

Fair Value

Congres CAA

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Outline presentation

- Introduction
- Why Fair Value
- What is Fair Value
- Applications of Fair Value
- Comparing Fair Value
- Implementing Fair Value

Introduction

Lecturer

- Pieter Bouwknecht, head ALM department at Nationale-Nederlanden / ING
- Experience in
 - Valuation techniques (classical, embedded value, fair value)
 - Financial risk management
 - Courses for Dutch and foreign actuaries on fair value and risk management

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Introduction

About presentation

- Purpose of presentation: get a feeling about Fair Value:
 - Why bother?
 - What are we talking about?
 - How can I apply it?
 - How does it compare to other valuation systems?
 - What are the consequences of implementation?

Why Fair Value

Reasons for interest

- IASB: it is not clear if phase II will use fair value => massive lobbying against it, however...
- New solvency regulations (EU: solvency II) are moving to fair value techniques
- Fair value is important technique for risk management
- Financial economic courses in universities use similar techniques for valuation complex financial instruments
- Some complex products can only be understood using these techniques

What is Fair Value

Definition (IASB)

- “The amount for which an asset could be exchanged or a liability settled between knowledgeable, willing parties in an arm's length transaction ”
- Definition is still too vague to start actual calculations

What is Fair Value

Road map for calculations

- 1 If you have reliable market prices use these
 - Reliable: liquid markets
- 2 If you have no market prices, but are able to replicate, then the price of the replicating portfolio is the price of the instrument
 - Replication: cash flow matching
- 3 If neither 1 or 2 applies, make a model to price the instrument as consistent as possible. Use of a Market Value Margin (MVM) is necessary
 - MVM: conservatism where is is inevitable

What is Fair Value

No arbitrage condition

- Arbitrage: make a profit without a risk
- In financial markets trading can take place with the desired volumes at every time
- Possibility of long and short positions (short: a debt)
- If a product has two prices than a trade will take place on a volume to adjust those prices
- In market equilibrium there can be no arbitrage, so one stream of cash flows has one price
- Extra expected return => take more risk
- Extra risk => get more return? Does this always hold?

What is Fair Value

(In-)complete markets

- Assume financial markets complete: possible to trade everything at required volume without influencing price
- When there is scarce information about market prices, try to use a guess at what prices instruments would be traded
- Example: if you have reliable interest rates until year five, extrapolate the curve using the same rate as in year five
- Non financial markets (mortality risks, PC risks) are incomplete: there is no active market for these risks use a MVM

What is Fair Value

Market Value Margin

- Market Value Margin reflects price of risk aversion of markets for non hedgeable risks
- Cost of Capital approach:
 - Extrapolate the required economic capitals until the end of the contract for the non hedgeable risks
 - Charge a price (required return) for being forced to hold that EC
 - Probably preferred approach in Solvency II (QIS 2)
- Confidence interval approach
 - Set non hedgeable risks at 75%, or 90%, or...
- Price of risk aversion is already included in quoted market prices (credit spread above expected defaults)

Applications of Fair Value

Insurance liabilities 1

- There are no well developed financial markets for insurance liabilities
- Number of transactions extremely low, prices do include also other considerations than the block of business
- A well known theorem in financial economics states: *Two assets with exactly the same cash flows must have the same price*
- Try to find the replicating portfolio
- The replicating portfolio should replicate all the insurance cash flows, so future mortality developments must be taken into account using best estimates
- Value insurance liabilities = Value replicating portfolio

Applications of Fair Value

Insurance liabilities 2

- Fixed outgo's can be valued using a term structure of interest
- The term structure of interest rates depicts the zero-rate for different durations
- Each moment in the future has it's own interest rate
- A bond is a collection of zero-coupon bonds
- In general the term structure is upward sloping (now in EURO: start at 3,5%, at > 10 year about 4,0%)

Applications of Fair Value

Insurance liabilities 3

- Profit sharing can be valued using (interest rate) derivatives, dependent on the wording of your profit sharing
- Use a Market Value Margin for non diversifiable risk: for future mortality there are no well developed financial markets
- Future mortality:
 - Use a time series model to extrapolate future mortality
 - Or assume that the mortality will converge to some level
 - Create statistics about model- and parameter uncertainty

