P&L Attribution
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Agenda

- Recap of P&L Attribution

- Performing the exercises

- Something to think about – a new use?
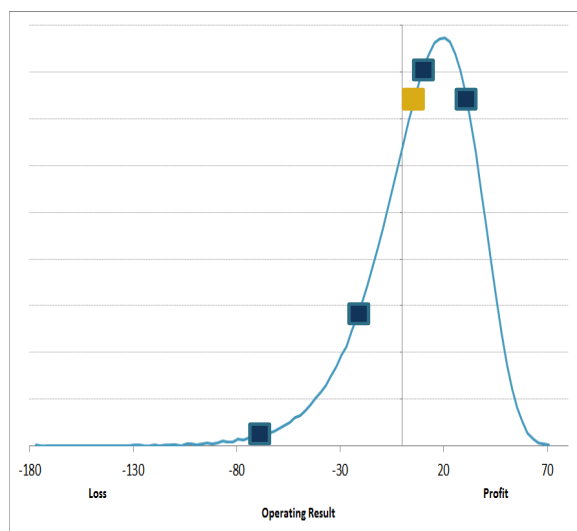 - Developing 'P&L Attribution' into 'Probabilistic Plan Evaluation'

Recap of P&L Attribution

- Hypothetical pdf of insurance company operating results showing the following percentiles in blue…
    - 0.5th (i.e. 99.5th loss), 10th, 50th , 75th
- … and the mean in gold
- What proportion of our time do we spend at each of the points?
- What are we likely to see on a year-to-year basis?
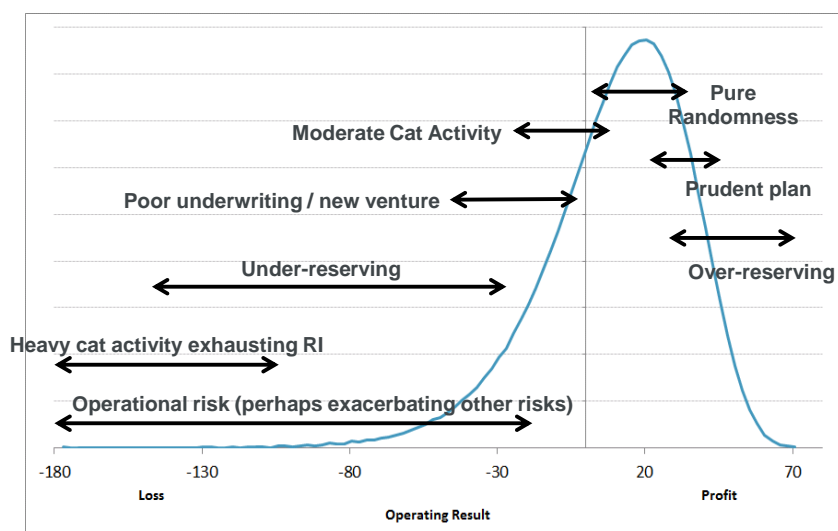- Which portion of the distribution gives us our (non-external) future capital resources?

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Recap of P&L Attribution

- P&L attribution is about ensuring all risk drivers:
    - are captured
    - at a 'useful' level of detail
    - are moving in the right way (individually and jointly)
    - are being thought of in the right way ("categorisation of risk")
    - are consistent between the model and the way the firm is run ("risk management")
    - are regularly reviewed
- It's a key component in changing thinking from a "**capital**" model" (99.5th) to an "**internal**" model"
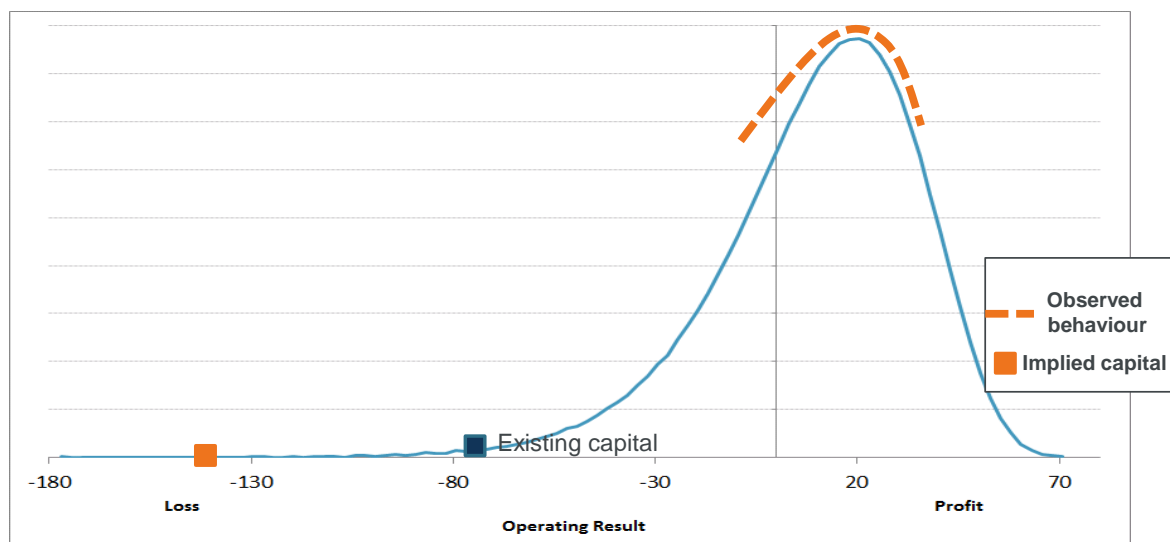
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Because fundamentally…

