



Liabilities valuation in insurance

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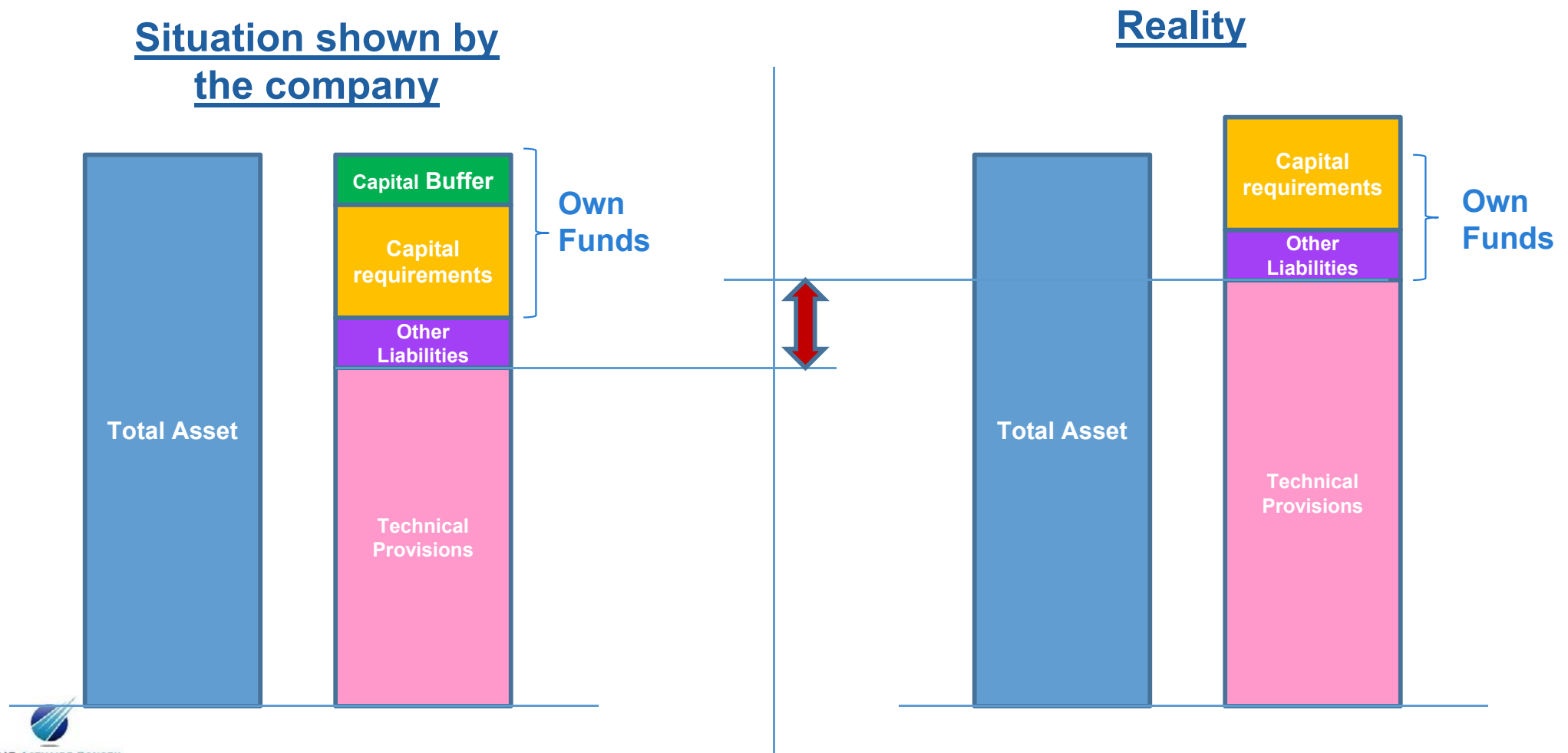
- ▶ 1. Introduction
- 2. Liabilities valuation principles
- 3. Focus on the Best Estimate / Current Estimate
- 4. Methodologies for non-life business
- 5. Challenge for supervisory authorities
- 6. Discussions and Case Study

