# The SOA Asia-Pacific Annual Symposium

6-7, July 2017

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# IBNR Robot

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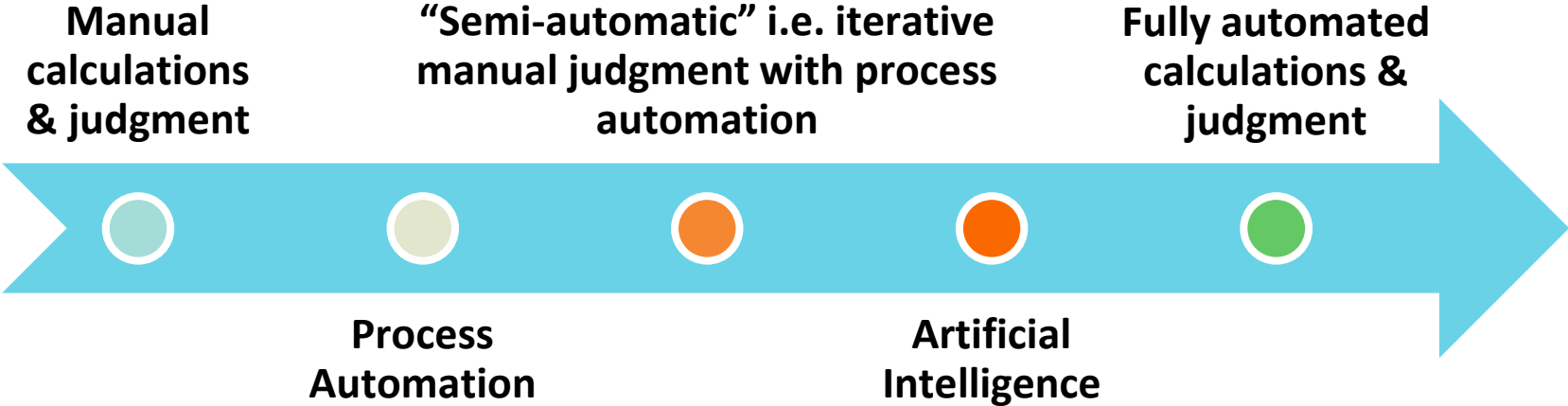**FOUNDER & ACTUARY | NICHOLAS ACTUARIAL SOLUTIONS**

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# Evolution of Actuarial Work with Technology

**Manual calculations & judgment**

**"Semi-automatic" i.e. iterative manual judgment with process automation**

**Fully automated calculations & judgment**

**Process Automation**

**Artificial Intelligence**

# Objective of IBNR Robot

The starting point of an actuarial reporting exercise shall be the download of a draft actuarial report from the IT system, not a download of raw policy and claims data.

The actuarial team shall work to analyse this draft report, apply critical judgment and deliver useful recommendations to the business. The actuarial team shall not be involved in producing the draft report.

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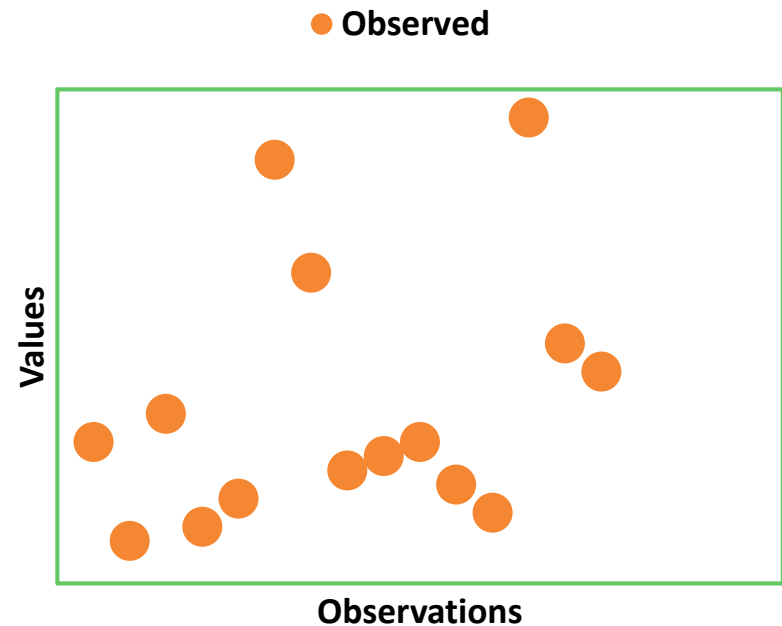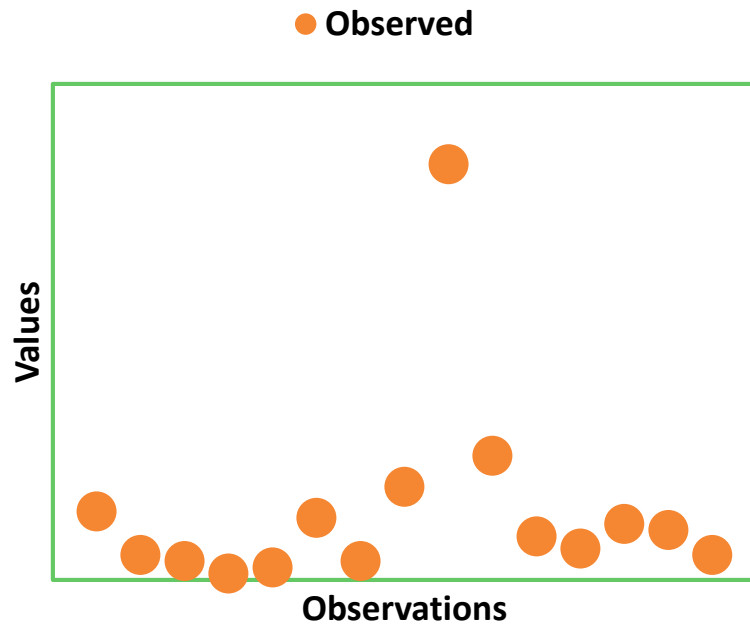# Main Applications of Artificial Intelligence in Actuarial Work

**Deal with unusual data values**

**Select parameters for actuarial models**
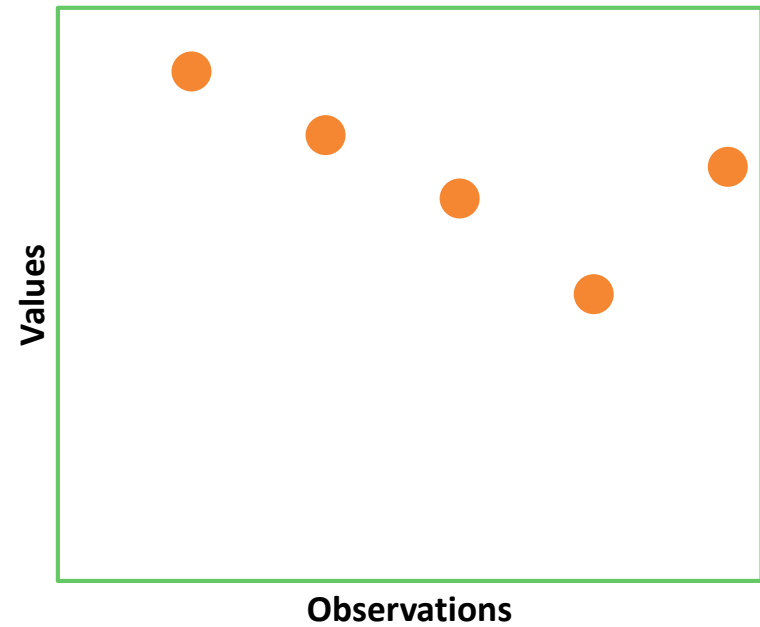
**Select most appropriate actuarial method**

