Reserve Methodologies to Account for Inflation

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Agenda

- Inflation – Why Bother?
- Future Expected Inflation
- Adjusting Traditional Methods
- Fischer-Lange Method

Inflation – Why Bother?

The Problem

Increased and increasing inflation is affecting multiple areas of insurer businesses and has become a dominant theme in our discussions around the industry. There is a wide concern around inflation and generally the heart of the issues is consistent:

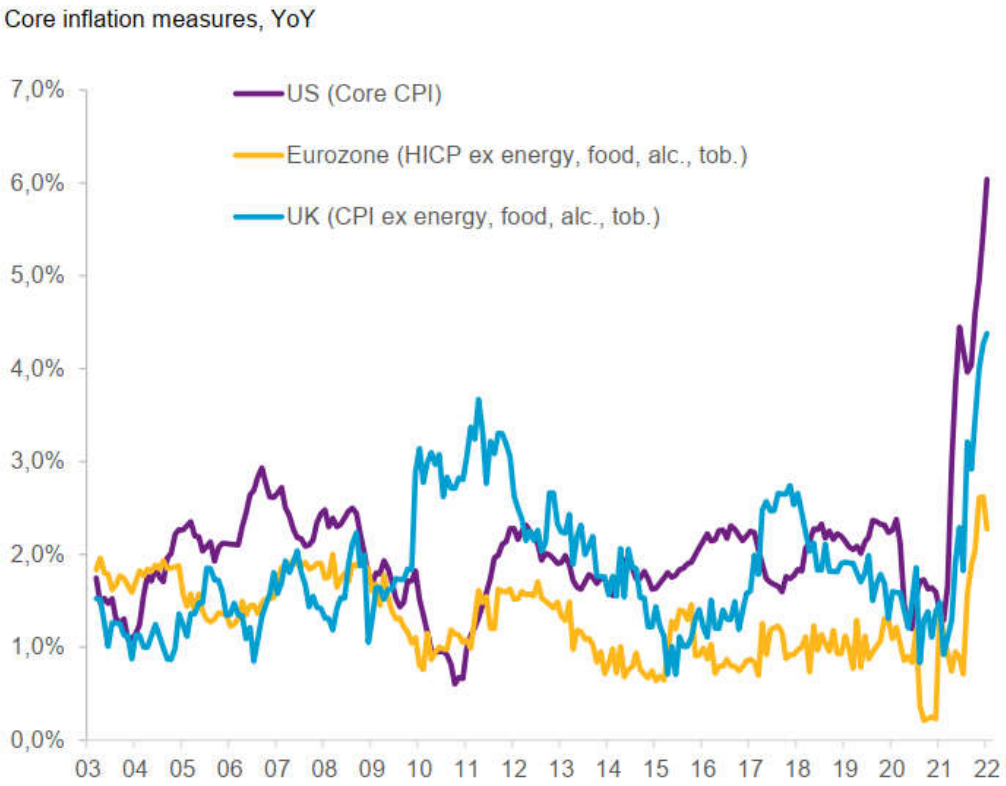
- **What does this mean for my balance sheet?** Today we will be focusing on implications to reserve estimates, but recognize there are potentially benefits on the asset side of the balance sheet

- **What considerations should be made for pricings and underwriting?** Simple allowances for inflation no longer feel appropriate given the higher levels of inflation being seen; there is a need to understand implications of higher inflation and to allow for that within pricing and underwriting

- **What is the magnitude of increased uncertainty?** Greater inherent uncertainty and greater materiality of the inflation makes management of uncertainty in terms of taking actions, understanding the range of outcomes, and mitigating new risks outside appetite all the more important

Past and Future Calendar Year Inflation

Underlying consumer inflation in much of the developed world is at or near multi-decade highs



Development in economic KPIs led industry in a highly uncertain situation. Every activity from pricing to reserving and capital management requires close attention.

Future calendar year inflation impacts different views:

- **Development periods:** Looking at the liability side standalone, insurers have a major problem if the time value of money, measured by real interest rates, is less than the nominal value. This is the case if claims inflation rates are higher than nominal interest rates and investments are short to cover the gap created by costs.
- **Origin periods:** Expected increase in claims cost levels are key for pricing & underwriting processes. Inaccuracies in setting this assumption could result in deficiency of premiums or loss of competitiveness. Ability to quickly react is key to minimize risks.

