



*Concurrent Session C4: 3 : Future of  
Non Life Insurance and DFA tools*

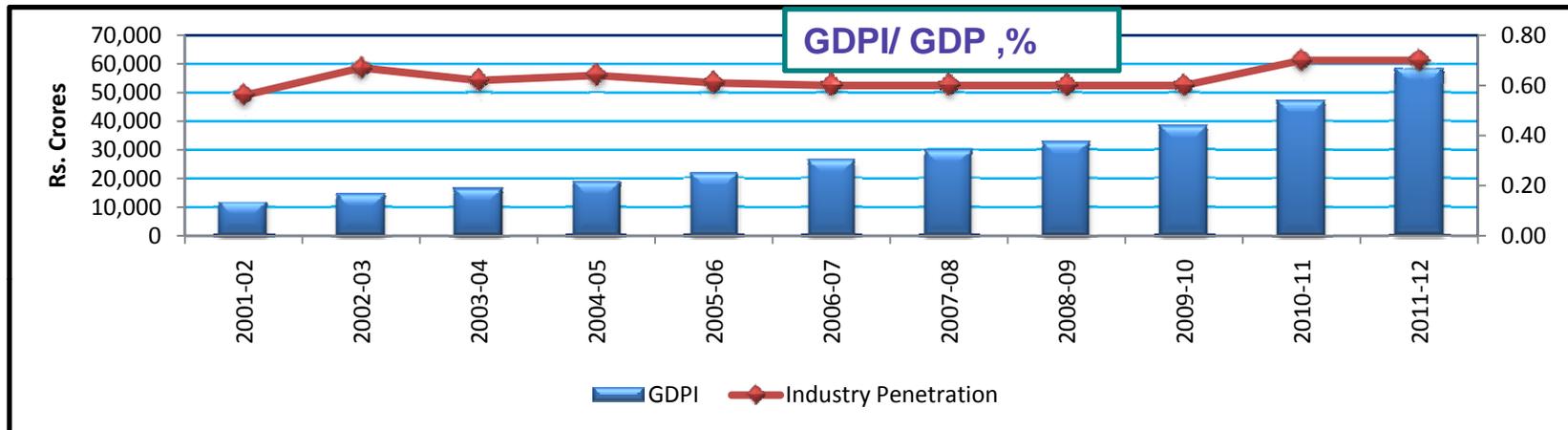
R. Chandrasekaran  
Secretary General, General Insurance Council India

*Waves of Reforms...Oceans of Opportunities*

*2013 AGFA & 15<sup>th</sup> Global Conference of Actuaries*

17<sup>th</sup> – 19<sup>th</sup> Feb, 2013 | Mumbai,  
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*Industry has grown 4 times in the past 11 years*



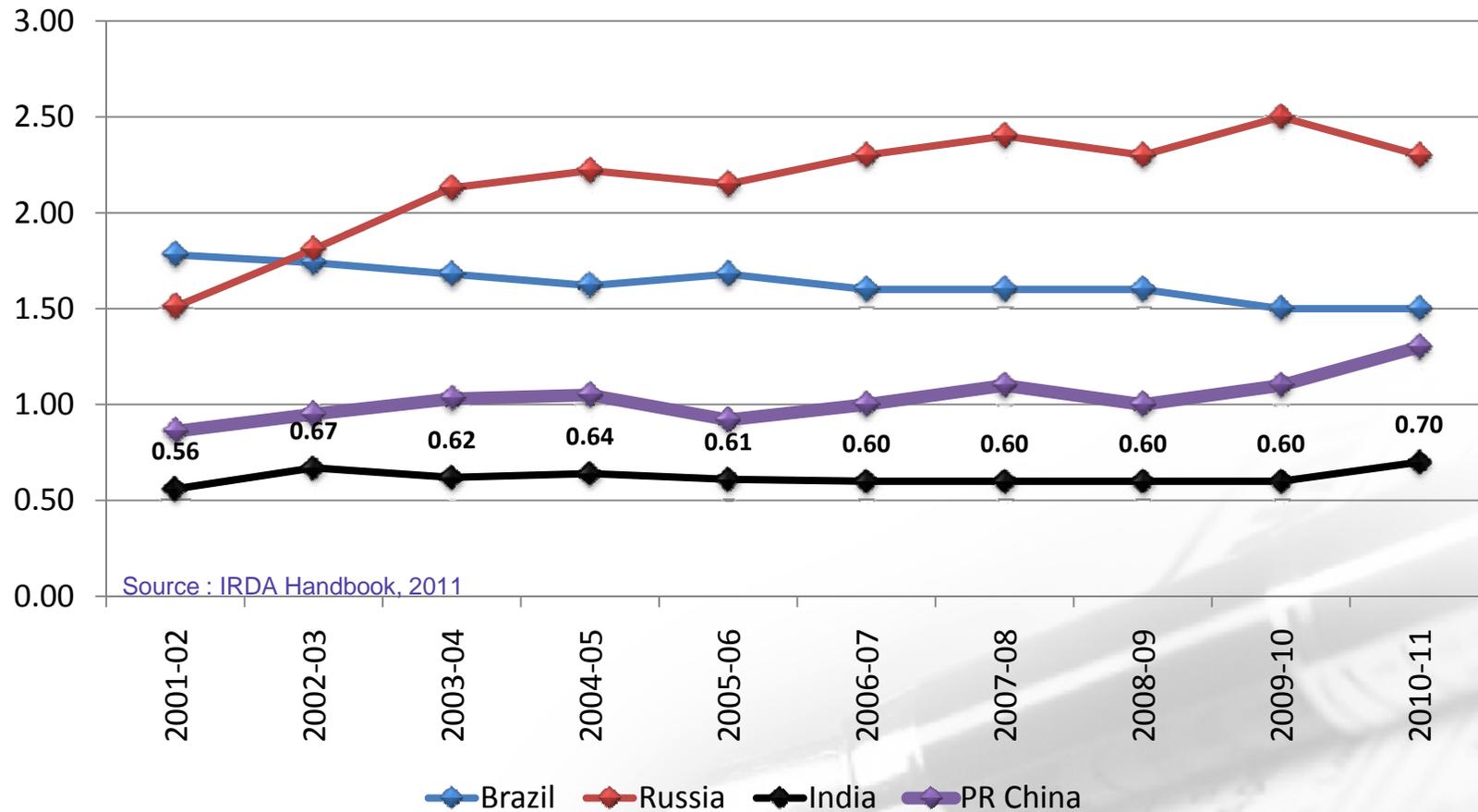
### General Insurance Industry Comparison (FY12 vs FY01)

Parameter	FY 12	FY 01
No. of Insurers	27	9
No. of Offices	7,035	3,252
No. of Policies (million)	100	37
No. of Employees	95,726	80,900
No. of Agents	461,886	45,000
Total Annual Premium (Rs. Crs) GDPI	58,326	10,137
Paid-up Capital (Rs. Crs)	7,396	1,247
FDI (Rs. Crs)	1,886	119
Investment (Rs. Crs)	18,758	850