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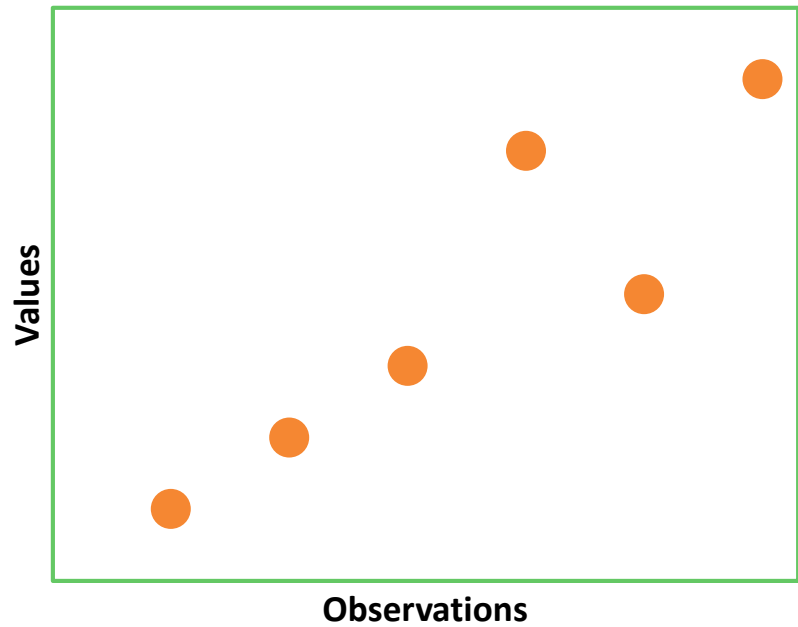SOCIETY OF ACTUARIES

# Artificial Intelligence
# Unusual Value Treatment



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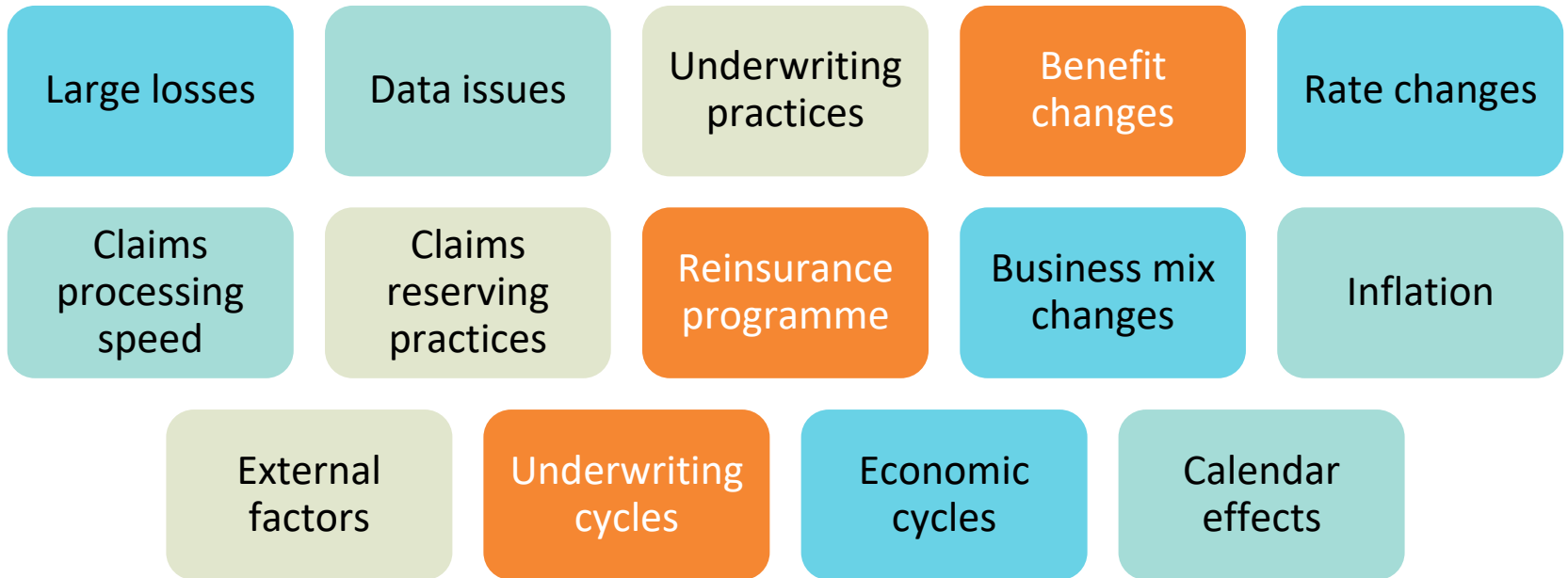
# Artificial Intelligence
# Pattern Identification

