From Traditional to Market-Consistent Embedded Values
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Faculty and Institute of Actuaries
The 2nd Younger Members Convention
1-2 December 2003
The Glasgow Moat House
European call option

Payoff

Price today

Payoff at maturity

Exercise price

Price of underlying
European put option
What is Traditional Embedded Value?

- Shareholder net worth
- PLUS Value of in force
- LESS cost of capital adjustment
Use of published Embedded Values globally
Embedded Value - a success story!

- Widely used, well understood, robust
- Clear view of new business value and development of in-force value
- Attributes business performance to correct time period
- Links pricing, performance and return on capital

So why the criticism?
As companies start to reconsider some aspects of their existing embedded value methodology, three key questions remain:

1. How should we set the Risk Discount Rate?
2. How should we allow for financial options and guarantees?
3. How should we allow for the “cost of capital”?
Market-Consistent Embedded Values ("MCEV") can address these problems in a robust manner

- An objective solution to the Risk Discount Rate dilemma
- Options and guarantees are valued consistently with the pricing of options in financial markets
- Allowance made for cost of corporate structure of company
What do we mean by Market-Consistent Embedded Values?

An “Economic Balance Sheet” (excluding some items):

<table>
<thead>
<tr>
<th>Assets</th>
<th>Liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>MV tangible assets</td>
<td>MCV liabilities XXX</td>
</tr>
<tr>
<td></td>
<td>Cost of capital XXX</td>
</tr>
<tr>
<td></td>
<td>Economic value XXX</td>
</tr>
<tr>
<td>Total assets</td>
<td></td>
</tr>
</tbody>
</table>

A “Market-Consistent Embedded Value” Balance Sheet

<table>
<thead>
<tr>
<th>Assets</th>
<th>Liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>MV tangible assets</td>
<td>Statutory liabilities XXX</td>
</tr>
<tr>
<td>Market-Consistent VIF</td>
<td>Cost of capital XXX</td>
</tr>
<tr>
<td></td>
<td>“MCEV” XXX</td>
</tr>
<tr>
<td>Total assets</td>
<td></td>
</tr>
</tbody>
</table>
## Traditional vs Market-Consistent Embedded Value

<table>
<thead>
<tr>
<th></th>
<th>Traditional Embedded Value</th>
<th>Market-Consistent Embedded Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Net worth</strong></td>
<td>Market Value of assets</td>
<td>Market Value of assets</td>
</tr>
<tr>
<td><strong>Value of in force</strong></td>
<td>Deterministic</td>
<td>Market Value of replicating portfolio</td>
</tr>
<tr>
<td><strong>Cost of capital</strong></td>
<td>Generally applied to Solvency Margin only</td>
<td>Applied to all capital, different rationale</td>
</tr>
<tr>
<td><strong>Embedded Value</strong></td>
<td>Sum of above</td>
<td>Sum of above</td>
</tr>
</tbody>
</table>

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Case study – life company XYZ

XYZ

NP FUND
- annuities
- term assurance
- UL pensions (with GAR)

WP 90:10 FUND
- CWP 90:10
- estate
In-force business of XYZ at 31 December 2002

<table>
<thead>
<tr>
<th>Product</th>
<th>Annualised Premium (£m)</th>
<th>Reserve (£m)</th>
<th>VIF (not MC) (£m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annuities</td>
<td>-</td>
<td>1,000</td>
<td>50</td>
</tr>
<tr>
<td>Term assurance</td>
<td>50</td>
<td>200</td>
<td>75</td>
</tr>
<tr>
<td>UL pensions (with GAR)</td>
<td>100</td>
<td>2,000</td>
<td>175</td>
</tr>
<tr>
<td>CWP 90:10</td>
<td>50</td>
<td>4,800</td>
<td>100</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>200</strong></td>
<td><strong>8,000</strong></td>
<td><strong>400</strong></td>
</tr>
</tbody>
</table>

In addition, the adjusted shareholder net worth is £250m

All values in this presentation are illustrative!
VALUING OPTIONS AND GUARANTEES
Market-Consistent option pricing techniques

Closed-form solutions VS Stochastic simulation
VALUING OPTIONS AND GUARANTEES

Calibrating the stochastic option pricing model

To be Market-Consistent, the option pricing model must:

- Be arbitrage free
- Reproduce the market prices of options
VALUING OPTIONS AND GUARANTEES

Valuing cost of GAR in non-profit fund

- Decompose UL product with GAR into GAR and stand-alone UL
- GAR resembles series of interest rate swaptions
  - option to purchase bond at fixed price (defined at option purchase) at specified time in future rather than purchasing bond at then market price (which depends on yield curve at that time)
- Co. XYZ – cost of GAR to shareholders is £35m
VALUING OPTIONS AND GUARANTEES

90:10 With Profits business - fund view

- Fund assets
- Realistic Estate
- Put options (guarantee)
- Asset Share

Assets | Liabilities
VALUING OPTIONS AND GUARANTEES

90:10 With Profits business - fund view

- Fund assets
- Realistic Estate
- Put options (guarantee)
  - Asset Share
- Call options (future bonuses)
  - PV of guaranteed benefits
VALUING OPTIONS AND GUARANTEES

90:10 With Profits business - the shareholder view

- **Fund assets**
- **Realistic Estate**
  - Call options (future bonuses)
  - PV of guaranteed benefits

<table>
<thead>
<tr>
<th>Assets</th>
<th>Liability of fund</th>
<th>Shareholder value</th>
</tr>
</thead>
<tbody>
<tr>
<td>10% estate</td>
<td>10% bonus</td>
<td></td>
</tr>
</tbody>
</table>

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VALUING OPTIONS AND GUARANTEES

Who pays when the realistic estate runs out?

