deviate from expected.
- Even if average salary increase is inline with expected increase, individual employees do see variation.
- To determine impact due to salary changes:
    - Determine record's this year liability using expected salary, PBO_{Exp}
    - Determine record's this year liability using actual salary, PBO_{TY}

Let's look at an example:

- Consider a Gratuity plan – 15 / 26 * Salary * Service
- Salary assumption – 10% p.a. & Discount rate – 8% p.a.
- Retirement age – 65 years
- For simplicity no withdrawal (attrition), mortality or disability.

ANALYSIS OF EXPERIENCE GAINS & LOSSES
G\L SALARY – GRATUITY W\O BENEFIT LIMIT

Year	Description	Young EE	Tenured EE	Combined
Last Year	Salary	25,000	100,000	125,000
	Age, Service	30, 5	60, 35	
	Liability	~ 137,000	~ 2,213,000	
Expected This year	Salary	27,500	110,000	137,500
	Age, Service	31, 6	61, 36	
	Liability	TBD	TBD	
Actual This year	Salary	30,000	107,500	137,500
	Actual Sal. Inc.	20%	7.50%	10%
	Age, Service	31, 6	61, 36	
	Liability	TBD	TBD	
Gain\Loss		TBD	TBD	TBD

$Liability_t = 15 / 26 * Salary_t * Service_t * (1.1 / 1.08)^{(65 - Age_t)}$

ANALYSIS OF EXPERIENCE GAINS & LOSSES
G\L SALARY – GRATUITY WITH BENEFIT LIMIT

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Year	Description	Young EE	Tenured EE	Combined
Last Year	Salary	25,000	100,000	125,000
	Age, Service	30, 5	60, 35	
	Liability	~ 135,000	~ 1,361,000	
Expected This year	Salary	27,500	110,000	137,500
	Age, Service	31, 6	61, 36	
	Liability	TBD	TBD	
Actual This year	Salary	30,000	107,500	137,500
	Actual Sal. Inc.	20%	7.50%	10%
	Age, Service	31, 6	61, 36	
	Liability	TBD	TBD	
Gain\Loss		TBD	TBD	TBD

$$Liability_t = Min(2{,}000{,}000,\ 15 / 26 * Salary_t * Service_t * 1.1^{(65 - Age_t)}) * (1/1.08)^{(65 - Age_t)}$$

ANALYSIS OF EXPERIENCE GAINS & LOSSES
G\L SALARY – GRATUITY W\O BENEFIT LIMIT

Year	Description	Young EE	Tenured EE	Combined
Last Year	Salary	25,000	100,000	125,000
	Age, Service	30, 5	60, 35	
	Liability	~ 137,000	~ 2,213,000	
Expected This year	Salary	27,500	110,000	137,500
	Age, Service	31, 6	61, 36	
	Liability	~ 177,000	~ 2,459,000	
Actual This year	Salary	30,000	107,500	137,500
	Actual Sal. Inc.	20%	7.50%	10%
	Age, Service	31, 6	61, 36	
	Liability	~ 194,000	~ 2,403,000	
(Gain)\Loss		16,000	(56,000)	(40,000)