# IBNR Robot – How does it work?

**Data**
- Paid claims development
- Incurred claims development
- Earned premiums

**Robot**
- Commonly used loss reserving methods
- Statistical optimization techniques
- Pragmatic solutions

**Results**
- Age-to-age factors including tail factors
- Seed loss ratios
- Optimal IBNR methodology
- Individual & aggregated reserve range
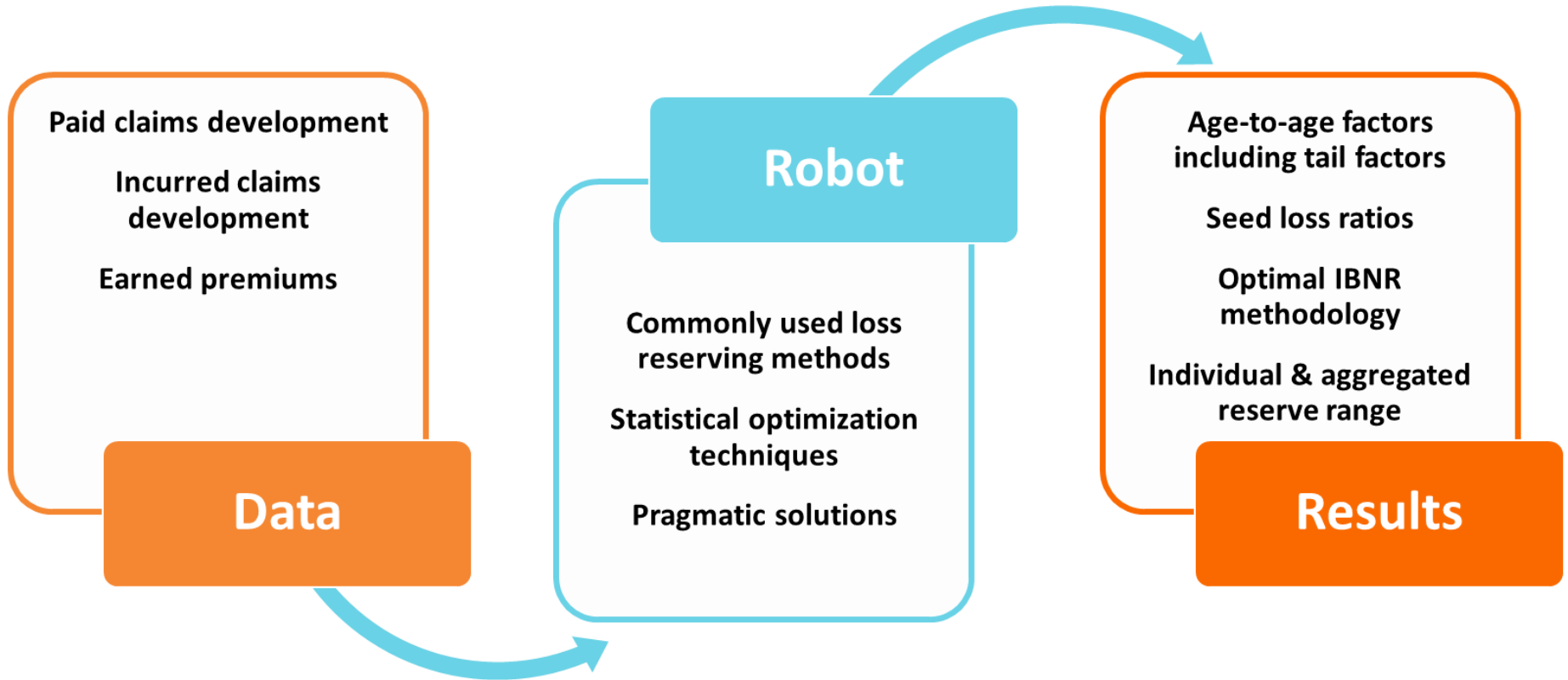
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# IBNR Robot – What can it do?

Large losses

Data issues

Underwriting practices

Benefit changes

Rate changes

Claims processing speed

Claims reserving practices

Reinsurance programme

Business mix changes

Inflation

External factors

Underwriting cycles
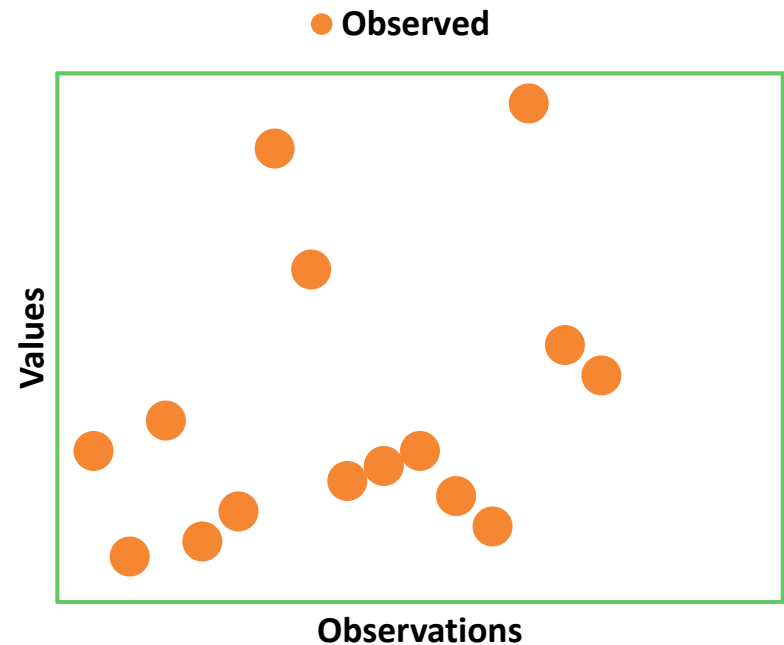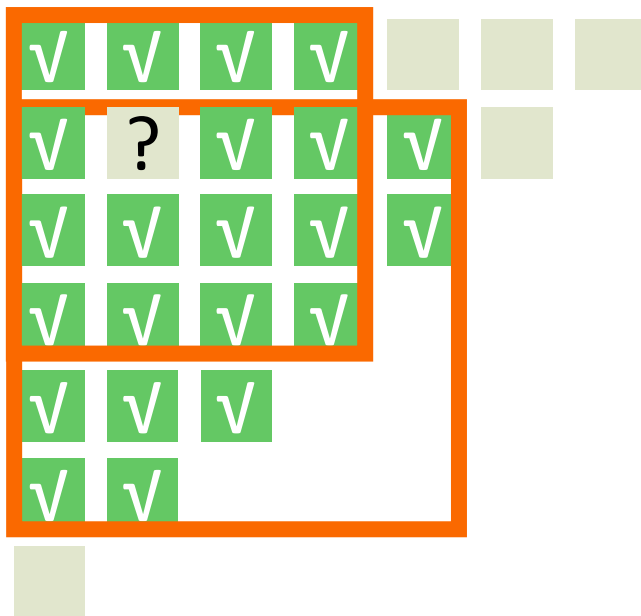
Economic cycles

Calendar effects

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# A. Link Ratio Method

# 1. Data Acceptance Replacement Test on Cumulative Claims Ratio
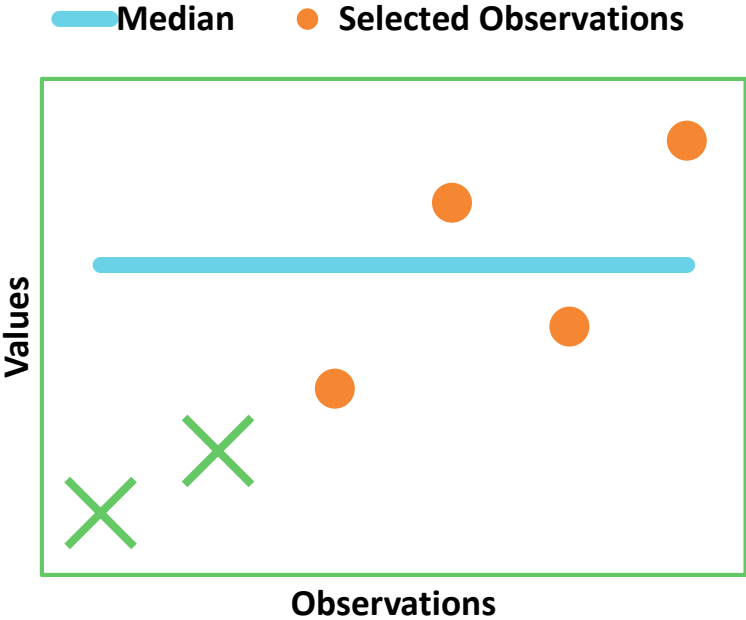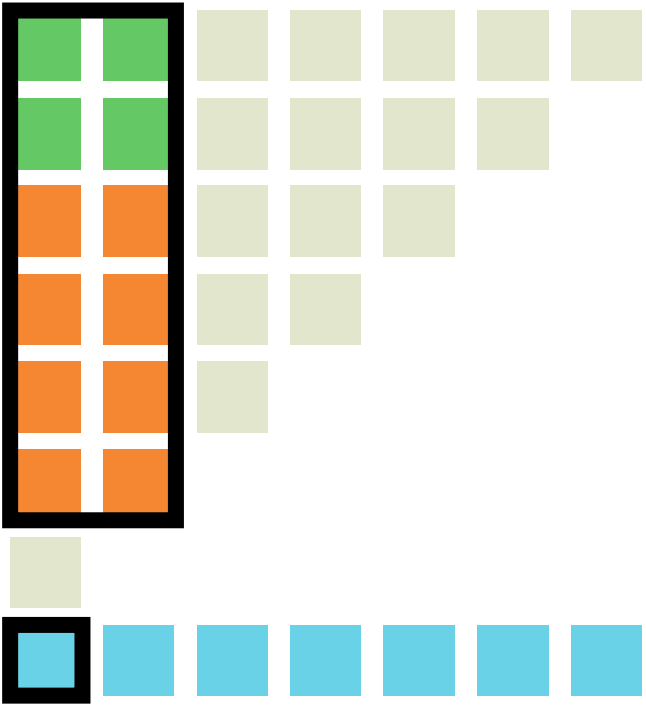# Objective: Reduce Distortions from Input Data Errors

