The Actuarial Profession
making financial sense of the future

Best Practice in Technical Pricing

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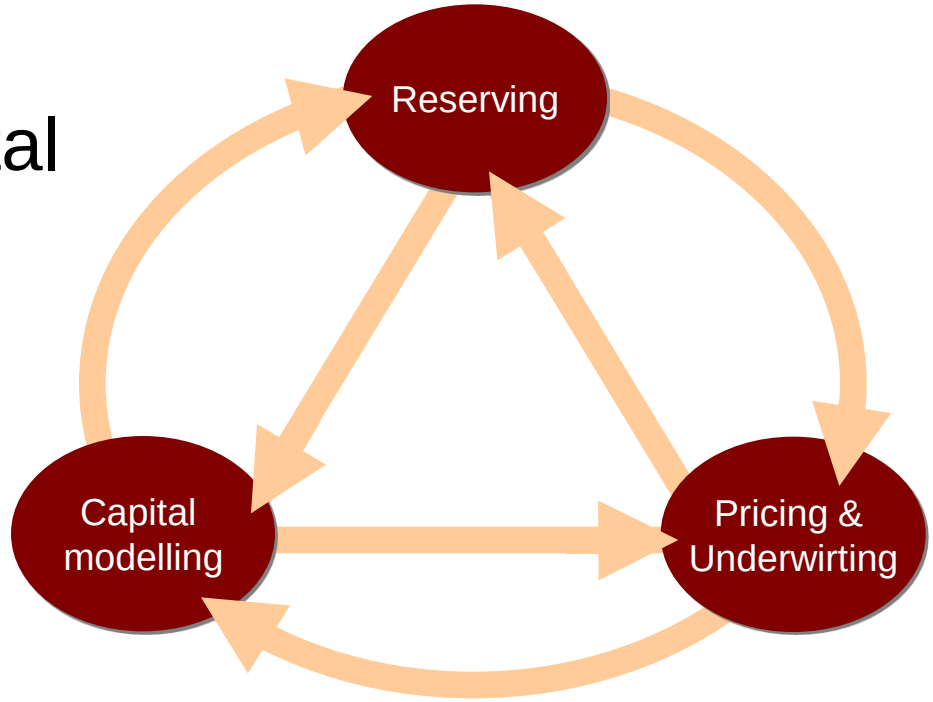
Key themes in technical pricing

- Process and control
- Understanding difference between expectations and reality
- Selecting the right tools for the job
  - Parsimonious modelling

Integrated business processes

- Rate monitoring
- Allocating cost of capital
  - Line of business
  - Policy
- Communication
  - Reserving
  - Underwriting
  - Capital modelling



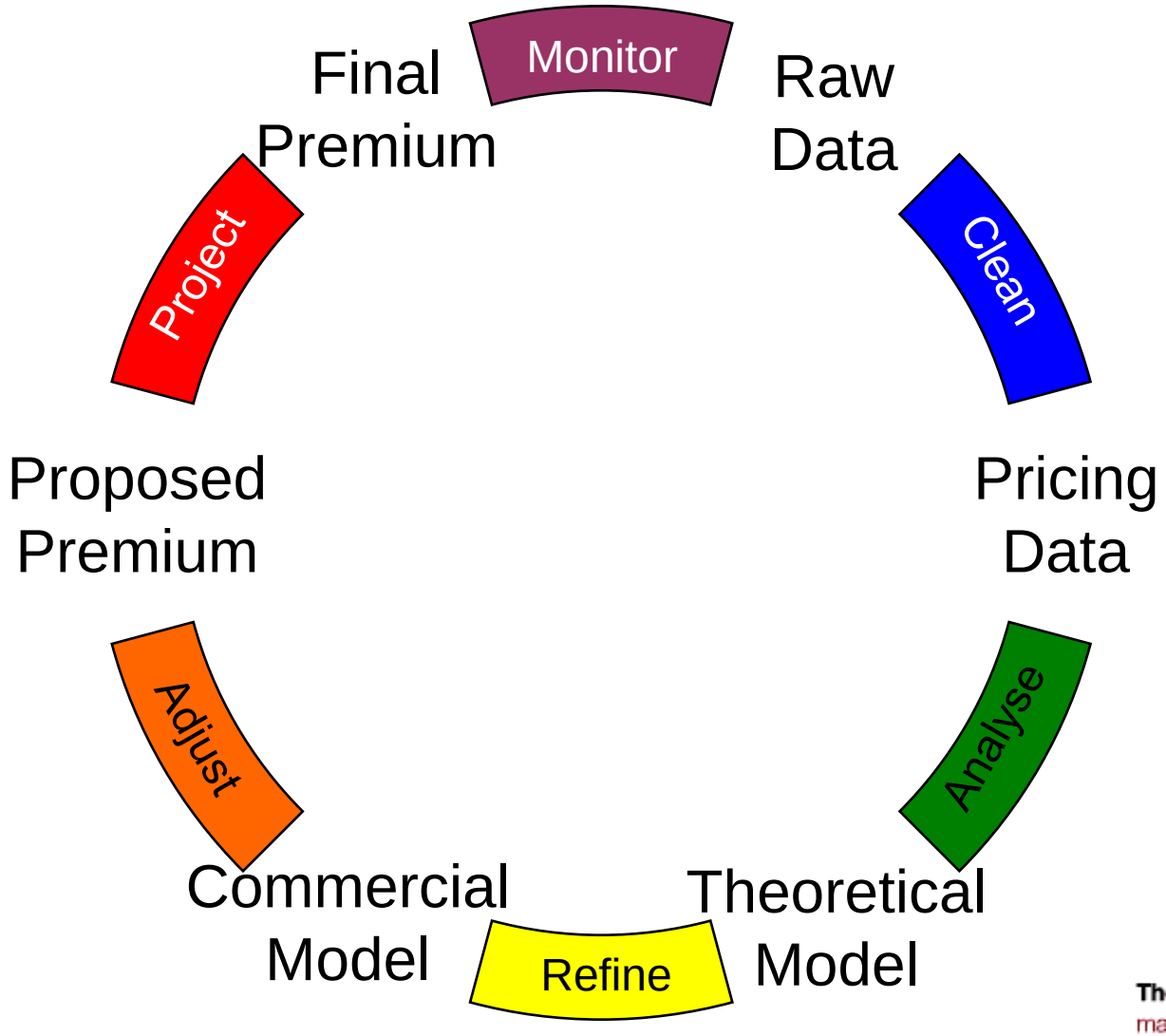
Processes and controls

- Managing operational risk is an important aspect of the business
- Rigorous controls are the norm for claims
- Pricing is key source of profit
- How do you protect your business against:
  - Charging the wrong price
  - Accusations of unfairness in pricing
  - Errors in key calculations
  - Loss of key staff

Processes and controls

- Need to have:
  - Clear and persistent records of analysis
  - Documentation of decisions
  - Standard methods to allow task sharing
- These should be:
  - Automatic and embedded within systems
  - Universal: Actuaries, Underwriters, Claims Managers
  - Regularly reviewed to check compliance
  - Not too onerous

Technical pricing overview



Clean

- Insurance data notoriously poor
- Common issues:
  - Duplicate data
  - Overlapping exposure
  - Miss-matching claims
  - Zero claims / nuisance claims (eg <£1)
  - …
- External data
  - Watch for non-matches

