The Actuarial Profession
making financial sense of the future

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An Introduction to Risk Based Capital

Steve Hunnisett

Watson Wyatt LLP

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An Introduction to Risk Based Capital

Agenda

- Why has RBC achieved such prominence?
- Generic methods to calculate RBC
- Techniques to develop stress tests
- Aggregation of results

What is it?

- RBC is exactly what it says it is
- An assessment of the amount of capital required to be held by a company based upon the actual risks being run by that company

Why now?

- Not a new idea:
  - FCR
  - Advanced models for some insurers
  - RBC formula based approach to capital by some regulators
  - Economic capital

Why now?

- But:
  - Governance – impact of recent corporate difficulties
  - Financial sector convergence – integrated regulators
  - International harmonization of supervisory approaches
  - Increased modelling capability
  - Increased focus on effective capital management

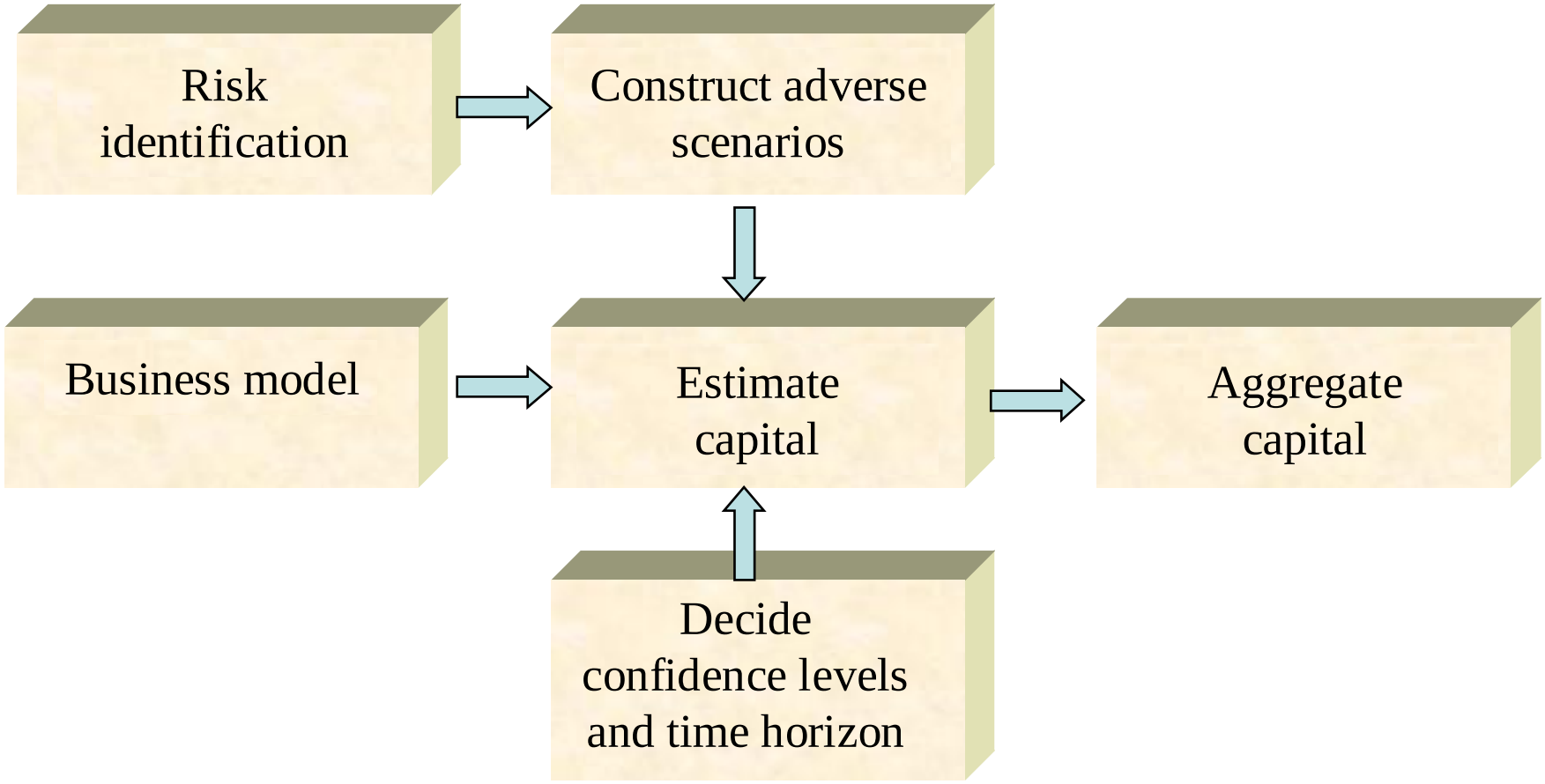
Why now?