Applications of Fair Value

Example bond valuation

- Consider 10 year 60.000 5% bullet

Year	Zerorate	Discount	CF bond	Value CF
1	2,997%	0,97090	3.000,00	2.913
2	3,747%	0,92907	3.000,00	2.787
3	4,247%	0,88269	3.000,00	2.648
4	4,497%	0,83865	3.000,00	2.516
5	4,597%	0,79873	3.000,00	2.396
6	4,697%	0,75926	3.000,00	2.278
7	4,797%	0,72036	3.000,00	2.161
8	4,897%	0,68216	3.000,00	2.046
9	4,997%	0,64476	3.000,00	1.934
10	5,097%	0,60826	63.000,00	38.320
				60.000

Applications of Fair Value

Example annuity valuation

- Consider 10 year 10.000 annuity

Year	Zerorate	Discount	CF policy	Value CF
1	2,997%	0,97090	10.000	9.709
2	3,747%	0,92907	9.900	9.198
3	4,247%	0,88269	9.702	8.564
4	4,497%	0,83865	9.314	7.811
5	4,597%	0,79873	8.755	6.993
6	4,697%	0,75926	7.967	6.049
7	4,797%	0,72036	6.852	4.936
8	4,897%	0,68216	5.550	3.786
9	4,997%	0,64476	2.830	1.825
10	5,097%	0,60826	-	-
				58.870

Applications of Fair Value

Example valuation profit sharing

- 80% of the positive difference between the EOY interest rate and the tariff rate is paid out in cash to the policyholder
- The profit sharing is calculated over the technical reserves based on the tariff rate
- This profit sharing rule can be replicated with swaptions, that also can be interpreted as options to buy/sell at par a bond with a fixed coupon
- The exact wording of the profit sharing determines which kind of derivatives one should consider

Applications of Fair Value

Example profit sharing valuation

- Consider previous profit sharing rule

Year	Volume PS	Factor PS	Value PS
1	57.585	0,000000	-
2	49.988	0,006014	241
3	42.286	0,012086	409
4	34.210	0,012117	332
5	26.449	0,010528	223
6	18.948	0,011737	178
7	11.979	0,012747	122
8	6.322	0,013580	69
9	1.361	0,014249	16
10	-	0,014768	-
			1.588

Applications of Fair Value

Sensitivity to instantaneous interest rate shocks

- We put a parallel shift to the initial term structure: what happens to the value of the three items?

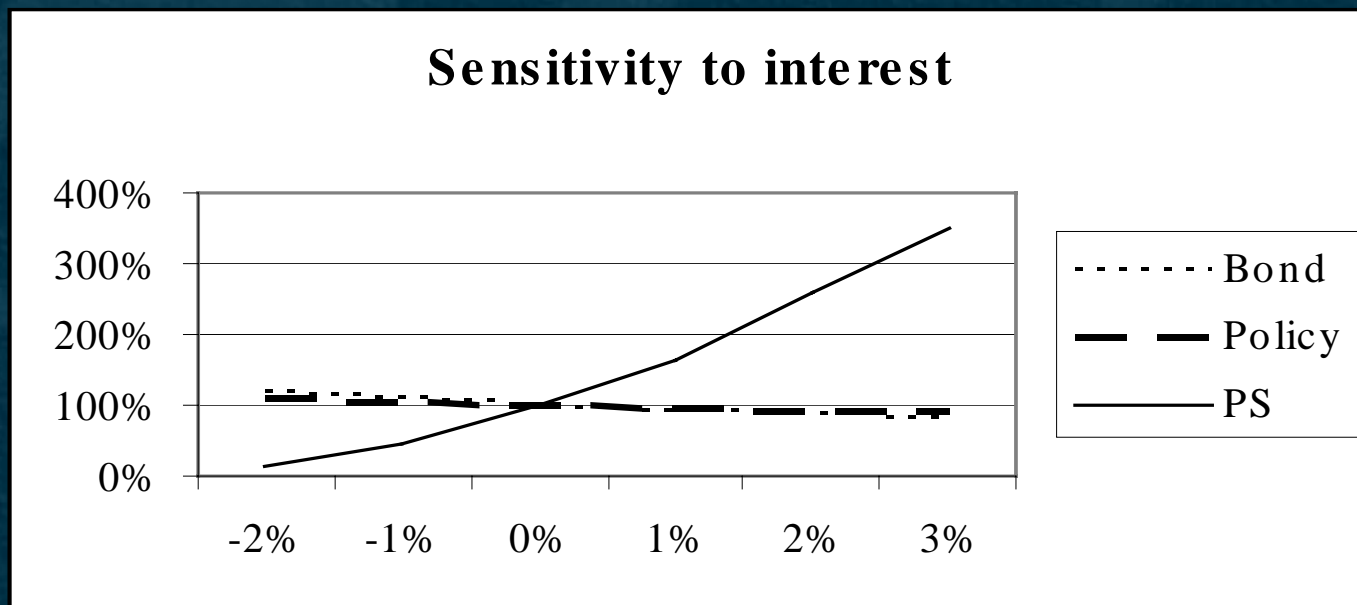
	Bond	Policy	PS	Profit
-2%	70.187	63.707	239	6.700
-1%	64.844	61.214	741	3.347
0%	60.000	58.870	1.588	-
1%	55.603	56.665	2.621	- 3.224
2%	51.608	54.587	4.113	- 6.634
3%	47.972	52.628	5.554	- 9.751

