



# Motor Pure Premium Modeling with Deductible: The Indian Context

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February 13, 2009

# Risk averse Vs Risk loving customers

“I haven’t had any claims on my motor insurance for the past 4 years. Should I have a policy with high deductible next year? It must be a lot cheaper!”

# Low risk Vs High risk customers

“I had one accident each year two years in a row. And have had to pay Rs 5000/- from my pocket. Gosh! I am ready to pay a higher premium if a company is ready to cover this 5000 too!”

# Presentation Flow

Allowed deductibles: The past and present scenario

Effects of increasing deductible

Methods of premium rating with deductibles

The Indian context

The way ahead

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# Allowed deductible: Past scenario

TYPE OF VEHICLES			COMPULSORY DEDUCTIBLE (Rs)
Commercial Vehicles (other than vehicles rateable under Class-D,E,F and G of CVT)	Goods carrying Vehicles	Passenger carrying Vehicles	
	GVW < 7500 Kg. GVW	# Passengers < 17	500
	7500 Kg.<= GVW < 16500 Kg.	17 <= # Passengers < 36	1,000
	GVW >= 16500 Kg.	# Passengers >= 36	1,500
Vehicles rateable under Class D of the Commercial Vehicles Tariff (CVT)			Max (0.5% of IDV of the vehicle, 2,000)
Vehicles rateable under Class E, F and G of the Commercial Vehicles Tariff (CVT)			Rs.50 for two-wheelers and Rs. 500 for others
Taxis and Three Wheelers rated as Commercial Vehicles (Not exceeding 1500cc)			500
Taxis and Three Wheelers rated as Commercial Vehicles (Exceeding 1500 cc)			1,000
Private Cars including three wheelers rated as Private Cars(Not exceeding1500cc)			500
Private Cars including three wheelers rated as Private Cars (Exceeding 1500 cc)			1,000
Motorized Two Wheelers.			50

Source: *Tariff Advisory Committee (Indian Motor Tariff 2002)*

# Allowed deductible: Present scenario

- IRDA relaxed the condition of fixed deductible by vehicle class effective 1 Jan, 2009

The Authority vide its circular no. 066/IRDA/F&U/Mar-08 dated March 26, 2008 advised all insurers to continue to use the coverage, terms & conditions, wordings, warranties, clauses and endorsements of the erstwhile tariff classes of insurance covers until further orders.

The Authority has now decided to permit following relaxations in the terms and conditions of coverages of the erstwhile tariff classes of business in fire, engineering, IAR and motor (OD) effective 1<sup>st</sup> January 2009:

1. Insurers are permitted to file variations in deductibles from those prescribed under the erstwhile fire, engineering, IAR and motor OD tariffs subject to written disclosures and acceptance by the insured prior to finalization of the insurance policy
2. Insurers are permitted to file add-on covers over and above the erstwhile tariff covers in fire, engineering, IAR and motor OD with appropriate additional premiums. 'Loss of use' and 'waiver of depreciation' under motor OD insurance are some examples.

- So, you have already started with the deductible rating
- If not, you better start soon 😊

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# Effects of increasing deductibles

- Frequency per policy decreases: Lesser claims burn through deductible
- Claim cost per claim<sup>#</sup> decreases: Net claim is lower as deductible is higher