P&L Attribution exercises

- Two main components:
    1. Checking the model has the right risk drivers
        - At the right/useful level of detail
        - Categorised correctly

    2. Checking the model is capturing the risk drivers in the right way
        - Backtesting
        - Check of management reports of P&L vs model output

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1. Checking model has right risk drivers

- We reviewed 5 years of history for our syndicate:
- Review of internal reserving reports & examine narrative
- Review of syndicate P&L accounts vs Plan
- Discussions with actuaries, finance etc.

- Check if profit/loss explicitly modelled
- E.g. "Unreported Large Loss from 2011 AY reported in 2013 from Liability line in USD"
- If not, is it modelled in an aggregate distribution and will this give limitations?
- If not, is this a problem?

- Check correct categorisation
- E.g. Reserve risk

<u>Example table</u>

Event	Risk Type	Use	
		SCR	RI
NZ Earthquake	UW Cat	Yes	Yes
Clash Large Losses	UW x Cat	Yes	Partial
Premium volume changes	UW	Partial	Partial
Unrealised capital losses	Market	Yes	N/A
Attritional reserve changes	Reserve	Yes	N/A

- Ideally
  - Cross-check P&L source against each of the model uses
  - Aggregate modelling may not cause SCR limitation but may cause RI / Business Planning limitation

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1. Findings

- Vendor model should cover vast majority of P&L sources for SCR Use

- Potential gaps/differences
  - Premium volume / exposure changes / Loss of UW team
  - RI programme changes
  - Change in mix of LoBs / Aggregate modelling of LoBs
  - Aggregate modelling of reserve risk, in particular modelling of prior RI
  - Non-modelled cats (assumed to be in attritional)
  - Multiple large losses with a single cause ("clash")

  - (Lloyd's only) Events between Final SCR submission & model start date
  - Op risk explicit in model but not in accounts
  - FX modelling for RI contracts
  - Unrealised capital gains/losses

- Some risks (e.g. Op Risk, RI dispute) can be quite hard to find in narrative

- <u>Deal with some gaps through model governance (i.e. trigger + re-run)</u>

- First time will highlight the majority of gaps

- Better to do this before building the model!
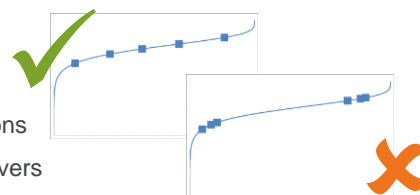
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2. Checking risk drivers modelled in right way

- Backtesting: Testing model output against actual experience
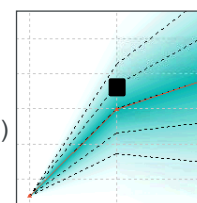- Two main types/methods
    - Retrospective
        - Plot (adjusted) historical data against output distributions
        - Should be done as part of parameterisation for risk drivers
        - Vulnerable to changes in business (real or perceived)
    - Prospective
        - Run model & wait for data to emerge.
        - Plot against original distributions generated to get percentile value ("pct-value")
        - Have to wait the model time-step (e.g. 1yr) to perform without approximations
        - Advantage is that assumptions and data should align
- Prospective is the more useful form for P&L Attribution

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2. Prospective Backtesting – simplified example

Item	Plan 2013AY completed @ 30 Sept 12	Actual 2013 AY @ 31 Dec 13		Pct-value @ 31 Dec 13 from model run @ 31 Dec 12
Premium				
Gross	500	450	**1**	10%
RI	50	48		20%
Net	450	402		8%
Plan Year Loss				
Gross	250	216		9%
RI	15	10		15%
Net	235	206		12%
Prior Year Loss				
Net	0	10	**2**	75%
Commission	150	113		10%
OIE	68	68	**3**	50%
Investments	15	17		60%
UW Result	**23**	**6**		**20%**
Operating Result	**38**	**23**		**25%**
NCR	**95%**	**99%**		**85%**