Introduction

- **ICP 14** establishes requirements for the valuation of assets and liabilities for the solvency purposes.
- This presentation, will be focused on liabilities, and more precisely on technical provisions
- Valuation of technical provisions is critical in a supervision context.
- In general, technical provisions represent the largest component of companies' balance sheets.
 - Could represent more than 75% of the total balance sheet
- A strong assessment of these technical provisions is required in order to ensure the solvency conditions of companies

Introduction

- Why technical provisions assessment is critical for solvency purpose?
- Situation that a supervision system would like avoid:



Agenda

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▶ 2. Liabilities valuation principles

3. Focus on the Best Estimate / Current Estimate

4. Methodologies for non-life business

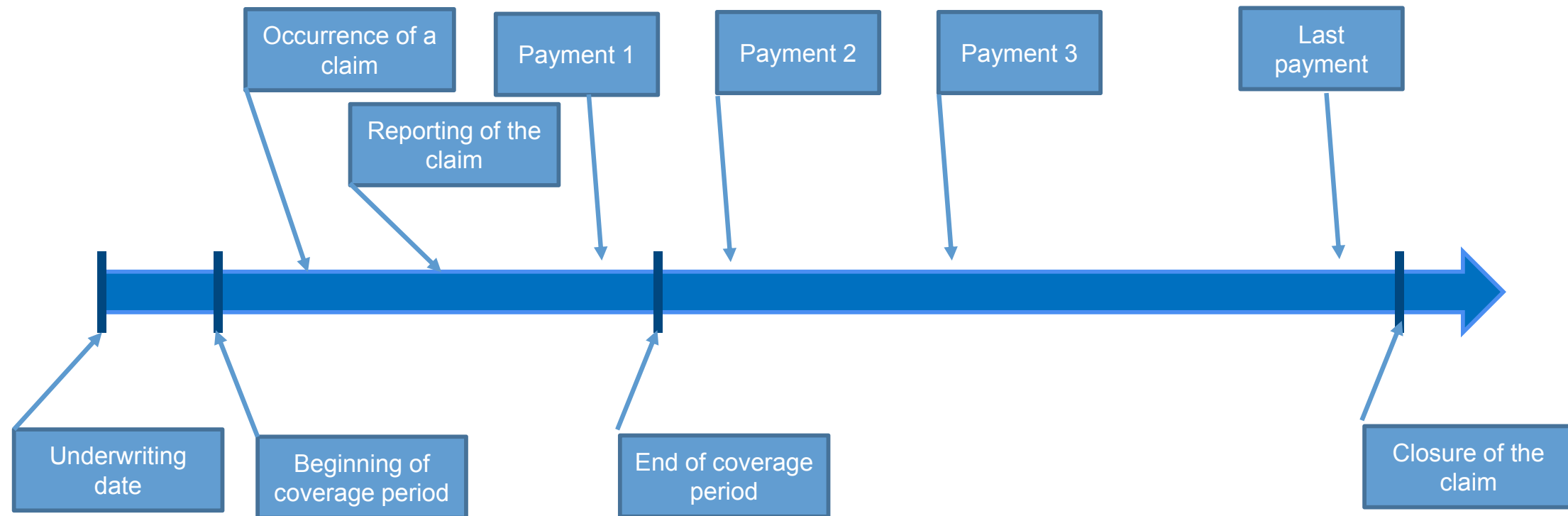
5. Challenge for supervisory authorities