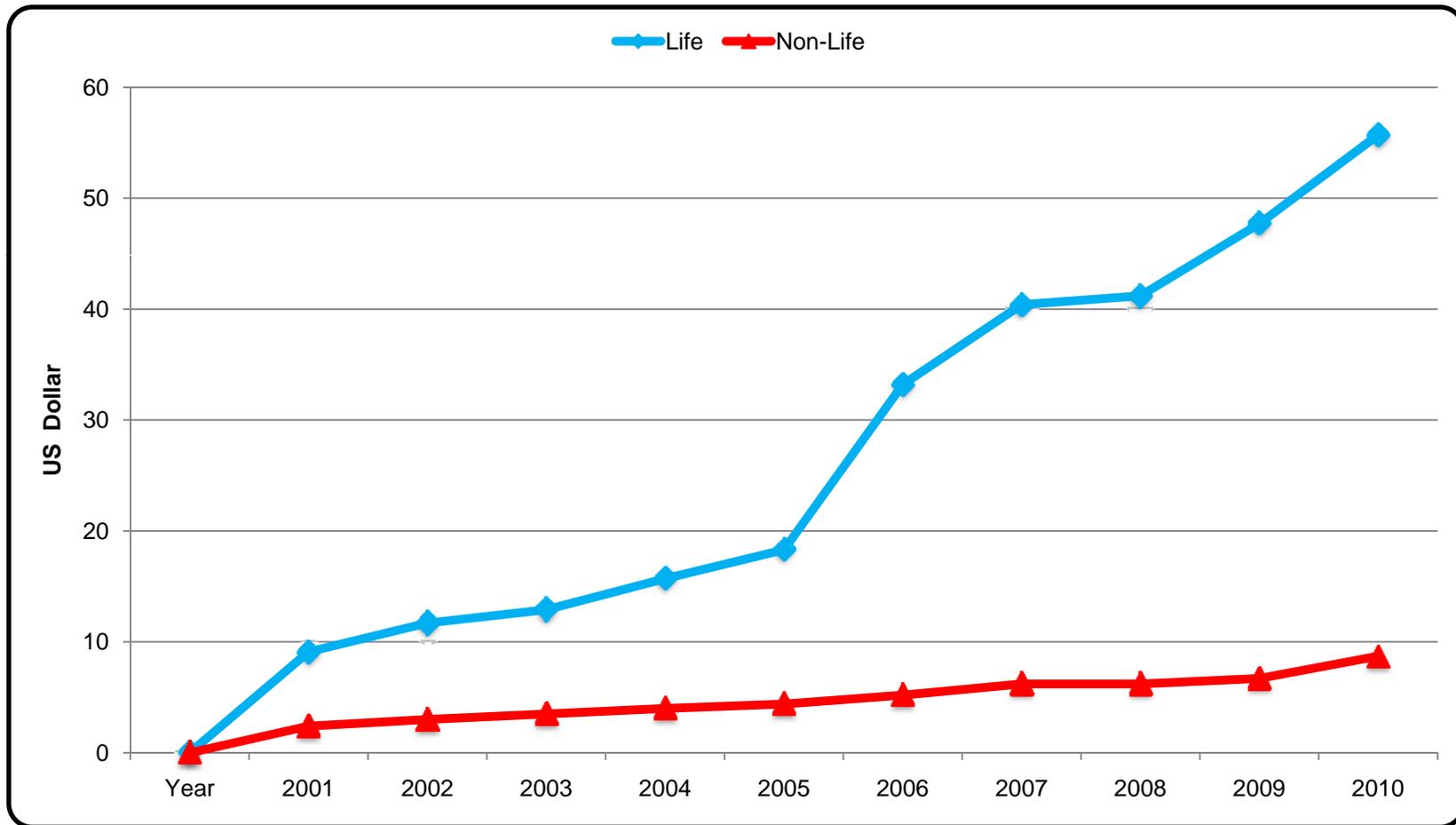
Source : IRDA Handbook, 2011, GIC Council Primary data