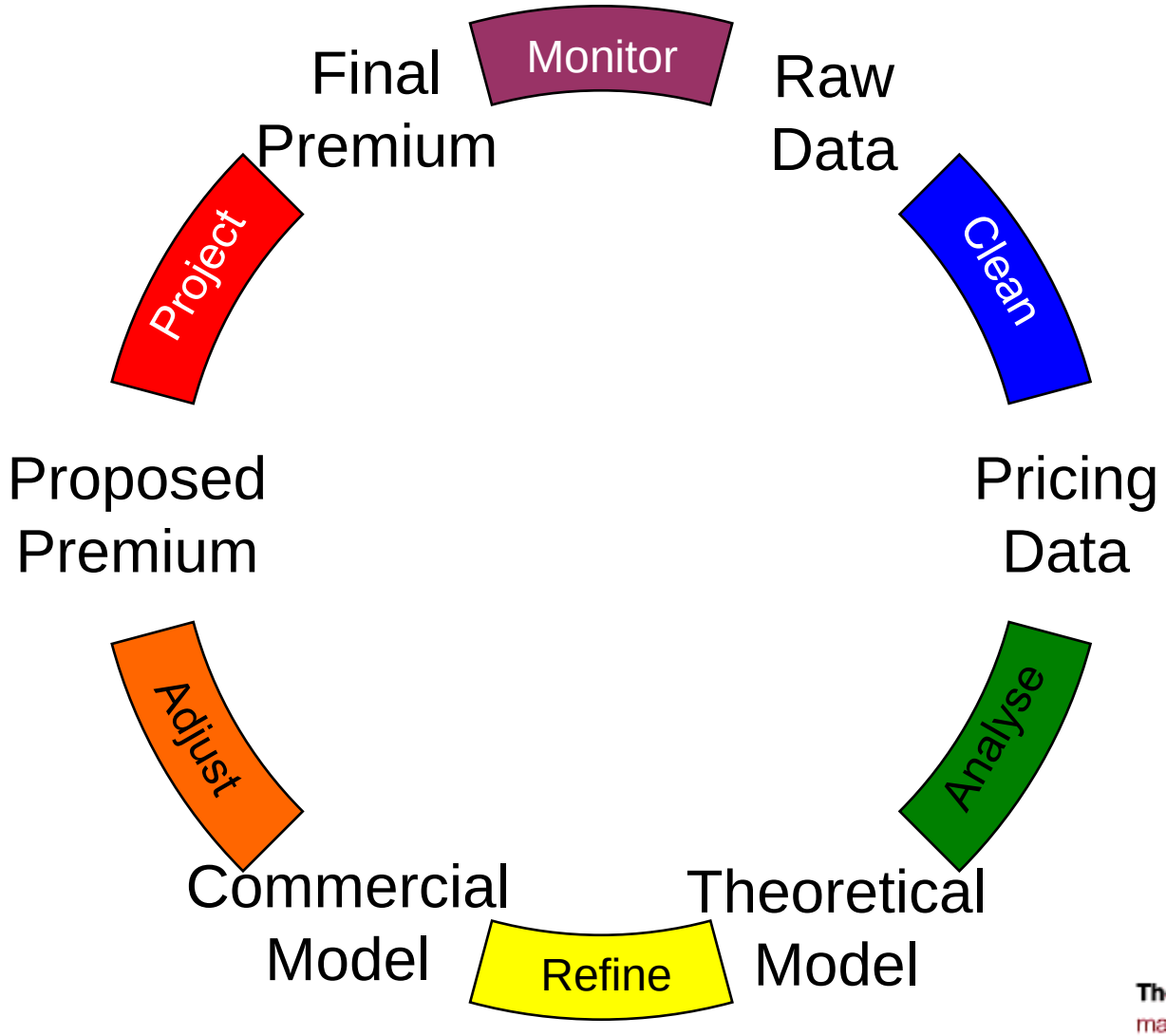
Clean

- Need to record steps and make it repeatable
  - Makes updates easier
- Don’t forget the sense checks:
  - Number of records
  - Total exposure, premium, claims
- Missing values
  - Ignore or correct?
  - Interpolation?

Clean
Common issues

- Character fields containing only numbers
- Equality mappings with rounding errors
  - 0.99999999 vs 1
- Concatenation and spaces
- Unexpected loss ratios
  - Earned or Unearned premium
  - Annual or Monthly premium
  - Current, Office or Actual premium
  - Mid-term cancellations/adjustments
  - Different as at dates for claims
  - Different mix of business

Technical pricing overview



Analyse

- Oneways and twoways still useful
- Understand outliers (distribution graphs)
- Iterate models
  - Start with simple variables
  - Add interactions
  - Consider grouping and splines
  - Take care not to over fit

Analyse
Type of modelling

- Pick suitable tools for the job
  - More than 1000 claims?
    - Use GLM
  - More than 50 claims?
    - Consider statistical methods on own data
  - Less than 50 claims?
    - Use benchmarks
- Can use mix of methods
  - Credibility can be used to blend results

Analyse
Model form

- Poisson / Gamma GLM
  - Standard for frequency / severity
  - Multiplicative model well suited to premiums
  - Best choice for mass market pricing
- Tweedie GLM
  - Useful for high level analysis
  - Can miss detail
  - Take care in interpretation

Analyse
Model form

- Probability models
  - Binomial error recommended
  - Choice of link functions
    - Logit
    - Probit
    - Log
    - All useful in different situations

Analyse
GLM or GAM

- GLMs useful in most cases
- GAMs have some nice extensions for continuous variables
- Use of splines sits in GAM world
  - Regression splines easily fitted using GLMs
- In general, GAMs are more processor hungry, often by an order of magnitude

