The Actuarial Profession
making financial sense of the future

32nd ANNUAL GIRO CONVENTION

The Imperial Hotel, Blackpool

Focusing the effort on improving the accuracy of reserving

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Focusing the effort on improving the accuracy of reserving

- This workshop discusses certain key decisions that need to be taken when providing a central estimate and a range around it which a Board of Directors can use as input into their decision as to the level of reserves to be established in a balance sheet.
- The guiding philosophy is to narrow the areas of major uncertainty and then focus on those areas.
- The particular aspect to be discussed is, inside a category, the manner in which the data should be split, eg subdivided by size of claim or capped, and the levels at which this should take place

Objective

- Example analysis: UK motor injury claims
- For different capping levels: to calculate probability distribution for gross reserve when:
  - There are potentially very large open and IBNR claims
  - Data on paid development of individual claims are available
  - Case estimates are highly uncertain on large claims

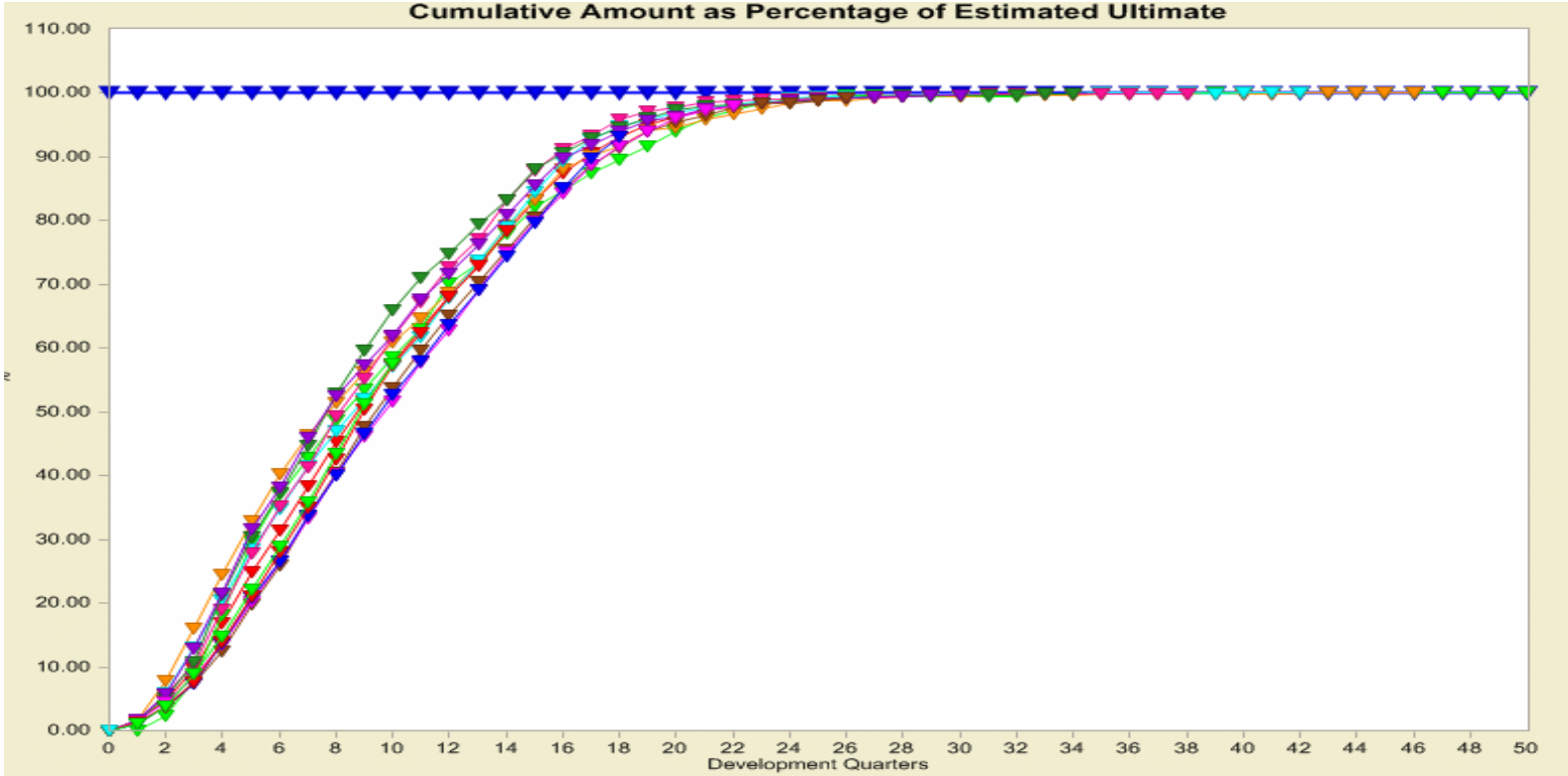
Overview of method

- Data adjusted for inflation by accident year
- Individual claim cap selected (*eg* £100k)
- Separate analysis of capped paid claims and excess amounts
- Results of capped and excess analyses combined to give final result