6. Discussions and Case Study

Liabilities valuation principles

The claim reserving concept

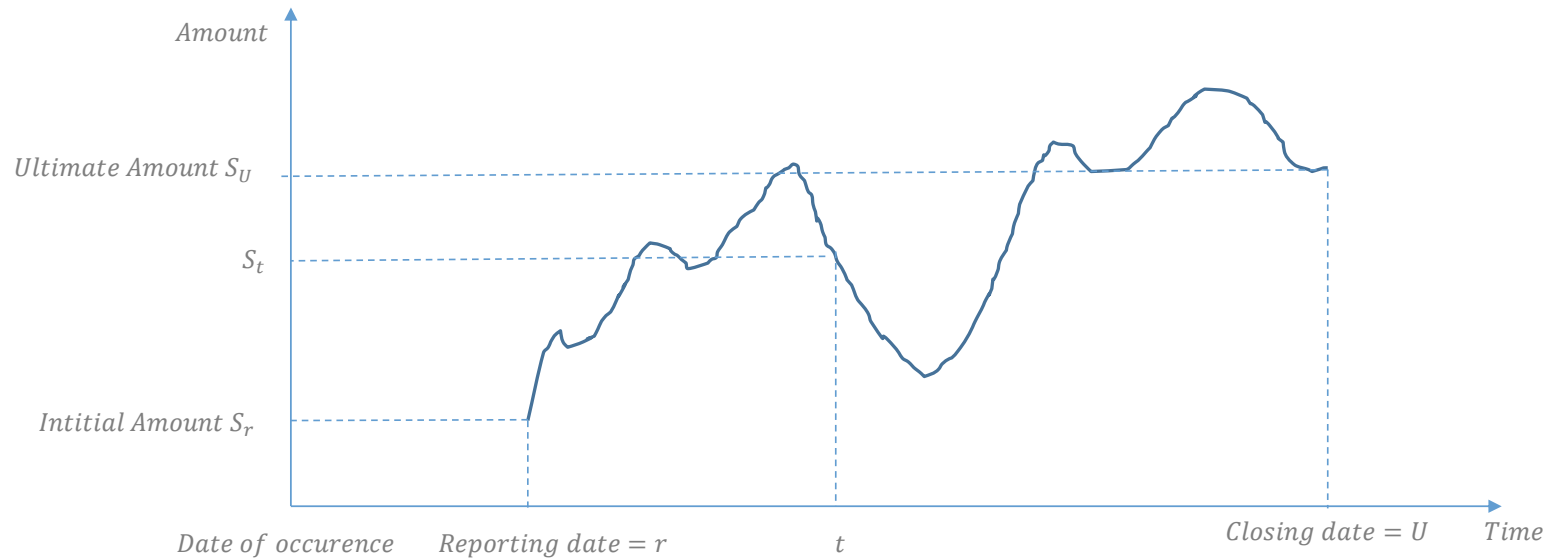
- Reserving in insurance is justified by the reverse production cycle specific to the insurance activity
 - Collection of premium in advance
 - Payment of claims that will occur during the coverage period



Liabilities valuation principles

The claim reserving concept

- In addition, at each time the company has to estimate the case reserve on each individual claim, based on information available at that time
- For this reason, depending on the type of claim, the value of each individual known claim (Cumulative Paid + Case Reserve) could vary significantly in time till the closing date



- For each segment and for each accident year, the role of the actuary is to estimate in the time, the IBNR (Incurred But Not Reported) amount required on the top of the incurred claim in order to reach the estimated value of ultimate claim amount. $IBNR = IBNER + IBNYR$
 - ▶ IBNYR = Incurred But Not Yet Reported (unknown claims)
 - ▶ IBNER = Incurred But Not Enough Reported (known claims)

Liabilities valuation principles

- Here, we select some articles of ICP 14, that present the requirements concerning the principles that should guide the valuation of technical provisions.
- **ICP 14.4: The valuation of assets and liabilities is an economic valuation**
 - ▶ An insurance financial position is not obscured by hidden or inherent conservatism or optimism in the valuation
- **ICP 14.5: An economic valuation of assets and liabilities reflects the risk adjusted present value of their cash flows**
 - ▶ Prospective valuation of the future cash flows (inflows and outflows) allowing for their riskiness and the time value
 - ▶ Quoted market value, or a current sale or purchase value may also reflect the prospective valuation of cash flows
 - ▶ Market consistent valuation or amortised cost are used by some jurisdiction