How does inflation impact P&C business?

- Adequacy of current reserves in financial statements under GAAP, IFRS17 and Solvency II
- Relation to interest rates
- Level of premiums and expenses in future underwriting years
- Effect on solvency coverage
- Sufficiency of reinsurance cover
- Impact on outstanding claims and increase in reserve risk
- Interaction with other risks (e.g. currency exchange)
- Diversification between segments and economies
- Risk of a “vicious cycle” (under-reserving and under-pricing)

If you know which parts of your business are impacted by inflation and how, you can manage risks from macroeconomic changes more effectively.

Inflation stresses every step in the insurance cycle

A Pricing | **B** Claims & Expenses | **C** Provisions | **D** Financials


Modelling


Cost management


Reserving


Investment


Underwriting


Process management

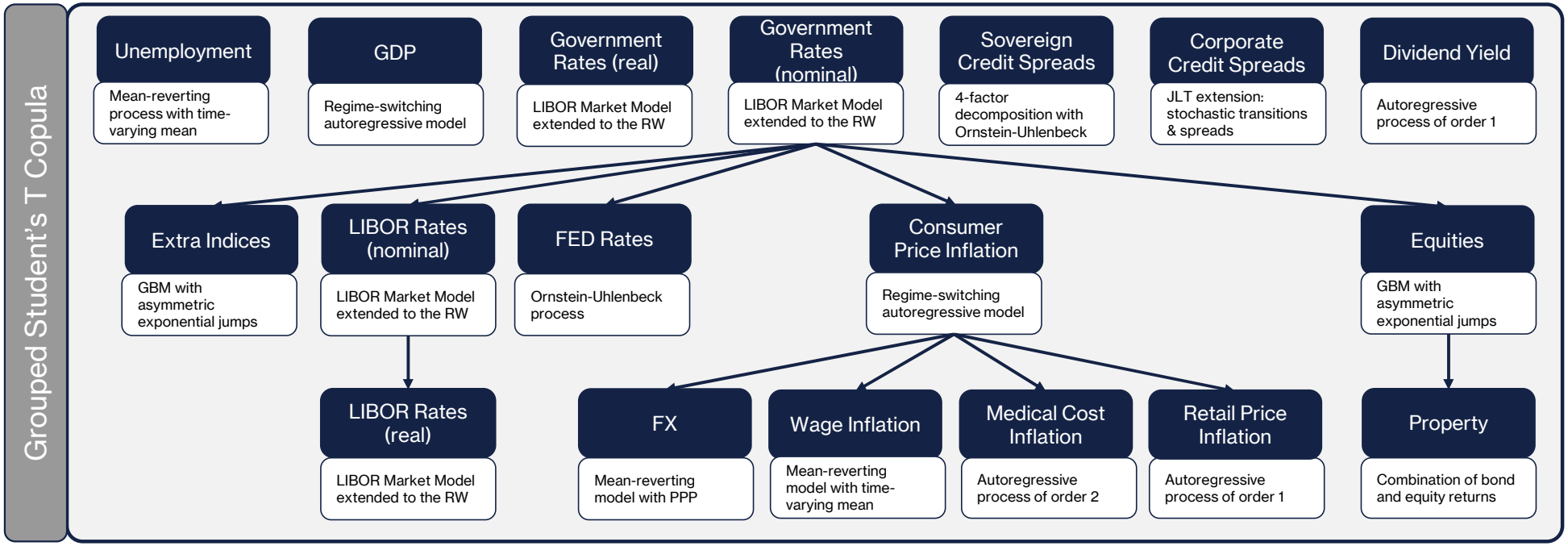

Capital


IFRS 17

Future Expected Inflation

Economic Scenario Generator

Sample Structure, can be tied to your company's capital model

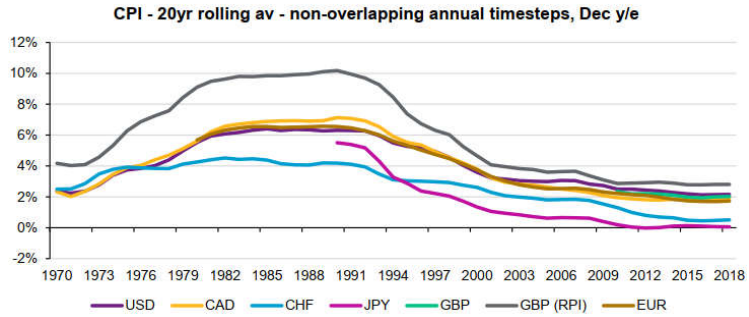


Economic variables modeled in a cascade structure. In addition, dependencies between variables and economies are applied via a copula that enables different degrees of tail dependency.

Expert Judgment Overlay of ESG: CPI

Long-term normative means

- CPI across developed countries has shown common trends since 1970. There was a period of higher inflation covering 20 year periods ending in the 1980s to early 1990s, followed by declining inflation thereafter.
- The Federal Reserve has a statutory mandate from Congress to promote stable prices. The Federal Open Market Committee (FOMC) has stated that in its judgement inflation of 2%, as measured by annual change in the price index for personal consumption expenditures (PCE), is most consistent over the longer run with the Federal Reserve's statutory mandate. CPI is structurally higher than PCE and we believe that the FOMC target for inflation is broadly consistent to CPI increases of around **2.5% p.a.**



Year	As Of	US CPI (average over 4 quarters)
	03/31/2022	8.5%
1	12/31/2022	8.3%
2	12/31/2023	5.3%
3	12/31/2024	2.8%