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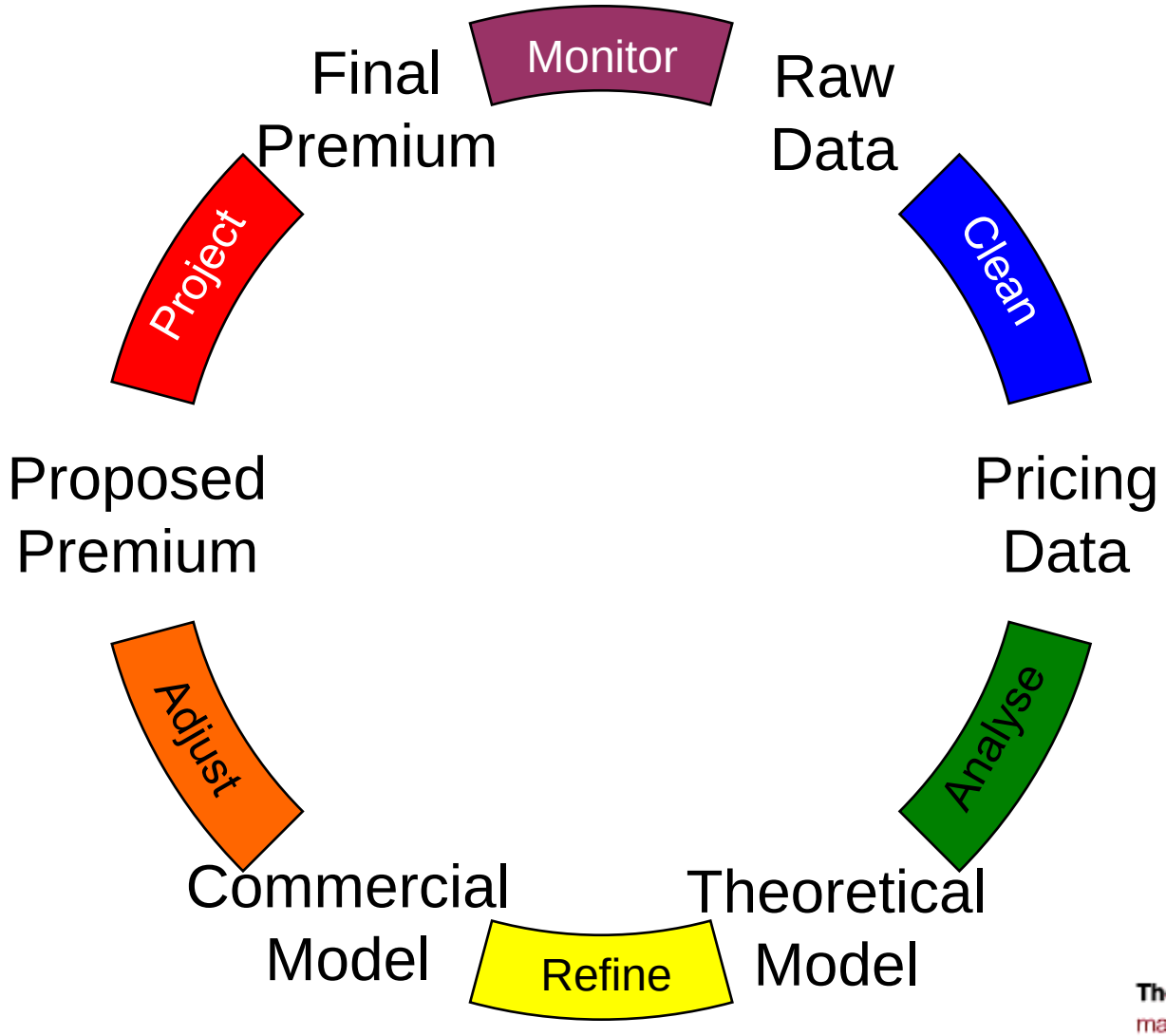
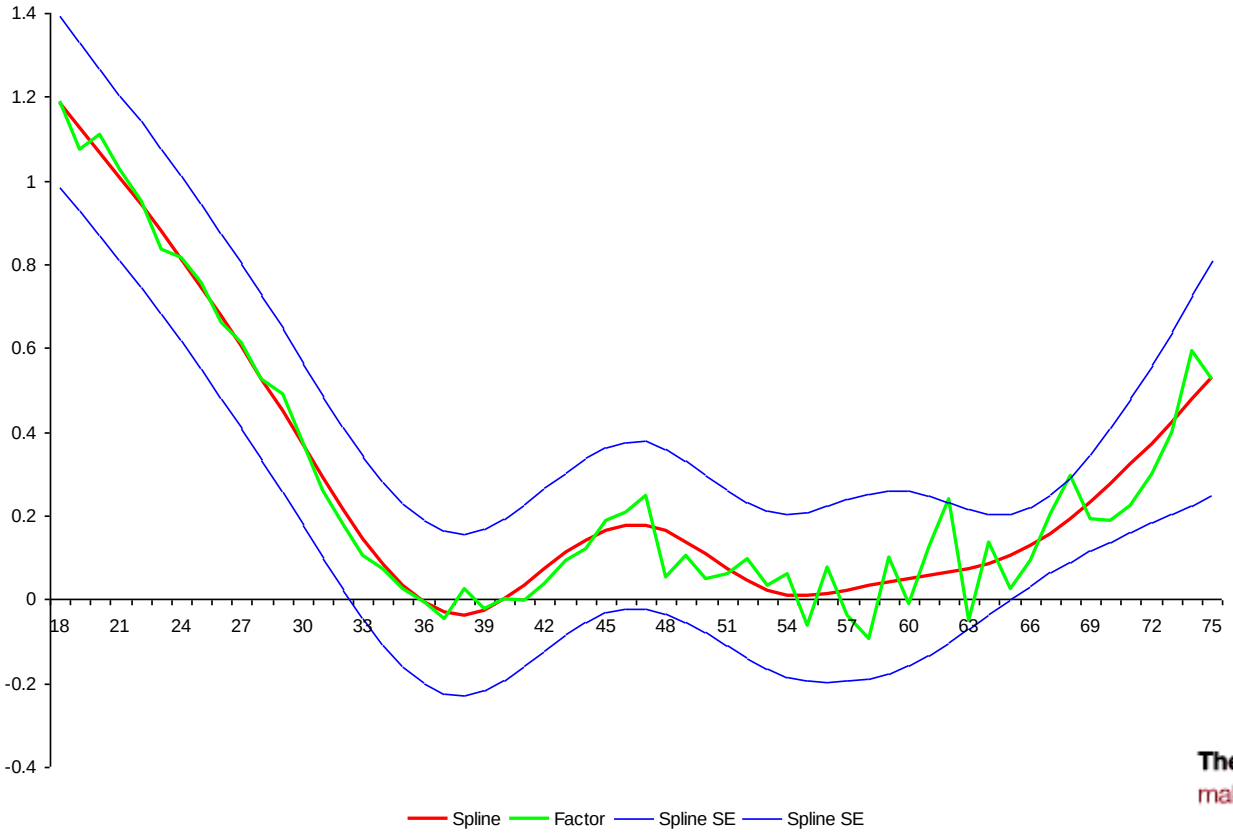


Refine

- Theoretical models useful and interesting
  - Eg: Can use in projections later
- Commercial models reflect the reality of what can be done
  - Still best model of data, just from a smaller set of variables
  - May include some restrictions where necessary

Refine
Continuous variables

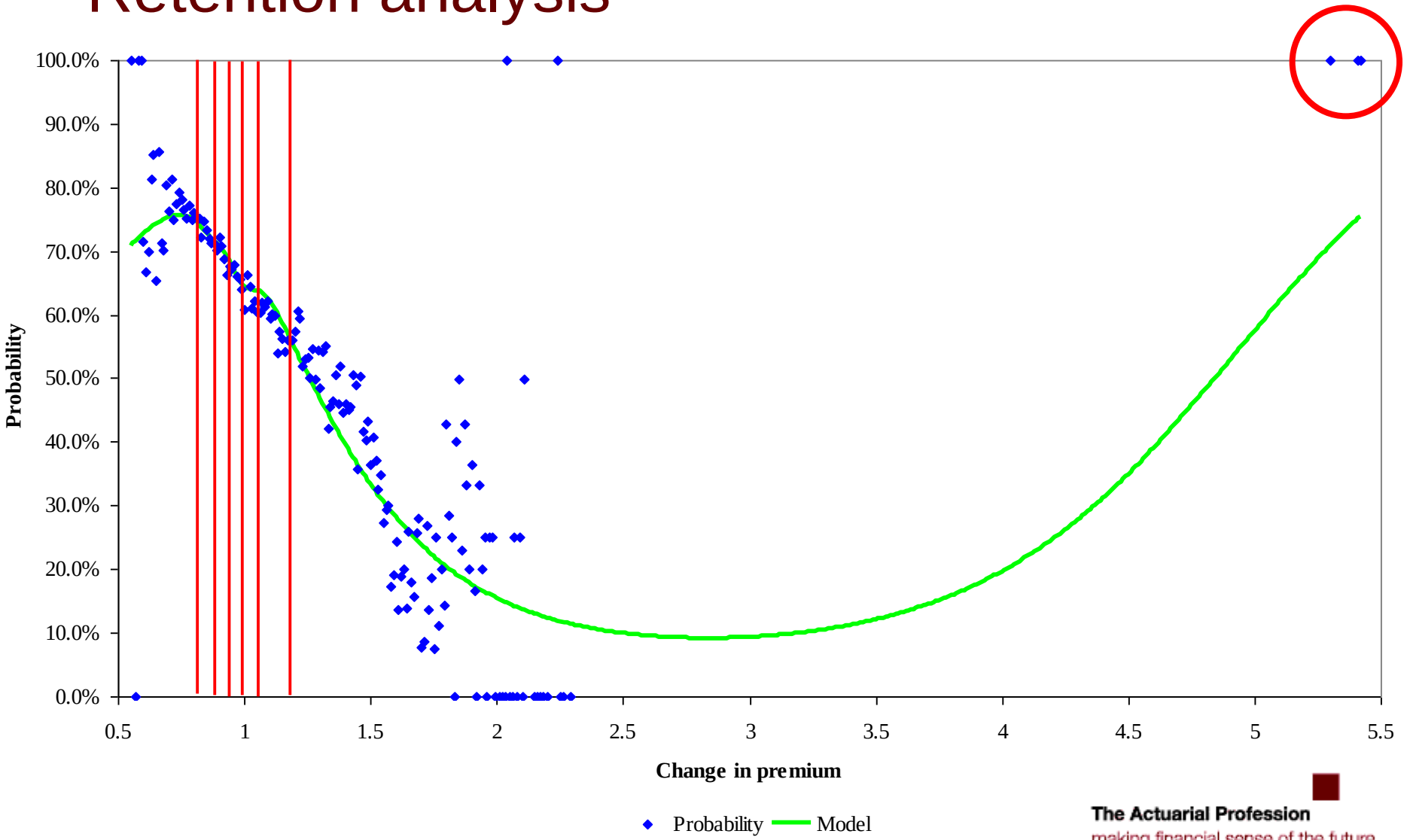
- Best treated as regression splines
- Easy to use, easy to understand



