XIII CONGRESSO NAZIONALE DEGLI ATTUARI
INNOVAZIONE TECNOLOGICA E RISCHI SISTEMICI: L'ATTUARIO VALUTATORE GLOBALE DELL'INCERTEZZA
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Real world vs risk neutral approaches to measure insurance liabilities under IFRS 17

Angelo Troiani
ONA

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Introduction

- IFRS 17 requires to measure insurance liabilities in a market consistent framework
- Most used market consistent apprach to measure insurance contracts is the «Risk neutral» (RN) approach that is also required to be applied by the Solvency II Directive to valuate Best Estimate of liabilities. This approach implies that all assets considered in the actuarial projection have a risk free return independently from their credit characteristics and are consequently discounted with risk free rates.
- Among other methods that could be considered for the purpose of IFRS 17 valuation, one possible alternative is the «Real World Deflator» (RW Deflator) approach. In this case, assets are projected considering their real world return (incl. credit spread) but are discounted using deflators (i.e. special discount factors that allow to grant market consistency).
- This slide deck has the aim of comparing RN vs RW Deflator approaches and demonstrating that they substantially lead to the same results both at inception and for subsequent measurement of the insurance liabilities.
- The example shown in the following slides is based on the the paper *State-Price Deflators and Risk-Neutral valuation of life insurance liabilities* published by Bell F. Ouelega in 2014.

Discounting requirements under IFRS 17

Contractual service margin

Risk adjustment for non-financial risk

Discounting

Expected future cash flows

General Requirements (par. 36 e B72-B85)

- Future cash flows to be discounted to reflect the time value of money and the financial risks related to those cash flows.
- Insurance liabilities reported in the Balance Sheet have to be valued on a **market consistent basis**, using current interest rates independently from the IFRS 17 measurement model applied.
- However, in case the General Model applies, the standard prescribes to use locked-in (historical) rates for interest accretion on the CSM and to determine insurance finance income or expenses in case the OCI option is selected.

IFRS 17 requires estimates of discount rates to be consistent with other estimates used to measure insurance contracts [IFRS 17 B74]:

a) *cash flows that do not vary based on the returns on any underlying items* ***(non Par Business)*** shall be discounted at rates that do not reflect any such variability;

b) *cash flows that vary based on the returns on any financial underlying items* ***(Par Business)*** shall be:

a) **discounted using rates that reflect that variability**; or

b) **adjusted for the effect of that variability and discounted at a rate that reflects the adjustment made**.[…]

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Market consistent approaches to measure insurace contracts

- As reported in paragraph 36, B48 and B78 of IFRS17, the estimation of discount rates should be based on a **market consistent approach** leveraging on observable market prices and shall include only relevant factors, ie factors that arise from the time value of money, the characteristics of the cash flows and shall not contradict any available and relevant market data.
- This implies to measure the value of option and guarantees in life participating business using **specific tecniques that grant consistency with observable market price**s.
- For instance, using one of the following methods also reported within the *International Actuarial Note (IAN) 100 on Application of IFRS 17 Insurance Contracts*:

Approaches	Comments
1 **Risk neutral scenarios:** in this technique, the projected average investment returns on the financial underlying items are calibrated to be equal to the deterministic risk-free discount rate (with adjustment for liquidity as appropriate).	✓ This is the approach currently used for Solvency II. ✓ Actuarial platforms have been generally implemented according to this methodology.
2 **Real world scenarios:** the financial underlying items are projected on a stochastic real-world basis. The discounting is done with a **stochastic real-world deflator set**, which is a set of interest rates that ensures the same valuation outcome as using risk neutral scenarios.	✓ This approach would allow to include the market risk premium in discount rates (avoid credit risk exclusion) ✓ This approach would imply a change of the logic underlying current actuarial systems used under SII
3 **Replicating portfolio techniques:** par. B46 states that *If a replicating portfolio exists for some of the cash flows that arise from a group of insurance contracts, the entity can use the fair value of those assets to measure the relevant fulfilment cash flows instead of explicitly estimating the cash flows and discount rate.*	✓ This approach does not properly take into consideration life underwriting risks (e.g. lapse) ✓ In many cases, it would require the implementation of new systems
4 **A closed form solution** might also be used where this exists depending on the nature of non-linear dependence.	✓ This approach is not appropriate in case insurance contracts embed complex financial guarantees