4	12/31/2025	2.5%
5	12/31/2026	2.5%
6	12/31/2027	2.5%

*'Average over 4 quarters' reflects the average quarterly price index across each calendar year compared to prior calendar year's average quarterly price index for the period ending as shown. Therefore, for 12/31/2023, the US CPI is an average across calendar year 2023 compared to average across 2022.

Short-/medium-term normative means

- We have considered the Consensus Economics forecasts from April 2022.
- These are based on predictions by researchers and journalists for economic variables for different economies. Consensus Economics ensures accuracy and completeness of the data.

Volatility and percentiles

- We expect somewhat higher volatility when CPI is higher. Therefore, with the increase in short-term inflation expectations in recent months, our projections also incorporate a higher short-term volatility.

Poll Question

What is your best guess for the increase in CPI in 2023?

A) 2.5% or below
B) 2.5 to 4%
C) 4% to 6%
D) 6% to 8%
E) 8% or more

Poll Question

When do you assume inflation will return to normative levels?

A) Mid to Late 2023
B) Early 2024
C) Late 2024
D) 2025
E) Never, we are all doomed

Forecasting Inflation

Indexing Claims Inflation Based on Economic Inflation

	T1	T2	T3
CPI	CPI_{T1}	CPI_{T2}	CPI_{T3}
Wages	W_{T1}	W_{T2}	W_{T3}
Legal	L_{T1}	L_{T2}	L_{T3}
Medical	Med_{T1}	Med_{T2}	Med_{T3}
Materials	Mat_{T1}	Mat_{T2}	Mat_{T3}

×

	General Liability
CPI	$Weight_1$
Wages	$Weight_2$
Legal	$Weight_3$
Medical	$Weight_4$
Materials	$Weight_5$

+

	General Liability
Social Inflation	X%

=

Claim Cost Inflation by T1, T2, etc.

General econometric indices × Insurance coverage weightings + Insurance specific adjustment = Insurance coverage specific forecast

Considerations for Claim Inflation Assumptions

- What are the economic cost drivers of various classes?
- How dependent are the ultimate costs on inflation through the time in which the claim is closed, as opposed to when the claim occurs?
- How is social inflation expected to change as economic inflation changes?
- To what extent do my actuarial assumptions already incorporate higher inflationary periods?