## Penetration – A comparison with BRIC countries

### Industry Premium as % of GDP



# Insurance Density in India

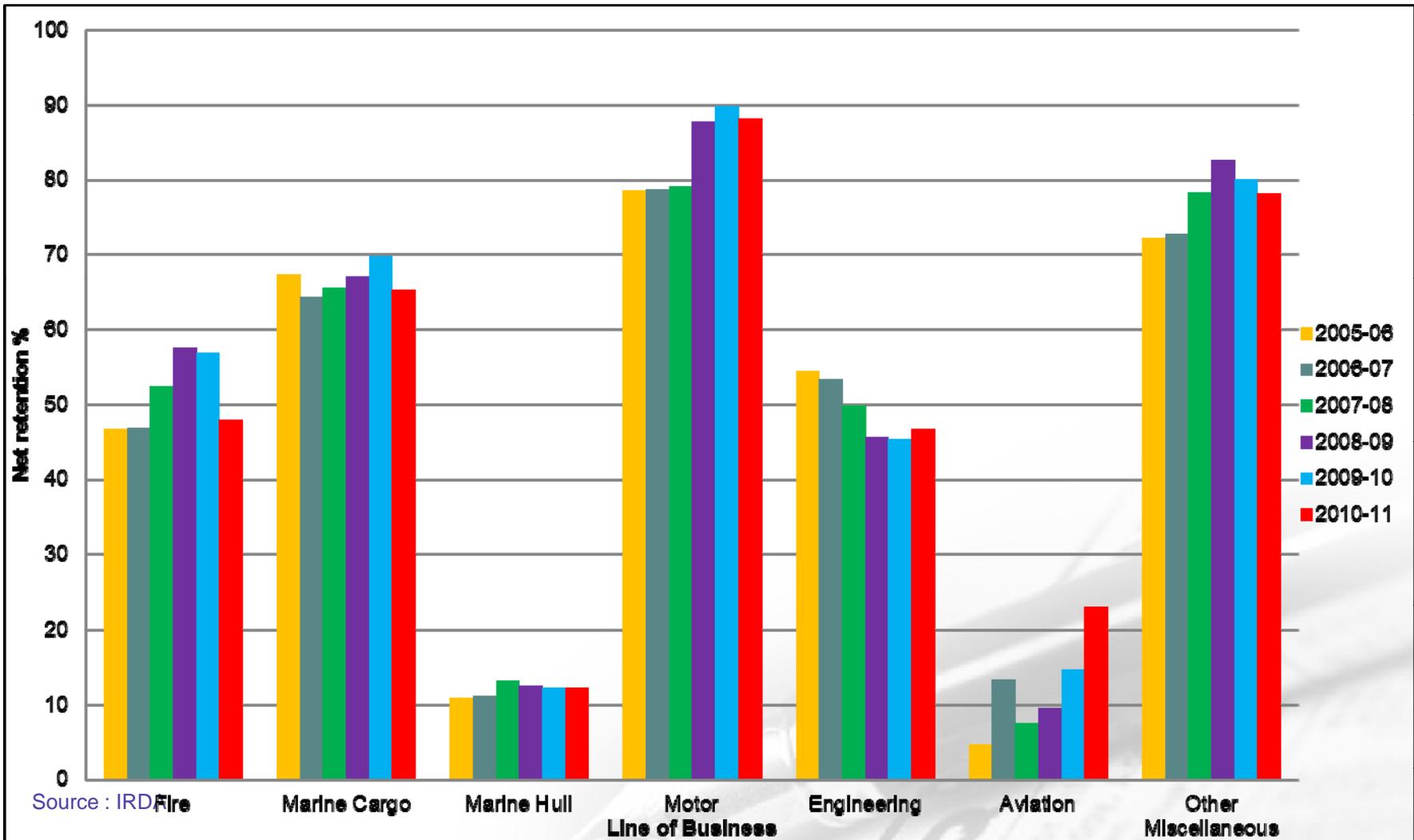


Source : Sigma report, Swiss Re

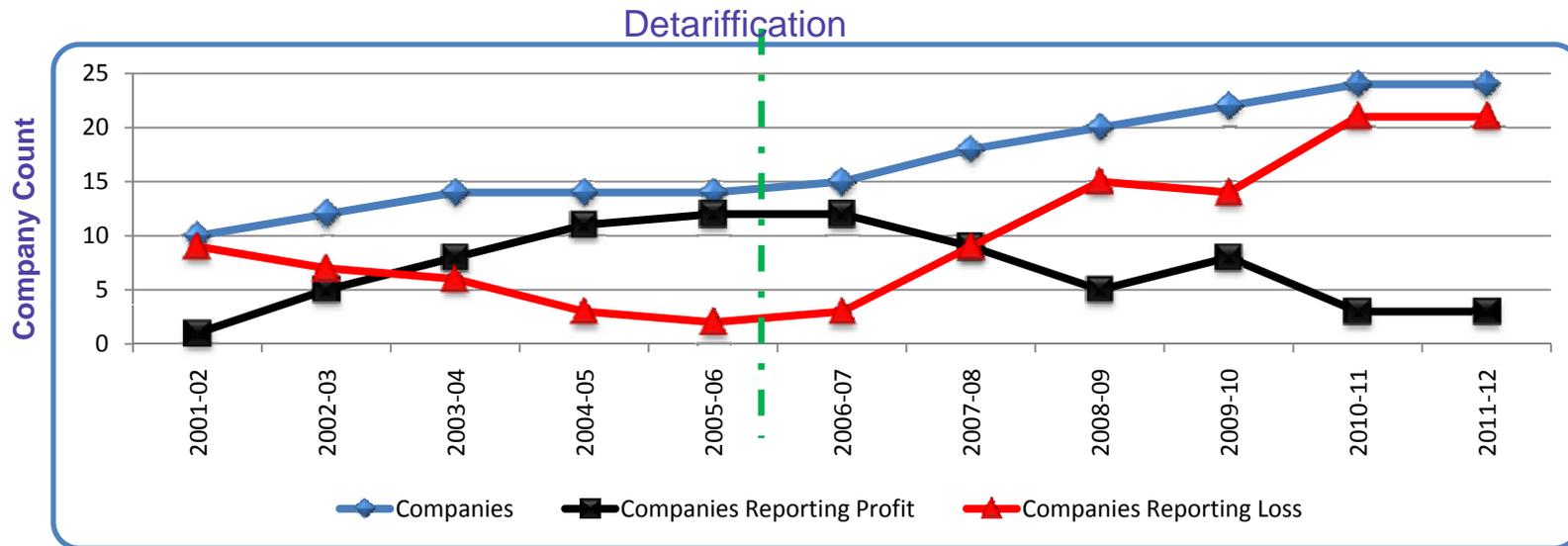
# Premium - 2001- 2012



# Net Retention 2005-06 till 2010-11



# Underwriting results



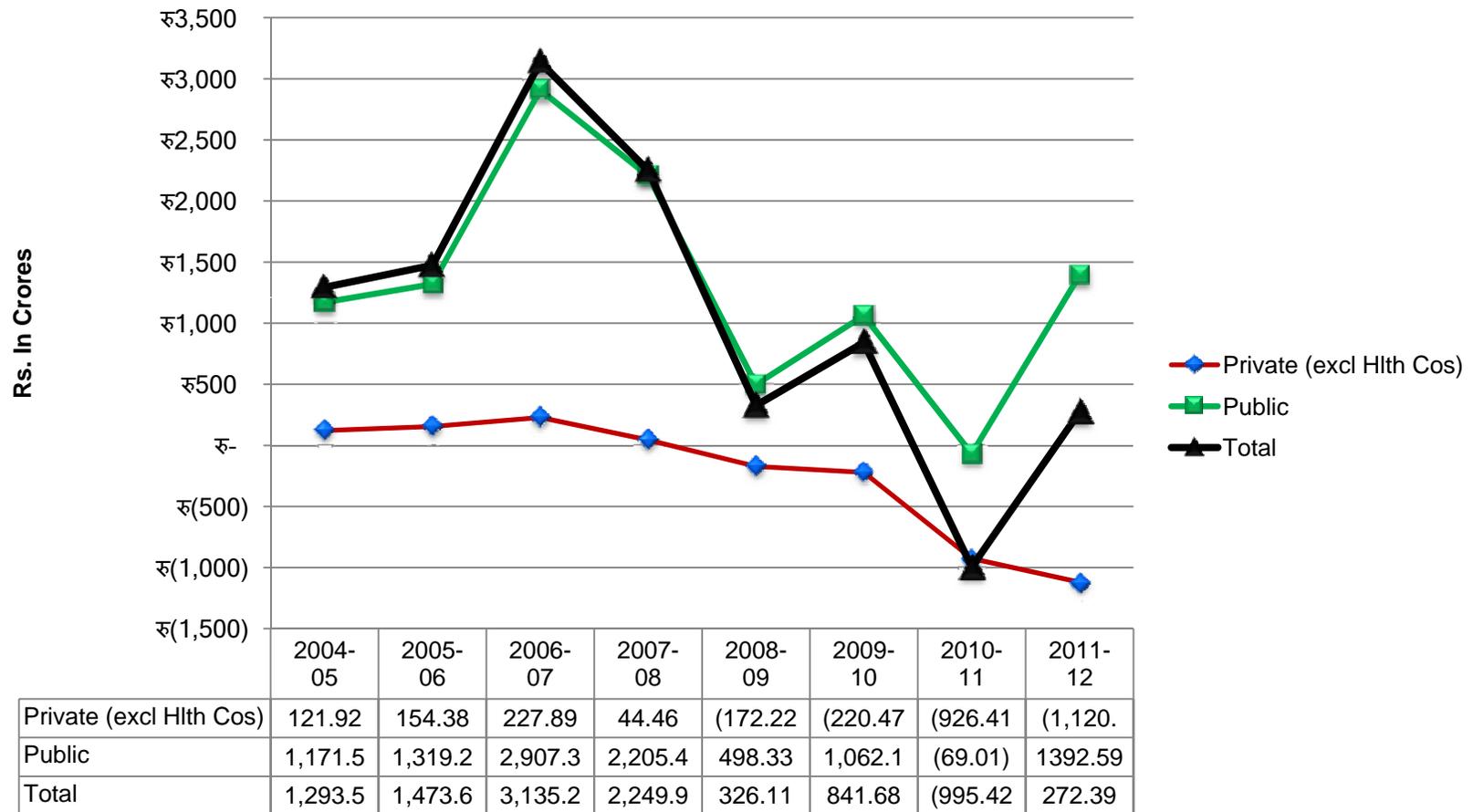
➤ 21 Cos in red for FY11 & FY12 – owing to Motor TP Insurance provisioning

➤ Declining support from investment income from FY09 onwards

➤ Between FY04 to FY08, significant contribution to PAT from PSUs, Private Sector Insurance companies & Specialized insurance Cos (ECGC, AIC)

Source : IRDA Handbook, 2011, GIC Council Primary data

# Profit After Tax



Source : Fin .Highlights; Figures exclude .ECGC / AIC;  
Figures exclude Health Companies



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## *Property Insurance*

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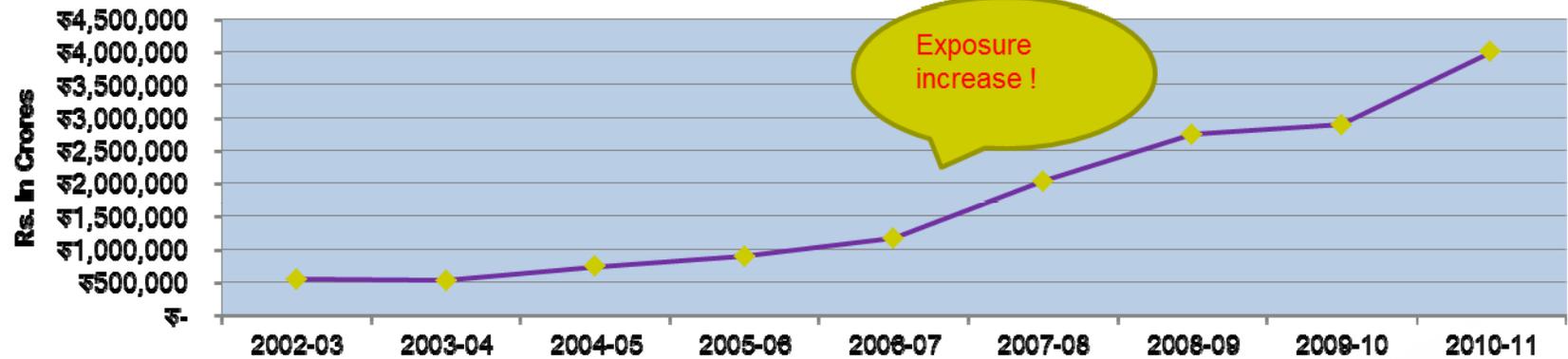
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## Property Exposure & Premium 2002-03 till 2010-11