Liabilities valuation principles

- **ICP 14.7: The valuation of technical provisions exceeds the Current Estimate by a margin (Margin over the Current Estimate or MOCE)**
 - ▶ Technical provisions = assets or liabilities that represent the economic value of the insurer fulfilling its insurance obligations to policyholders and other beneficiaries arising over the lifetime of the insurer's portfolio of policies.
 - ▶ Includes a margin (MOCE) to cover the inherent uncertainty of those obligations
 - ▶ Current Estimate = Expected present value of cash flows (use of actuarial and statistical techniques)
 - Cash flows include premium receivable, claims payable, any other policy cash flows, future administrative expenses, acquisition costs, ...
 - ▶ MOCE is the cost of covering the uncertainty in the cash flows e.g by holding capital or hedging or reinsurance or other risk mitigation techniques
 - Where, for example, capital is required to give a level of confidence required by the solvency regime, the technical provisions should at minimum cover the cost of holding that capital
 - ▶ Technical Provisions = Current Estimate + MOCE
- **Comparison with Solvency II**
 - ▶ *Best Estimate* ⇔ *Current Estimate*
 - ▶ *Risk Margin* ⇔ *MOCE*

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Best Estimate valuation is crucial under Solvency II

- For Non-Life companies, an underestimation of the BEL will directly impact the Own Funds
- Best Estimate of Liability is also a key input of the SCR calculation when standard formula is applied. The volume used to calculate the non-life premium and reserve risk include the BEL (Claims Provisions)
- $$\text{Solvency Ratio} = \frac{\text{Own Funds}}{\text{SCR}}$$
 - ▶ An under-estimation of the BEL will increase the Own Funds and decrease the SCR
- Consequence
 - ▶ Significant distortion of the Solvency ratio



Best Estimate

- The best estimate should correspond to the probability weighted average of future cash-flows taking account of the time value of money
- Cash flows should include (non-exhaustive list):
 - ▶ Benefit payments to policyholders and to the beneficiaries
 - ▶ Expenses directly allocated to the claim (expertise cost, ...)
 - ▶ Receivables for salvages and subrogations
 - ▶ Future premiums
 - ▶ Expenses
 - Administrative,
 - claims management,
 - investments management,
 - Acquisition.
- Cash-flows shall be discounted

Best Estimate calculation

- Best Estimate shall be calculated gross and without deduction of the recoverables from reinsurance contracts and SPV
- The Best Estimate of recoverables shall be calculated separately and should take account of the expected default of the reinsurer
- Undertakings should use **actuarial and statistical techniques** for the calculation of the best estimate which appropriately reflect the risks that affect the cash-flows
 - ▶ **No prescribed valuation method**

Best Estimate calculation

For Life business

- Cash flows projection shall be made for each policy.
- However, when this calculation is undue burden, undertakings may, under certain conditions, perform this projection on grouping data (model points)
- In certain circumstances, the BE of liabilities could be negative:
 - this is acceptable and undertakings should not set the value of BE to 0
- Best estimate should take into account:
 - discretionary benefits,
 - all financial contractual guarantees and options
- For this purpose, simulation methods should sometimes be necessary to value the Best Estimate.



Best Estimate calculation

For Non-Life business

- Separate calculation should be made for:
 - ▶ The Best Estimate of premium provision
 - ▶ The Best estimate of outstanding claims provision

- The Best Estimate of outstanding claims provisions is generally calculated following the steps below:
 - ▶ Valuation of Undiscounted Best Estimate
 - ▶ Projection of the future claim cash flows
 - ▶ Projection of future expenses cas flows
 - ▶ Projection of future premium (if any)
 - ▶ Discounting of cash flows

Best Estimate of claims provision (gross)

Undiscounted claims provisions

- The first step corresponds to the classical claims reserves actuarial estimation
- The actuarial community agrees on applying “Macro Models” for this purpose:
 - ▶ Methods using aggregate data
- In general development triangles are used
 - ▶ Paid triangle
 - ▶ Incurred triangle (Cumulative Paid + Case Reserves)
 - ▶ Number of claims triangle
 - ▶ ...
- In Non-Life, the calculation of Best Estimate does not require the use of stochastic methods:
 - ▶ Deterministic methods are generally sufficient.