Poll Question

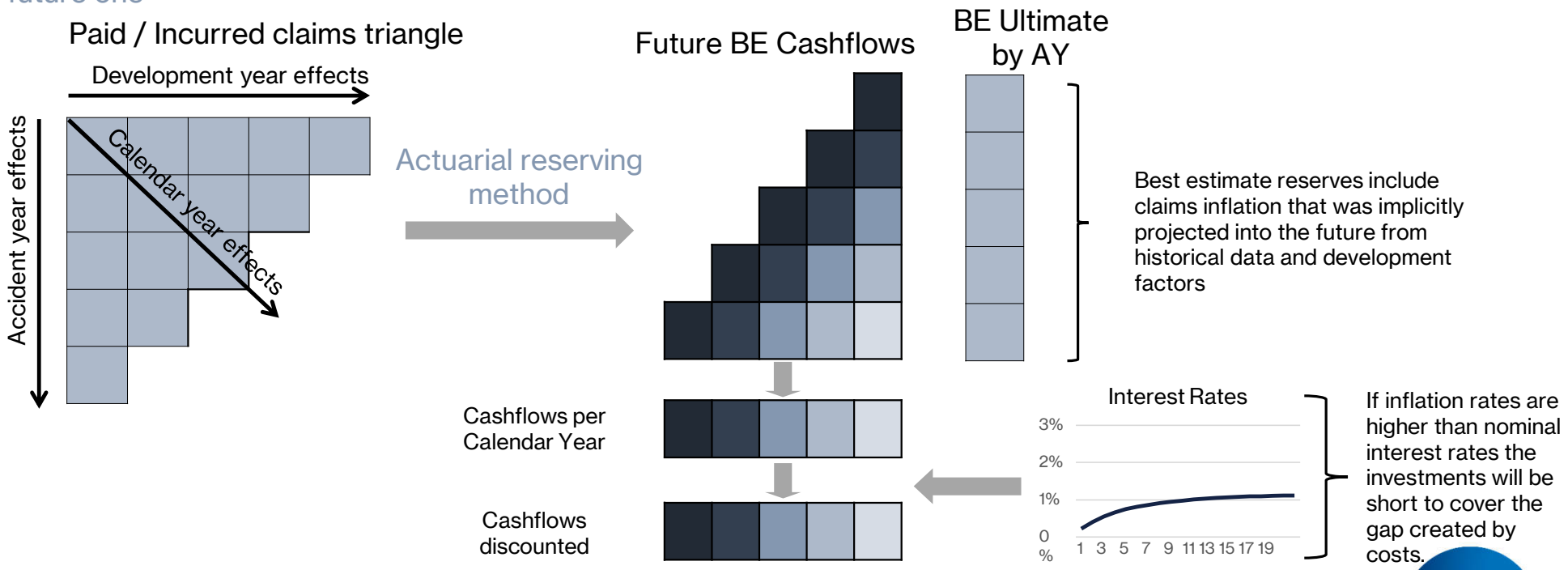
What adjustments has your company made to pricing and reserving to account for increased inflation?

A) No adjustments to pricing or reserving
B) Explicit adjustments to pricing, no adjustments to reserving
C) No adjustments to pricing, explicit adjustments to reserving
D) Explicit adjustments to both pricing and reserving
E) Other

Adjusting Traditional Methods

Approach 1: "Standard" Reserving

- Implicit consideration of historical claims inflation – suitable if past inflation is assumed to be constant and equal to future one

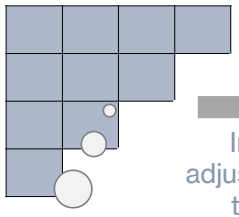


This approach is easy and might be sufficient in calm market environments. However, it is inadequate if future claims inflation deviates materially from past levels! It doesn't facilitate the business to react appropriately to changes in the market environment.

Approach 2: Account for Inflation Explicitly (1)

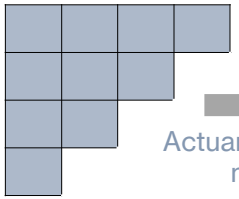
- Explicit consideration of historical claims inflation – suitable if past inflation is not constant - and future expected inflation

Claims triangle in nominal terms



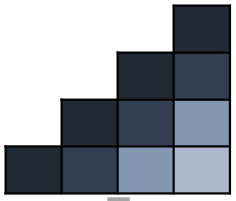
Inflation-adjusting claims triangles

Claims triangle in real terms (at current price levels)