Refine Splines

- Take care with missing values
  - Use indicator flag to avoid distortion
- Verify actual shape of curve, especially at edges
- Common issues:
  - Knot placement
  - Overfitting to noise
  - Inappropriate extrapolation

Inappropriate extrapolation
Retention analysis



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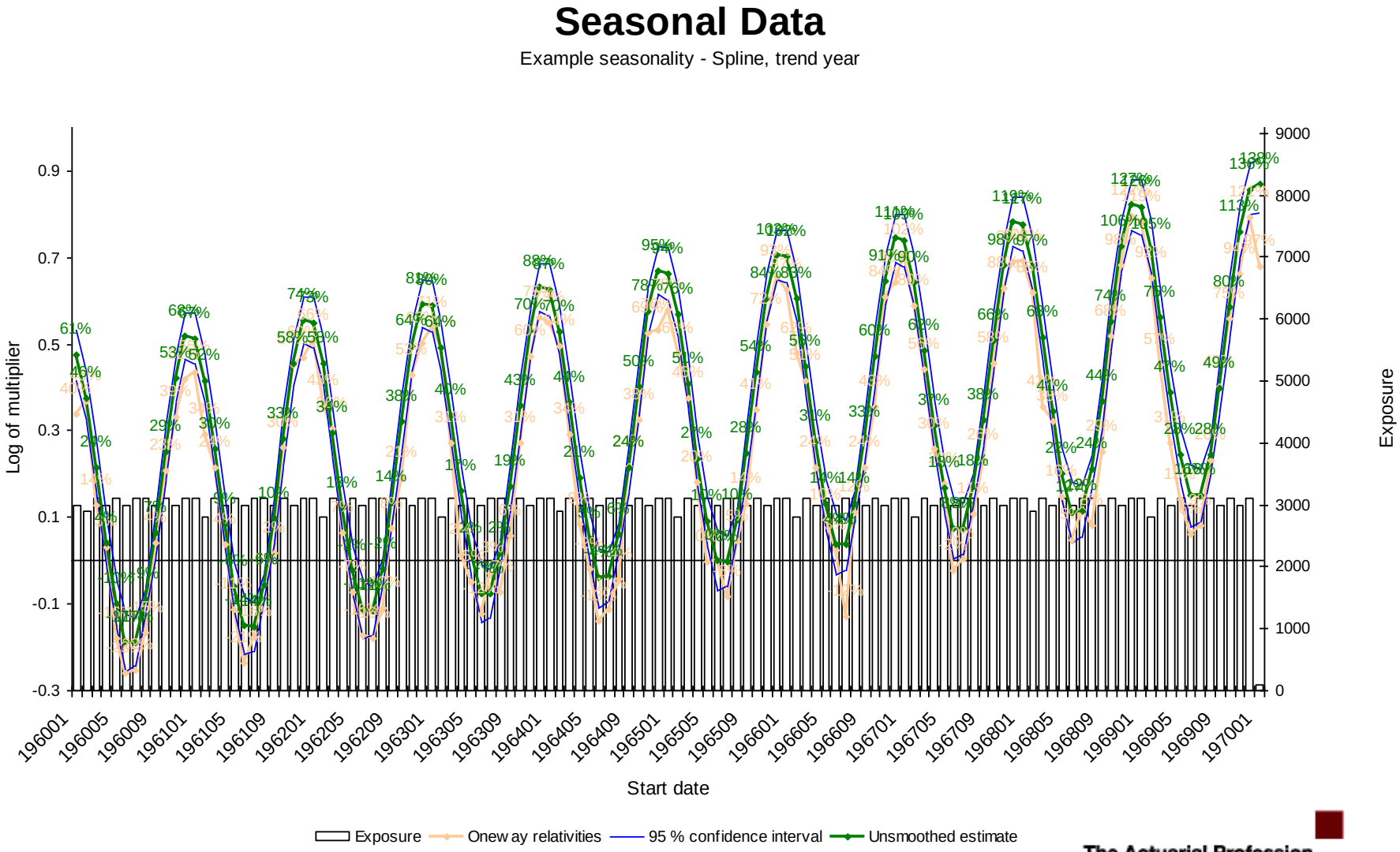
Refine Seasonality

- Relevant for monthly projections and very short term products (eg travel)
- Also useful for models of claims
  - Reserving
  - Initial claims estimate
- Can model using circular splines
  - Add underlying trend factor to deal with inflation