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Best Estimate of claims provision

Undiscounted claims provisions

- The actuarial community agrees in applying the following actuarial methods when calculating the claims reserves
 - ▶ Chain Ladder
 - ▶ Bornhuetter Ferguson
 - ▶ Naïve Loss Ratio
 - ▶ Number of Claims / Average Cost

- Other methods exist and can be used if needed. As examples:
 - ▶ Separation methods
 - Taylor
 - Verbeek
 - ▶ De Vylder method
 - ▶ ...

Best Estimate of claims provision

Undiscounted claims provisions

- Most popular approach: Chain Ladder
 - ▶ Applied on cumulative data

Origin Year	Development period								
	1	2	...	j	...	n-i+1	...	n-1	n
1	C_{11}	C_{12}	...	C_{1j}	$C_{1,n-1}$	C_{1n}
2	C_{21}	C_{22}	...	C_{2j}	$C_{2,n-1}$	-----▶
...
i	$C_{i,j}$...	$C_{i,n-i+1}$	-----▶	-----▶	-----▶
...
n-j+1	$C_{n-j+1,j}$	-----▶	-----▶	-----▶	-----▶	-----▶
...
n-1	$C_{n-1,1}$	$C_{n-1,2}$	-----▶	-----▶	-----▶	-----▶	-----▶	-----▶	-----▶
n	C_{n1}	-----▶	-----▶	-----▶	-----▶	-----▶	-----▶	-----▶	-----▶

f_1	f_2	f_j	f_{n-i+1}	f_{n-1}
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Development Factors or Link Ratios

Best Estimate of claims provision

Undiscounted claims provisions

■ Most popular approach: Chain Ladder

▶ Underlying assumptions

- $i = \text{accident year}, j = \text{development period}$
- $E \left[C_{i,j+1} \mid C_{i,0}, C_{i,1}, \dots, C_{i,j} \right] = f_j \times C_{i,j}$ (Thomas Mack – 1993)
- Where f_j is estimated by

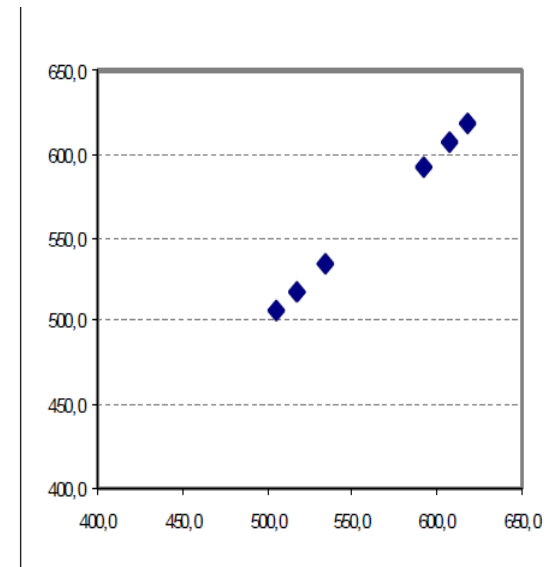
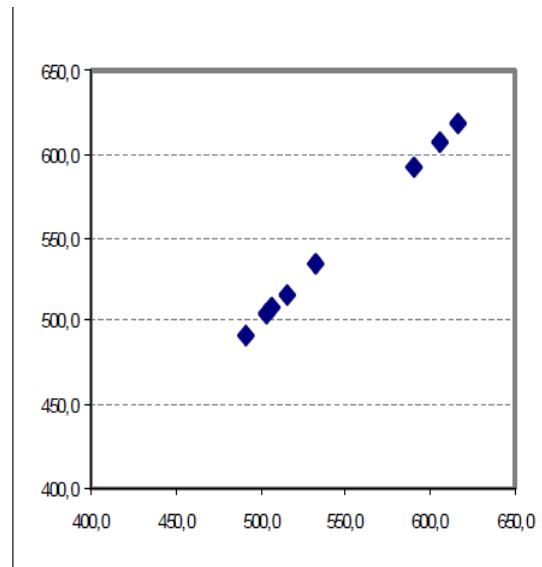
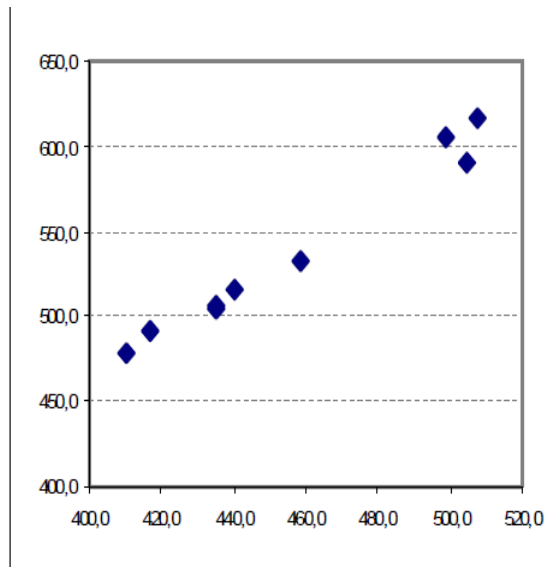
$$\hat{f}_j = \frac{\sum_{i=1}^{n-j} C_{i,j+1}}{\sum_{i=1}^{n-j} C_{i,j}} = \frac{\sum_{i=1}^{n-j} C_{i,j} \times f_{i,j}}{\sum_{i=1}^{n-j} C_{i,j}}$$