- Approx. Gain\Loss = $[1 – (1 + Sal_E) / (1 + Sal_A)] \times AL_{Act}$

ANALYSIS OF EXPERIENCE GAINS & LOSSES
G\L SALARY – GRATUITY WITH BENEFIT LIMIT

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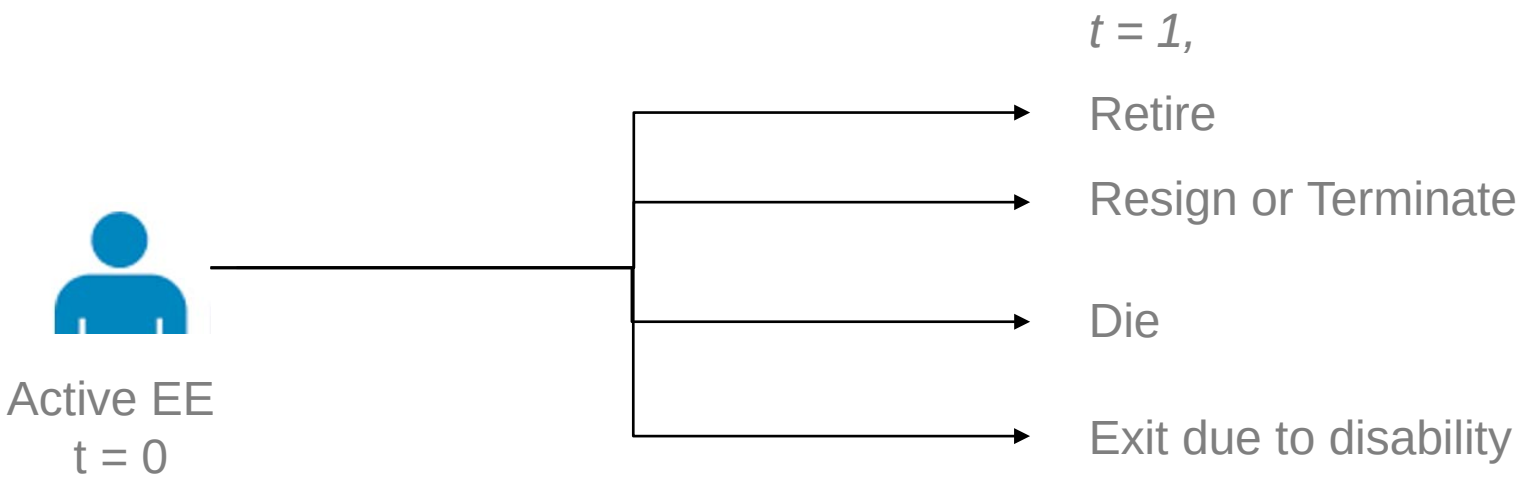
Year	Description	Young EE	Tenured EE	Combined
Last Year	Salary	25,000	100,000	125,000
	Age, Service	30, 5	60, 35	
	Liability	~ 135,000	~ 1,361,000	
Expected This year	Salary	27,500	110,000	137,500
	Age, Service	31, 6	61, 36	
	Liability	~ 146,000	~ 1,470,000	
Actual This year	Salary	30,000	107,500	137,500
	Actual Sal. Inc.	20%	7.50%	10%
	Age, Service	31, 6	61, 36	
	Liability	~ 146,000	~ 1,470,000	
(Gain)\Loss		-	-	-

ANALYSIS OF EXPERIENCE GAINS & LOSSES
GAIN\LOSS DUE TO DECREMENTS

- Estimates of Gain\Loss due to decrements is a bit more complex.
- Decrement gain\loss occur in two broad categories:
  - Continuing Active - Gain\Loss because decrement assumption didn't materialize
    - A certain portion of LY estimated liability assumed employee will exit organization
  - Active to Non-Active – Gain\Loss because decrement assumption did materialize
    - Only a certain portion of LY estimated liability assumed employee will exit organization



Each decrement if applicable over an year is likely to result in a Gain\Loss

ANALYSIS OF EXPERIENCE GAINS & LOSSES
G\L DECREMENT – WITHDRAWAL RATES

Description	With. rate – 10%
Salary	25,000
Age, Service	30, 5
Exp. Duration	10
a. Liability	~ 87,000
b. Actual Benefit	72,000
Continuing Active	
Estimated release of active liability	8,700 (10% * 87,000)
Estimated add to inactive liability	7,200 (10% * 72,000)
c. (Gain)/Loss	1,500
Active to Non-Active	
(Gain)/Loss	-13,500 (b. – a. + c.)

*Liability = 15 / 26 * Salary * Service * (1.1 / 1.08)^(Duration)

Let's look at an example:

- Consider a Gratuity plan with no benefit limit
- Salary assumption – 10% p.a.
- Discount rate – 8% p.a.
- Retirement age – 65 years
- No mortality or disability.