- The world continues to change:
  - Greater transparency demanded by consumers
  - Regulator becoming more proactive
  - Existing regulatory reporting framework has become outdated
  - Capital scarcity
  - Increased shareholder sophistication and analysis

Calculation methods

- No current standard methodology in UK
- Multiple stages each with different possibilities
- Internal model approach

Calculation methods



Methodology

- Clarify objectives
- Risk identification
- Run off, short term stress test, ..
- Risk aggregation and correlation

Objectives

- What are the key objectives, eg
  - Target rating
  - Earnings volatility
  - Solvency?
- How much certainty, over what time horizon?
- Internal model versus comparability for FSA

Risk appetite

Risk identification

- Could identify risks using:
  - Existing risk analyses (eg traffic light scoring)
  - Senior management interviews
  - Feedback from FSA visits
- Classification of risks set out in CP195
  - Market, insurance, operational, credit, liquidity
- Model significant risks

Possible approaches

- Generating the capital requirements
  - Deterministic stress tests
  - Stochastic stress tests
  - Stochastic run-off
- Defining the capital level
  - Percentile
  - Contingent Tail Expectation (CTE)

Could be based on RBS, RBS plus solvency margin or statutory

Could be simply cashflows or could include a balance sheet with or without solvency margin

Run off or short term shock?

Body	Run off	Short term shock
ABI	No	Yes
Institute	?	?
EU (Solvency II)	No	Yes
IAA	Yes	Yes

Run-off method

- If based only on meeting cashflows
  - Unrealistic treatment of scenarios with fall + recovery
  - Dependent on mean reversion & equity risk premium
  - But avoids the difficulty of projecting "fair values"
  - May be harder to allow for non-market risks
  - Harder to calibrate (longer time period => less data)
- If based on projected balance sheet
  - Unduly harsh if ignores some management actions such as capital raising, reinsurance and transfer
  - Complex if stochastically generated balance sheet

Short-term shock method

- Assumes that management (or regulatory) actions can deal with any problems after the time horizon
- Leans heavily on balance sheet calculation
- Possible nested stochastic run complication
- But easier to develop plausible scenarios for all risks, but particularly non-market risks

Neither method is perfect

Realistic valuation

- Performing a realistic valuation
  - Assets at market value
  - Liabilities on “best estimate” of future payouts
  - Non discretionary benefits fairly straight forward
  - Discretionary benefits not so simple

Realistic valuation

- For contracts with non discretionary benefits
  - Use model of expected cashflows
  - Best estimate assumptions to be used
  - Discount using risk free rates
  - Investment guarantees at “market value”

Realistic valuation

- For contracts with discretionary benefits
  - Incorporate full impact of management and policyholder behaviour
  - Best estimate assumptions to be used
  - Discount using risk free rates
  - Stochastic methodologies preferable
  - Approximate methods exist eg closed form solutions

Techniques to develop stress tests

- An extract from CP195:

For each of the major sources of risk identified in accordance with *PRU* 1.2.21R, the *firm* must carry out stress tests and scenario analyses that are appropriate to the nature of those major sources of risk, as part of which the *firm*:

(1) takes reasonable steps to identify an appropriate range of realistic adverse circumstances and events in which the risk identified crystallises; and

(2) estimates the financial resources the *firm* would need in each of the circumstances and events considered in order to be able to meet its liabilities as they fall due.

Techniques to develop stress tests

- So what is an appropriate range of adverse scenarios?
- Plenty of possibilities to consider…

Techniques to develop stress tests

- Another extract from CP195:
  - Some further areas to consider in developing the ***market risk*** scenario might include:

    (1) the possibility of a severe economic or market downturn or upturn leading to adverse interest rate movements affecting the *firm's* investment position;
    (2) unanticipated losses and defaults of issuers;
    (3) price shifts in asset classes, and their impact on the entire portfolio;
    (4) inadequate valuation of assets;
    (5) the direct impact on the portfolio of currency devaluation, as well as the effect on related markets and currencies;
    (6) extent of any mismatch of assets and liabilities, including reinvestment risk;
    (7) the impact on the portfolio value of a dramatic change in the spread between a market index of interest rates and the risk-free interest rates; and
    (8) the extent to which market moves could have non-linear effects on values, such as derivatives.