- ▶ Thomas Mack showed that under the assumption above, \hat{f}_j is an unbiased estimator of f_j

Best Estimate of claims provision

Undiscounted claims provisions

- Application of Chain Ladder raises several questions
 - ▶ How to validate that a Chain Ladder can be applied on a triangle?
 - A practical way to check if the assumption above is valid could be to check graphically, for each development period j if the set of couples $(C_{i,j}, C_{i,j+1})$ pour $1 \leq i \leq j$ are aligned or regularly distributed around the line including the couple $(0, 0)$ and with a slope equal to f_j



Best Estimate of claims provision

Undiscounted claims provisions

- Application of Chain Ladder raises several questions
 - ▶ Use of Paid or Incurred (Cumulative Paid + Case Reserve) data?
 - The Paid Chain Ladder is usually applied in the following cases:
 - When it can be assumed that the case reserves do not include sufficient additional information
 - For the short tail business
 - Attention should be paid on the specific cases, where some known individual claims can make the Paid approach irrelevant
 - Incurred Chain Ladder is used when it is considered that Case reserves contain significant information that can improve the estimation
 - Example: Long Tail Business (General Liability, Motor Third Party Liability, Non Proportional reinsurance business ...)
 - In reality, the paid model will be applied in any case, at least for the payments patterns estimation purpose (To be discussed later)

Best Estimate of claims provision

Undiscounted claims provisions

- Application of Chain Ladder raises several questions
 - ▶ Tail Factor estimation
 - In several cases, the length of the historical development of paid is not sufficient to cover the complete development of an accident year
 - Need to estimate the tail
 - Possible approaches
 - Benchmarking
 - Curve fitting
 - Pragmatic method using the Case Reserves
 - Identify a development period at which it can be assumed that there will not be any IBNYR claim and no development of known claim is expected
 - Assume that the cumulative link ratio from this development period to the ultimate is equal to the ratio of Incurred claims divided by the cumulative paid,
 - ▶ Large Claims
 - Usually, when needed, undertakings separate large losses from the attritional
 - Specific treatments are then applied to these large losses.
 - The approaches used should avoid under-estimation of IBNER on these large losses

Best Estimate of claims provision

Undiscounted claims provisions

■ Pros of Chain Ladder method

- ▶ Simple to apply
- ▶ Assumptions and results are easy to explain
- ▶ Method generally accepted by the profession
- ▶ ...

■ Cons of Chain Ladder method

- ▶ When used mechanically, Chain Ladder could lead to abnormal results
- ▶ As a multiplicative method, Chain Ladder is in general inappropriate for less developed origin year (example: the last origine year).
 - In order to avoid this problem, Chain Ladder is in general supplemented by the Bornhuetter Ferguson method for these origin years
- ▶ Chain Ladder is not appropriate when significant diagonal effect appears in the triangle (important change in the inflation)
- ▶ ...