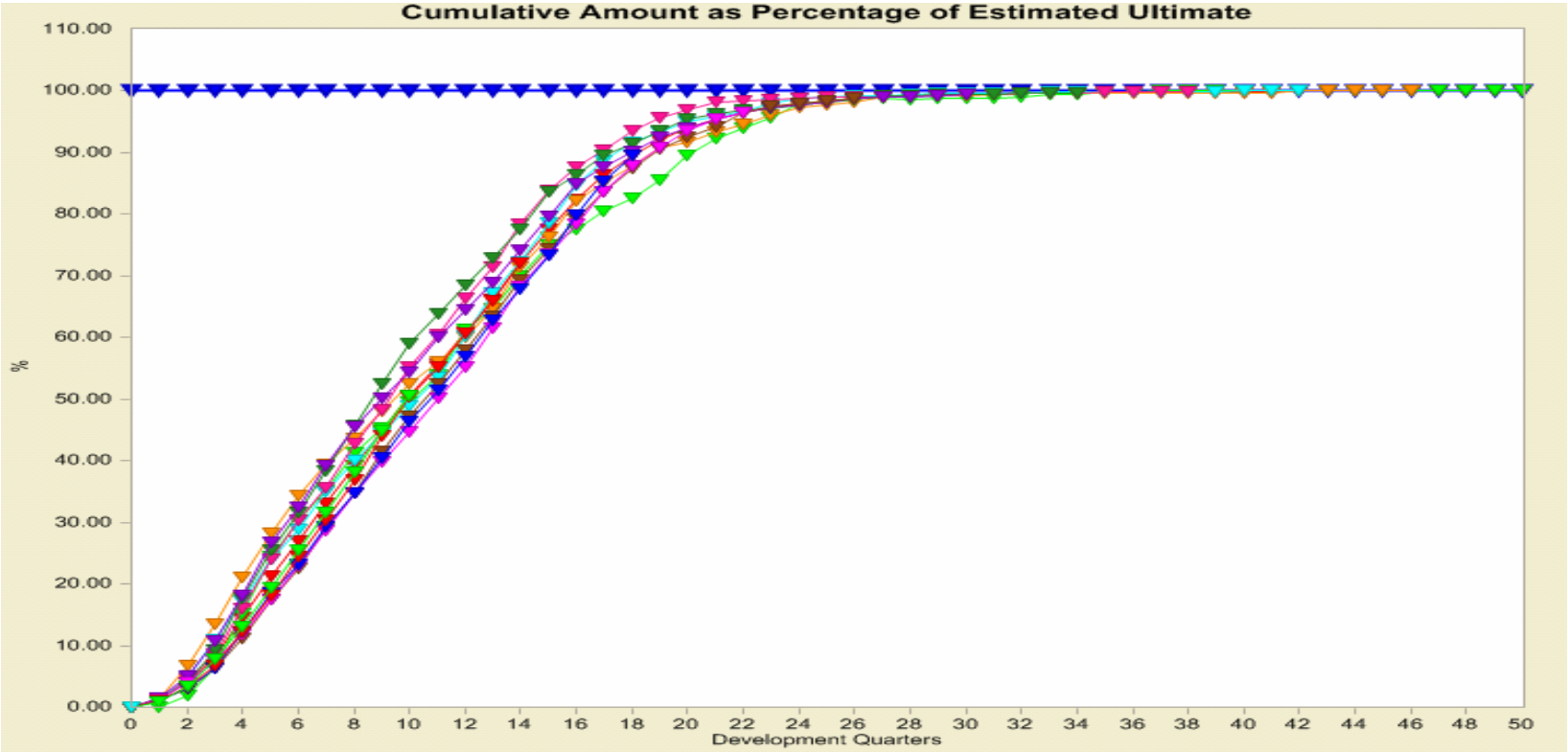
Data

Bands	Numbers of Claims
All Claims	33,815
> £50k	2,228
> £100k	851
> £250k	289
> £500k	116
> £1m	52