Actuarial reserving method

Future BE Cashflows at current price levels



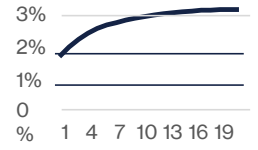
BE Ultimate by AY at current price levels

Preferably use payments, as incurred claims might already include some unknown expectation future of inflation

Cashflows per Calendar Year at current price levels

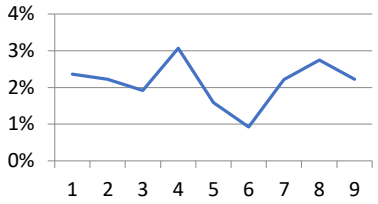
Cashflows per Calendar Year at future price levels including explicit future inflation

Calibrated expected future claims Inflation



Inflating reserves using the payment pattern and future inflation

Past Inflation

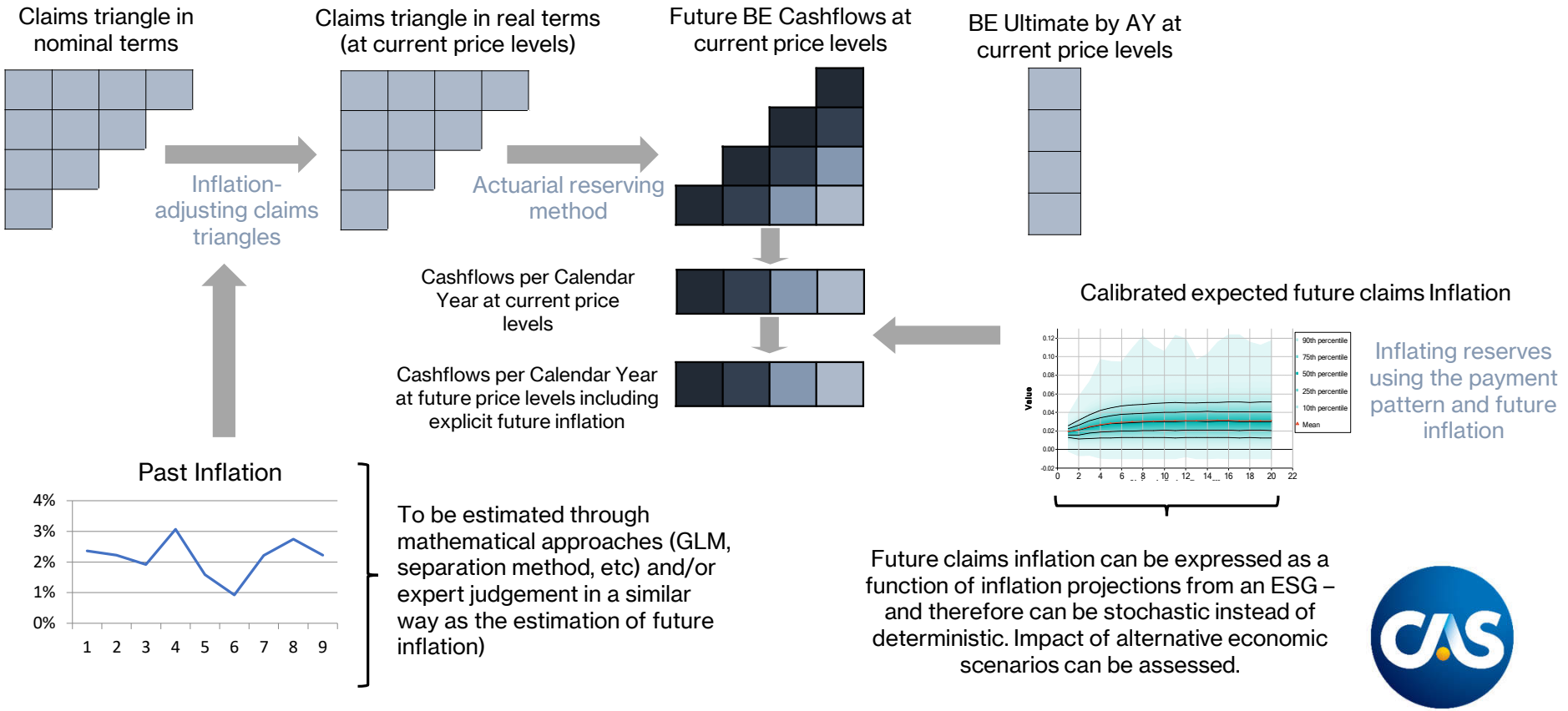


To be estimated through mathematical approaches (GLM, separation method, etc) and/or expert judgement in a similar way as the estimation of future inflation)