Seasonality plus trend



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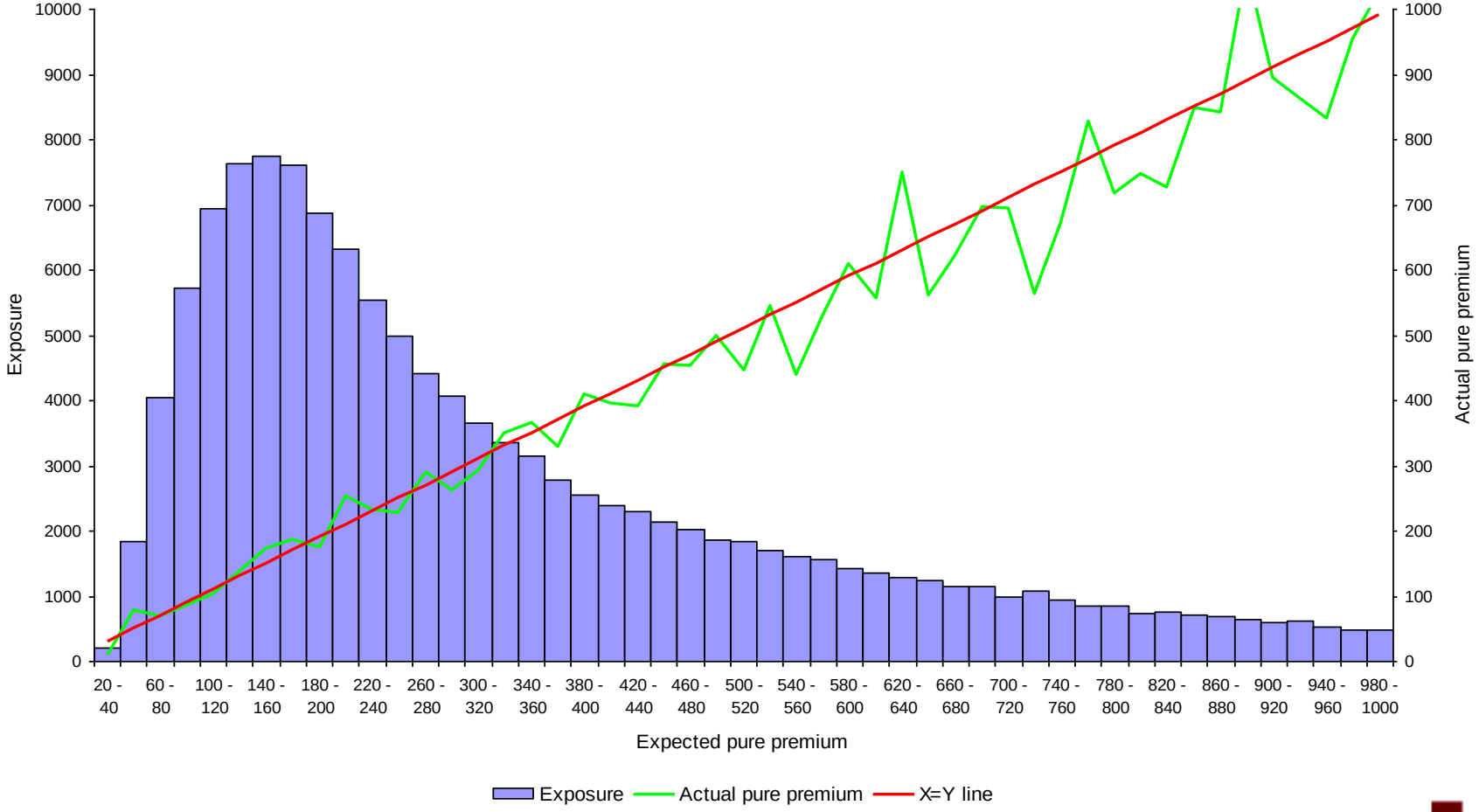
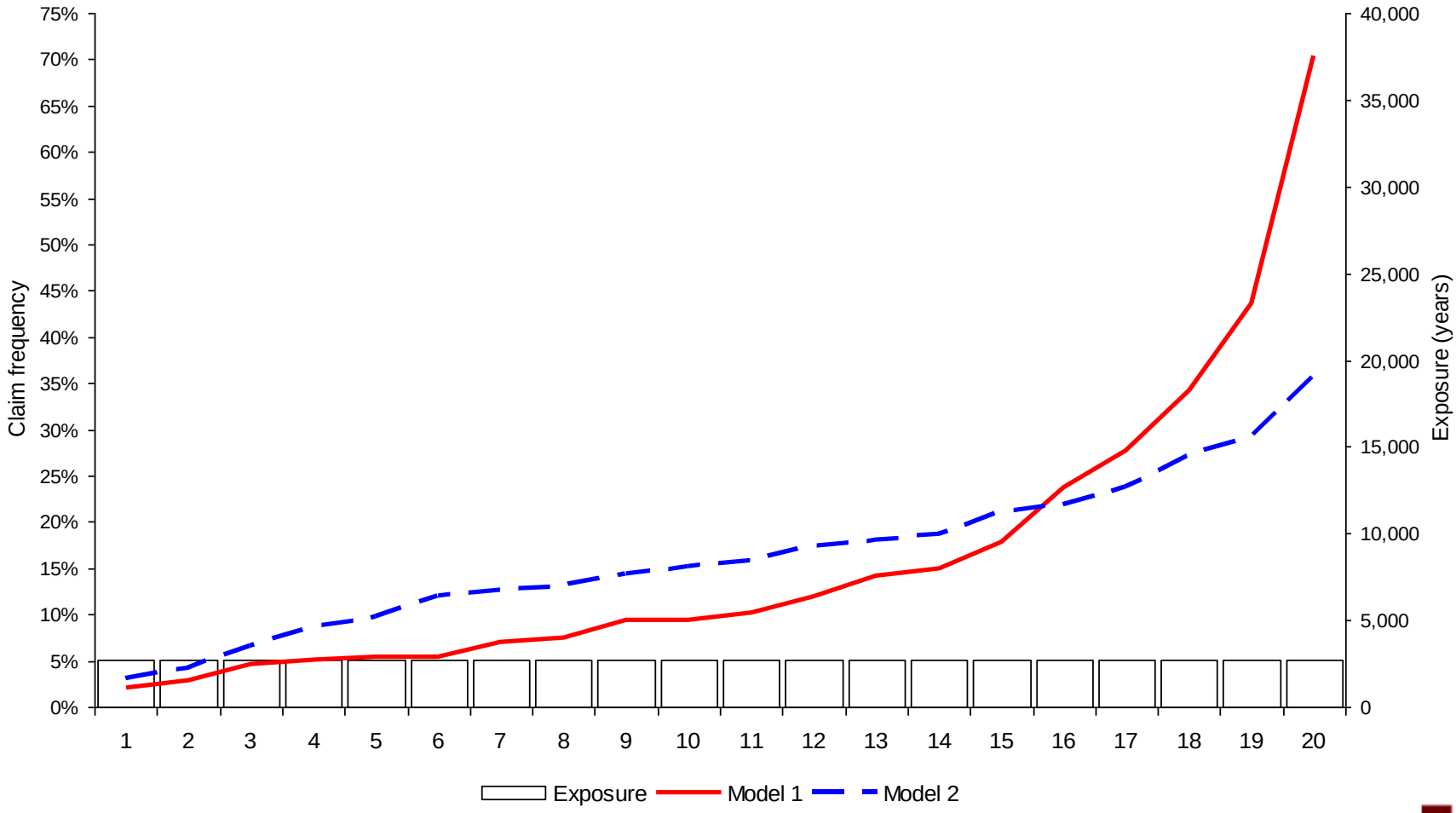
Refine
Check the model's fit

- Ideally keep hold out sample
  - 80/20 or 60/40
  - No hard rule
- Check the model for:
  - How well does it predict
  - How well does it separate
  - Improvement over existing models