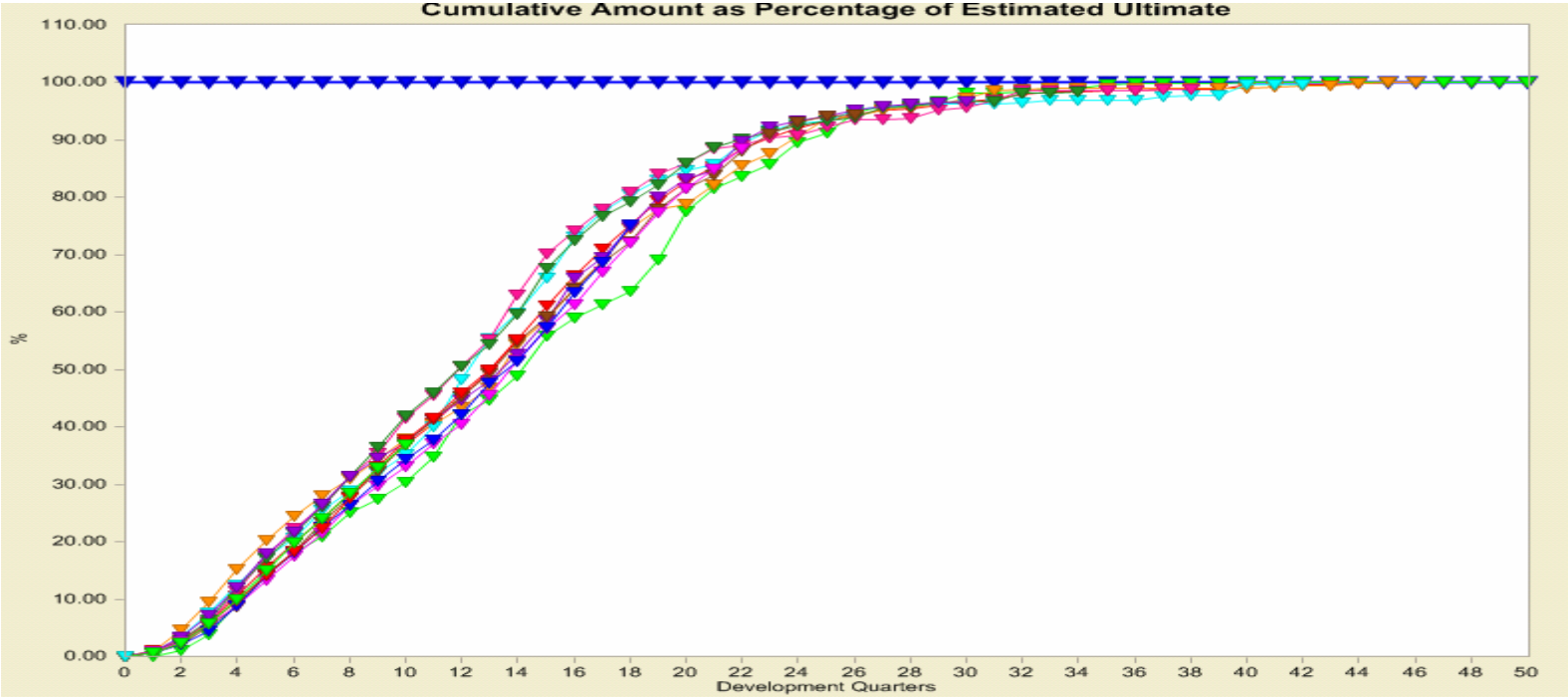
Capped £50k – Qtr 16 : 84% - 91%



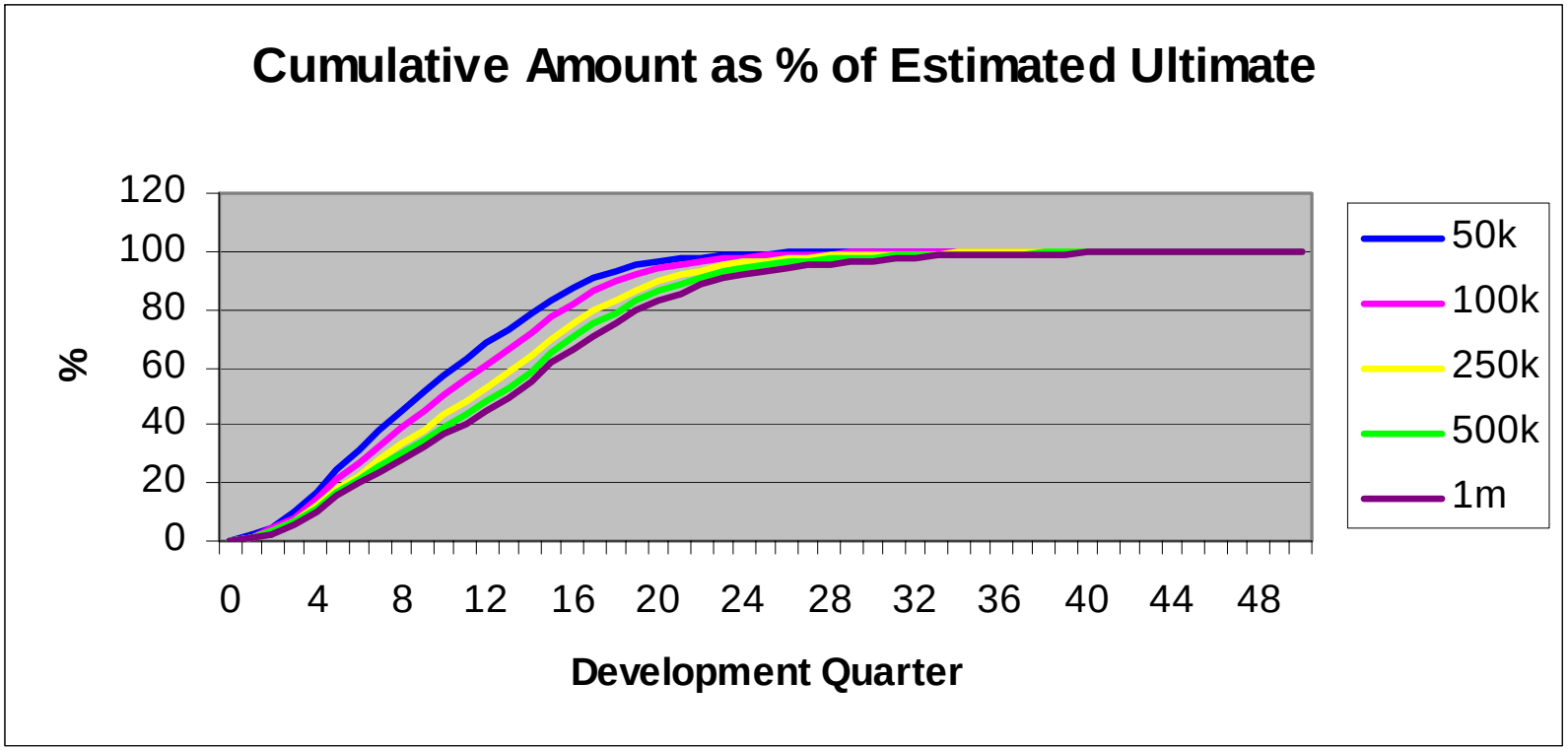
Capped £100k – Qtr 16: 78% - 88%



Capped £1m – Qtr 16: 59% - 74%



Fitted Paid Curves for different capping levels



Data needed for the analysis

- Capped Paid Triangle
- List of Claims for which the paid has exceeded the capping level
  - d-quarter
  - Inflated Excess Paid Amount to Date
  - Flag if Claim is closed

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Analysis of capped claims

- Stochastic projection of aggregate capped paid amounts triangle
- Capped amounts of large claims included in capped triangle (to preserve development pattern)
- For the example analysis, we used basic chain ladder with Mack's standard errors
- Produces best estimate and standard error of aggregate capped reserve (OS+IBNR)