For each business, weighting of the economic inflation drivers must be performed and adjusted by other factors (e.g. social inflation) in order to estimate future expected claims inflation per insurance business. This process leverages on public information (e.g. breakdown of overall CPI projections) in combination with expert judgement

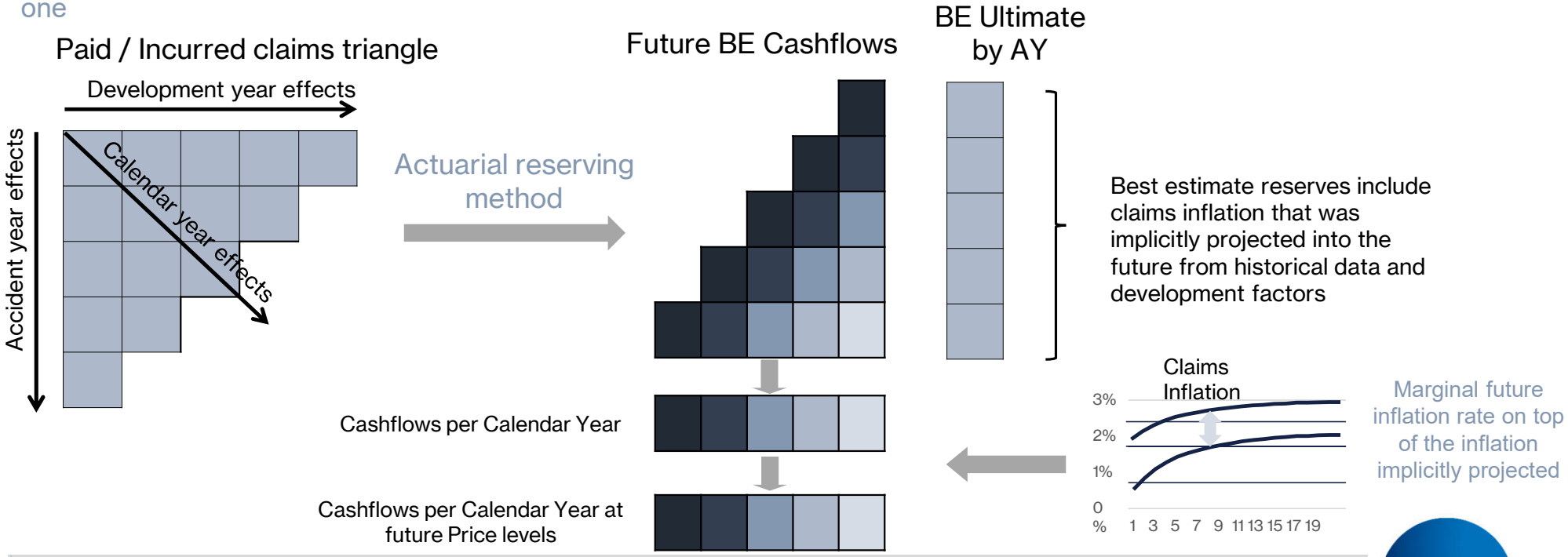
Approach 2: Account for Inflation Explicitly (2)

- Explicit consideration of historical claims inflation – suitable if past inflation is not constant - and future expected inflation



Approach 3: "Standard" Reserving Plus Change in Future Inflation

- Implicit consideration of historical claims inflation – suitable if past inflation is assumed to be constant but different to future one



This approach is a mix of the previous two approaches. Historical inflation is assumed to be constant and implicitly considered in the projection. However, future cashflows are inflated by marginal (+ or -) future inflation on top of past historical rates implicitly projected. Therefore, this approach still requires estimation of future claims inflation for each business.