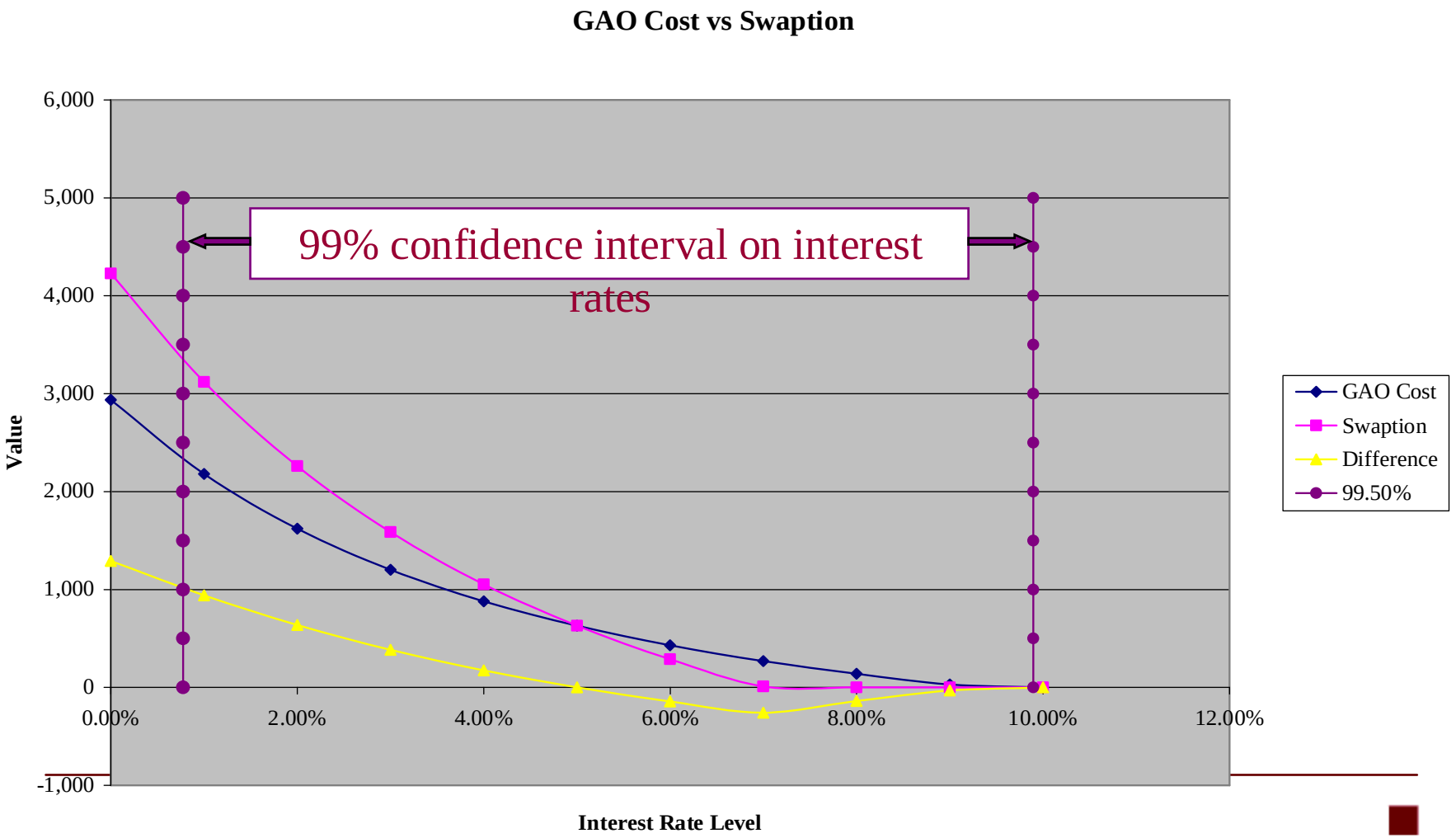
Techniques to develop stress tests

- Several different methods available
- Different risks lend themselves to different methods
- Strengths and weaknesses mean decision is not clear cut