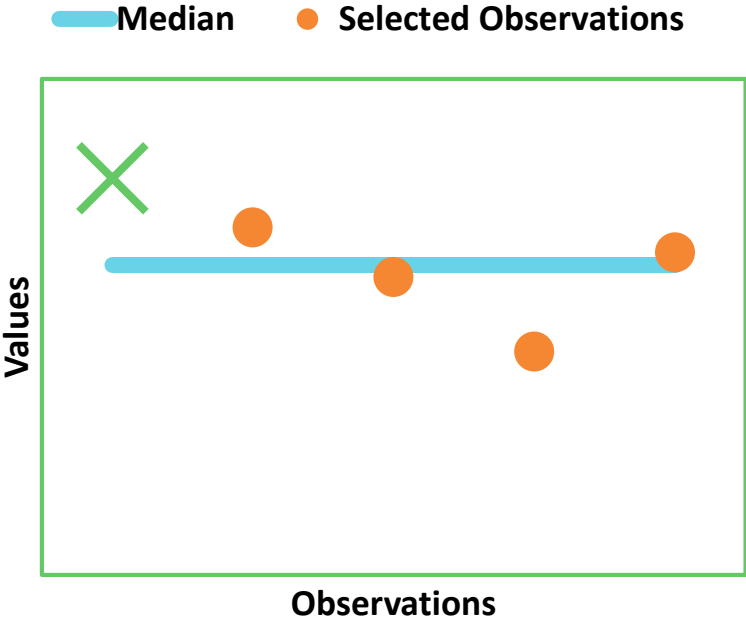# Birds of a Feather Flocks Together

# 2. Development Factors Runs Test
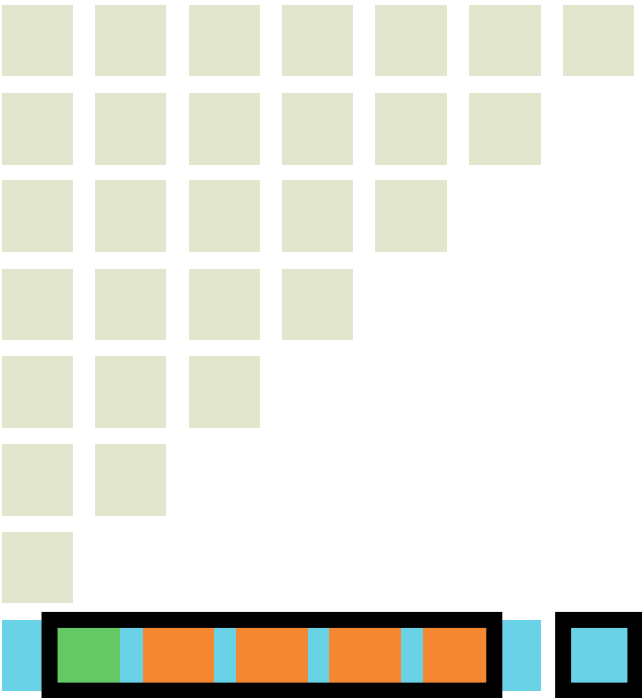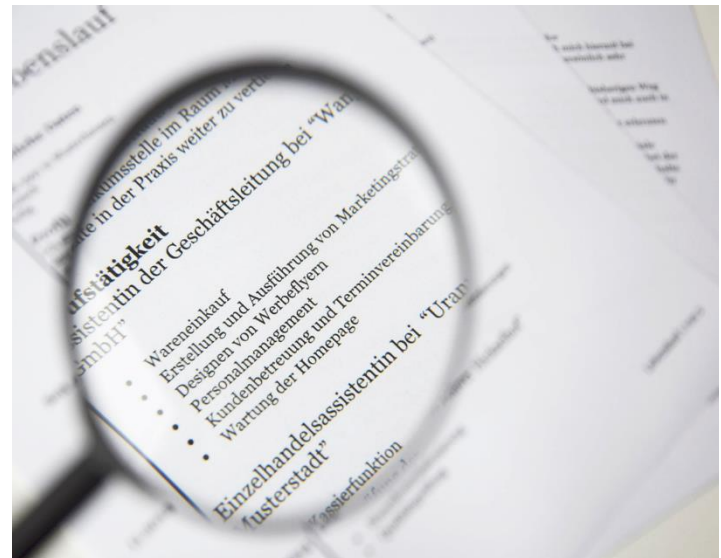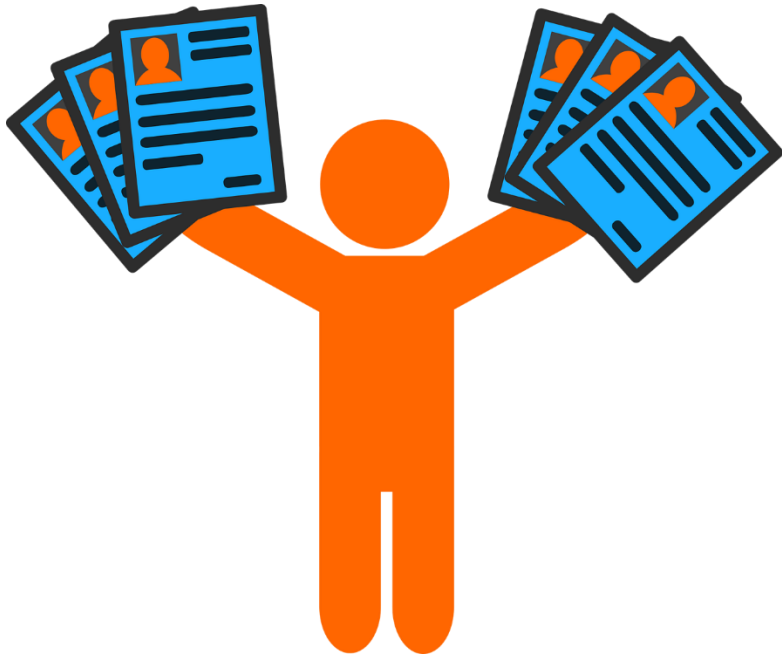# Objective: Optimise Relevance and Credibility Effects in Development Factors