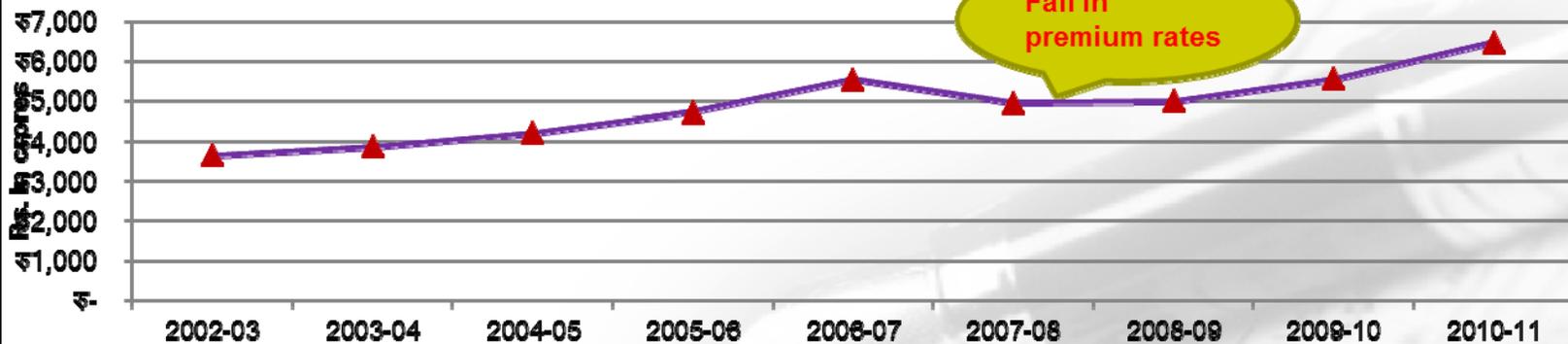
<u>Financial Year</u>	<u>S.I Accumulation (Rs. In Crs)</u>	<u>% increase or decrease in Accumulation from last year</u>	<u>Premium (Rs. In Crs)</u>	<u>% increase or decrease in Premium from last year</u>
2003	538,922.20		3,658.89	
2004	516,609.00	8.58	3,876.87	5.96%
2005	731,713.31	41.64	4,207.30	8.52%
2006	886,276.50	21.12	4,725.25	12.31%
2007	1,161,536.19	31.06	5,533.55	17.11%
2008	2,019,586.99	73.87	4,949.62	-10.55%
2009	27,41402.65	35.74	4,993.74	0.89%
2010	28,83,830.96	5.20	5,554.89	11.24%
2011	39,99,313.82	38.70	6,471.18	16.51%