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Model framework

- Let's suppose to price a European Call option with strike K and maturity t with both a Risk-neutral and Real-World deflator approach. For both approaches we assume that the returns follow a Black & Scholes process. In case of **RN approach**, the equity returns follow the process:

$$Log\big(S(t)\big) - Log\big(S(0)\big) \sim Normal\left(\left(r - \frac{\sigma^2}{2}\right); \sigma\sqrt{t}\right)$$

- In this process, **r** is the annual risk-free rate and **σ** is the equity annual volatility. The discount factor used for the risk-neutral valuation is:

$$e^{-rt} = D_t^{RN}$$

- In case of RW approach, the process is:

$$Log\big(S(t)\big) - Log\big(S(0)\big) \sim Normal\left(\left(\mu - \frac{\sigma^2}{2}\right); \sigma\sqrt{t}\right)$$

- In this case, μ is the underlying annual expected yield of return, r is the risk free yield of return (it is assumed μ > r) and σ is the same volatility defined in the RN approach.

- The related discount factor (deflator) with maturity t follows the following equation:

$$\boldsymbol{D_t = exp\left\{-\left(r + \frac{1}{2}\left(\frac{\mu - r}{\sigma}\right)^2\right) \times t - \left(\frac{\mu - r}{\sigma}\right) \times z_t\right\}}$$

Model framework

- **The stochastic discount factor (D) should meet two important properties considering N Monte Carlo simulations**:
  - It should be able to price the underlying assets: $S(0) = \frac{1}{N}\sum_{i=1}^{N} D_i \times S_P^i(t)$
  - It should be able to price the zero-coupon bond for the considered period: $e^{-rt} = \frac{1}{N}\sum_{i=1}^{N} D_i$
- Finally, the market value of the strike price of the option with RN approach is:

$$MV(Call) = \frac{1}{N} \times D_t^{RN} \times \sum_{i=1}^{N} MAX(S_{i,t}^{RN} - K; 0)$$

- The same value under the RW approach is defined as:

$$MV(Call) = \frac{1}{N} \times \sum_{i=1}^{N} D_{t,i} \times MAX(S_{i,t}^{RW} - K; 0)$$

- **Market consistency implies that the law of absence of arbitrage holds and consequently, the price of the contarct under valuation is unique independentely from the approach considered.**

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Example – Contractual features and assumptions

Contract	Model	Assumptions
• Unit linked contract with 5 year duration; benefits are linked to the return of a specified fund. • Minimum guaranteed: 0% • Management fee: 1.25% • Single premium (incl. charges): 130, invested premium: 100; • In case of surrender, the fund value (without guarantee) is paid back to policyholder. • For the sake of simplicity, this contract is assumed to fall within the scope of IFRS 17 (even if it is not exposed to insurance risk)	• In order to calculate the time value of options and guarantees (TVOG), a simulative example has been set in order to capture analogies and differences between Risk Neutral and Real World approach. • For the purpose of calculating the component related to the minimum guarantee provided by the contract, a "Monte Carlo" simulation of 10,000 economic scenarios has been carried out, both with RW and RN approach. • In this example it is assumed that the **fund return is modelled according to the Black and Scholes framework**. In a real application more sophisticated models could be used.	• Surrender probability: 5%; • Actual investment return in each year is equal to the expected RW return; • IFRS 17 measurement model: Variable Fee Approach • Risk adjustment is considered to be 0; • CSM is released with a linear pattern. • Fund volatility: 10% • RN expected return: -0.28% (spot rate) • RW expected return: 0.96% (spot rate) **Discounting factors are defined consistently with the valuation approach and to guarantee market consistency.**

In the next slides are reported the differences between the two approaches in terms of initial valuation and after one year from the valuation.

Example – Initial measurement

Below are reported the main results obtained by comparing RW and RN approach.

