• Start with the primary fair value condition
• **present value of contributions must equal the present value of the promised pensions**
• This defines **the internal growth rate (IGR)** of a scheme
• This is the weighted average cost of capital for a sponsor employer or equivalently the weighted rate of return to pensioners.
• In order to compare apples with apples:
  – **Project Liability Expense Cash-Flows**
  – **Project Asset Income Cash-Flows**
  – **Compare these at the Internal Growth Rate integral to the awards.**
• This produces accurately accurate, stable and unbiased results
• The reported liabilities are accurate and the scheme funding ratio correct
A system is a big black box
Of which we can’t unlock the locks,
And what we can find out about
Is what goes in and what comes out.
Perceiving input-output pairs,
Related by parameters,
Permits us, sometimes, to relate
An input, output and a state.
If this relation’s good and stable
Then to predict we may be able,
But if this fails us – Heaven forbid!
We’ll be compelled to force the lid!

Kenneth Boulding
• Many technologies are possible
• Investment (DCF/Sum of Present Values)
• Linear Amortisation, and others
• Different technologies have different efficiencies.
• Mark to market

Technology Efficiency

Mark to Market and Discount Rate Valuations

- Contribution
- Pension
- IGR
- Asset-MtM
- Liability (Gilt)

• Hedging strategies
• MTM Very inefficient
• M-t-M induces substantial bias and volatility

Bias and Volatility

Surplus and Deficit Relative to IGR Cost of Production

• What use is this for prediction or management?
The proposed method

- With the same input parameters
- Equity dividends are an order of magnitude less volatile than prices
Deficit Reported under Current and Proposed Methods

- Deficit Reported
- Deficit Proposed

Error and Bias
Estimating the IGR

Solve for IGR under $P_v(C) = P_v(P)$

IGR (7.68%)

[Graph showing financial data and timelines with labels for Amortised Contributions, Liabilities, Accreted Contribution, and Sum Present Values.]
Cash Flow Projections

- Asset cash flows – Bonds contractual and Equities constant real income.
Contributions

• Contributions are amortised as pensions are paid and members die.
## Comparison of Current and Possible Methods

<table>
<thead>
<tr>
<th>Method</th>
<th>Assets</th>
<th>Liabilities</th>
<th>Surplus</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Illustrative Scheme</td>
<td>132,017,010</td>
<td>117,735,917</td>
<td>14,218,094</td>
<td>112%</td>
</tr>
<tr>
<td>Pensions Act</td>
<td>186,030,788</td>
<td>182,433,905</td>
<td>3,596,884</td>
<td>102%</td>
</tr>
<tr>
<td>Accounting</td>
<td>186,030,788</td>
<td>222,631,806</td>
<td><strong>36,601,018</strong></td>
<td>84%</td>
</tr>
<tr>
<td>Gilt</td>
<td>341,353,967</td>
<td>222,631,806</td>
<td>118,722,161</td>
<td>153%</td>
</tr>
<tr>
<td>Asset Implied</td>
<td>186,030,788</td>
<td>153,468,329</td>
<td>32,562,459</td>
<td>121%</td>
</tr>
</tbody>
</table>
• Apply Prudent Assumptions
• Increase Total Pensions by 15%

The IGR increases from 7.68% to 7.91%
• The funding ratio declines from 112% to 105%
Conclusions

• The proposed method is precise and accurate.
• It is a fair value approach.
• It outperforms all existing and many possible methods.
• It is decision and prediction useful.
• It varies only with variation in pension and contribution factors.
• It carries with it incentives for DB scheme provision.
• And long-term investment.
• We next consider some related issues.
The proposed method is fair value, but it is not market consistent.
We can introduce market consistency with a simple adjustment.
The illustrative scheme has a surplus of £14.2 million under the IGR.
If we multiply this by a factor \( \frac{\text{Market value of assets}}{\text{IGR value of assets}} \) we have the market consistent surplus of £20 million:
\[
14.2 \times \frac{186,030}{132,218}
\]
This factor will be positive everywhere when the cash flow returns from markets are below the IGR on pensions awarded – and they usually are.
It multiplies the volatility of markets.
This factor is incredibly volatile – for the statisticians / probabilists, it is technically Cauchy – having no defined mean.
It will tend to rise as the IGR rises – for a 12.00% IGR the multiple is 2.18 times.
If we have a scheme with a 12% IGR, in perfect balance and market volatility of 20%, valuation volatility is unbounded.
The general position is that the closer to balance the worse the reported volatility.
Liability Valuation

• Should two schemes with exactly the same assets and liabilities have the same funding ratio?
• Consider two zero coupon bonds – a 15 year issued at a yield of 10% and a 10 year issued at 5% yield.
• Both are evaluated five years prior to their common maturity at par.
Two views

- When schemes have same assets and liabilities, and this is all, then funding does trump covenant because there is no sponsor support.
- But in the UK support is statutory – funding does not trump covenant.
- We illustrate the consequence for corporate finance where the funding is sufficient to meet liabilities at an expected return on assets of 7.5%.

- The distortions relative to contracted corporate liabilities are everywhere.
• For a scheme in deficit, we may introduce the IGR deficit into sponsor liabilities
• Here it displaces retained earnings and perhaps equity.
• If it exceeds these, then the sponsor is balance-sheet insolvent.
• However, the pension problem is equitable insolvency.
• Now we need to examine the return on capital of the sponsor employer
• If this exceeds the IGR on the pension (deficit) capital, then the sponsor may be viable.
• In more usual circumstances where the deficit is less than retained and equity, we need also to consider dividend policy
• This approach gives us the traditional asset coverage and service coverage ratios of credit analysis.
• And it informs us of the value of the sponsor covenant to the scheme.
• Market prices are driven by fear and greed - Anomalies abound
• Volatility is extremely high.
• Prices drive returns – Beebower, Brinson.
• Market returns are negatively correlated with GDP growth out to about five years
• This violates Arrow Debreu fixed point efficient resource allocation equilibria.
• But as we move to long holding periods, income dominates and volatility declines.
• Long term returns are positively correlated with GDP growth
• In other words, short term market price moves converge to the long-term fundamentals and allocative efficiency

• But not if we use them as indicators for short-term management actions
• Such as special contributions and management techniques like LDI which are hedging regulatory and accounting nonsenses.
• The minimum length of time to distinguish signal from noise
• If we assume normality in return, we can estimate these:

How long?

Minimum Time to Distinguish

• Only with high return, low volatility strategies are market prices informative. Everywhere else, we are working with noise.