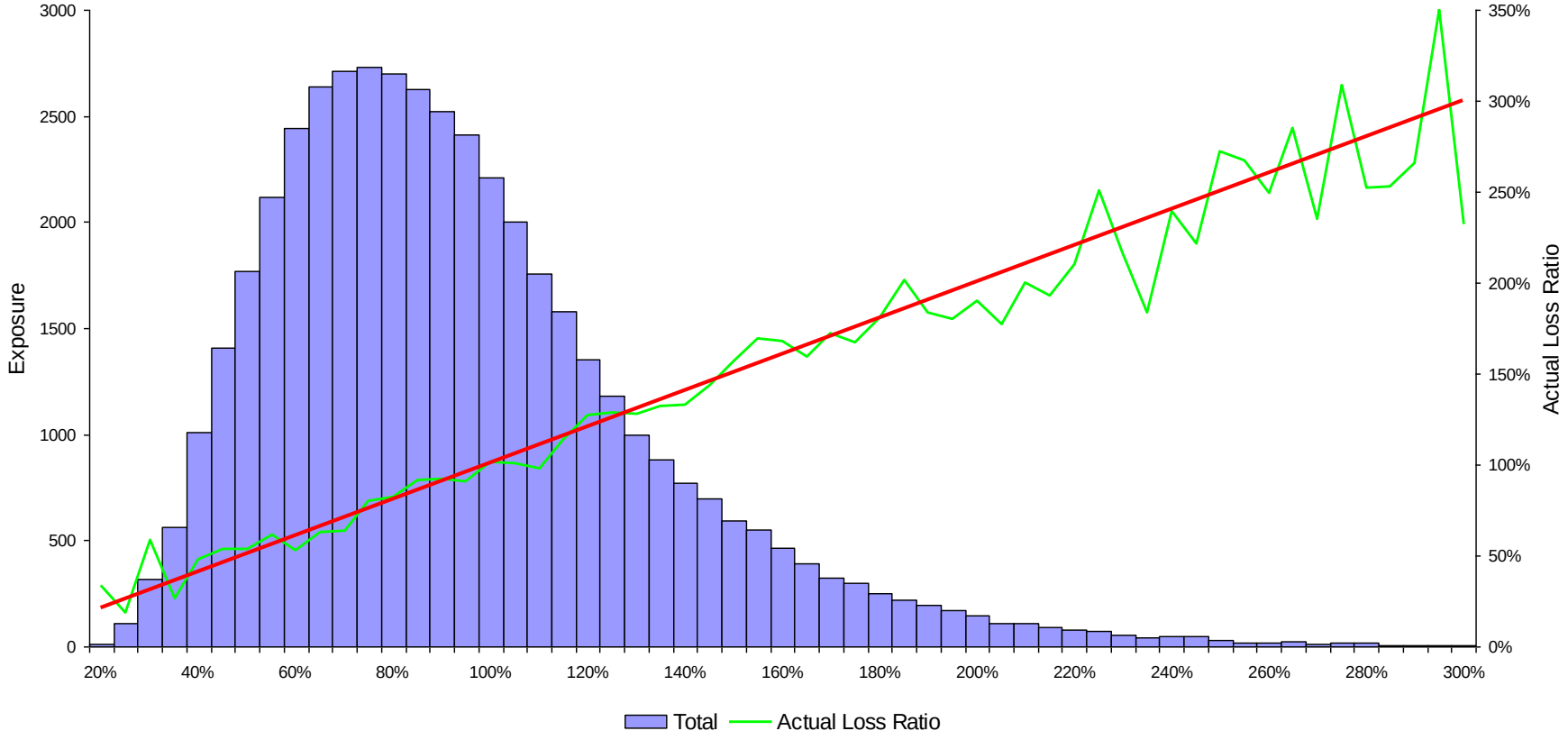
Refine
Model validation



Refine
Lift curves



Refine
Loss ratio impact



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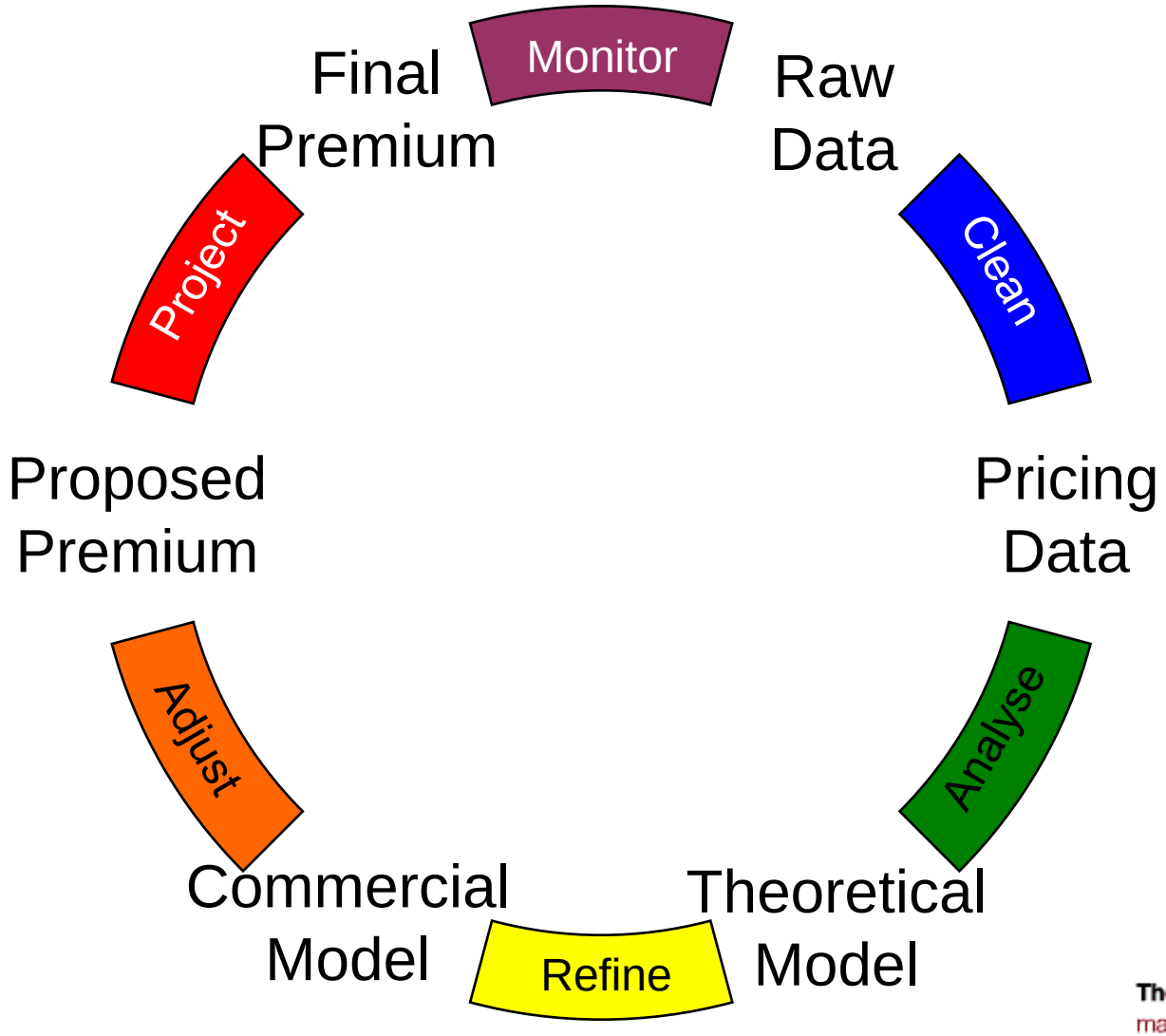
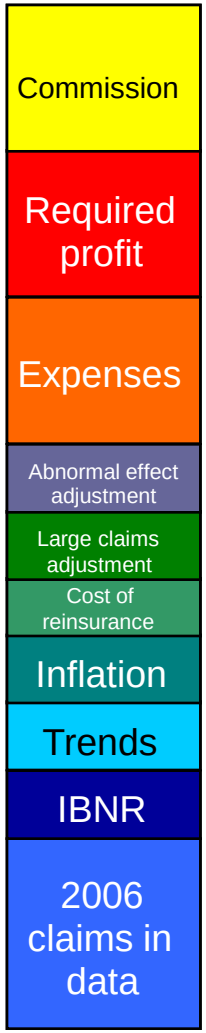


Adjust

- Modelling process delivers relativities
  - Smooth if necessary
- Base level may not reflect reality
  - Slicing
  - Weighting
  - Where clause
  - Gamma typically within +/-10% (usually less than 5%)

Absolute rates

- What premium income is required?
- For claims consider
  - IBNR / IBNER
  - inflation
  - trends
  - large claims
  - abnormal effects
- Then add on expense / commission /profit loadings etc



(not to scale!)

Adjust

- Update intercept to hit target income on assumed portfolio
- Take care with maturing portfolios
- Remember that discounts and offers change both premium and risk profile