Analysis of large claims (excess amounts) – step (a)

(a) Stochastic projection of future number of claims exceeding cap:

- gives best estimate and standard error of number that will exceed cap in future
- for the example analysis, we used Mack's method on paid numbers exceeding cap
- use of incurred numbers and/or exposure-based stochastic method would be better for later accident years

Analysis of large claims (excess amounts) – step (b)

(b) Loss distribution analysis of individual claim amounts in excess of cap

- uses open (right-censored) and closed claims
- gives loss distribution of ultimate individual amounts in excess of cap
- ultimate loss distribution may depend on when a claim first exceeds cap

Analysis of large claims (excess amounts) – step (c)

(c) Combine (a) stochastic projection of number of claims that will exceed cap in future with (b) loss distribution for individual ultimate excess amounts

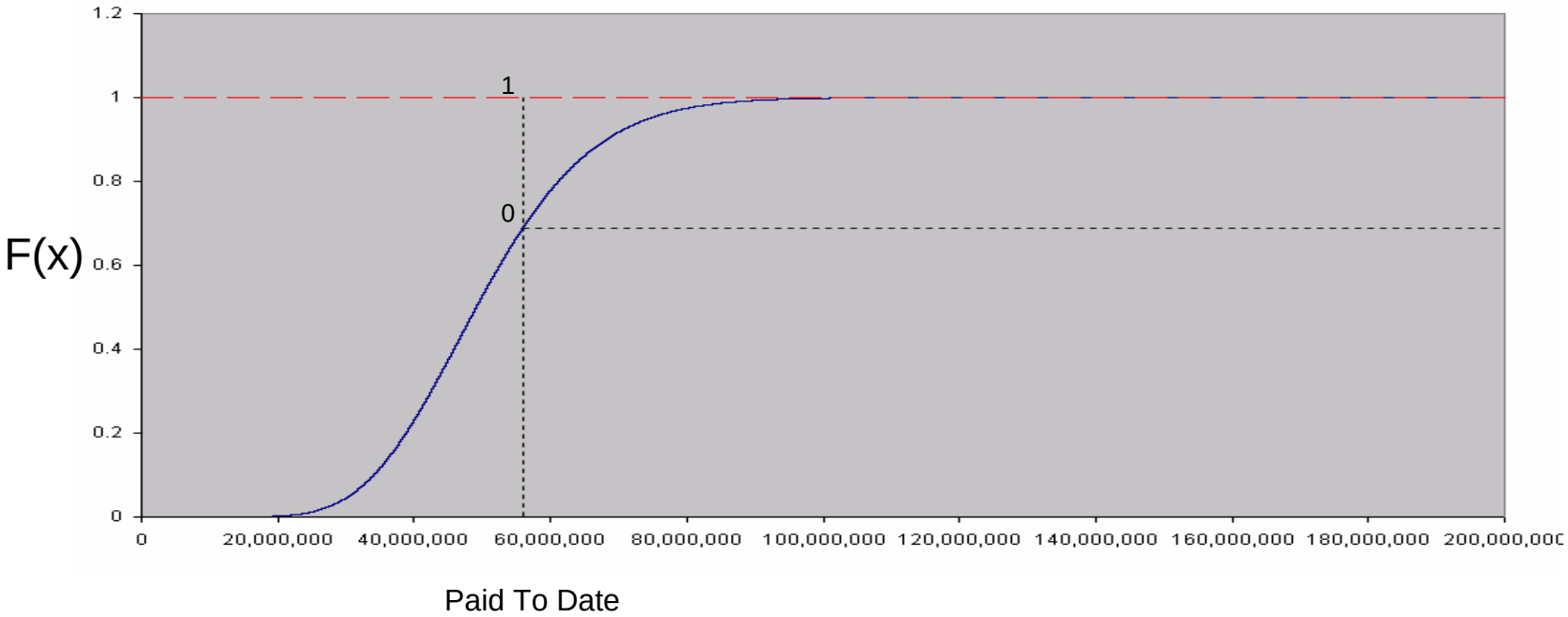
- gives aggregate excess probability distribution for 'IBNR' reserve (*ie* large claims that have not yet exceeded the cap)
- for the example analysis, we used Panjer's method

Analysis of large claims (excess amounts) – step (d)

(d) For outstanding amounts on open claims that have already exceeded cap

- left-truncate appropriate loss distribution from step (b) at the amount paid to date: gives conditional distribution for the amount outstanding on each claim
- calculate convolution over all open claims of these conditional distributions
- gives aggregate probability distribution for amount outstanding on all open large claims

Diagram to illustrate step (d)



Example analysis – Step (a) ‘IBNR’