Approach 3: Steps to Inflation Study

Project Impacts of Inflation on Unpaid Losses using Workers Compensation as an example

Step 1: Estimate historical inflation underlying our development patterns based on published inflation indices

- Estimate which indices weigh into claim cost (i.e. CPI, Wage, Medical, Construction, Legal) by line of business
- Dependency on payment date (known as the alpha factor)
- Social inflation
- Leverage factor to reflect attachment points for the excess business

Workers Compensation

- Determination of claim costs is split between Indemnity and Medical Payments

	Indemnity	Medical
CPI		
Wages	100%	
Legal		
Medical		100%
Materials		

✖

	Indemnity	Medical
Weight	40%	60%

✖

	Indemnity	Medical
Alpha	15%	100%

For this Workers Compensation example, we assumed no social inflation and no leverage factor required for primary business

Approach 3: Steps to Inflation Study

Project Impacts of Inflation on Unpaid Losses using Workers Compensation as an example

Step 2: Determine the implicit inflation assumptions in development selections

- Consider experience period underlying selections as well as experience period underlying any benchmark patterns
- Weight between experience and benchmarks

Workers Compensation

- We apply the weights from Step 1 x Historical Inflation Indices (for this example, from the Department of Labor) = History by Calendar of WC Claim Cost Inflation
- Using this as basis and weighing if we are using a benchmark with years of higher levels of inflation, we select our “normative” claim inflation expectation baked within our history and within our traditional reserving methodologies

Approach 3: Steps to inflation study

Project Impacts of Inflation on Unpaid Losses using Workers Compensation as an example

Step 3: Determine mean of modelled future inflation assumptions

- We create projections of future annual claims inflation rates per segment based on our historical claims analysis and the US price, wage and medical inflation projections from our Real World economic scenario generator (ESG) STAR
- In a stochastic analysis, we take into account social inflation with a Normally distributed error term for the segments for which we believe this to be a claims cost driver
- Construction and Legal are not available directly in the ESG model, therefore we perform a regression analysis on CPI, Wage, and Medical to project future Construction and Legal indices
- We use the weights from Step 1 to determine the appropriate future claims inflation projections

Workers Compensation

- We again apply the weights from Step 1 x Projected Future Inflation Indices = Projected Future Claim Inflation for WC

Approach 3: Steps to inflation study

Project Impacts of Inflation on Unpaid Losses using Workers Compensation as an example

Step 4: Determine the 'Delta' factor between inflation from history Step 2 and mean of modelled inflation in Step 3

- Delta equals the difference between Step 3 inflation and Step 2 inflation
- That delta factor is used to inflate projected future cashflows of unpaid losses using the payment pattern without an inflation adjustment
- The resulting factor is the unpaid loss loading factor

Workers Compensation Example

	T1	T2	T3	T4	T5	T6
Normal Claim Inflation	3.4%	3.4%	3.4%	3.4%	3.4%	3.4%
Projected Claim Inflation	5.1%	4.9%	4.2%	3.6%	3.5%	3.4%
Excess Claim Inflation	1.7%	1.5%	0.8%	0.2%	0.1%	0.0%
Excess Inflation x Alpha	1.1%	1.0%	0.6%	0.2%	0.1%	0.0%

Approach 3: Steps to inflation study

Project Impacts of Inflation on Unpaid Losses using Workers Compensation as an example

Step 5: Determine Ultimate Loss Loading for Inflation

- We review the implied ultimate loss adjustment factor from the unpaid inflation loss adjustment factor and assumed percent unpaid
- Discussions with the claims department are important to understand if current case reserve levels reflect higher levels of inflation, generally assumed this has not manifested for casualty lines
- We also determine the impact of inflation on exposures, which helps mitigate the impacts on the current accident year

Workers Compensation

For this example, the economic inflation load is 24.9 or 2.5% of the unadjusted loss reserves

	Total Unpaid Losses	T1	T2	T3	T4	T5	T6+
Claim Payments (Normal Inflation Scenario)	1,000.0	150.0	250.0	200.0	100.0	50.0	250.0
Claim Excess Inflation		1.011	1.022	1.028	1.030	1.030	1.030
Inflated Claim Payments	1,024.9	151.7	255.5	205.6	103.0	51.5	257.6
Economic Inflation Load	24.9	1.7	5.5	5.6	3.0	1.5	7.6

Poll Question

Which line of business are you expecting to see the largest inflation impacts on reserves?