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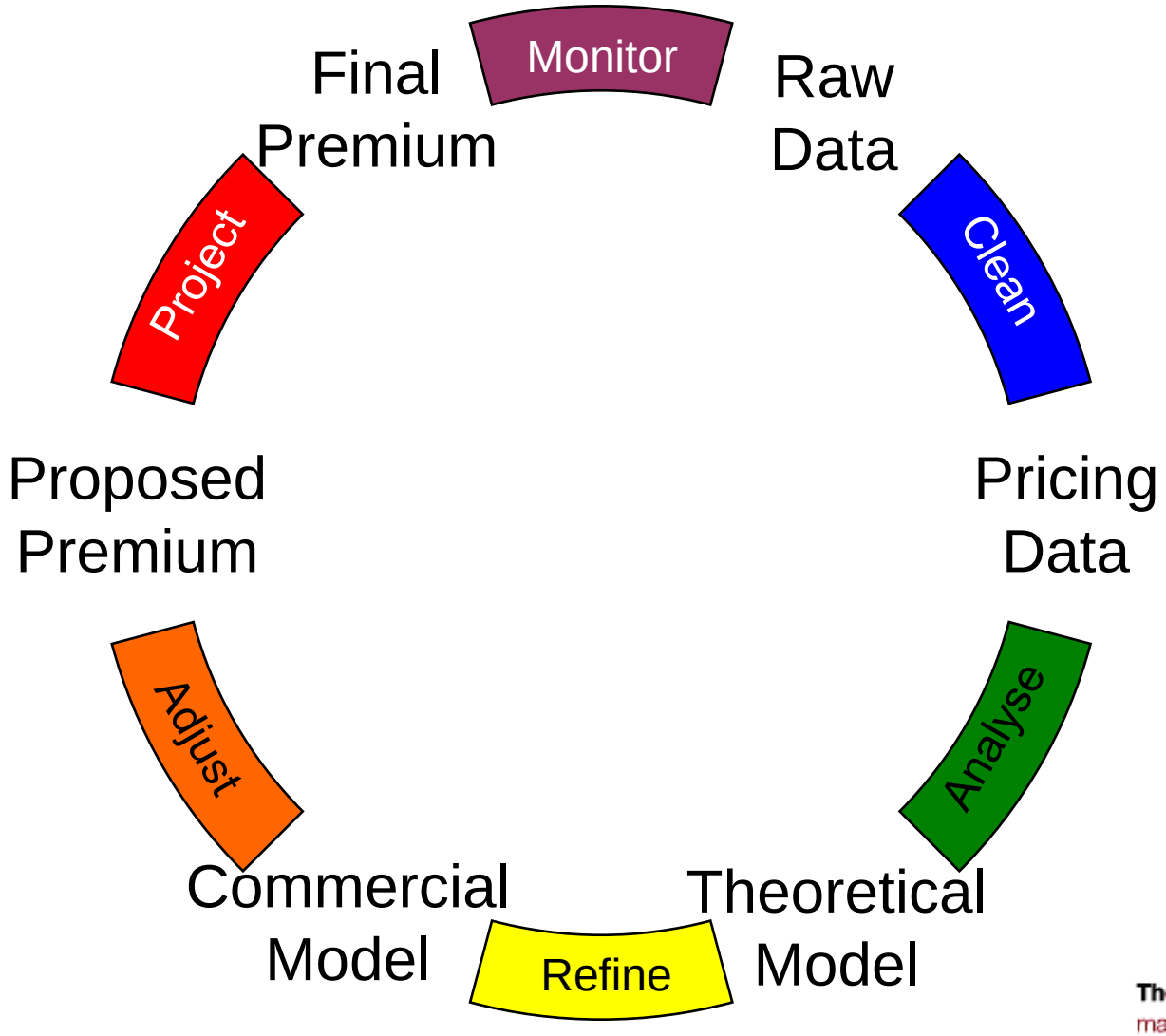
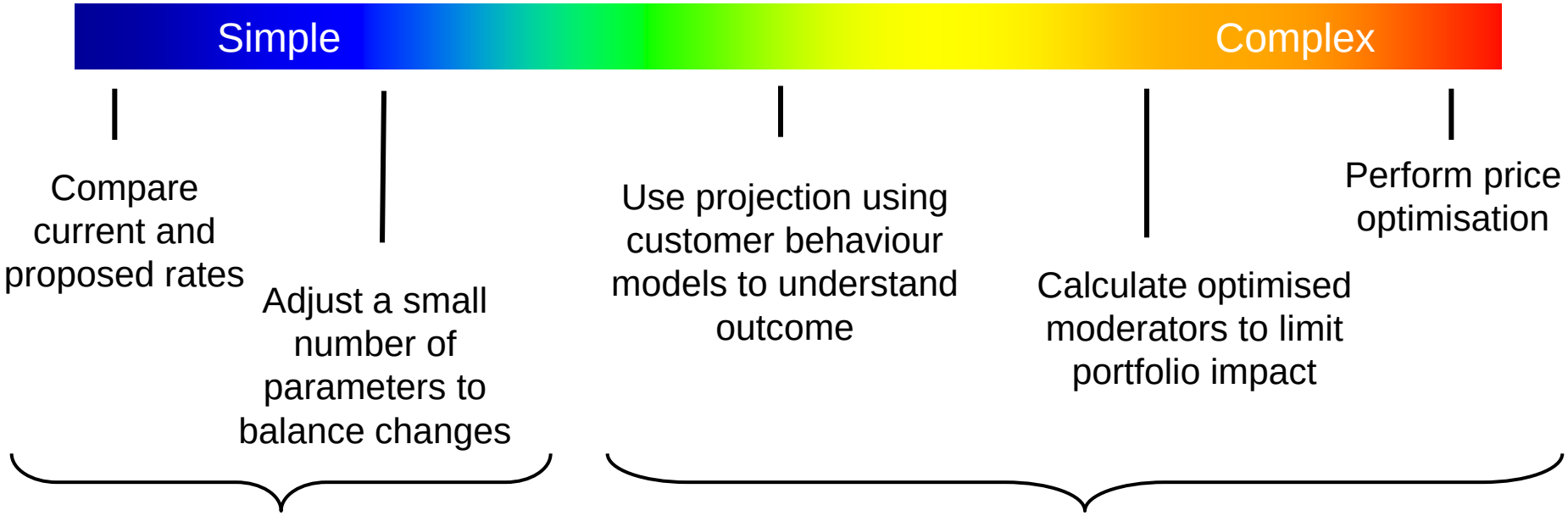


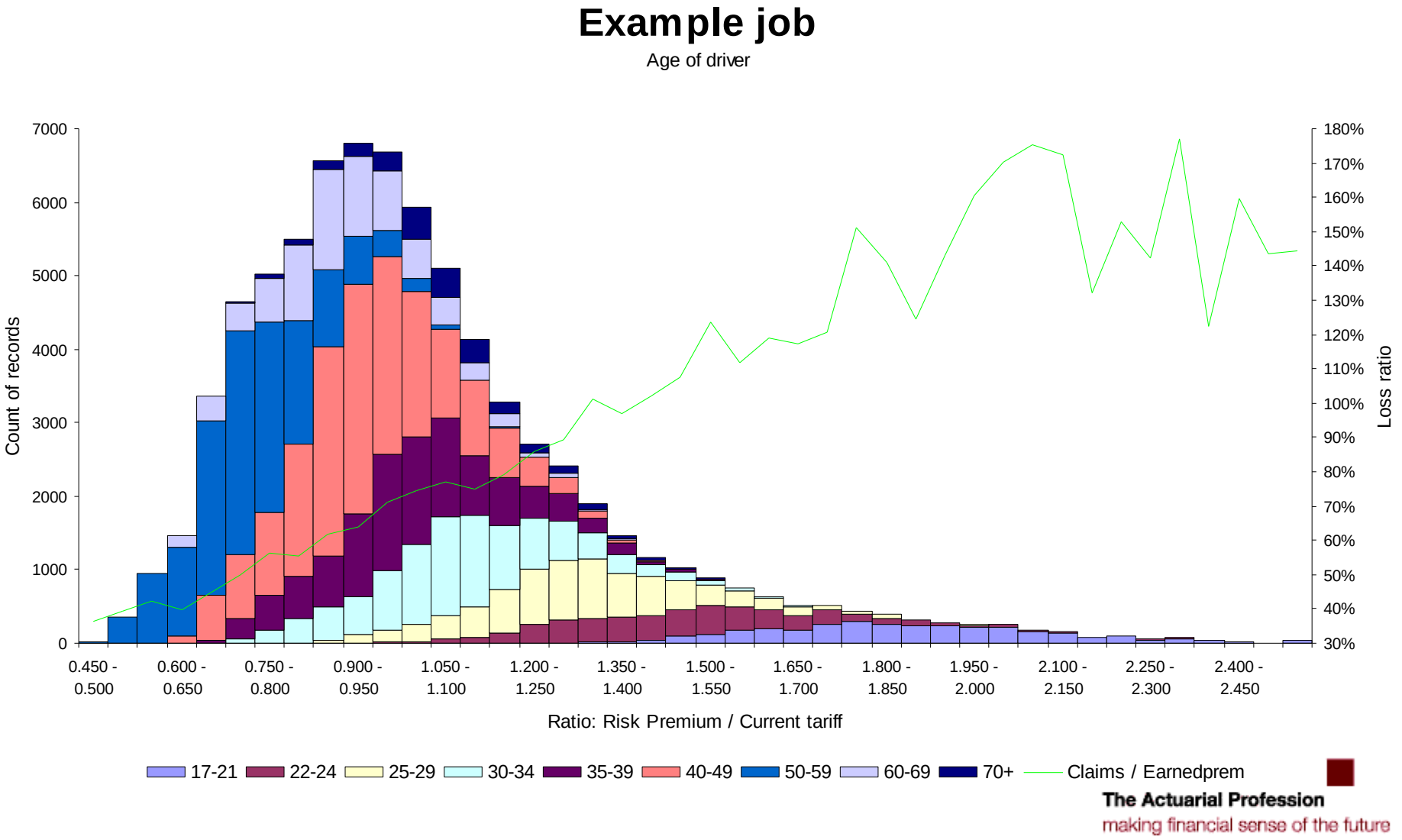
Project

- Try to understand what will happen following a change in premium
- Many actions have unexpected consequences
  - Try to anticipate some of these!

