

## The Actuarial Profession

making financial sense of the future

### 2005 Pensions Convention

The top 10 papers every scheme actuary should know about

Charles Cowling  
5 – 7 June  
Grand Hotel, Brighton

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### Top 10 Papers?



- **Actuaries, pension funds and investment** – Arthur, Randall (1989)
- **The financial theory of defined benefit pension schemes** – Exley, Mehta, Smith (1997)
- **Pensions, funding and risk** – Chapman, Gordon, Speed (2001)
- **Reinventing pension actuarial science** – Bader, Gold (2002)
- **Note on the relationship between pension assets and liabilities** – Speed, Bowie, Exley, Jones, Mounce, Ralston, Spiers, Williams (2003)
- **Principles of Corporate Finance** – Brealey, Myers (2003)
- **Essentials of corporate bonds for pensions actuaries** – Forman, Freeman, Marshall, McKinlay (2003)
- **Funding defined benefit pension schemes** – Cowling, Gordon, Speed (2004)
- **Longevity in the 21<sup>st</sup> Century** – Willets, Gallop, Leandro, Lu, MacDonald, Miller, Richards, Robjohns, Ryan, Waters (2004)
- **Financial aspects of longevity risks** – Jones, Richards (2004)

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## Actuaries, pension funds and investment

Arthur, Randall (1989)



### Key lessons

- The importance of asset / liability matching
- The implications of mismatching
- Performance measurement
- The sponsoring employer
- Investment objectives

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## Actuaries, pension funds and investment

Arthur, Randall (1989)



### Further Reading

- Objectives and methods of funding defined benefit pension schemes –  
McLeish, Stewart (1987)
- A realistic approach to pension funding - Thornton, Wilson (1992)

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## On the risk of stocks in the long run

Bodie (1995)



### Key lessons

- Measure risk by the cost of insuring against that risk
- The cost of insuring against a fall in stock values increases with time
  - Put-call parity
- The riskiness of equities (stocks) increases with time (as does the expected return)
- Investment implications for individuals

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## On the risk of stocks in the long run

Bodie (1995)



### Further reading

- **Lifetime Portfolio Selection by Dynamic Stochastic Programming: The Continuous Time Case** – Merton (1969)
- **Principles of Corporate Finance** – Brealey, Myers (2003)
- **Financial Calculus An introduction to derivative pricing** – Baxter, Rennie (1996)
- **Derivatives The Theory and Practice of Financial Engineering** – Wilmott (1998)
- **The Pricing of Options and Corporate Liabilities** – Black, Scholes (1973)
- **Theory of Rational Option Pricing** – Merton (1973)

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## The financial theory of defined benefit pension schemes

Exley, Mehta, Smith (1997)



### Key lessons

- Pension schemes and corporate finance
- Measure assets (and liabilities) at market value
- A blueprint for pricing and hedging liabilities
- Bonds are the best match for pension liabilities
- Link between equity returns and salary growth is spurious
- Allocation of fund assets to bonds/equities has no material impact on economic cost of the liabilities
- Pension liabilities should be priced relative to bonds (term structure models of interest rates)
- View company and pension scheme as a single economic entity
- Shareholder value is enhanced by pension fund investment in bonds

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## The financial theory of defined benefit pension schemes

Exley, Mehta, Smith (1997)



### Further reading

- **Risk and reward in corporate pension funds** – Treynor (1972)
- **Corporate pension funding policy** – Sharpe (1976)
- **Executive compensation, pension funding, signalling and taxation** – Scholes (1979)
- **The tax advantages of pension fund investment in bonds** – Black (1980)
- **Taxation and Corporate Pension Policy** – Tepper (1981)
- **Pension funding and corporate valuation** – Miller, Merton, Scholes (1981)
- **What are corporate pension liabilities?** – Bulow (1982)
- **Optimal funding and asset allocation rules for defined benefit pension plans** – Harrison, Sharpe (1983)

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## The price of actuarial values Gordon (1999)



### Key lessons

- Modern finance theory
- Application to UK pension schemes
- Actuarial myths
  - "Modern finance theory is not practical"
  - "Modern finance theory is invalid because it is based on unrealistic assumptions"
  - "Investing the assets of a DB pension scheme in equities reduces company cost"
  - "Equities are the best match for salary-related liabilities"
  - "Risk premiums need to be allowed for when valuing long-term liabilities"
  - "In the long term ..."
  - "Smoothed values are a good thing"
  - Risk can be diversified over time
  - The pension scheme investment success story"
  - Paying pensions with new money means we can ignore the short term"

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## The price of actuarial values Gordon (1999)



### Further reading

- Pension fund asset valuation and investment – *Dyson, Exley (1995)*
- Actuaries and derivatives – *Kemp (1997)*
- Pensions, funding and risk - *Chapman, Gordon, Speed (2001)*

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## Reinventing Pension Actuarial Science

Bader, Gold (2002)