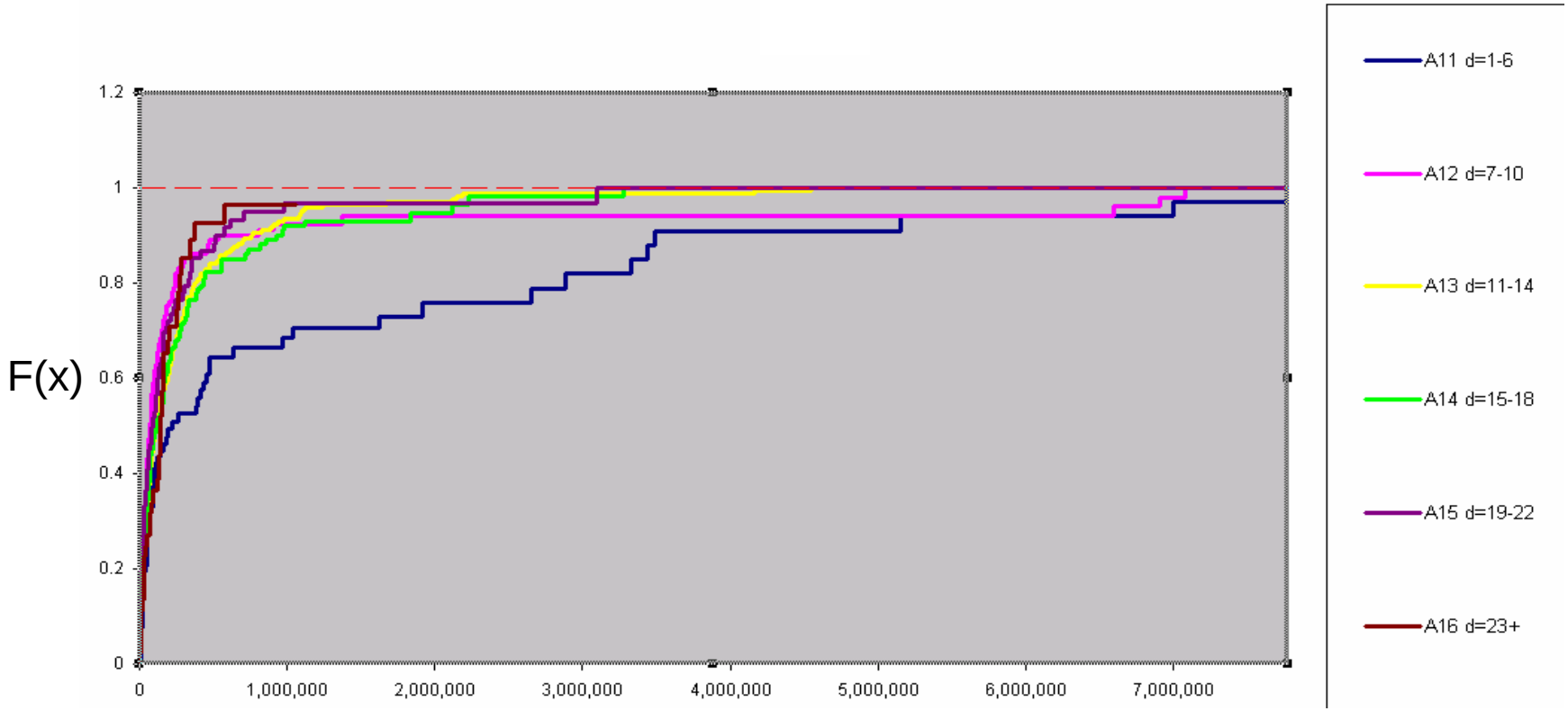
- Stochastic projection of future number of claims exceeding cap (‘IBNR’)

Cap	£100k	£1m
To date	851	52
“IBNR”	158	50
Std Error	31.3	28.2

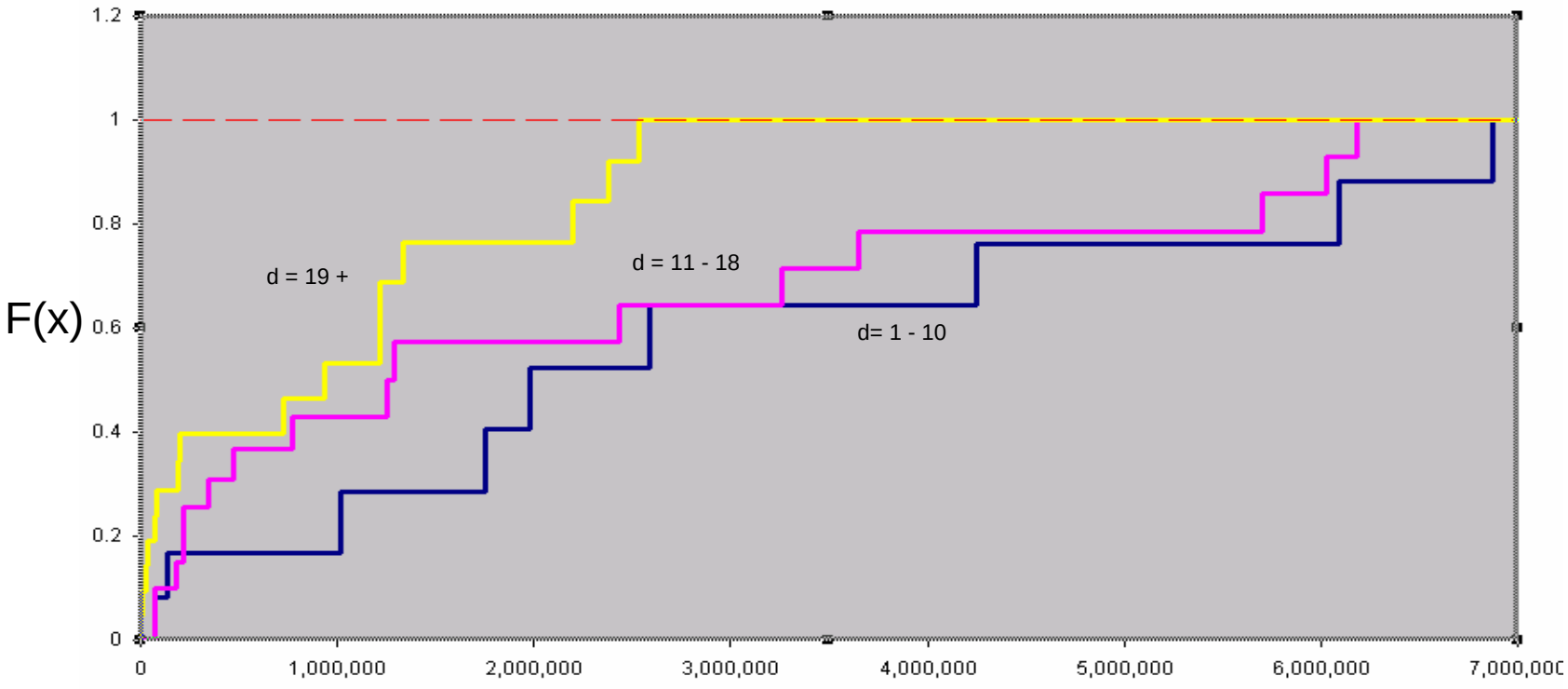
Example analysis – step (b)