SO

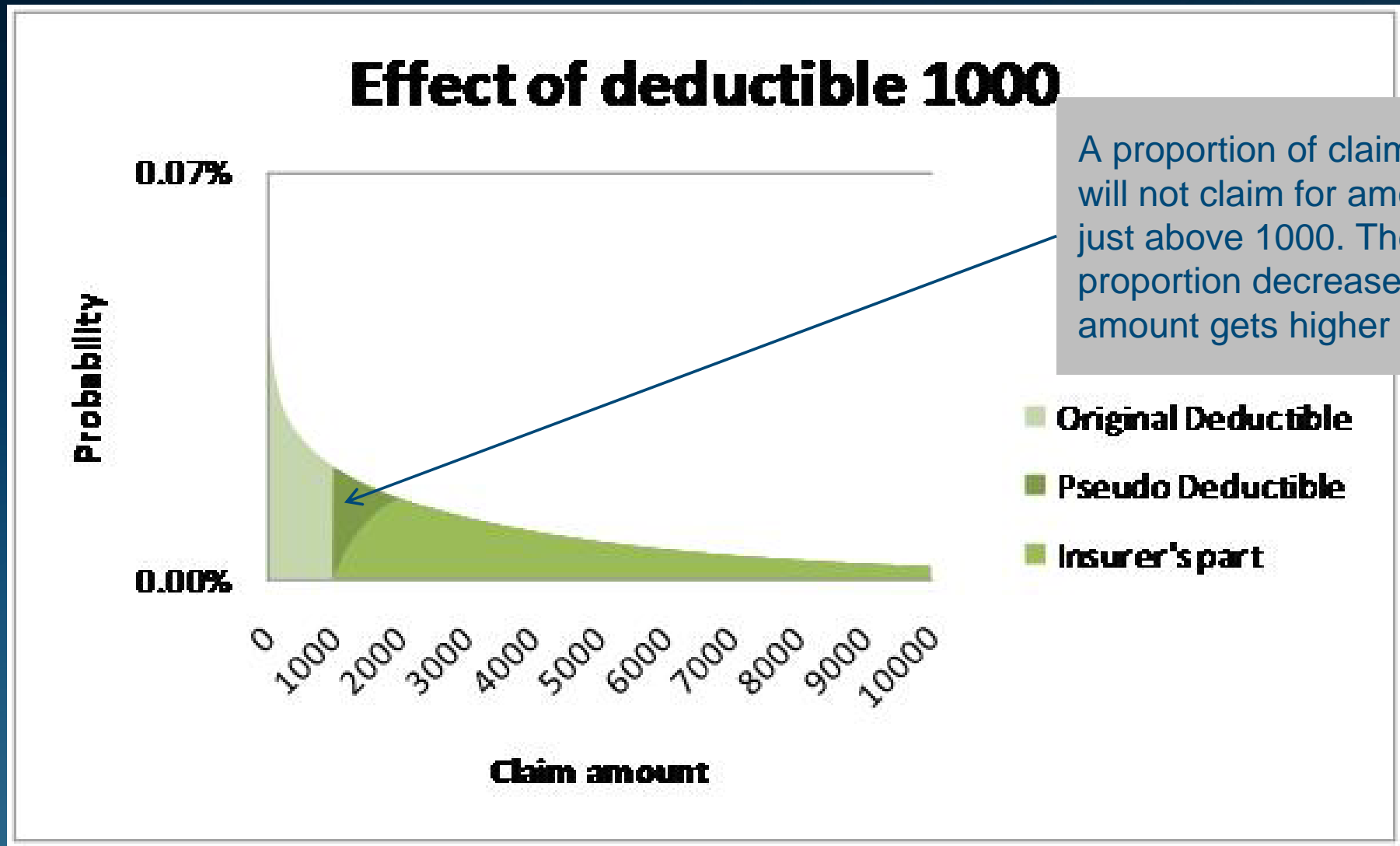
- Claim cost per policy decreases

But by HOW MUCH?

<sup>#</sup>: Taken over all claims not just the claims reported



# Effect of increasing deductible



## Pseudo-Deductible Effect

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# Methods of premium rating with deductibles

- Traditional Methods
  - Loss elimination ratio (LER)
  - Loss distribution adjustment
- GLM Methods
  - Fit GLM using other variables then adjust estimates for deductibles
  - Use deductible as a rating variable in GLM

# Loss elimination ratio

- Total claim cost at deductible X (current) = Rs 10 lacs
- Total claim cost at deductible Y (new, higher deductible) = Rs 8 lacs

Loss elimination ratio = 20%

If  $Z_x$  = Net claim amount at deductible X and  $Z_y$  = Net claim amount at deductible Y