Shareholder Value

0

PV of guaranteed benefits

Fund assets
The shareholders!

Shareholder Value

PV of guaranteed benefits

Fund assets

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## Market-Consistent Value of In Force ("MC VIF") of guarantee products of XYZ at end 2002 (£m)

### WP Fund
- MC VIF of SHT (exhausting estate) 95
- MC VIF of estate burn-through (25)
- **Total MC VIF of 90:10 business** 70

### NP Fund
- MC VIF of stand-alone GAR (35)
Practical approach to valuing cash flows with no optionality

The “Certainty Equivalent” approach:
1. Project using risk free rate
2. Discount using risk free rate
This ensures asset risk premia are not capitalised

This approach works with existing EV models
SETTING THE PROJECTION AND DISCOUNT RATES

What is an appropriate risk free rate?

Zero Yield curves as at 31 December 2002

Source: Bloombergs

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### Summary of Market-Consistent Value of In Force of XYZ at 31 December 2002 (£m)

<table>
<thead>
<tr>
<th>Product</th>
<th>VIF (not MC)</th>
<th>Market-Consistent Cost of Options</th>
<th>MC VIF before option cost</th>
<th>Market-Consistent Value of In Force</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annuities</td>
<td>50</td>
<td>-</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Term assurance</td>
<td>75</td>
<td>-</td>
<td>90</td>
<td>90</td>
</tr>
<tr>
<td>UL pensions (with GAR)</td>
<td>175</td>
<td>(35)</td>
<td>195</td>
<td>160</td>
</tr>
<tr>
<td>CWP 90:10</td>
<td>100</td>
<td>(25)</td>
<td>95</td>
<td>70</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>400</strong></td>
<td><strong>(60)</strong></td>
<td><strong>385</strong></td>
<td><strong>325</strong></td>
</tr>
</tbody>
</table>

- Shareholder net worth unchanged at £250m
In an MCEV framework, why hold additional capital?

- Regulatory requirements
- Rating agency pressures
- Desire to write new business
- Buffer against risks:
  - Asset liability mismatch risk, given company does not hedge market risk
  - Insurance risk that actual experience differs from mean best estimate
  - Operational risks, including Compliance and Mis-selling risks
- Holding capital has associated cost
What are the frictional costs to holding capital?

Corporate finance theory tells us there are two main costs to holding capital:

- Cost of Double Taxation
- Agency Costs

Note: Allowing for this replaces the need to allow for a “Cost of Solvency Margin”
THE COST OF CAPITAL

Deducting a cost of capital to allow for Double Taxation

- Rationale?
- Assumption required: tax status of typical shareholder
- Allowance already in MC VIF (assuming surpluses are paid out as dividends as they arise)
- Haircut required on shareholder net worth
THE COST OF CAPITAL

Considerations around Agency Costs?

- Agency Costs relate to investors’ perceptions
- Purpose of valuation
  - need to calculate Agency Costs?
  - accuracy required?
## REPORTING MARKET-CONSISTENT EMBEDDED VALUES

**Balance Sheet of XYZ at end 2002 and end 2003**

<table>
<thead>
<tr>
<th>Asset</th>
<th>Value at end 2002 (£m)</th>
<th>Value at end 2003 (£m)</th>
<th>Change (£m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shareholder net worth</td>
<td>250</td>
<td>275</td>
<td>25</td>
</tr>
<tr>
<td>Market-Consistent VIF</td>
<td>325</td>
<td>360</td>
<td>35</td>
</tr>
<tr>
<td>Cost of Double Taxation</td>
<td>(30)</td>
<td>(35)</td>
<td>(5)</td>
</tr>
<tr>
<td><strong>Market-Consistent</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Embedded Value</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Agency Costs at 1% p.a.</strong></td>
<td>545</td>
<td>600</td>
<td>55</td>
</tr>
</tbody>
</table>

### Note:

1. The impact of agency costs on the value is shown at an illustrative figure of 1% p.a. of shareholder capital. This allows the user of the information to quantify their own assessment of the quality of management and the associated risks, without prejudicing this assessment by suggesting a level.
The Analysis of MCEV profit (£m)

- Value created through insurance management
  - Experience Variances
  - Assumption changes
  - Value of new business written

- Value created through investment management
  - Investment return on net worth
  - Investment return on value of in-force
    - Return on assets backing in-force
    - Mismatch profit (or loss)

Total Value created 55
MCEV provides new insights for management

- Communicating with shareholders
- Pricing mismatching risk, guarantees and options
- Balancing risk and reward
- Evaluating de-risking strategies
- Assessing value in a restructuring or M&A situation

MCEV - a Framework for:

- Financial Reporting
- Pricing
- Internal Performance Management
- Risk and Capital Management
- M&A

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SUMMARY

There are four steps to calculating MCEV:

1. Value cost to shareholders of options using market-consistent option-pricing techniques
2. Discount non-option cash flows using discount rate reflecting market risk in that cash flow
3. Allow for Double Taxation
4. Consider allowance for Agency Costs
Still interested?

Further reading:
- “Market-Consistent Economic Valuations for the Wealth Management Industry” available on actuaries.asn.au
- “Market-Consistent Embedded Values: Allowing for risk within an Embedded Value framework” available on tillinghast.com

Questions and feedback? Contact details:
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