- Excess loss distributions analysed by development quarter when cap was exceeded
- Closed and open (right-censored) claims included in analysis
- Kaplan-Meier plots show non-parametric estimates of ultimate excess loss distributions
- MLE used to fit analytic curves to excess loss data for open and closed claims
- At all capping levels tried, there is evidence that ultimate amount tends to be higher for claims that exceed the cap earlier

Kaplan-Meier plots (cap = £100k)



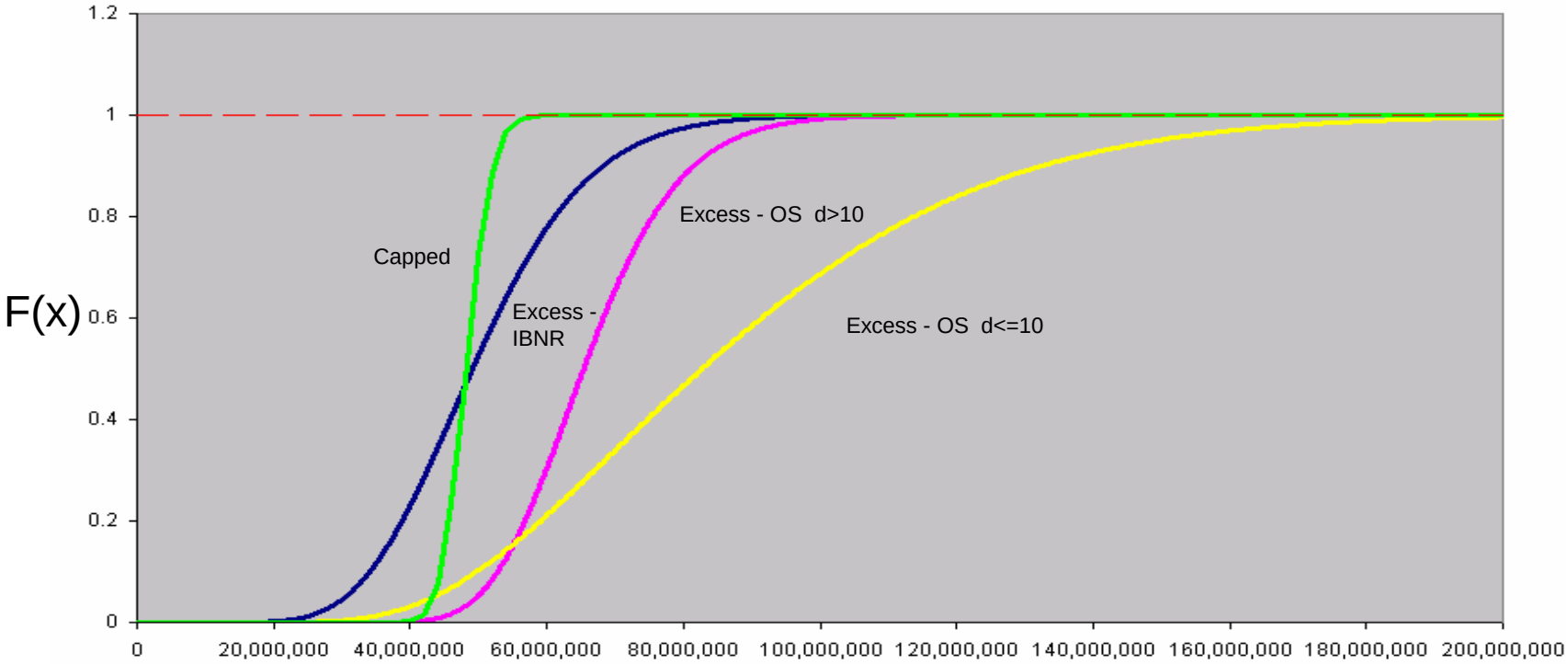
Kaplan-Meier plots (cap = £1m)



Use of industry benchmarks

- For £100k cap, K-M plots and statistical tests show ultimate amounts higher if cap exceeded in first 10 development quarters
- Dataset of such claims comprises 45 open and 182 closed amounts excess of £100k
- Curves fitted by MLE subject to constraint on mean
- Mean ultimate amount excess of £100k derived from IUA data

Components of total reserve (£100k cap)