	Valuation at issue date – RN vs RW comparison	RW	RN
PVFCF and CSM	• **PVFCF is substantially equal in the two approaches**. The difference is due to a simulation error that would be nil in case of a higher number of simulations. • Hence, **CSM also has the same value in the two approaches**. This result is in line with the expectations as the discount factors in the RW approach are set to grant market consistency. • PVFCF valuation is substantially independent from the RW expected return value thanks to the effect of deflators. RN rate, on the other hand, has a direct impact on PVFCF. **The difference in the two approaches can be observed in the distribution of future undiscounted cash flows.**	**PVFCF**	
		104.5	**104.4**
		CSM	
		25.5	**25.6**
Deterministic PVFCF and TVOG	• By dividing PVFCF in the deterministic component and in the so-called "TVOG" (time value of options and guarantees – equal to the difference between stochastic and deterministic PVFCF) it can be noted that in the **RW approach, against a lower deterministic PVFCF (due to the more favourable assumptions), there is a much higher TVOG than the RN case.**	**PVFCF determ.**	
		95.6	**100.3**
		TVOG	
		8.9	**4.1**

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Example – CSM roll forward

- In t=1 asset return is equal to the RW expected return (+1.2).
- Actual lapses are equal to expected (5% of portfolio).

	CSM movement – RN vs RW comparison	RW	RN
Opening CSM	• As expected opening CSM is almost equal under the 2 approaches. • The little difference between the 2 CSMs is due to simulation error. If a higher number of simulation was used the 2 values would converge.	**25.5**	**25.6**

Change in the entity's share of UI (CES)	• Considering a total return RW of +1.2, the CES is equal to:
	  • +0.2 under RW, equal to the interest accretion of CSM
	  • +1.0 under RN, equal to the difference between total return (+1.2) and RN unwinding (-0.3) and economic variance (+0.5) of PVFCF;
		0.2	**1.0**

TVOG Expected release	• TVOG expected release has been recognised within the CSM as per IFRS17.B113 b • The sum of the TVOG release and the CES is very similar in both RW and RN approach.	**1.3**	**0.5**
Operating and investment component variances	• In the RN approach a non distinct investment component variance related to lapses arises due to the fact that RN expected lapses are equal to 4.9, actual lapses (with real world rate) are equal to 5.	**0**	**-0.1**
CSM release	• CSM release is the same in the two approaches as the previous adjustments lead to a residual CSM value of 26.4 before amortization.	**-5.4**	**-5.4**
Closing CSM	• As a consequence of the previous steps, closing CSM in the central scenario is substantially the same.	**21.7**	**21.7**

Example – Income Statement t=1

- In t=1 asset return is equal to the RW expected return (+1.2).
- Actual lapses are equal to the expected (5% of portfolio).

	Income Statement year 1 – RN vs RW comparison	RW	RN
Insurance contarct revenues	• Revenues are equal to the CSM release and are the same in both RN and RW approaches (please refer to the next slide for CSM release focus). • Expected lapses are not recorded within revenues as they are considered to be **non distinct investment components.**	**5.4**	**5.4**
Insurance contarct expenses	• Expenses are equal to 0 since no insurance payments have been incurred in t=1. • Actual lapses are not recognized as they are considered to be non distinct investment components.	**0**	**0**
Finance income	• Investment income are defined based on assumed RW return. It is the same for both the approaches.	**1.2**	**1.2**
Finance expense	• Based on Variable Fee Approach they are equal to the investment income.	**-1.2**	**-1.2**
Profit/Loss	• Although in the RN approach there is an economic variance (RW rate against RN expected), Income statement result is the same in both approaches.	**5.4**	**5.4**

Conclusion

- **Stochastic PVFCF value at issue date and at subsequent dates is the same in both Deflator RW and RN approach;**
- As a consequence, **CSM value at issue date is the same in both Deflator RW and RN approach**;
- In the RW approach there will be a more realistic PVFCF unwinding and a lower economic variance than in the RN world, where the unwinding is lower and dependent on risk free rates.
- Considering that TVOG release adjusts CSM, no significant variances are expected to emerge when rolling forward the CSM. Indeed CSM before release is the same under the 2 approaches.
- Items that could generate differences between the 2 approaches in terms of profit recognition are:
  - Variances in insurance components (e.g. death benefits) that directly hit the P&L;
  - Consideration of volume based Coverage Units CU for CSM release pattern. In case of undiscounted CU, closing CSM could be slightly different.