Then  $Z_y = \text{Max} (Z_x + X - Y, 0)$

# Loss elimination ratio

## Frequency/ Severity Estimates

- This method calculated the pure premium directly
- No Frequency/severity estimates are calculated

## Advantage

- Simple and fast ball-park calculation

## Disadvantage

- Doesn't use the claims data *at* new deductible for calculations

# Loss distribution adjustment

1. Fit a statistical distribution to the truncated<sup>#</sup> claims data
2. Find best fitting statistical distribution and parameter estimate

<sup>#</sup>:Claims data will be truncated at the existing deductible

# Loss distribution adjustment

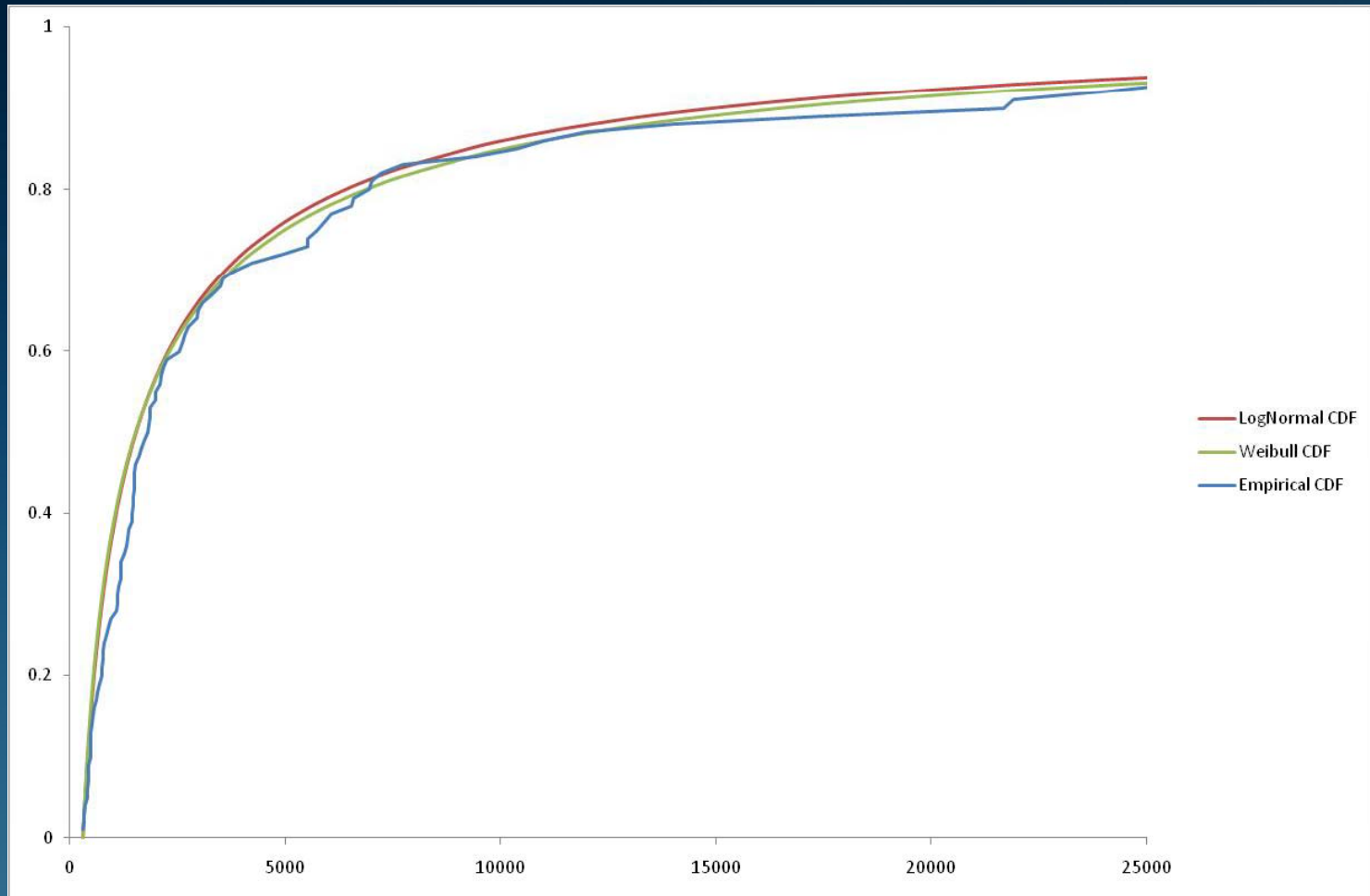
- Past scenario:
  - Data deductible: 500<sup>#</sup>
  - New policy deductible: 500
- New scenario
  - Data deductible: 500
  - New policy deductible: can be higher than 500. Or lower.