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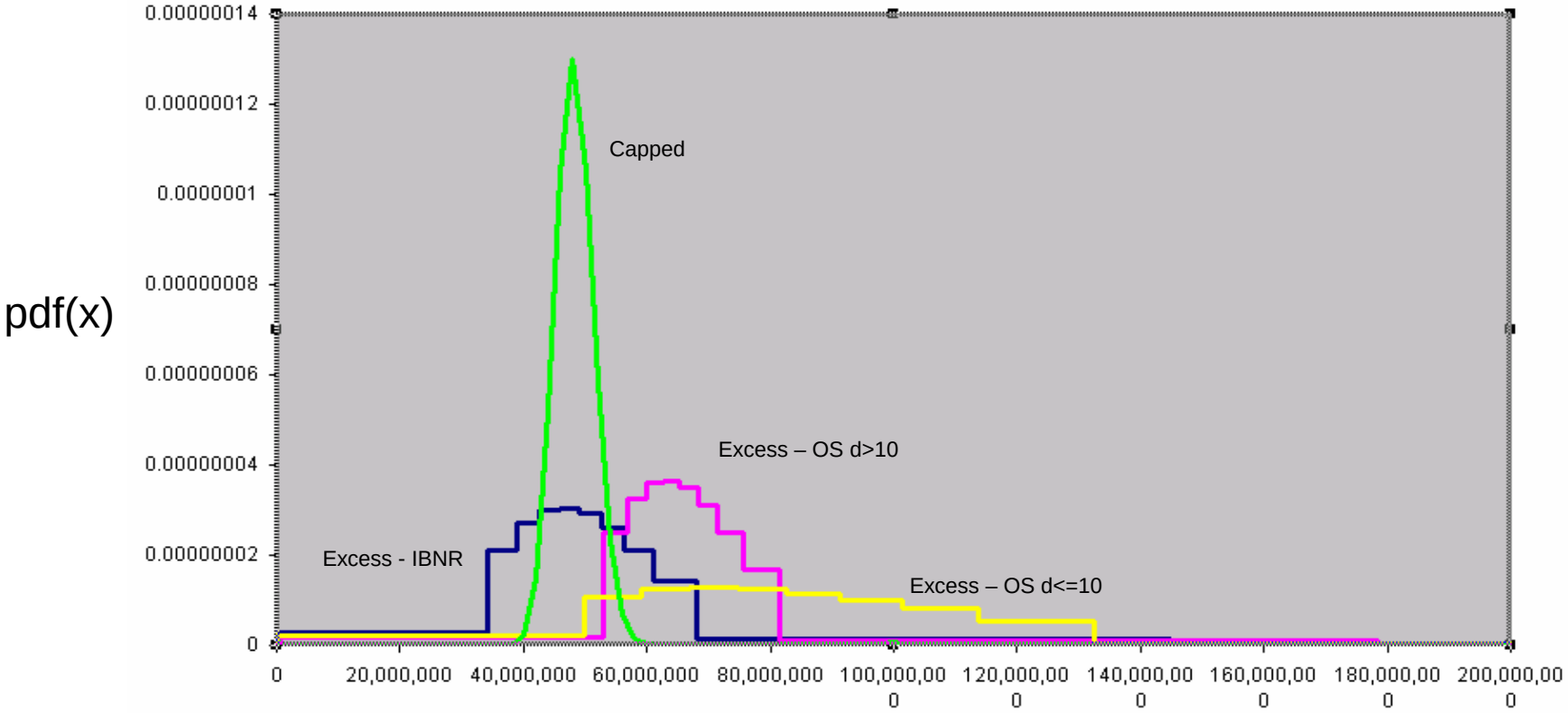
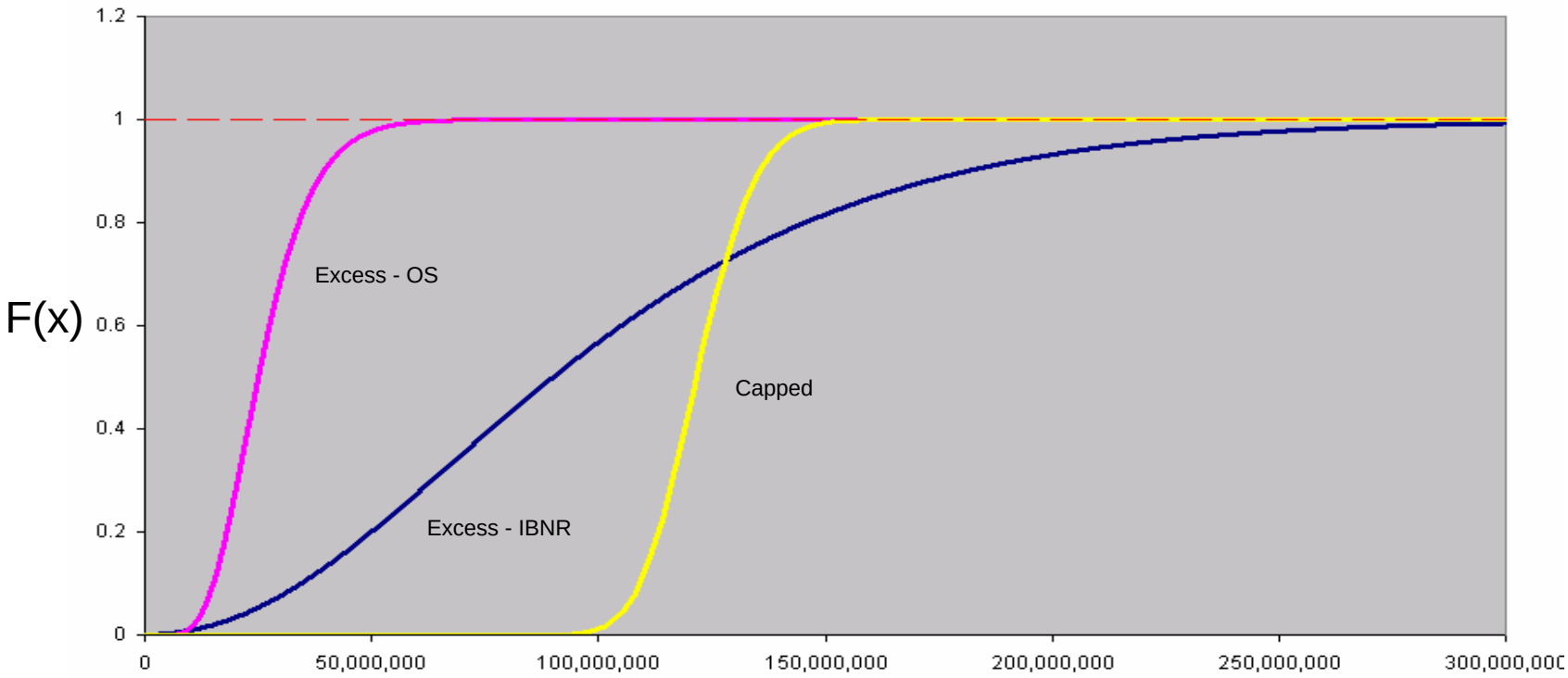
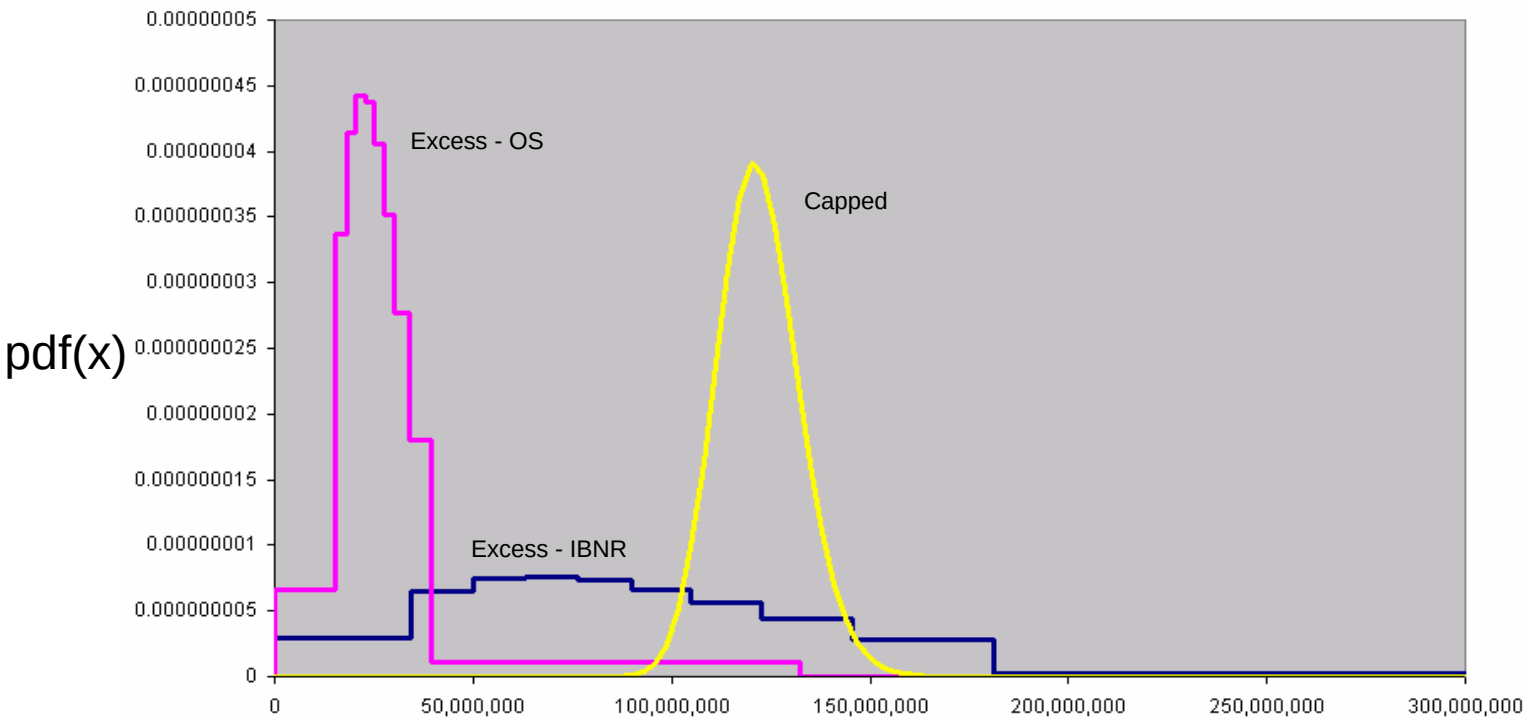