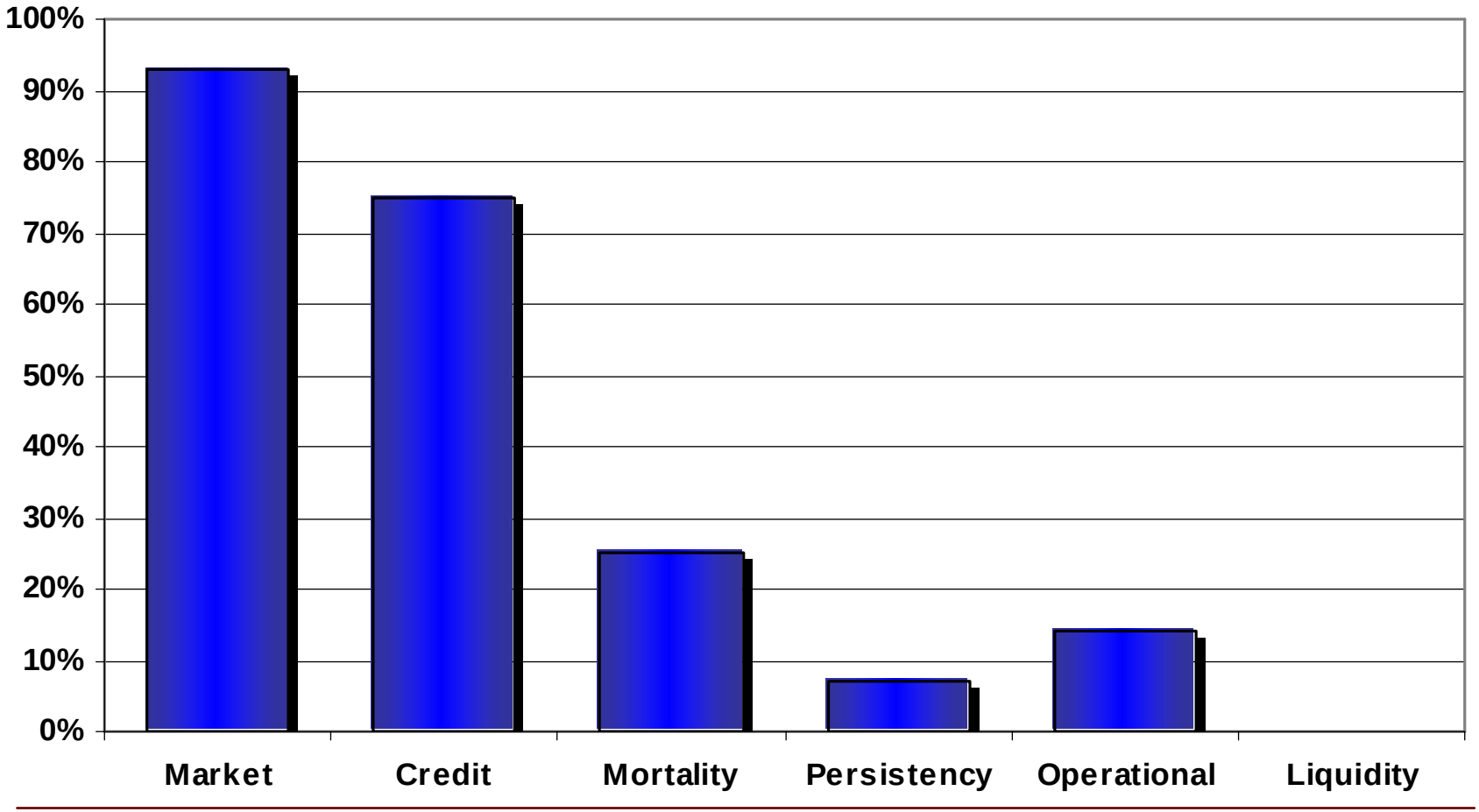
Developing stress tests

- Delphi method
- Expert opinion
- Simple VAR approach
- Extreme value theory
- Monte Carlo simulations