# Property exposure and Premium

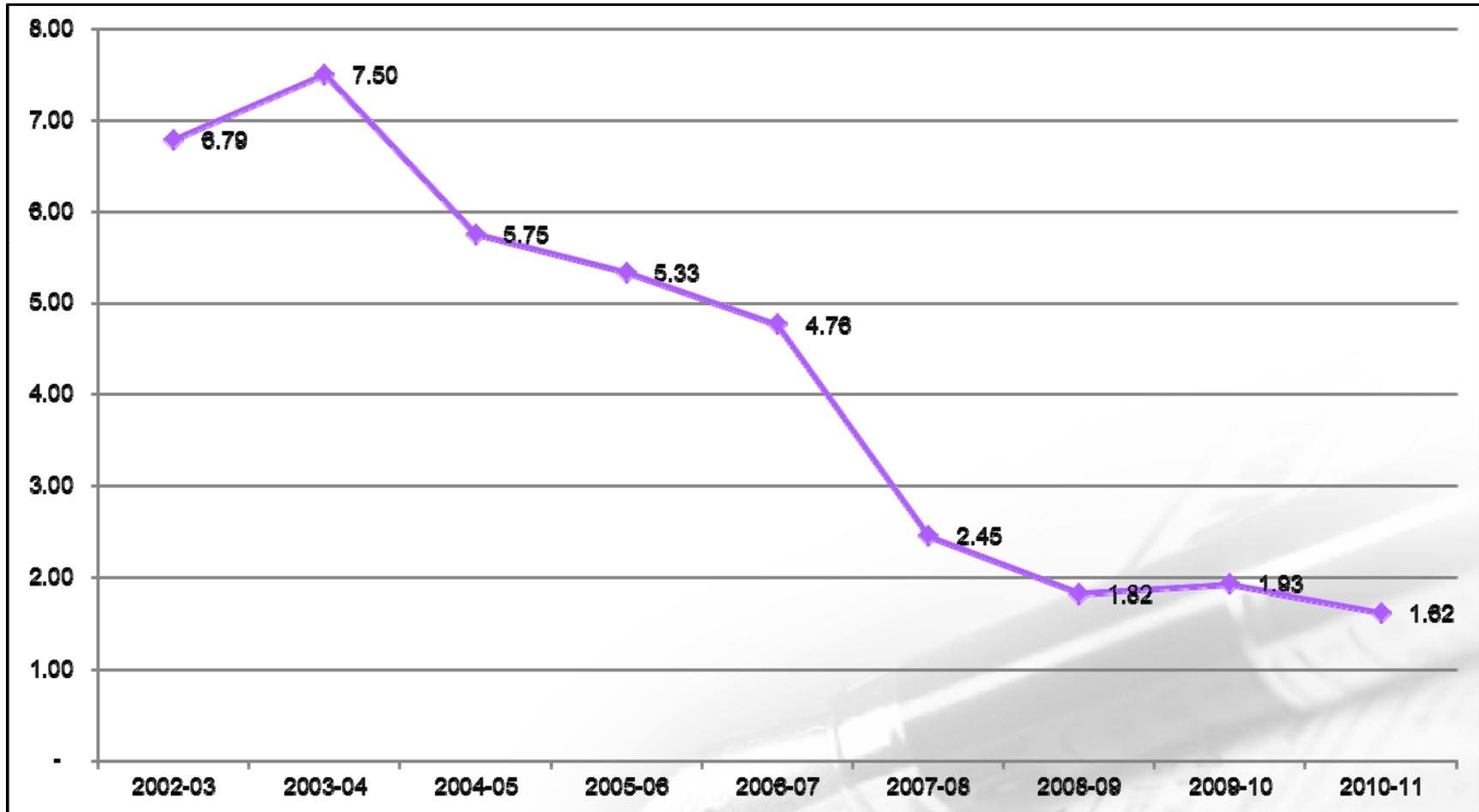
## S.I. Accumulation



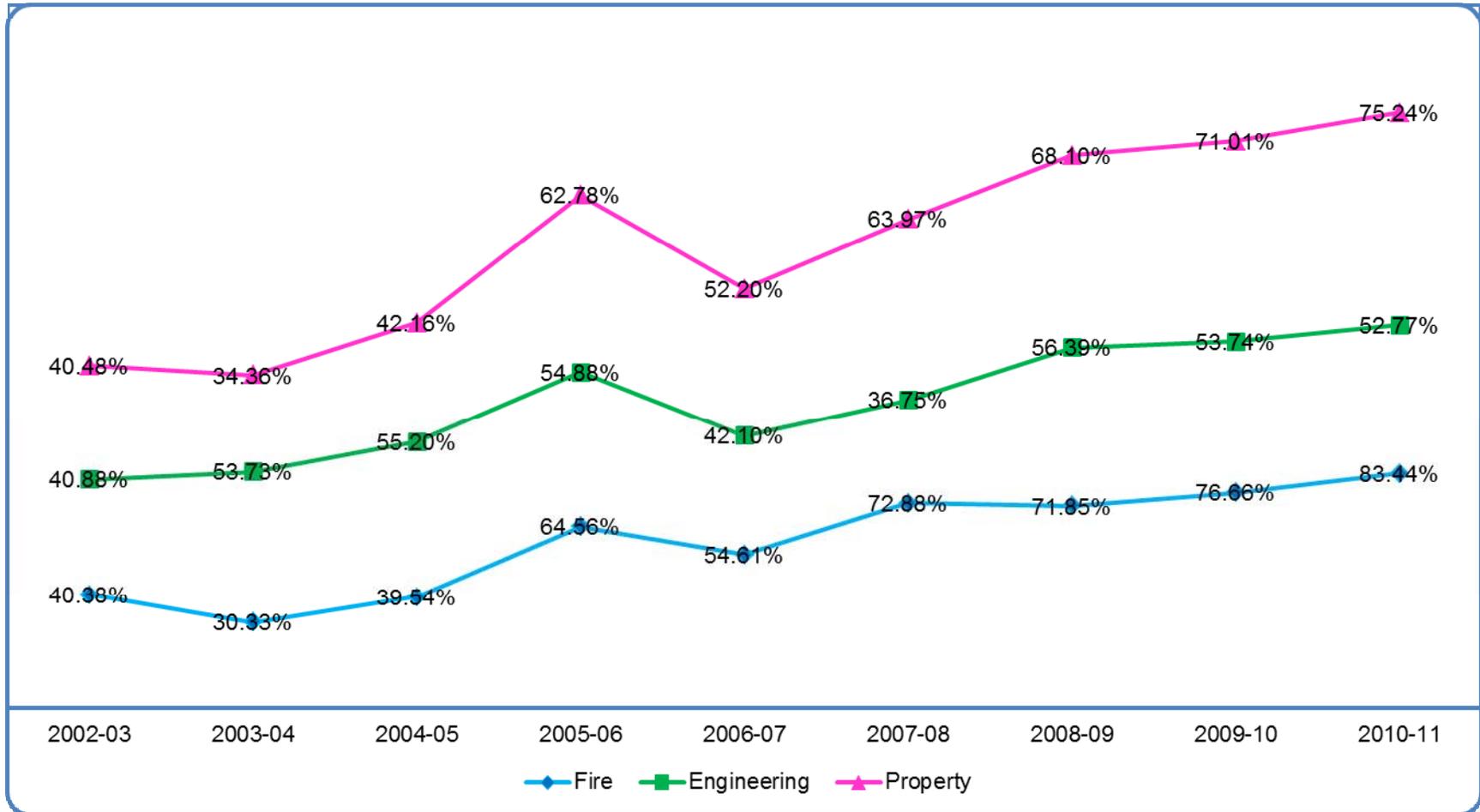
## Premium



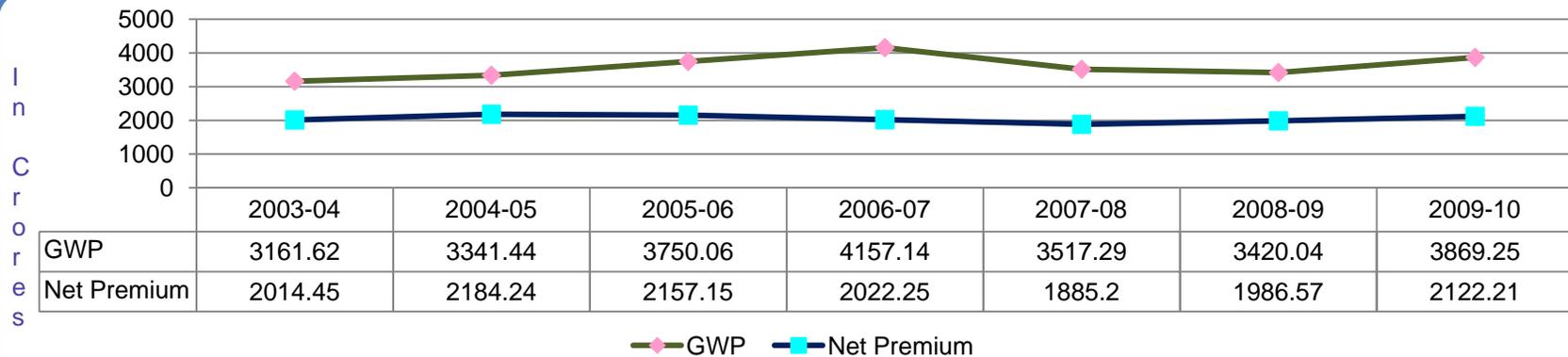
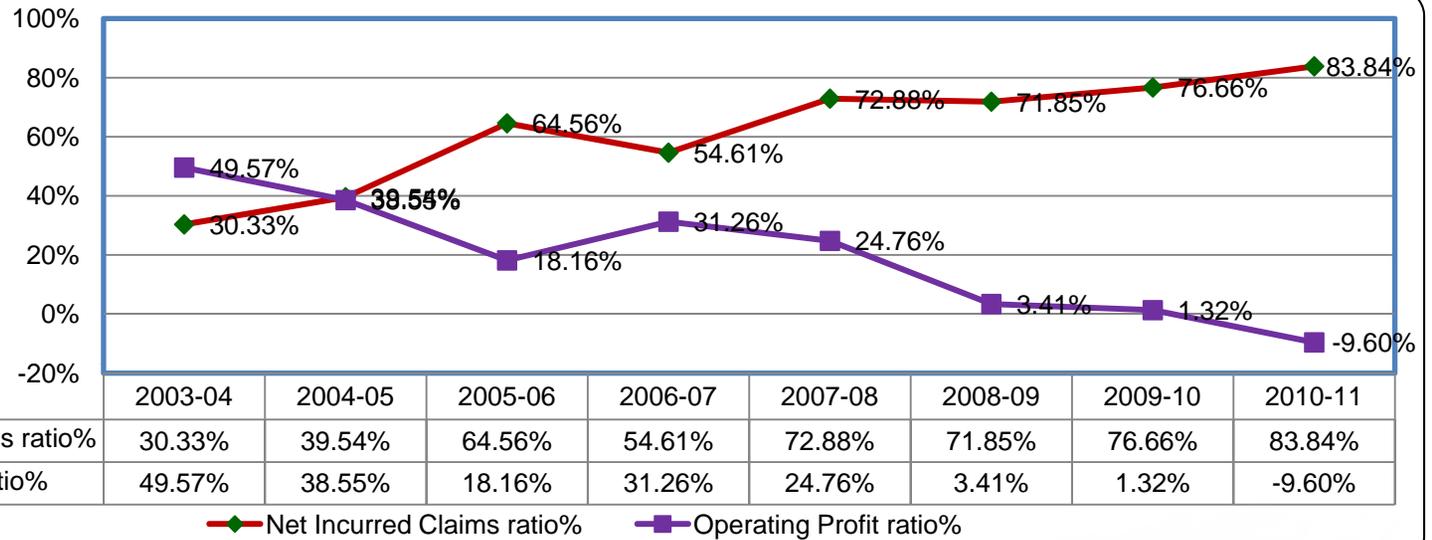
## *Fire Insurance – (Rate per mille)*



# Net Incurred Claim Ratio Trend



# Trend Analysis - Fire





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## *Dynamic Financial Tool for non life insurance industry*

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## *What is DFA?*

- Dynamic Financial Analysis (DFA) Systems model the Entire Operations (Liabilities and Assets) of an Insurance Company
- Statistical Simulation Techniques are used to model not only Point Estimates, but also the **Distribution of Outcomes**
- This Provides Answers Conventional Analysis cannot
  - *What Is The Chance Of A Given Financial Result?*
  - *How Often Is A Given Alternative Better?*
  - *To What Degree?*
  - *Under What Circumstances?*