# 3. Decay Factors Runs Test
## Objective: Optimise Relevance and Credibility Effects in Tail Factor



Median    Selected Observations

Values

Observations

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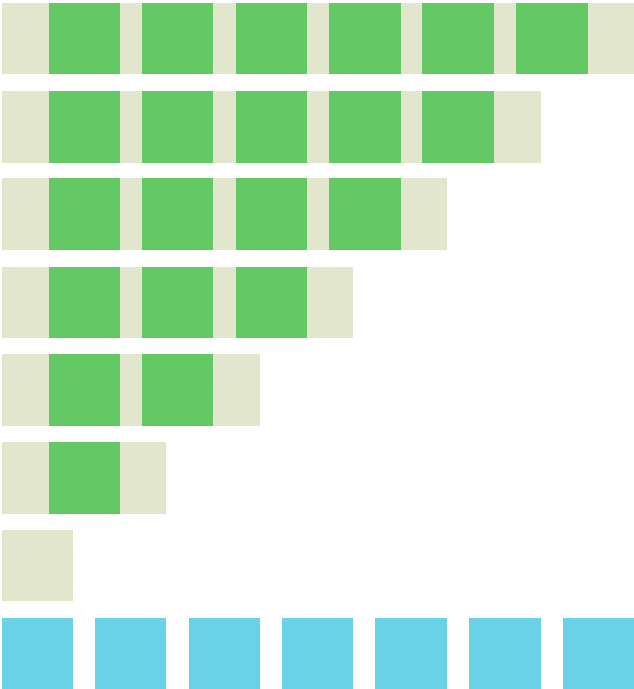# Include or Exclude?
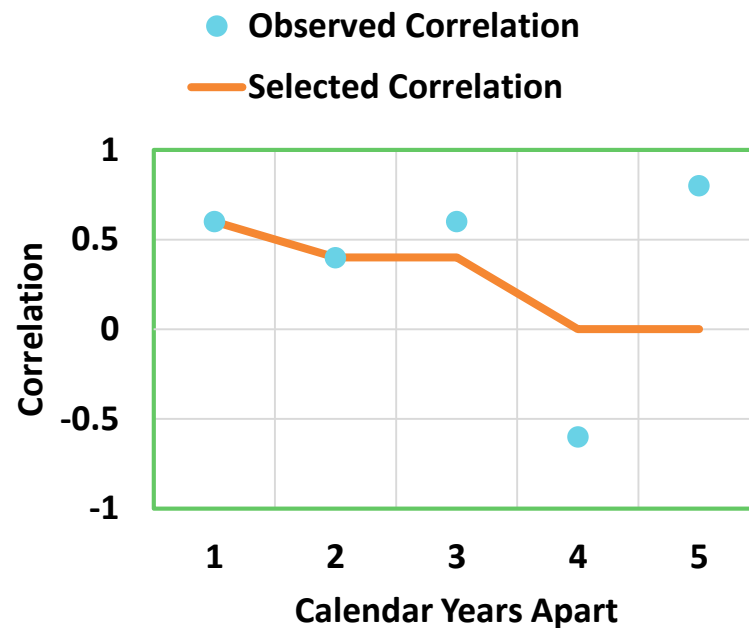
# 4. Significance Test on Correlation Between Methods
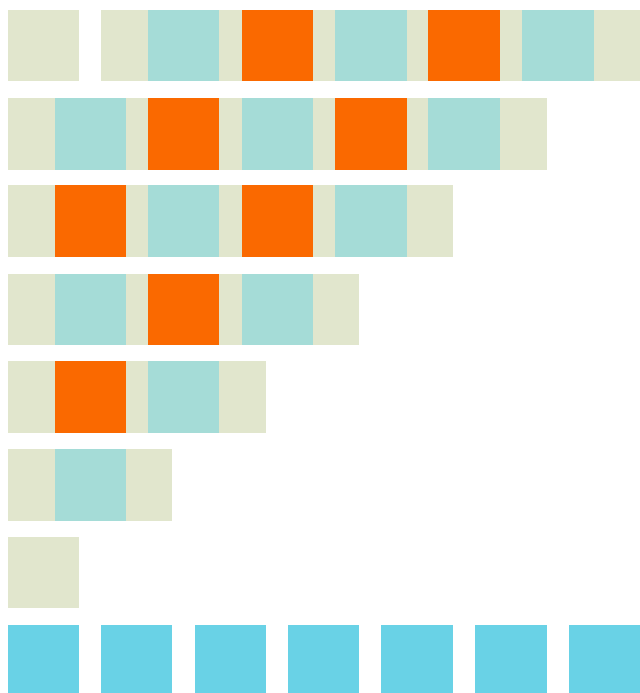# Objective: Optimise Standard Deviation Estimate

# Similar but Different
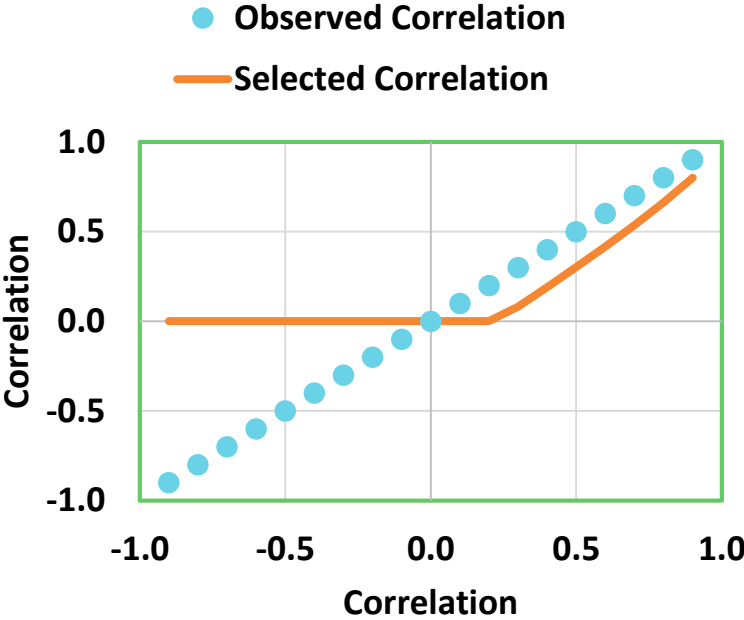
# 5. Significance Test on Correlation Between Calendar Years
# Objective: Optimise Standard Deviation Estimate
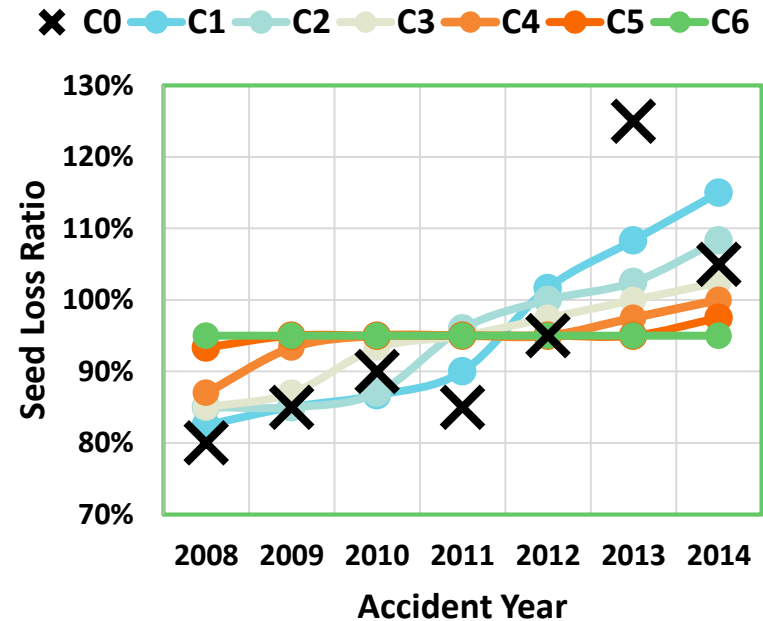
# Alike or Unlike?