- In this example:
    1. Gross premium & exposure is 10% below plan
    2. There's a prior year loss
    3. Fixed expense is about the same
- Challenges
    - Conditionality within an exercise
    - Cross-terms
    - What to measure
    - Statistics
    - Practicalities

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2. Conditionality – Within an exercise

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- Many items in the P&L Account are dependent on items higher up

- Potential solutions
  1. Don't adjust but investigate & explain differences
  2. Examine deviation from expectation
  3. Use ratio approach
  4. Use model output and derive conditional pct-values*
  5. Recalibrate model and re-run*
  6. **Combination recommended**

* - I'm planning to look at these for our next exercise

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2. Cross-terms

- Some modelled variables affect multiple risk types:
  - Exchange rates, Inflation, Yield curves
- Recommendation: be pragmatic…
  - Remove these effects as early as possible:
    - Recalculate opening balance sheet and business plan on closing/average rates to examine the impact of FX
    - Examine model output using by currency / fixed rates
    - Build a process that's repeatable, consistent & easily reconcilable (i.e. follow the actual Y.E. reports' rates)
    - Avoid allocations – likely to be unstable over time
- … but don't miss potential model weaknesses
  - E.g. mean reversion in ESGs
  - Potentially consider running model with only economic variables as stochastic
- Materiality will depend on hedging & model granularity
  - Material issues indication model not granular enough

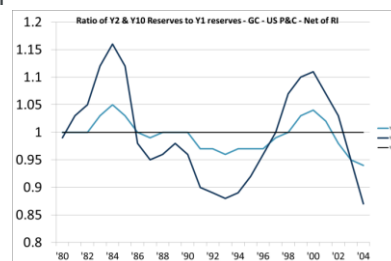|	Con USD		
GBP	1.50	2.00	FX Risk
100	150	200	50
80	120	160	40
Res Risk	-30	-40	10

- Reporting in USD
- Expecting 100 GBP @ 1.50
- Actual 80 GBP @ 2.00
- Risk is 10 but is it:
  - 50 FX and -40 Res?
  - 40 FX and -30 Res?

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2. What to measure

- The items above but…ultimates may take some time to reach their true ultimate (reserving cycle)
    - pct-values potentially understated after one year of data

- If practicable use data to gain leading-indicators:
    - Premiums in
    - Paid claims out
    - Attritional: Incurred movements
    - Large loss or Catastrophe: Claim frequency & average incurred severity
- Area for model improvement: Greater focus on incremental modelling?
- Granularity: Two layers of analysis (e.g. Business Unit, Total) will allow some analysis of dependencies

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http://www.guycarp.com/content/dam/guycarp/en/documents/dynamic-content/Industry%20Reserve%20Update%20-%20Which%20Way%20is%20the%20Cycle%20Turning.pdf

2. Statistics

- Aggregate means can be deceptive:

	Gross Loss £m					
	Total	Line A	Line B	Line C	Line D	Line E
Plan	53	20	10	15	5	3
Actual	52	5	13	21	8	5
pct-value	50%	3%	80%	95%	93%	99%

- pct-values: 10 (independent) cells and a threshold of 90% means a 64% chance of at least one triggering just by random…
    - … and they're probably not independent
- Consider using Binomial-based tests measured using inverse distributions from the internal model output to capture correlation

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2. Other considerations

- First time:
  - Concentrate on value-add
  - Concentrate on first-order effects
  - Start simple

- Form a narrative – easy to get lost in details

- Basis: GAAP or SII?

- Length of time between parameterisation & exercise

- Use to improve:
  - Internal reporting
  - Operational risk monitoring

- pct-values
  - Keep pct-values consistent?
  - Do you want to set extreme pct-values?

- Beware of non-continuous distributions

- Conditionality between exercises

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A new model use?

- Despite challenges, pct-value information could be very useful in quarterly reserving / financial reporting:

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	Q1	Q2	Q3	Q4
Reserve increase	+5	+5	+8	+3
Qtrly pct-value	60%	60%	70%	55%
YTD pct-value	60%	80%	90%	93%

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	Deviation from plan	pct-value
Low Volatility Line	+5	75%
High Volatility Line	+10	65%

- As well as engaging underwriters with the parameterisation of the internal model

  - Underwriting freedom tied to consistent pct-value history

  - Natural balance between wanting more downside variability (and better implied pct-values) and resulting capital allocated

  - Use of pct-values in setting bonuses

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