- Clearly, an increase in interest rates leads to losses, due to the difference in duration of the bond and the policy

Applications of Fair Value

The explosion of the value of the profit sharing

- With higher interest rates the value of the PS increases rapidly, as it gets more likely that PS will be paid out
- Derivatives like PS introduce non-linearity problems



Applications of Fair Value

Balance sheet and P&L

- In balance sheet all the items at Market Value/Fair Value
 - No allowance for non-cash items like depreciation DAC
 - Include value future profit sharing in liabilities
 - Only renewals when an obligation of the company exists
- In P&L all the changes in value of balance sheet items and cash items
 - Change in value technical reserves
 - Change in market value assets
 - Premiums, benefits, cash profit sharing, expenses
 - Fair Value P&L looks like a classical P&L

Applications of Fair Value

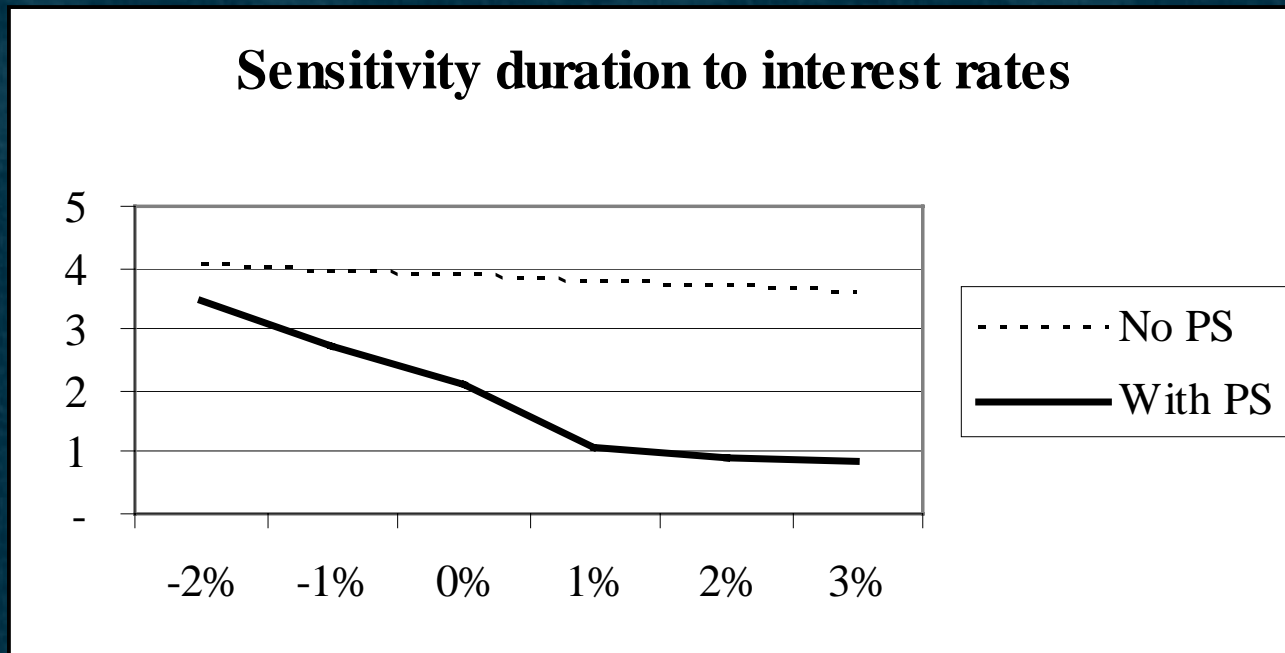
Influence profit sharing on duration

- In general
 - Fixed cash flows (guarantees) lead to a high duration
 - Profit sharing decreases duration
- When interest rates are high compared to guarantee the duration is dominated by the guarantees => high duration of contract
- When interest rates are low compared to guarantee the profit sharing dominates => low duration of contract (depending on type PS)

Applications of Fair Value

Influence profit sharing on duration

- The next graph depicts the duration of the policy dependent on the initial interest rates



Applications of Fair Value

Other important embedded derivatives in policies

- Due to legal reasons and terms of insurance the policyholder often has a lot of options
 - Increase the premiums with inflation-%
 - Lapse the policy
 - Stop paying premiums and leave the policy
 - Buy an annuity at minimum rates
 - ...

Applications of Fair Value

Effect of embedded options

- Sometimes these options can get very expensive
 - Equitable in the UK: company went down having given the right to buy annuities with guaranteed rates
- Behavior of policyholder can change and get more adverse to the company (do not be overoptimistic)
- Subtle wordings can get very important
 - For instance: has the policyholder the right to increase the premiums “at the then prevailing tariffs” or “at the original conditions”

Comparing Fair Value

Classical accounting

- Classical accounting (historical cost prices)
 - Deep in the minds of people in the industry, well understood and known techniques
 - Intuitively appealing: the coupon of a bond is the profit
 - Difficult for evaluation of guarantees and risk management
 - Can give a very stable earnings stream, that does not reflect current market circumstances