Best Estimate of claims provision

Undiscounted claims provisions

- Bornhuetter-Ferguson method is additive
- This method can be presented as a credibility approach between Chain Ladder method and Ultimate Loss Ratio method
- According to this method, the ultimate claim for each origin year is estimated as following:

$$C_{i,n} = \underbrace{C_{i,n-i+1}}_{\substack{\text{Observations} \\ \text{(dernière} \\ \text{diagonale)}}} + \underbrace{(1 - Q_{n-i+1}) \times E_i \times \emptyset_i}_{\substack{\text{Estimation du développement de} \\ \text{la sinistralité au-delà de la dernière} \\ \text{diagonale}}}$$

- ▶ \emptyset_i is an a priori Ultimate Loss Ratio (could be provided by the pricing department, market benchmark, ...)

Best Estimate of claims provision

Projection of the claims cash-flows

- Run a paid Chain Ladder
- Estimate the Link Ratios (including the tail factor)
- Estimate the payment patterns
- Calculation of the future claim cash-flows by application of the payments patterns on the undiscounted Best Estimate of claims provisions
- Estimate the sequence of cash-flows after the last known development period
 - ▶ Extrapolation of the observed sequence
 - ▶ Extrapolation based on theoretical curves
 - ▶ ...

Best Estimate of claims provision

Projection of the expenses cash-flows

- The Best Estimate of claims provision should reflect all future cash flows arising from expenses that will be incurred servicing existing policies (earned risks)
 - ▶ Claims management expenses
 - ▶ Investment management expenses
 - ▶ Acquisition expenses
 - ▶ Administration expenses

- Assumptions should relate to future cash-flows:
 - ▶ Generally based on the undertaking experience
 - ▶ Allowance for future cost increase (inflation)
 - ▶ Future changes in the environment
 - Undertaking environment (change in the claims management organization, ...)
 - External environment (economic, legal, demographic, social, medical, technological, ...)

Best Estimate of claims provision

Projection of the expenses cash-flows

- The expenses component in the Best Estimate (claims and premium provision) is an important challenge for insurance / reinsurance undertakings, and for the actuaries.
- Undertakings shall review, document the expenses allocation between these destinations in a consistent manner.
- Actuaries shall be able to understand the cost allocation process in order to be in a position to make reliable estimation to be included in the Best Estimate.

Best Estimate of claims provision

Future premium

- In general for direct insurance undertakings, the future premium is not an issue when calculating Best Estimate of claim provision.
- However for undertakings with non proportional reinsurance business, reinstatement premium can be due by cedants depending on the claims experience.
- These reinstatement premium can be considered as cash in by the reinsurers, when calculating the Best Estimate of claims provision.

Best Estimate of claims provision (Gross)

Discounting

- Cash-flows shall be discounted using the basic risk free rates
- Discounting by currency

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The challenge for a supervisory authority

- Intrinsically, reserving is not an easy task.
 - ▶ The actuary's objective is to predict future cash flows based on historical information on claims and any other internal and external information
- This task is more complicated for an external stakeholder (the supervisory authority)
- In general, quantitative information (development triangles, methods applied, development factors, ...) provided by the company are not sufficient to gain confidence in the results produced.
- Additional qualitative information are required

The challenge for a supervisory authority

■ Examples of qualitative information

- ▶ Documentation of the reserving process, going from the contracts selling to the claims payments and valuation
 - Nature of risk covered
 - History of the portfolio
 - Description of the claim management process
 - Overview of the claims managements policy
 - How is the actuary involved in this process?
- ▶ Documentation about the data quality
 - Description of the collection of the data used for the reserving purpose
 - Controls and reconciliations
 - Description of any limitation in the data and impact on the analysis made by the actuary
- ▶ Documentation of the methodology used and why this methodology is appropriate to the underlying risk
- ▶ Justification of assumptions made
- ▶ Any change in the methodology shall be documented
- ▶ Sensitivity analysis
- ▶ Variation analysis (N-1 versus N)
- ▶ ...

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Discussions

- Reserves calculation for a long tail business



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