# B. BF Method

# 6. Seed Loss Ratios Generation
## Objective: Optimise Homogeneity Effects Between Accident Years
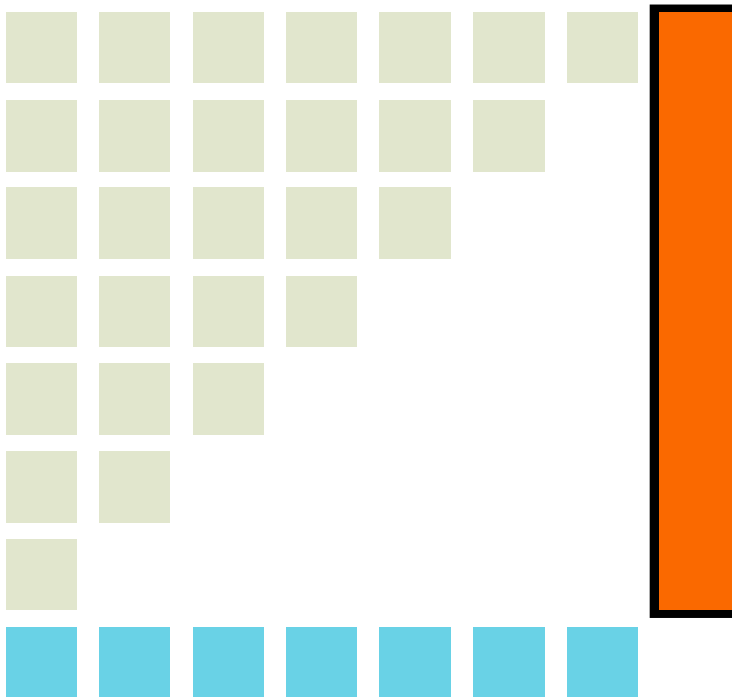
# Trial & Error



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# C. Putting it together

# 7a. Repeat Steps 4 & 5 for BF Method
# 7b. Apply Method of Lagrange Multiplier
# Objective: Optimise Individual Class Ultimate Loss Estimate



Distribution of Ultimate Losses – Auto

# 7a. Repeat Steps 4 & 5 for BF Method
# 7b. Apply Method of Lagrange Multiplier
# Objective: Optimise Individual Class Ultimate Loss Estimate