ANALYSIS OF EXPERIENCE GAINS & LOSSES
G\L DECREMENT – SCENARIOS

Description	With. rate – 10%	With. rate – 20%	With. rate – 50%	Retire in one year
Salary	25,000	25,000	25,000	25,000
Age, Service	30, 5	30, 5	30, 5	65, 5
Exp. Duration	10	5	2	1
a. Liability	~ 87,000	TBD	TBD	TBD
b. Actual Benefit	72,000	72,000	72,000	72,000
Continuing Active				
Estimated release of active liability	8,700 (10% * 87,000)	TBD	TBD	TBD
Estimated add to inactive liability	7,200 (10% * 72,000)	TBD	TBD	TBD
c. (Gain)/Loss	1,500	TBD	TBD	TBD
Active to Non-Active				
(Gain)/Loss	-13,500 (b. – a. + c.)	TBD	TBD	TBD

Liability = 15 / 26 * Salary * Service * (1.1 / 1.08)^(Duration)

ANALYSIS OF EXPERIENCE GAINS & LOSSES
G\L DECREMENT – SCENARIOS

Description	With. rate – 10%	With. rate – 20%	With. rate – 50%	Retire in one year
Salary	25,000	25,000	25,000	25,000
Age, Service	30, 5	30, 5	30, 5	65, 5
Exp. Duration	10	5	2	1
a. Liability	~ 87,000	~ 79,000	~ 75,000	~ 73,000
b. Actual Benefit	72,000	72,000	72,000	72,000
Continuing Active				
Estimated release of active liability	8,700 (10% * 87,000)	15,800	37,500	73,000
Estimated add to inactive liability	7,200 (10% * 72,000)	14,400	36,000	72,000
c. (Gain)/Loss	1,500	1,400	1,500	1,000
Active to Non-Active				
(Gain)/Loss	-13,500 (b. – a. + c.)	- 5,600	- 1,500	-

Liability = 15 / 26 * Salary * Service * (1.1 / 1.08)^(Duration)

ANALYSIS OF EXPERIENCE GAINS & LOSSES
INVESTMENT EXPERIENCE

i	=	Valuation discount rate
F	=	Actual fund return since last actuarial valuation

Approx. G\L = (F – i) * ($Assets_{t-1}$ + $Assets_{t}$) / 2

- Deviation b\w actual vs. assumed rate of return on assets is often the most significant but not sole reason for gain or loss on asset side.
- Other reasons are:
  - Timing of benefit payments, contributions – assumed vs. actual
  - Actual amount of contributions, benefit payments vs. assumed
  - Expenses assumed
  - Proportion of benefit payments made from assets vs. direct benefit payments
  - Fluctuations due to ULIP funds.

ANALYSIS OF EXPERIENCE GAINS & LOSSES
INVESTMENT EXPERIENCE

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Reconciliation	Expected*	Timing	Amounts	Return	All
Assets at B.O.Y	1,00,000	1,00,000	1,00,000	1,00,000	1,00,000
+ Contributions	10,000	10,000	5,000	10,000	5,000
- Benefit Payment	(5,000)	(5,000)	(10,000)	(5,000)	(10,000)
+ Expected Return	8,200	8,200	8,200	8,200	8,200
+/- Gain\Loss	-	TBD	TBD	TBD	TBD
Assets at E.O.Y	1,13,200	TBD	TBD	TBD	TBD
	Assumed 8% return and mid-year timing for contribution & payments	Actual 8% return and BOY timing for contribution & payments	Actual 8% return and mid-year timing for contribution & payments	Actual 10% return and mid-year timing for contribution & payments	Actual 10% return and BOY timing for contribution & payments

- Expected scenario reflects results expected based on assumptions made at BOY about EOY assets.
- All other scenarios reflect actual results.

ANALYSIS OF EXPERIENCE GAINS & LOSSES
INVESTMENT EXPERIENCE

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Reconciliation	Expected*	Timing	Amounts	Return	All
Assets at B.O.Y	1,00,000	1,00,000	1,00,000	1,00,000	1,00,000
+ Contributions	10,000	10,000	5,000	10,000	5,000
- Benefit Payment	(5,000)	(5,000)	(10,000)	(5,000)	(10,000)
+ Expected Return	8,200	8,200	8,200	8,200	8,200
+/- Gain\Loss	-	200	(400)	2,050	1,300
Assets at E.O.Y	1,13,200	1,13,400	1,02,800	1,15,250	1,04,500
	Assumed 8% return and mid-year timing for contribution & payments	Actual 8% return and BOY timing for contribution & payments	Actual 8% return and mid-year timing for contribution & payments	Actual 10% return and mid-year timing for contribution & payments	Actual 10% return and BOY timing for contribution & payments

- Expected scenario reflects results expected based on assumptions made at BOY about EOY assets.
- All other scenarios reflect actual results.

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THANK YOU
ANY QUESTIONS?