A) Property
B) Primary GL
C) Umbrella
D) Workers Compensation
E) Automobile Liability
F) Homeowners

Practical Considerations for Claim Inflation

- The extent to which higher inflation is being included in case reserve levels
- Possibility for lag in inflationary impact on losses and loss expenses
  - For example, medical fee schedules in Workers Compensation as well as attorney rates which are subject to negotiated agreements
- Impact of higher exposure trends for certain lines
  - Would not impact older years
- How to incorporate adjustments into reserve estimates
  - Could be explicit additional adjustment
  - Could adjust development patterns and initial expected loss ratios
- Reliability of payment patterns becomes more important even in lines where reported methods are relied upon
- How to adjust methodologies over time

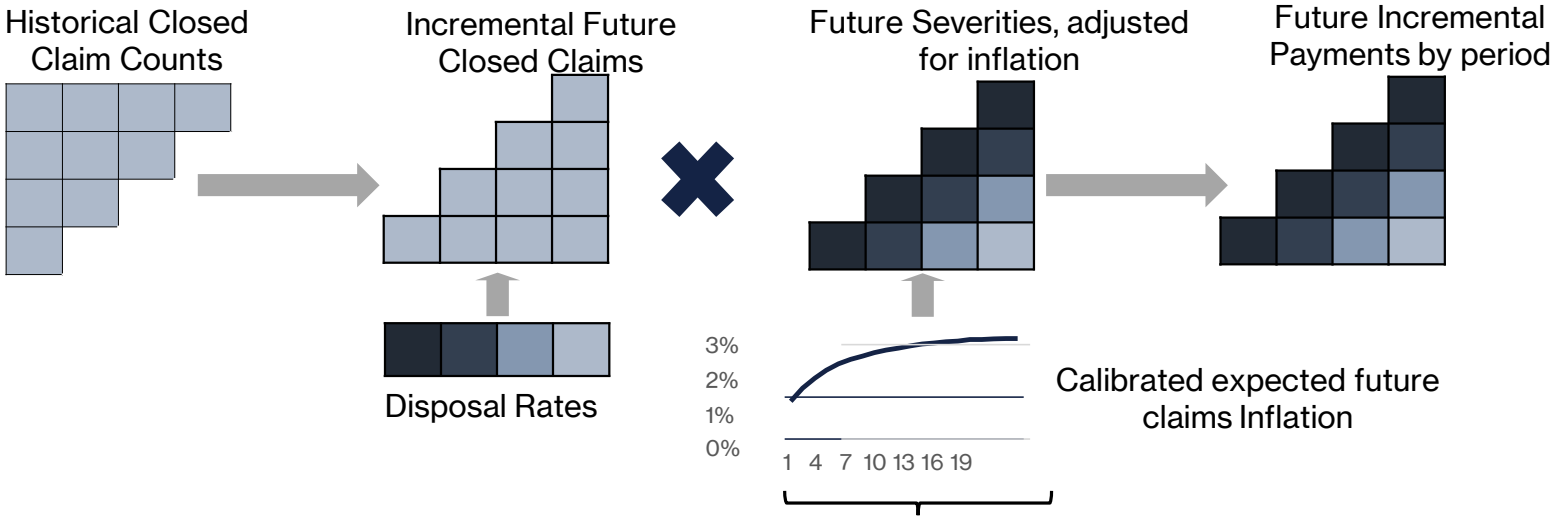
Fischer-Lange Method

Fischer-Lange Method

- Expected Unpaid Loss = Number of Closed Claims x Average Cost per Claim
  - Uses incremental Closed Claim numbers and Paid Losses
- Select disposal rates (Incremental Closed Claims / Number of total Unclosed Claims at beginning of period)
  - Unclosed Claims = Ultimate Claims – Cumulative Closed Claims
  - Requires closed claim triangle, and initial estimate of ultimate claim numbers
- Select Average Cost per Claim for each developmental period
- Can adjust for Calendar Year inflation and Accident Year factors

Fischer-Lange Method

- Explicit consideration of future claims inflation



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