## *Steps in a DFA methodology*

1. Identify Company's Needs and Objectives
  - i. **Return** – *What is your measure of success?*  
Usually stated in accounting terms
  - ii. **Risk** – *Why do you buy reinsurance?*  
Measure of volatility of return, **usually downside**
2. Develop a Model Underlying Gross Liabilities by Line of Business
3. Select Reinsurance Options to Compare
  - a) How does changing retentions impact net results?
  - b) What combination of excess and pro-rata work best?
  - c) What is impact of changing covers or inuring structure?
  - d) How do loss sensitive and commission terms impact results?
  - e) What is effect of combining programs across operating units?
4. Run DFA Model Several Times with Varying Structures
5. Create Output Statistics and Graphs / Tables to Evaluate Options

# A DFA model for an Insurance company

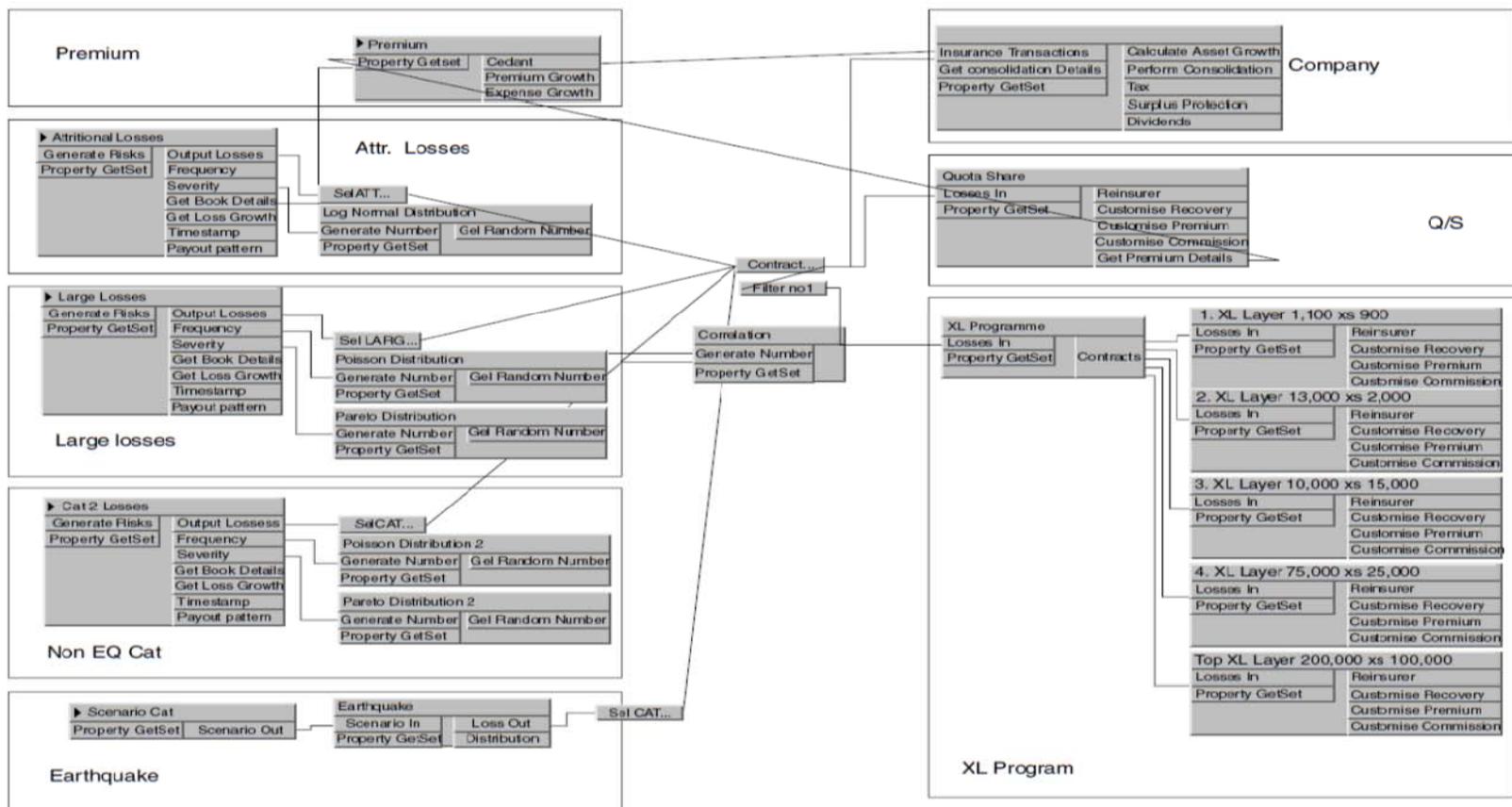


Figure 2 Extract from a DFA company model

# Data Requirements for a DFA tool

Data item	Category	Primary Source	Secondary Source
Exposure	Earning	Business Plan	
Premium rates	Earning	Business Plan	
Premium receipt pattern	Earning	IT	
Earning pattern	Earning	IT	
Acquisition costs	Expenses	Business Plan	
Operating costs	Expenses	Business Plan	
UPR as at 31 Dec	Run-off	IT	
Claim reserves as at 31 Dec	Run-off	IT	Actuarial
Claim payment pattern	Losses	Actuarial	IT
Claims inflation	Losses	Business Plan	
General inflation	Economic	Business Plan	
Mean of attritional loss ratio	Losses	Business Plan	Actuarial
Standard deviation of attritional loss ratio	Losses	Actuarial	
Mean of large loss frequency	Losses	Claims	
Standard deviation of large loss frequency	Losses	Actuarial	
Mean of large loss severity	Losses	Claims	
Standard deviation of large loss severity	Losses	Actuarial	
Cat loss output	Losses	Internal Auditor	
Retrocession programs	Retrocession	Internal Auditor	
Retrocessionaire shares and credit ratings	Retrocession	Internal Auditor	
Correlations between groups	Correlations	Management	Actuarial
Correlations between years	Correlations	Management	Actuarial
Correlations between investment assets	Correlations	Management	Actuarial
Correlations of investment assets with credit defaults	Correlations	Management	Actuarial
Investment portfolio composition	Investment	Accounts	
Mean of return for each asset class	Investment	Management	Accounts
Standard deviation of return for each asset class	Investment	Management	Accounts
List of major operational risks	Operational	Internal Auditor	
Loss distribution for each major operational risk	Operational	Management	Internal Auditor
Correlation of operational risks with other components	Operational	Management	Internal Auditor
Capital required for special contracts	Special Contracts	Management	Technical
Correlation of special contracts with other components	Special Contracts	Management	Technical
Required output	Output	Management	



# Single (Risk) Loss

## Poisson Pareto parameter review

Expected single loss exceedence (Pareto severity):

EVENT SEVERITY AND FREQUENCY		
Percentile	Loss	Mean Excess Frequency
50.0%	347,060	0.20
60.0%	414,200	0.16
90.0%	1,225,182	0.04
96.0%	2,433,154	0.02
98.0%	3,939,794	0.01
99.0%	6,035,646	0.00
99.6%	9,365,998	0.00
99.8%	11,714,682	0.00
99.9%	13,485,644	0.00
Mean	668,424	

EVENT RETURN PERIOD		
Percentile	Years	Loss
50.0%	2	
80.0%	5	318,172
90.0%	10	576,101
96.0%	25	1,206,188
98.0%	50	2,051,494
99.0%	100	3,378,457
99.6%	250	6,028,835
99.8%	500	8,538,326
99.9%	1,000	11,007,971
	Annual Mean	267,369