Earlier one could work with the parameter estimates of the net distribution

Now, parameter estimates of gross distribution will be needed; These will then be adjusted as per the new deductible value

<sup>#</sup>: For private car with capacity < 1500 cc

# Loss distribution adjustment



Comparative graph of the empirical and two statistical CDFs for truncated data



# Loss distribution adjustment

3. Find frequency and expected claim amount at new deductibles



Effect of increasing deductible on the claim probability distribution

# Loss distribution adjustment

- Say the claim amount random variable is  $Z$ , with CDF  $F_Z$
- Old deductible =  $X$
- Claim Frequency =  $\text{Freq}_X$  (known, from the data)
- Expected claim amount =  $E(Z | Z > X) = \text{Exp}_X$
- Expected claim per policy =  $\text{Freq}_X * \text{Exp}_X$
  
- New deductible =  $Y (>X)$
- Claim frequency for deductible  $Y$ ,  $\text{Freq}_Y = \text{Freq}_X * (1 - F_Z(Y)) / (1 - F_Z(X))$
- Expected claim amount =  $E(Z | Z > Y) = \text{Exp}_Y$
- Expected claim per policy =  $\text{Freq}_Y * \text{Exp}_Y$

# Loss distribution adjustment

- Frequency/ Severity Estimates
  - Frequency estimate calculated based on exceedence probability
  - Severity estimate is the limited expected value at the deductible
- Advantage
  - Simple
  - Smooth results
- Disadvantage
  - Doesn't use the claims data *at* new deductible for calculations
  - Doesn't account for pseudo-deductible
  - A suitable distribution fit may not be found
  - Doesn't account for rating variable effects

# Fit GLM without deductible as a rating variable

- For claims modeling, rating variable information should be used as much as possible
- So the GLM modeling framework should be used
- The model should be able to produce gross parameter estimates (May not be possible using standard statistical tools)#

#: Guiahi, 2001 has prescribed a method for such parameter estimation. Needs coding in S-Plus, R

# Fit GLM without deductible as a rating variable

- Deductible adjustment to parameters can be done subsequently for the desired deductible