Distribution of Ultimate Losses – Work

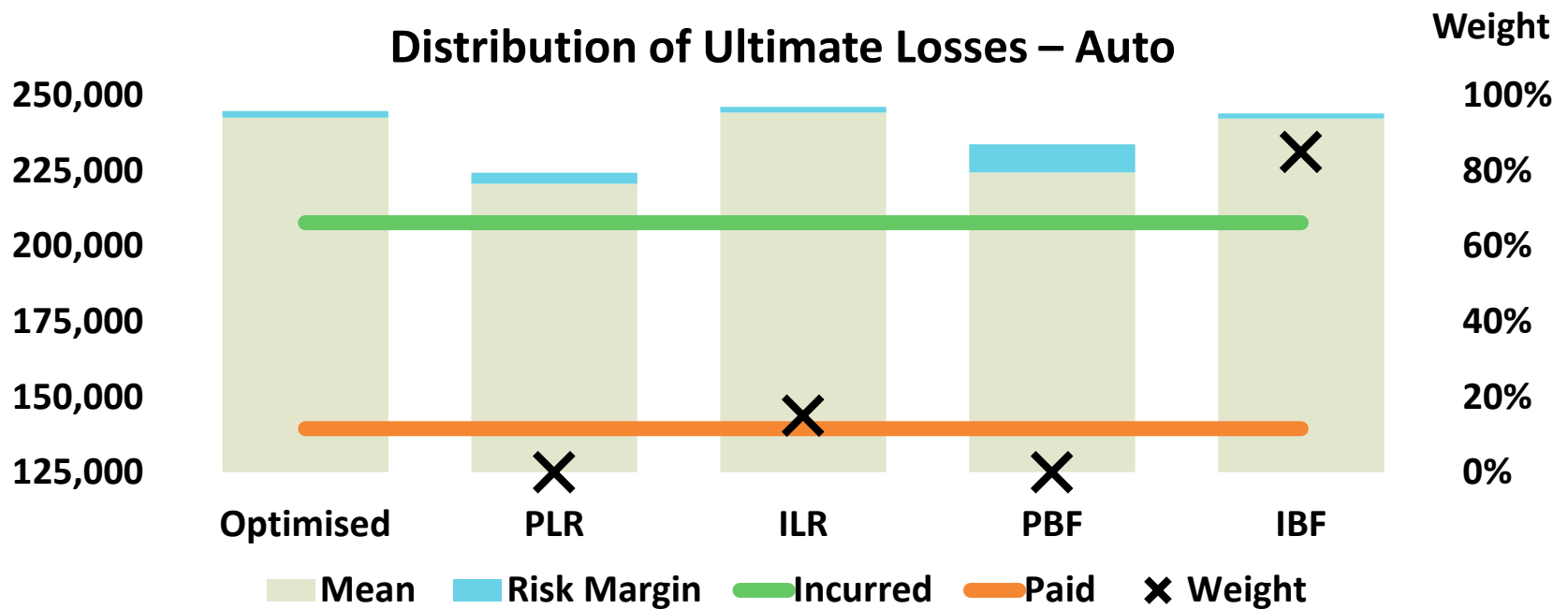# 7a. Repeat Steps 4 & 5 for BF Method
# 7b. Apply Method of Lagrange Multiplier
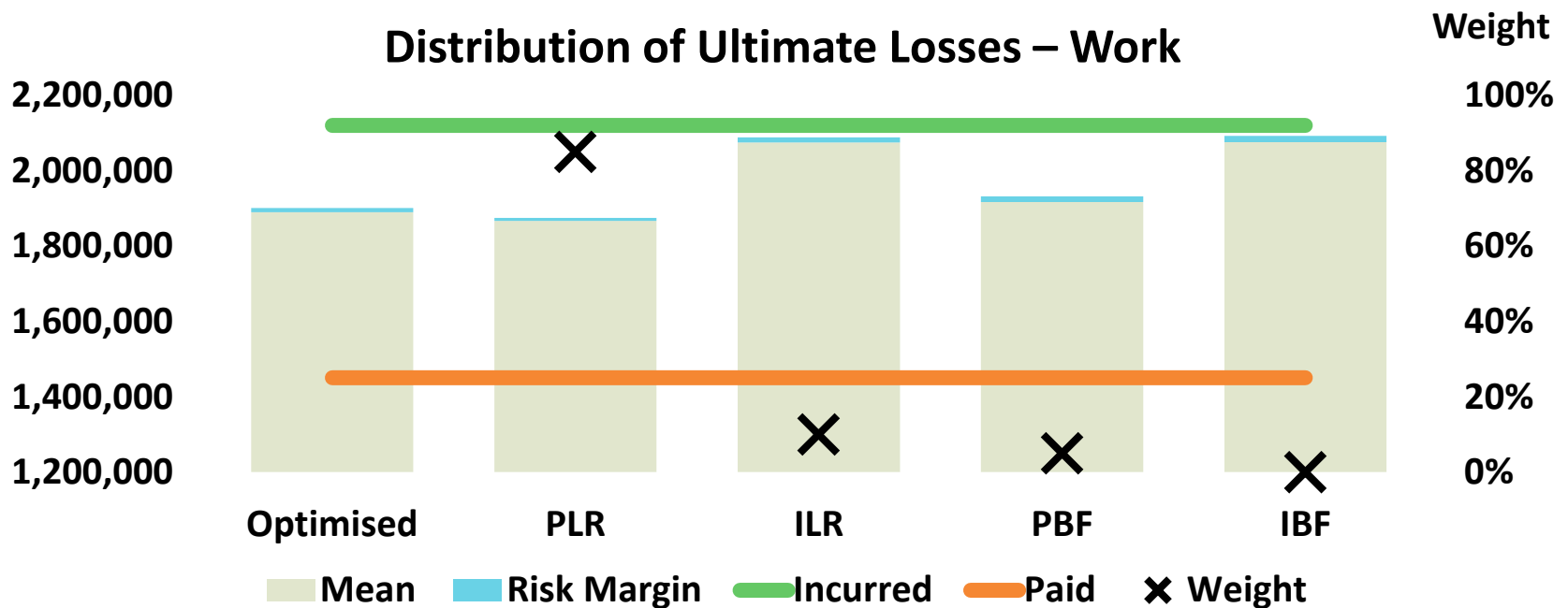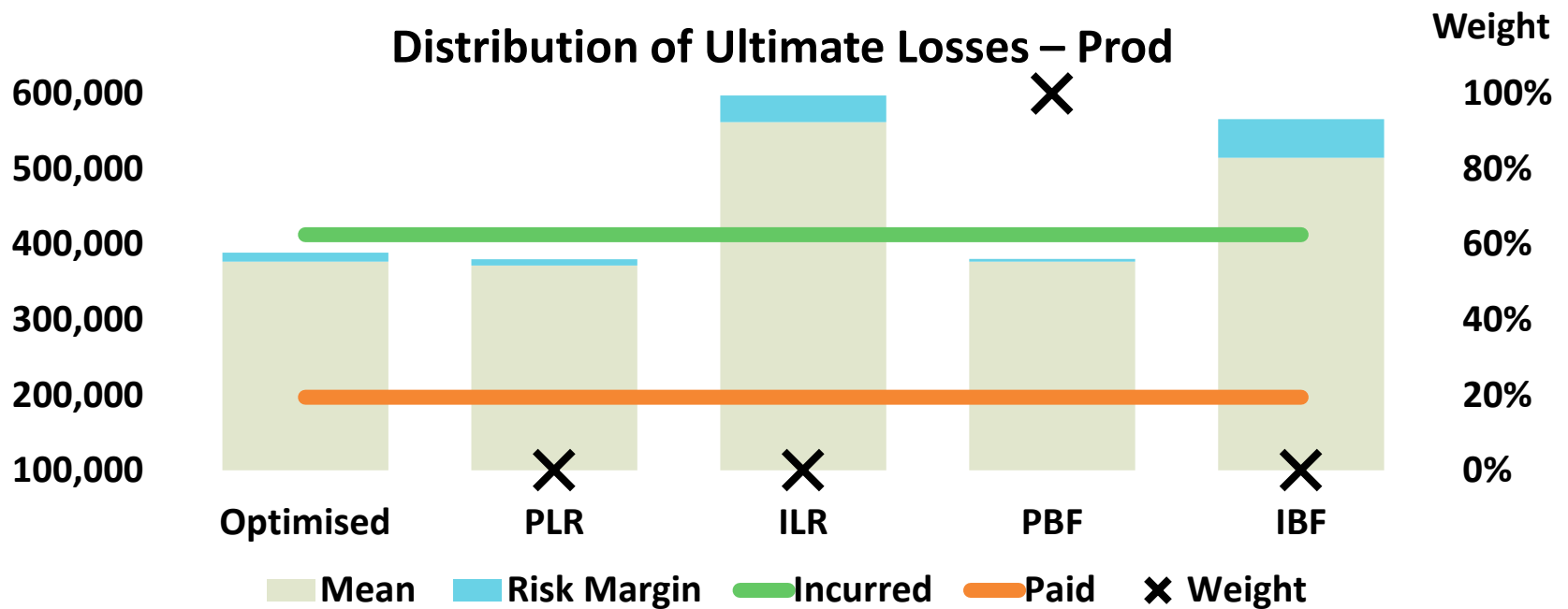# Objective: Optimise Individual Class Ultimate Loss Estimate