Project
Range of projection complexity



Project
Simple impact graph



Project

- Projection will give some indication of likely impact of premium
- Final selected premium will be customised to meet specific targets
- No plan ever survives contact with the enemy

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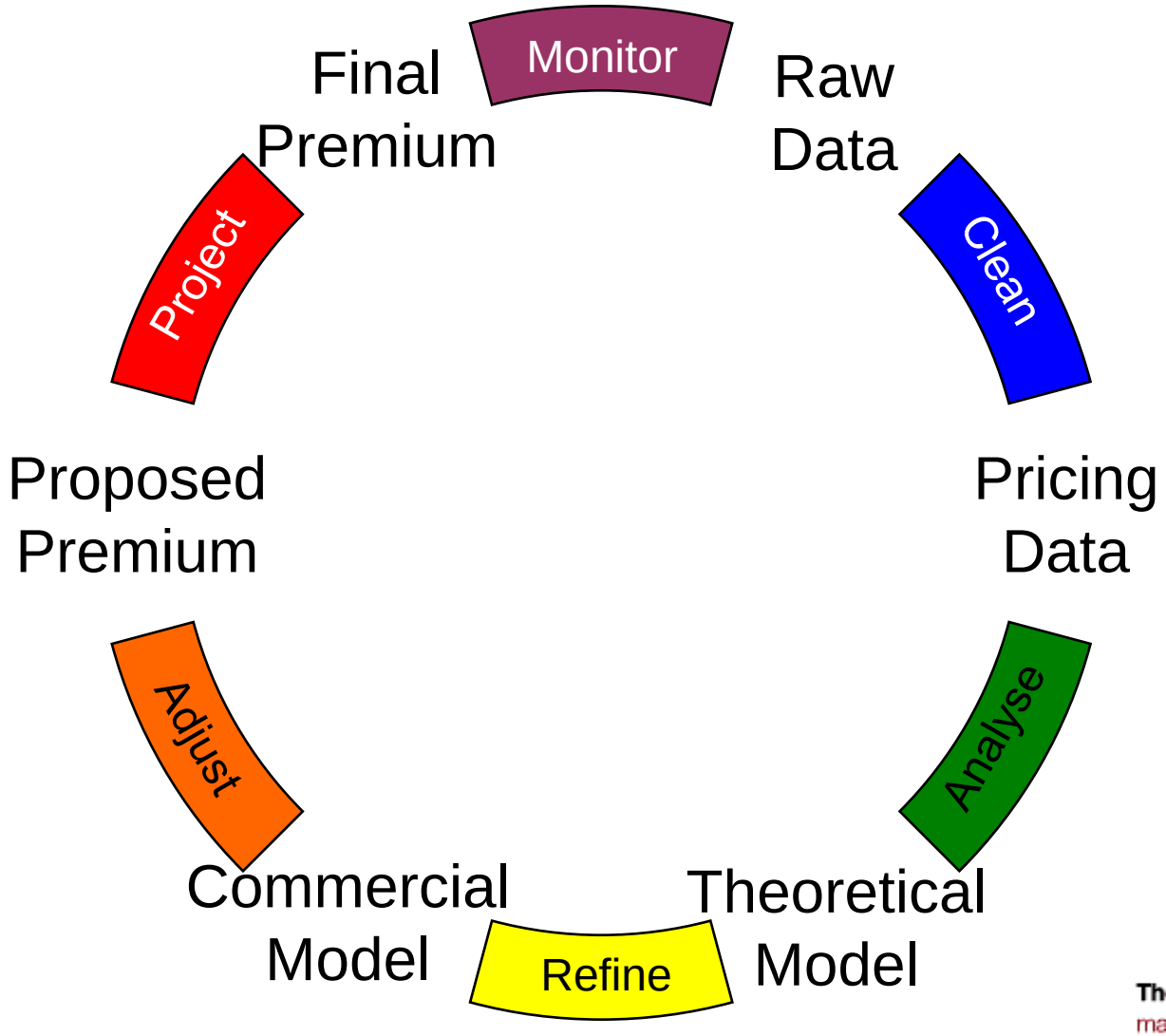

Monitor

- Monitor actual outcome against projection
  - Volumes
  - Average premiums
  - Loss ratios
- Take care with IBNR / IBNER
  - Can get caught by late developing claims
  - Important to stand back and take longer term view

Monitor

- Work to improve data quality and capture new data
- Can short circuit process:
  - Mini-price changes
  - Quick analyses
- Return to start to do regular re-rating

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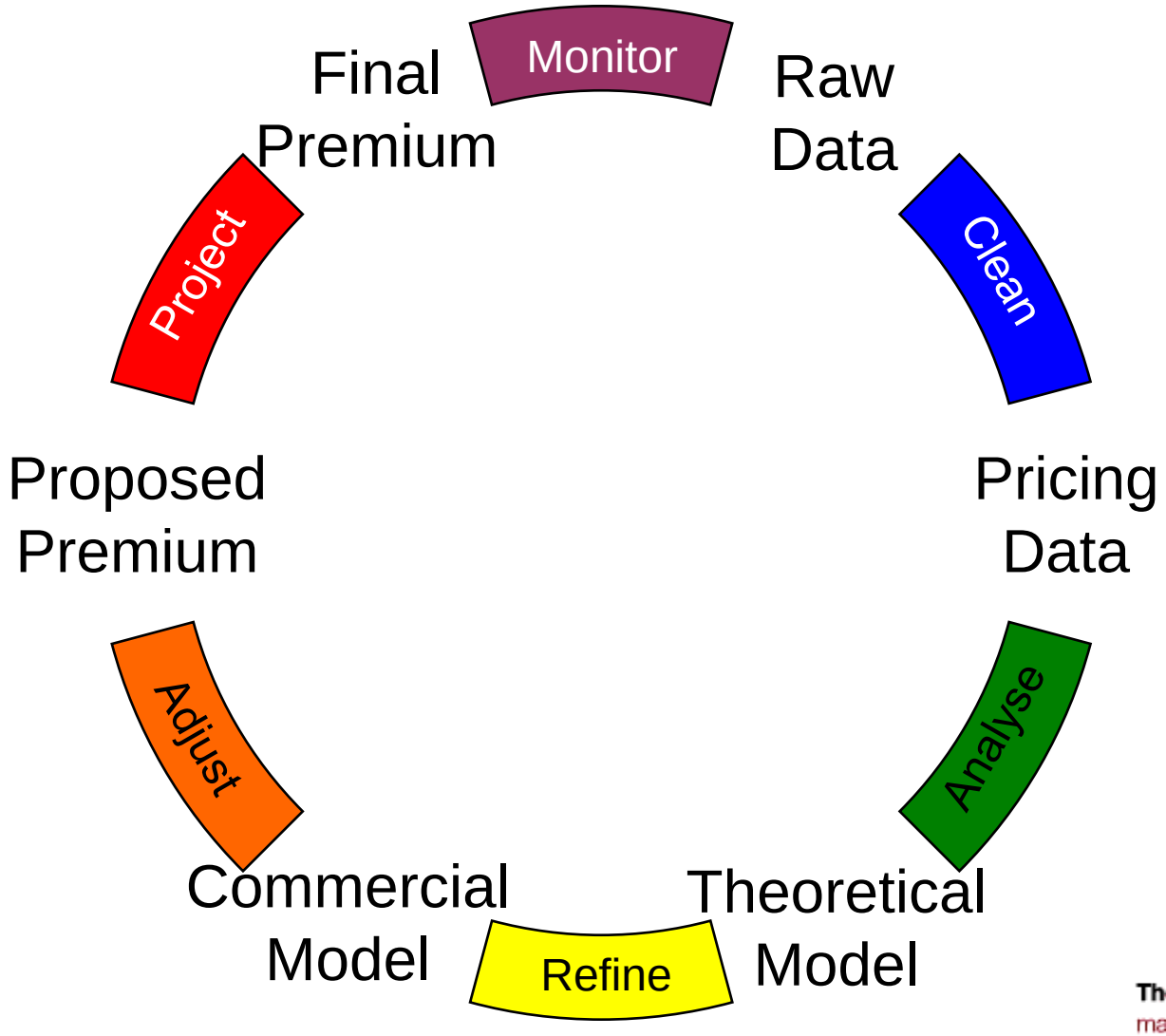

Best practice

- Document each step
  - Reproducible
  - Checkable
  - Auditable
- Use common software, templates and methods
- Check and peer review of work
- Use suitable methods & experiment with new ones

Questions

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