Components of total reserve (£1m cap)



Components of total reserve (£1m cap)



Combining components

- Probability distribution for gross reserve by numerical convolution of the distributions for capped, excess-IBNR, excess-OS
- For capped component, used Log-Normal distribution fitted to moments give by Mack's method
- Components approximated as independent (not quite true because capped claims used in all components)
- Could use judgemental correlations between components

Example analysis – final results (£m)

Cap	£100k		£1m	
	Mean	St Error	Mean	St Error
Capped	48.3	3.1	122.0	10.3
Excess-IBNR	50.4 (158 x £0.32m)	13.5	100.8 (50 x £2.0m)	59.9
Excess-OS	154.2 (167 x £0.92m)	34.9	26.4 (11 x £2.4m)	9.8
Combined	252.8	37.6	249.2	61.6

If number of ‘IBNR’ claims were known with certainty:

Cap	£100k		£1m	
	Mean	St Error	Mean	St Error
Capped	48.3	3.1	122.0	10.3
Excess-IBNR	50.4 (158 x £0.32m)	9.1	100.8 (50 x £2.0m)	19.4
Excess-OS	154.2 (167 x £0.92m)	34.9	26.4 (11 x £2.4m)	9.8
Combined	252.8	35.0	249.2	24.1

Example analysis – final results (£m)

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Excess-OS	154.2 (167 x **£0.92m**)	34.9	26.4 (11 x £2.4m)	9.8
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Questions?