FREQUENCY (Poisson)	
Mean	0.400

SEVERITY	
Min	200,000
Max	16,000,000
Pareto (inputs)	
Alpha	1.25
Beta	0

# Exposure curves used as Inputs!

	LOCAL	ARAB	FAR EAST	INDIA	IRAN & TURKEY
<b>Fire</b>	Small commercial (Swiss Re c = 2) (SI basis)	Small commercial (Swiss Re c = 2) (SI basis)	Small commercial (Swiss Re c = 2) (SI basis)	Small commercial (Swiss Re c = 2) (SI basis)	Small commercial (Swiss Re c = 2) (SI basis)
<b>Motor Accident</b>	UK / International Commercial GL - Low	Benfield internal curve	UK / International Commercial GL - Low	UK / International Commercial GL - Low/Benfield internal curve for Proportional	UK / International Commercial GL - Low/Benfield internal curve for Proportional
<b>Med Ex</b>	n/a	n/a	n/a	n/a	n/a
<b>GA Other</b>	n/a	n/a	n/a	n/a	n/a
<b>Engineering</b>	Medium commercial (Swiss Re c = 3) (SI basis)	Medium commercial (Swiss Re c = 3) (SI basis)	Medium commercial (Swiss Re c = 3) (SI basis)	Medium commercial (Swiss Re c = 3) (SI basis)	Medium commercial (Swiss Re c = 3) (SI basis)
<b>Hull</b>	Medium commercial (Swiss Re c = 3) (SI basis)	Medium commercial (Swiss Re c = 3) (SI basis)	Medium commercial (Swiss Re c = 3) (SI basis)	Medium commercial (Swiss Re c = 3) (SI basis)	Medium commercial (Swiss Re c = 3) (SI basis)
<b>Cargo</b>	Medium commercial (Swiss Re c = 3) (SI basis)	Medium commercial (Swiss Re c = 3) (SI basis)	Medium commercial (Swiss Re c = 3) (SI basis)	Medium commercial (Swiss Re c = 3) (SI basis)	Medium commercial (Swiss Re c = 3) (SI basis)

## Profit and Loss Calculations

	Accident Year
<b>Region</b>	<b>Western</b>
<b>Line of Business ( LO B )</b>	<b>Fire</b>
<b>Gross premium Earned</b>	<b>2,180,000</b>
<b>Base RI Premium Earned</b>	<b>206,868</b>
<b>Re instatement premium</b>	<b>15,555</b>
<b>Total RI Premium Earned</b>	<b>222,424</b>
<b>Net Premium Earned</b>	<b>1,958,241</b>
<b>Gross Losses incurred</b>	<b>1,653,535</b>
<b>Recoveries Incurred</b>	<b>88,451</b>
<b>Net Losses Incurred</b>	<b>1,565,084</b>
<b>Gross Expenses</b>	<b>436,133</b>
<b>Commission on Inward Business</b>	<b>0</b>
<b>Net Expenses</b>	<b>436,133</b>
<b>Gross Underwriting Result</b>	<b>90,997</b>
<b>Net Unerwriting Result</b>	<b>(42,976)</b>
<b>Net Reinsurance Benefit</b>	<b>(133,973)</b>

## A Gross and a Net Summary

	Local						
	Fire	Motor Acciden	Med Ex	GA Other	Eng	Hull	Cargo
Gross Premium	550,201	304,492	0	0	344,754	237,105	509,452
Net Premium	494,552	298,314	0	0	310,359	201,860	449,316
RI premium	55,649	6,178	0	0	34,395	35,245	60,136
Gross losses	416,731	237,179	0	0	200,344	199,215	213,404
Net losses	399,394	237,179	0	0	189,937	108,266	121,615
Reinsurance recoveries	17,338	0	0	0	10,408	90,949	91,789
Gross Underwriting Result	23,430	6,414	0	0	75,459	-9,531	194,157
Net Underwriting Result	-14,883	236	0	0	51,471	46,174	225,811
Net Benefit of reinsurance	-38,313	-6,178	0	0	-23,988	55,704	31,653
Gross Loss Ratio	76%	78%			58%	84%	42%
Net Loss Ratio	81%	80%			61%	54%	27%



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## *DFA Application for reinsurance*

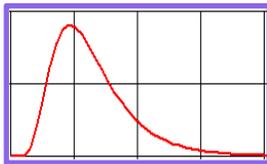
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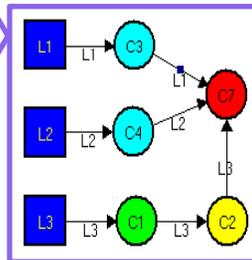
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# Schema DFA model for Reinsurance

**Model Insurance  
and Asset  
Portfolio**



**Define Reins  
Structure**



**Simulate  
Results**



**Gross,  
Ceded, and  
Net Results,  
in Financial  
Accounting  
Framework**

**Loss distributions  
Premiums  
Balance Sheet**

**Limits  
Retentions  
Ceded Rates**

# *Reinsurance Model Options*

- Gross Business – Loss Models
  - Aggregate loss models
  - Individual Loss Models – Frequency - Severity models for large losses
  - Catastrophes losses
    - Individual Loss models
    - Inputs from external CAT models
- Reinsurance Options – Net Business
  - XOL retention
  - Pro Rata
    - Cession
    - Fixed vs Sliding scale commission
  - Stop loss (attaching at 85% loss) and LAE (10 points of limit)