**Distribution of Ultimate Losses – Prod**

Legend: Mean, Risk Margin, Incurred, Paid, ✖ Weight

Categories: Optimised, PLR, ILR, PBF, IBF

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# Consistency is the Key
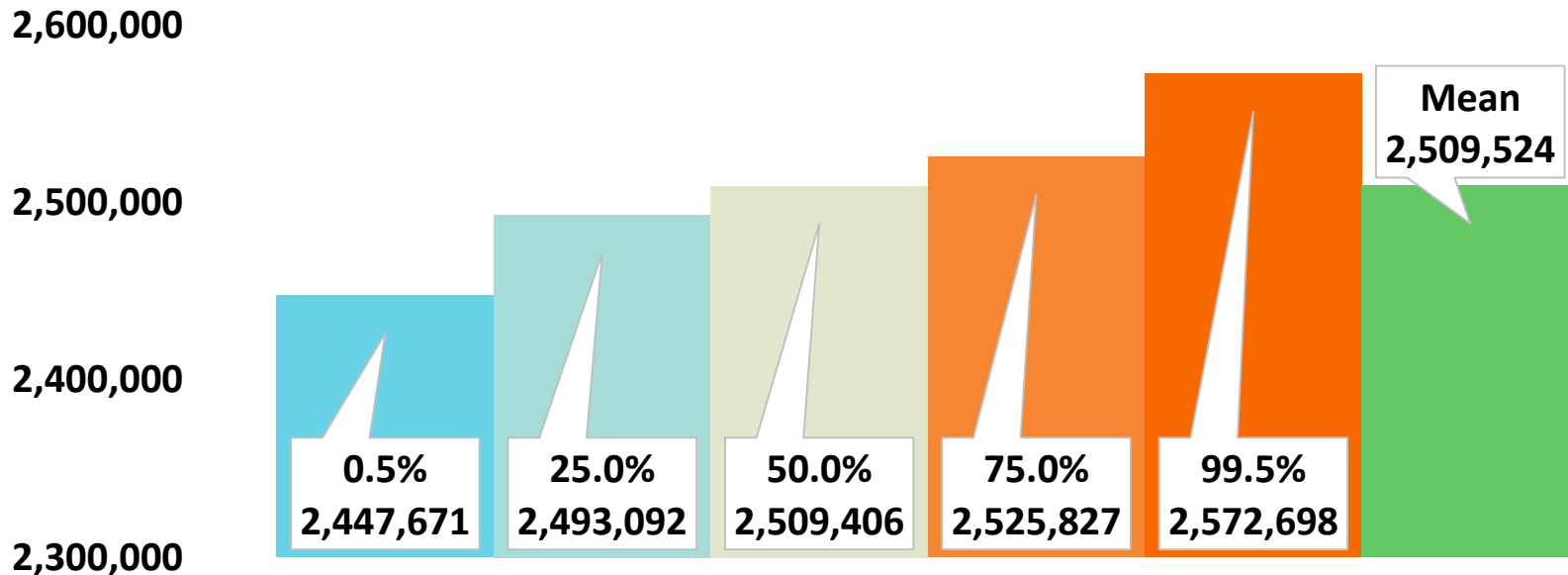
# 8. Repeat Step 4 Across Business Classes Objective: Optimise Aggregate Ultimate Loss Estimate

**Optimised Loss Reserves Distribution**

| | |
|---|---|
| 2,600,000 | |
| 2,500,000 | |
| 2,400,000 | |
| 2,300,000 | |

Mean
2,509,524

0.5%
2,447,671

25.0%
2,493,092

50.0%
2,509,406

75.0%
2,525,827

99.5%
2,572,698

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# Strengths & Challenges

Consistent

Independent

Instant

Robust

Inertia

Learning Curve

| Coefficient of Variation Study | Industry Wide Benchmarking |
|---|---|
| Independent Reserves Review | Confidence & Compliance |
| Robot Actuarial Analyst | Operational Efficiency |
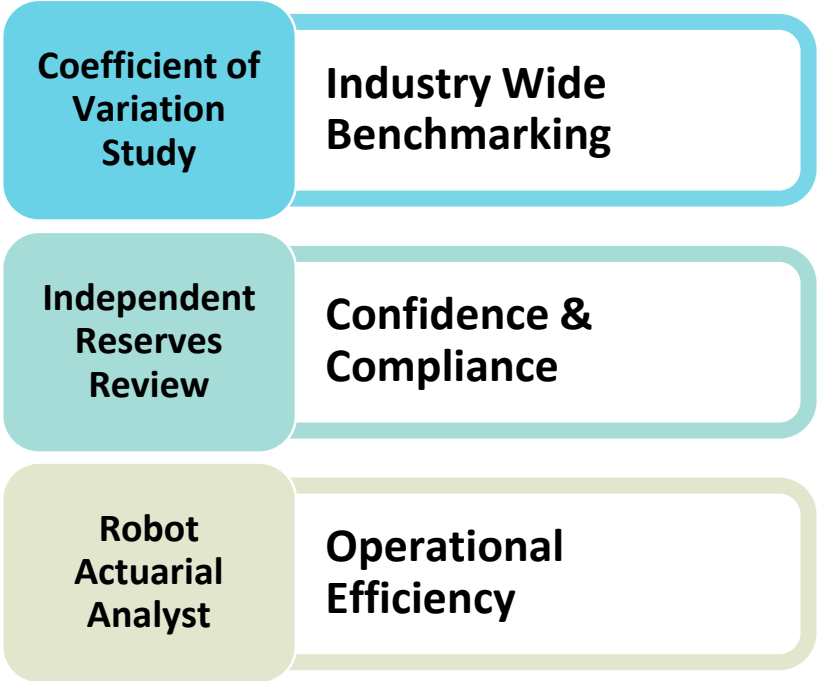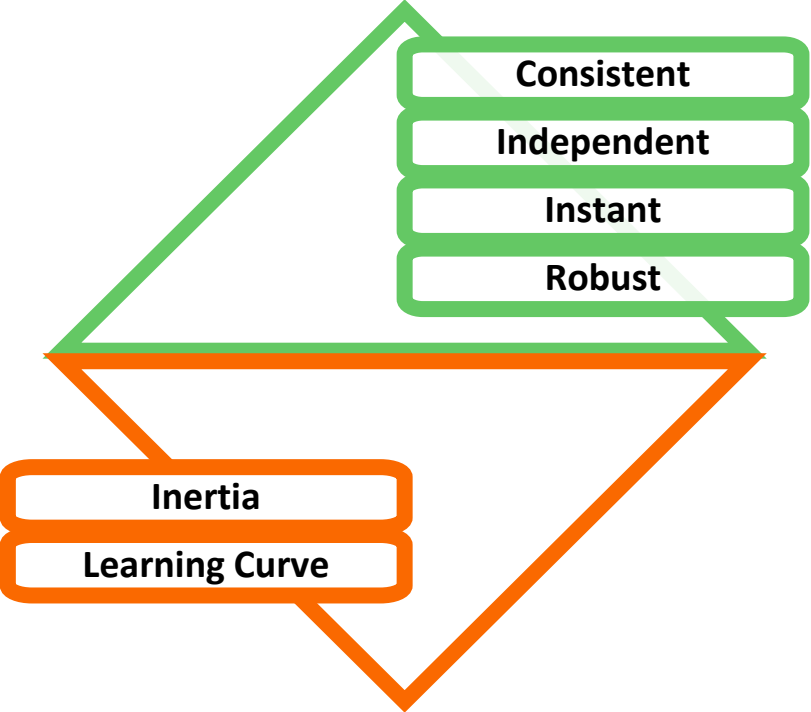
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# Annexure
# Stepwise Explanation

| Step | Data – Paid & Incurred Claims, Earned Premiums | Paid & Incurred Link Ratio | Paid & Incurred BF | Individual Class Reserves | Aggregate Reserves |
|---|---|---|---|---|---|
| 1 | Data Acceptance Replacement Test | | | | |
| 2 | Input | Development Factors Runs Test | | | |
| 3 | | Decay Factors Runs Test | | | |
| 4 | | Inter-Method Correlation Significance Test | | | |
| 5 | | Calendar Year Correlation Significance Test | | | |
| 6 | | Input | Seed Loss Ratios Generation | | |
| 7 | | | Repeat Steps 4 & 5 with BF Method | Apply Method of Lagrange Multiplier | |
| 8 | | | Input | | Repeat Step 4 Across Classes |

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# Thank you!
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