### Key lessons

- Corporate finance principles:
  - \$1million of bonds has the same value as \$1million of equities
  - A fair trade of a marketed security or portfolio must occur at a market price
  - All parties to market transactions are entitled to full current information on the market prices of the relevant assets and liabilities
  - A liability is valued at the price at which a reference security trades in a liquid and deep market. A reference security (or portfolio) has cash flows that match the liability in amount, timing and probability of payment
  - Risks are borne and rewards are earned by individuals not by institutions
- Actuarial violations of corporate finance principles
  - Transferring risk to future generations
  - Underpricing pensions in compensation decisions
  - Actuarial / accounting processes biasing investment decisions
  - Hypothetical actuarial gains concealing real economic losses
  - Concealing risk by smoothing
  - Extended amortization

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## Reinventing Pension Actuarial Science

*Bader, Gold (2002)*



### Further reading

- Is the Pension Benefit Guaranty Corporation the FSLIC of the nineties – *Bodie (1992)*
- On the management of financial guarantees – *Bodie, Merton (1992)*
- What the Pension Benefit Guaranty Corporation can learn from the Federal Savings and Loan Insurance Corporation – *Bodie (1996)*
- Pension deficits – an unnecessary evil – *Bader (2004)*

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## Note on the relationship between pension assets and liabilities

*Speed, Bowie, Exley, Jones, Mounce, Ralston, Spiers, Williams (2003)*



### Key lessons

- Response to Myners
- Greater transparency to trustees and sponsors on the relationship between assets and liabilities
- Liability Benchmark Portfolio (LBP)
- Monitor assets against LBP
- Measure risk against LBP

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## Essentials of corporate bonds for pensions actuaries

*Forman, Freeman, Marshall, McKinlay (2003)*



### Key lessons

- Sterling bonds are issued by a wide variety of issuers
- Corporate bonds offer higher expected returns than gilts but with various risks
- Risk profile is asymmetric
- Swaps can provide longer durations than the physical market
- Investment grade corporate bonds are closely correlated with gilts

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## Essentials of corporate bonds for pensions actuaries

*Forman, Freeman, Marshall, McKinlay (2003)*



### Further reading

- **Equity Gilt Study** – *Barclays Capital (2005)*

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## Pension fund asset allocation

*Bianco, Cooper (2003)*



### Key lessons

- Analysts are beginning to look at the pension scheme assets and liabilities as assets and liabilities of the company
- Three key principles beginning to emerge:
  1. Treat pension deficits as corporate debt
  2. Fund pensions fully – through borrowings if necessary
  3. Investing pension fund assets in bonds maximises shareholder value
- Catalysts for change
- Analysis by equity analysts (as well as bond analysts and credit rating agencies) is getting a lot better

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## Pension fund asset allocation

*Bianco, Cooper (2003)*



### Further reading

- **JP Morgan, ABN AMRO, Merrill Lynch, Moody's, Standard & Poors**
- **Credit Rating Criteria** – *Standard & Poors (2004)*
- **Did pension plan accounting contribute to a stock market bubble?**  
*Coronado, Sharpe (2003)*
- **Do a firm's equity returns reflect the risk of its pension plan?** – *Jin, Merton, Bodie (2004)*

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## Funding Defined Benefit Pension Schemes

*Cowling, Gordon, Speed (2004)*



### Key lessons

- Actuaries should use a solvency measure to value liabilities
- Funding advice should disclose the broad impact of priority rules
- Funding objectives should be well-defined
- Funding targets should be described unambiguously in terms of solvency
- Highlight if contributions are insufficient to maintain solvency
- Reserve fully for options
- Consider reliance to be placed on company covenant
- Full disclosure of amortisation methods
- Disclose projected solvency position at next valuation
- Advise on contributions only up to next valuation

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## Funding Defined Benefit Pension Schemes

*Cowling, Gordon, Speed (2004)*



### Further reading

- Should Trustees be more like bankers? - *Greenstreet (2005)*

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## Financial aspects of longevity risks

*Richards, Jones (2004)*



### Key lessons

- Greatest private-sector exposure to longevity risk is in companies with large DB schemes – big surprises in store?
- Some longevity assumptions are dangerously out of date
- Better disclosure of mortality assumptions
- Longevity now dominant risk for immediate annuities
- Uncertainty over projections of future mortality
- Financial impact of uncertainty
- Mortality differentials
- Asset backing implications
- Mortality projections and cohort effects

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## Financial aspects of longevity risks

Richards, Jones (2004)



### Further reading

- **CMIB Report No 17** – *Continuous Mortality Investigation Bureau* (1999)
- **CMIB Working Paper No 1** – *Continuous Mortality Investigation Bureau* (2002)
- **CMIB Working Paper No 3** – *Continuous Mortality Investigation Bureau* (2004)
- **Longevity in the 21<sup>st</sup> Century** – Willets, Gallop, Leandro, Lu, MacDonald, Miller, Richards, Robjohns, Ryan, Waters (2004)
- **The Cohort effect: Insights and Explanations** – Willets (2004)
- **How long do people expect to live? Results and implications** O'Brien, Fenn, Diacon (2005)

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