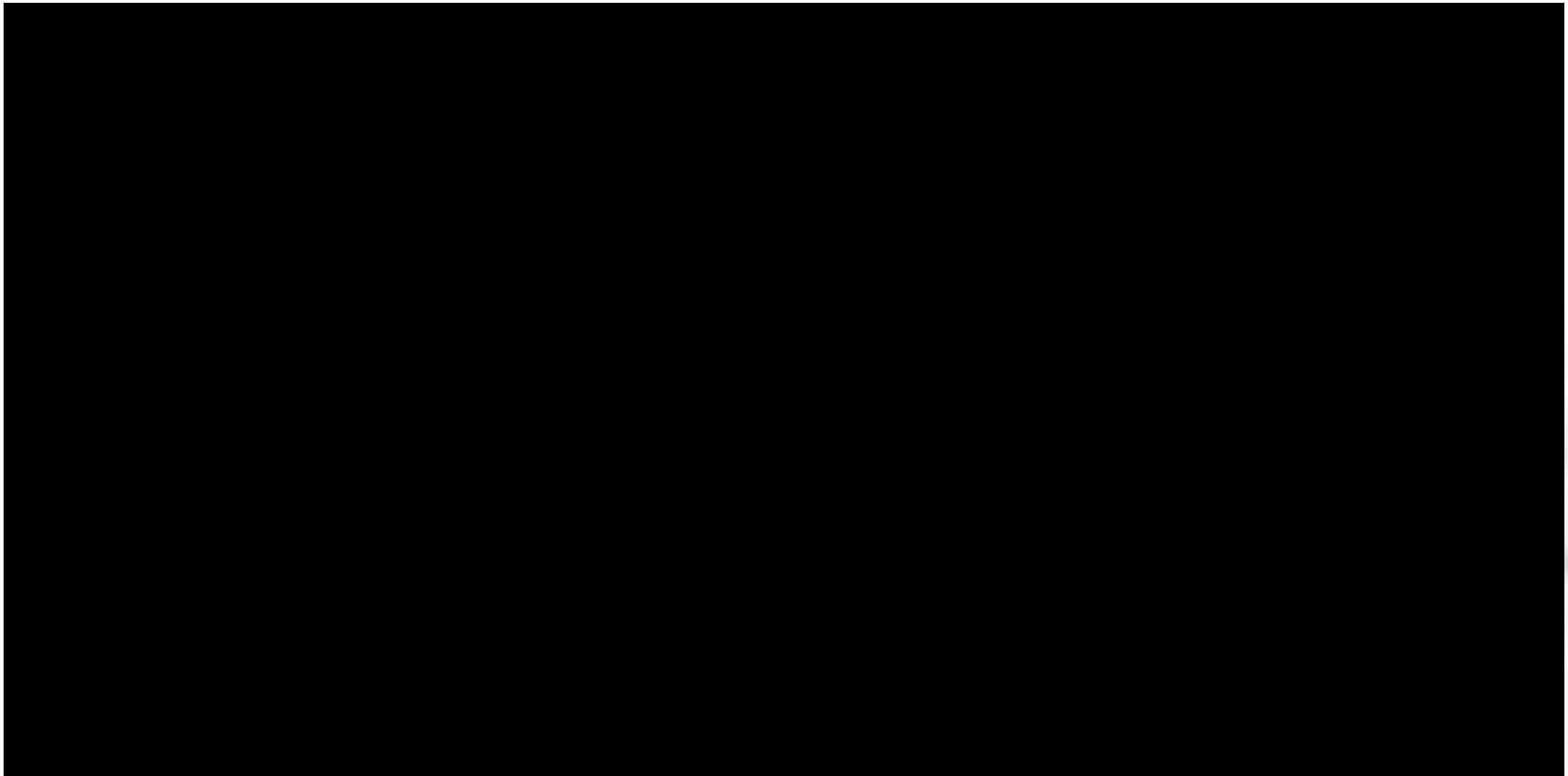
## Model Outputs

- **Graphs**  
*Shows range of outcomes for various options*
- **Distribution table**  
*Shows outcome averages and risk measures*
  - *Mean and Standard Deviation*
  - *Percentiles*
- **Risk – Return graph**  
*Shows risk – return trade-off*
- **Financial Statements**
  - **Balance Sheets**
    - *Nominal*
    - *Net Present Value*
  - **Income Statements**
  - **Cash Flow**



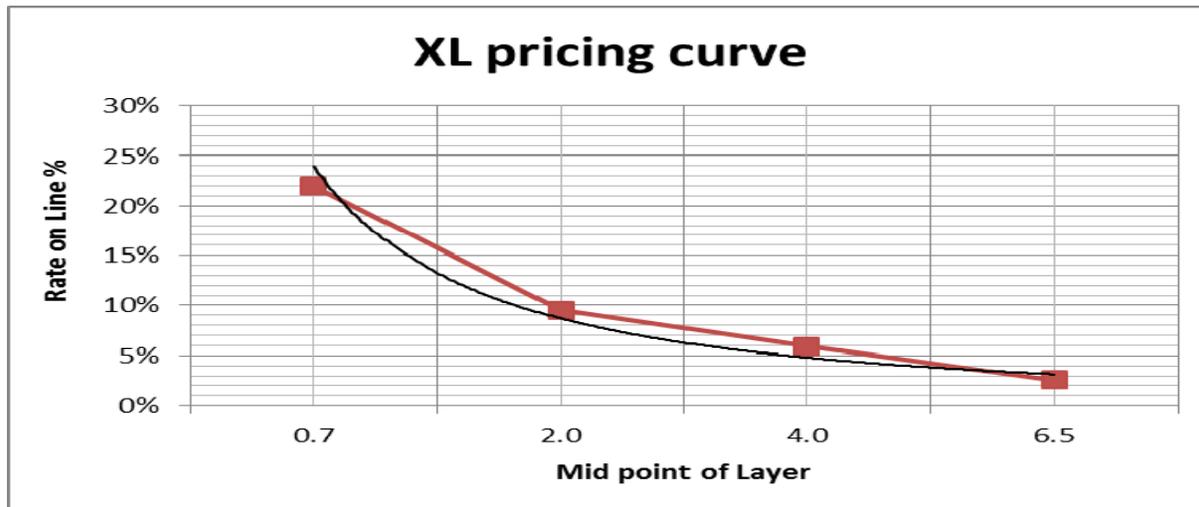
## *Individual large loss*

Individual Occurrence exceedence curves at various return periods for each Territory, Class and Sub-Class of business



# Catastrophe Excess of Loss pricing

Actual Layering Information						
XL layer	Limit	Deductible	Actual ROL%	Loss Ratio	Adj Rate	Implied risk rate
1	600,000	400,000	22.00%	60.00%	15.20%	16.13%
2	2,000,000	1,000,000	9.50%	39.58%	3.91%	3.92%
3	2,000,000	3,000,000	5.90%	33.75%	2.03%	1.54%
4	3,000,000	5,000,000	2.56%	25.00%	0.64%	0.80%



ROL %	Loss Ratio %
22	60
20.4	57.1
18.8	54.2
17.1	51.3
15.5	48.3
13.9	45.4
12.3	42.5
10.7	39.6
9	36.7
7.4	33.8
5.8	30.8
4.2	27.9
2.6	25

## Property cat XL evaluation

Terms	Turkey plus rest of rest of world			
	cat layer 1(3)	cat layer 2(3)	cat layer 3(3)	cat layer 4(3)
Limit	600,000	2,000,000	2,000,000	3,000,000
Deductible	400,000	1,000,000	3,000,000	5,000,000
ROL	22.0%	9.5%	5.9%	2.6%
# of reinst	2	1	1	1
reinst cost	100%	100%	100%	100%

Net Benefit	Turkey plus est of rest of world			
	cat layer 1(3)	cat layer 2(3)	cat layer 3(3)	cat layer 4(3)
Mean	-74,115	-114,168	-83,601	-47,772
SD	150,850	331,937	241,072	274,695
1 in 2	-132,000	-190,000	-118,000	-76,800
1 in 5	-132,000	-190,000	-118,000	-76,800
1 in 10	158,303	-190,000	-118,000	-76,800
1 in 25	336,000	601,252	-118,000	-76,800
1 in 50	336,000	1,620,000	445,543	-76,800
1 in 100	411,086	1,620,000	1,764,000	1,271,831
1 in 200	610,249	1,620,000	1,764,000	2,846,400
1 in 500	804,000	1,620,000	1,764,000	2,846,400
Prob of Profit	13.4%	6.3%	2.3%	1.3%

Recoveries	Turkey plus est of rest of world			
	cat layer 1(3)	cat layer 2(3)	cat layer 3(3)	cat layer 4(3)
Mean	74,172	83,669	36,544	29,790
SD	193,070	365,658	256,007	281,904
Prob of Loss	18.9%	7.6%	2.4%	1.3%
Prob burn 1 limit	7.7%	2.5%	1.3%	0.7%
Prob burn 2 limits	0.3%	0.0%	0.0%	0.0%
Prob burn 3 limits	0.0%	0.0%	0.0%	0.0%

## *Benefits of DFA Process*

- Evaluate alternative Reinsurance Programme
- Risk vs Return trade off
  - Net profit, Return on Equity, Return on Capital, etc., can all be used to define Return
  - Standard deviation or Variance can be used as simple measures of risk ; however it is more common to look at measures such Value at risk (VaR) or Tail value at risk (TVaR).
- Ceded premium vs ceded risk
- Maximise net profit vs return on equity
- Impact on capital requirement

## *Utility of DFA methodology*

- DFA studies can be made on a one-time basis, if strategic decisions of great significance are to be made.
  - Mergers and Acquisitions,
  - Entry in or exit from some business,
  - Thorough rebalancing of
    - Reinsurance structures or
    - Investment portfolios, or
    - Capital market transactions
- If a company has set up a DFA model, it can recalibrate and rerun it on a regular basis, (quarterly or yearly) in order to evaluate the in-force strategy and possible improvements to this strategy.
- In this way, DFA can be an important part of the company's business planning and enterprise risk management setup.

## *Non life insurance and DFA tools*

- ***Business mix:***
- ***Reinsurance:***
- ***Asset allocation:***
- ***Capital:***
- ***Profitability***
- ***Solvency:***
- ***Compliance:***
- ***Sensitivity:***
- ***Dependency:***



## *Conclusion*

- Non life insurance industry is poised for significant growth in volume and complexity in the next decade.
- Management analytical tools cannot be static; instead they need to be dynamic to project downside probabilities and severity
- The market needs to adopt DFA tools and methodologies.





*Thank you*

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