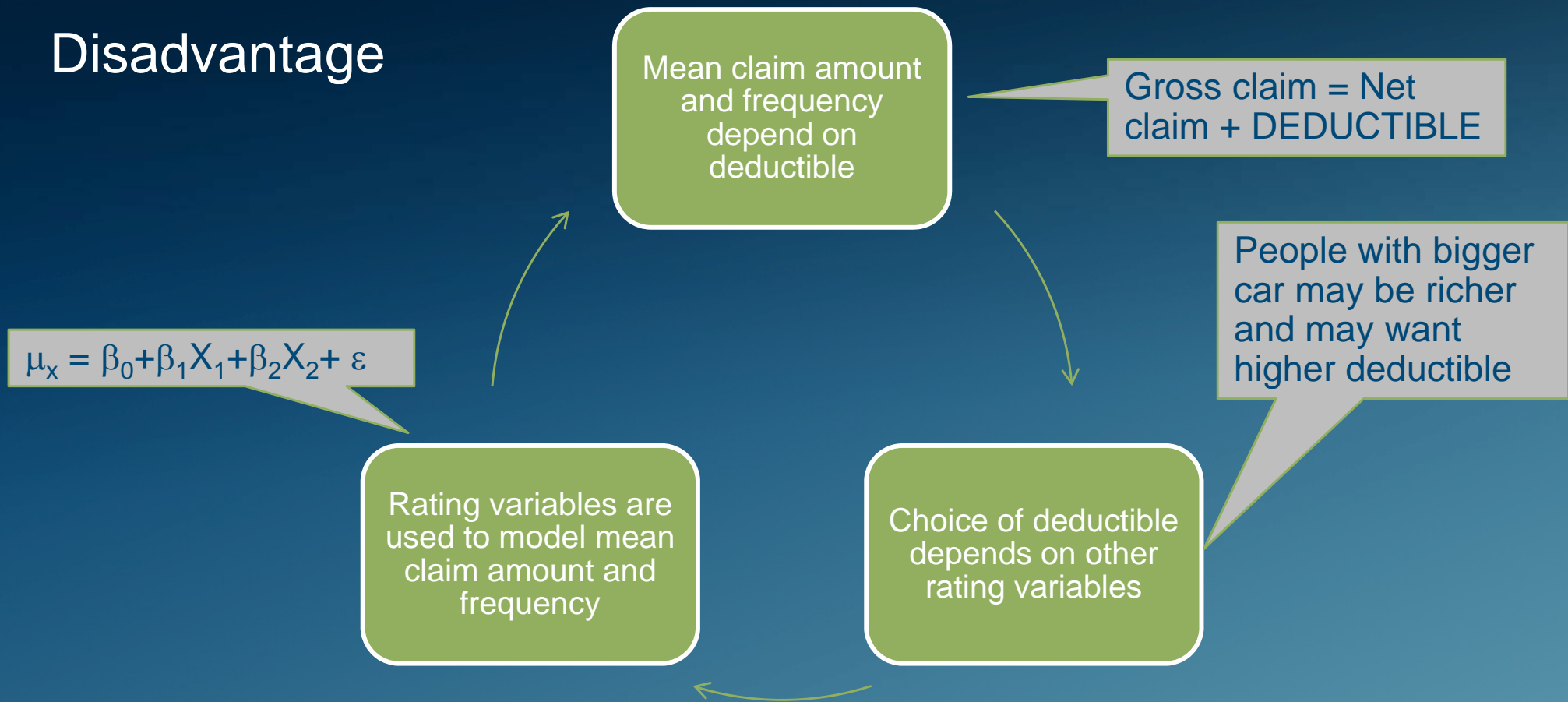
This method is best suitable and will give most accurate results in the current Indian market scenario

# Fit GLM without deductible as a rating variable

- Frequency/ Severity Estimates
  - Frequency estimate calculated based on exceedence probability
  - Severity estimate is the limited expected value at the deductible
  - The estimates can be calculated for each combination of rating variables
- Advantage
  - Uses the GLM framework. More accurate and segment-wise estimates
- Disadvantage
  - Doesn't use the claims data *at* new deductible for calculations
  - Doesn't account for pseudo-deductible
  - A suitable distribution fit may not be found
  - Severity distribution used to derive frequency; may be inaccurate

# Fit GLM without deductible as a rating variable

## Disadvantage



To accurately model frequency and severity at a deductible, policy and claim data AT that deductible is required

Deductible can then be used as a rating variable

# Fit GLM *with* deductible as a rating variable

You have policies at various deductible levels and now you want to review the rates at those deductibles

- Policy and claim data has deductible information as well
- Use deductible as a rating variable
- May need to check the correlation of deductible with other 'independent' rating variables
- Either frequency/severity modeling or a direct pure premium modeling can be done

This method is best suitable next year onwards when companies will have policy and claim info with deductible