 - Leaves some room for creative accounting on asset-side

Comparing Fair Value

With classical accounting

- Fair Value requires a lot of new thinking and learning, so is in the first time less informative
- Fair Value seems less intuitively for fixed interest bonds, but more for equity
- Fair Value gives less information about the historical base of tariffs, but detects problems earlier
- In the first time Fair Value may leave more room for creativity on liability side

Comparing Fair Value

Embedded value

- Embedded value
 - Based on projection of classical accounting
 - Uses discount rate that prices all risks
 - Can miss important guarantees
 - Possible arbitrage in investment policy ($\text{€}100 \leftrightarrow \text{€}100$ when exchanging bonds for equities)
- European Embedded Value principles
 - Use a family of scenario's
 - More standardized disclosures

Comparing Fair Value

With embedded value

- Fair Value does not try to improve on classical thinking, but proposes a deeper revision
- Fair Value is superior in capturing time value of guarantees
- Fair Value has no eternal discussion on discount rate
- Fair Value has less steering wheels than embedded value, is more well defined in outcomes
- Fair Value seems to be better explainable
- Hedging is good reflected in Fair Value, but can give nasty effects in embedded value

Comparing Fair Value

P&L effects

- Fair Value introduces undesirable volatility in P&L
 - Volatility will increase, though the amount depends on the quality of the matching
 - Is the lack of volatility in current accounting a good reflection of economic performance of the company?
 - Some argue that “the cost of capital will increase, and the stock price will decrease because of higher earnings volatility “
 - “P&L will be dominated by new production”

Implementing Fair Value

A lot of work to do

- A tremendous job must be done in upgrading the financial systems of insurance companies
- A lot of work must be done by actuaries, in order to define mathematics behind Fair Value
- A huge effort must be done by people setting up information (accounting department)
- A change in thinking by management and decision makers is required

Implementing Fair Value

First experiences

- When using Fair Value for pricing, we discovered
 - Guarantees were underpriced
 - Embedded value pricing led to unrealistic low prices due to projected investment results
- When using Fair Value for risk management, we see
 - There is a strong incentive to match assets and liabilities better
 - Use of asymmetrical interest rate derivatives (i.e. swaptions) is rewarding, as we have written these options massively
 - Asset management becomes a joint problem of investors and actuaries