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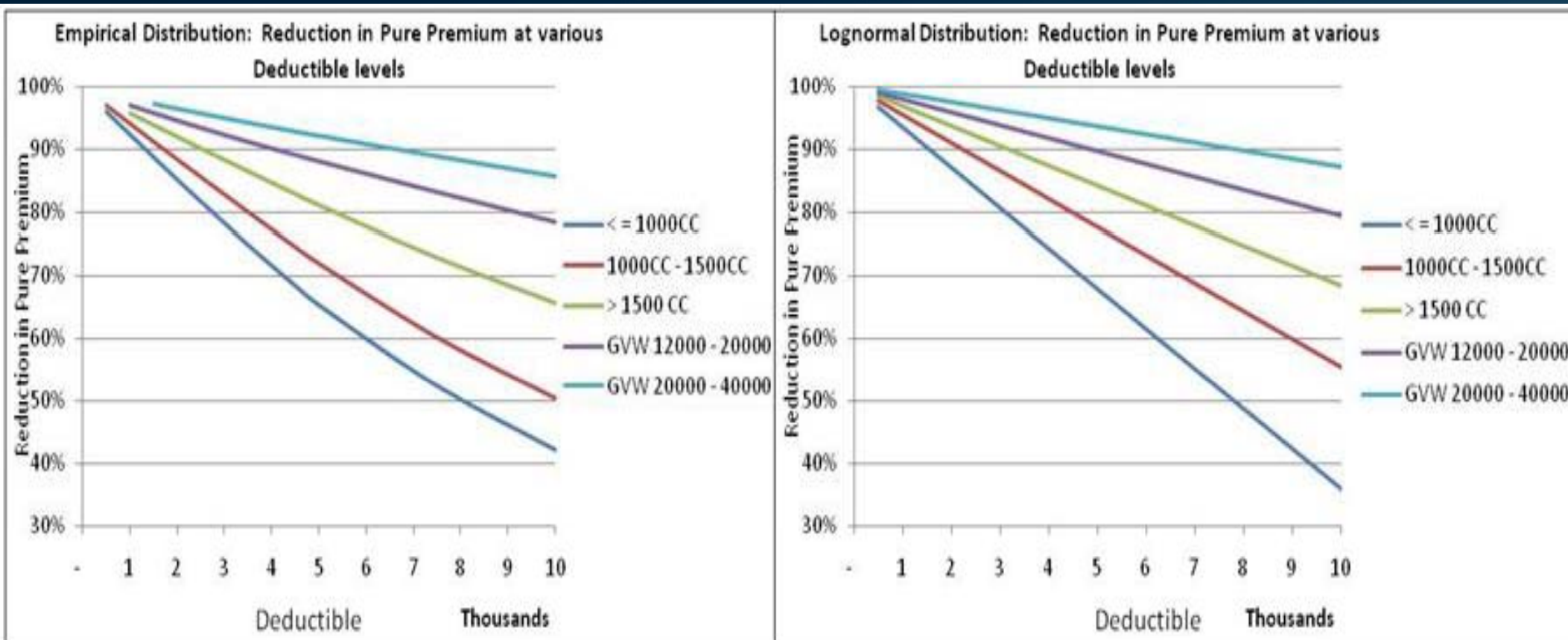
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# The current Indian scenario

- So far deductible fixed for each segment
- So, deductible cannot be used as a rating variable
- Either traditional methods or GLM-with-other-variables can be used
- Particular attention should be given to set-up assumptions about pseudo-deductible effect

# Traditional method results



There is significant difference in the effect of deductible by segment  
Correct distribution fit is necessary for correct modeling of deductible effect

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- Claim analysis of Motor own damage has so far been simple due to some reasons:
  - No reason to do complex analysis for pricing as the rates were tariffed
  - No reason to do complex analysis for innovative terms and conditions as they could not be changed
  - Very few rating variable captured in the data
  - Some captured rating variables could not be used as the data captured was not reliable.

# The way ahead

- This situation is going to change very soon
- As the pricing terms and conditions are relaxed, innovation will be the key to gain market share
- But innovation will need
  - Capturing new variables and reliable data which enables such analyses and
  - Being able to carry out rigorous analysis using captured data

# The way ahead

- Different-levels-of-deductible is just a beginning.
- It will be interesting to see how the General Insurance companies and the customers react
- For the companies it will mean:
  - Developing new products
  - Making changes to the IT systems
  - And much more

**As for the customers, as always the  
rational ones will buy the best!**



**Thank you**