A problem with deterministic stress tests



Stochastic modelling of risks



Source: Watson Wyatt survey of ICA approaches December 2003

Aggregating results

- Ultimate objective is to calculate total capital for a given confidence level
- Hence need to combine results from separate stress tests
- The problems are correlation and non linearity

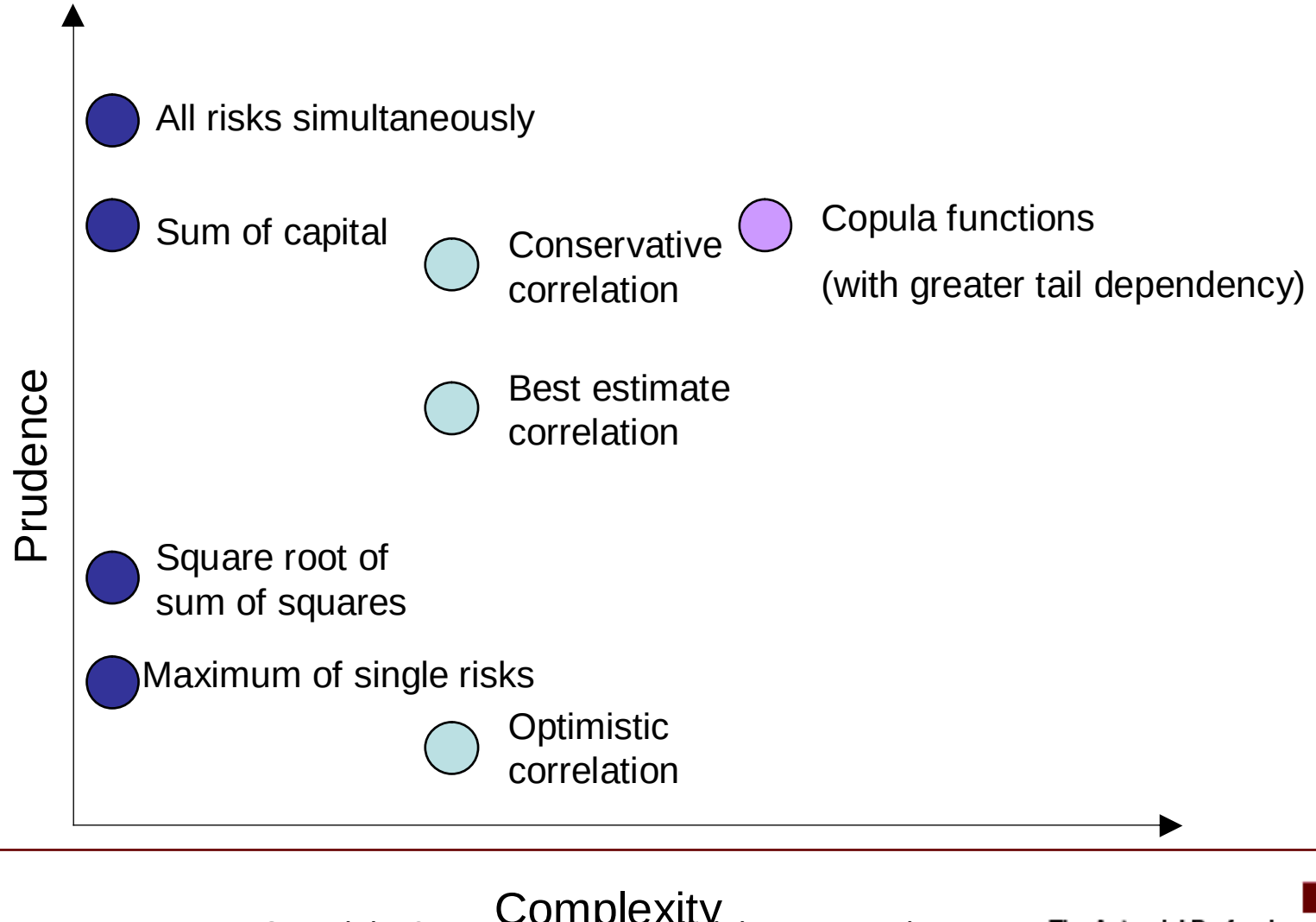
Aggregating results

- Stochastic methods combine all risks but need correlations as an input
- Capital can be easily derived from simulation output for multi-variate stochastic models
- Other methods need to combine results from separate stress tests

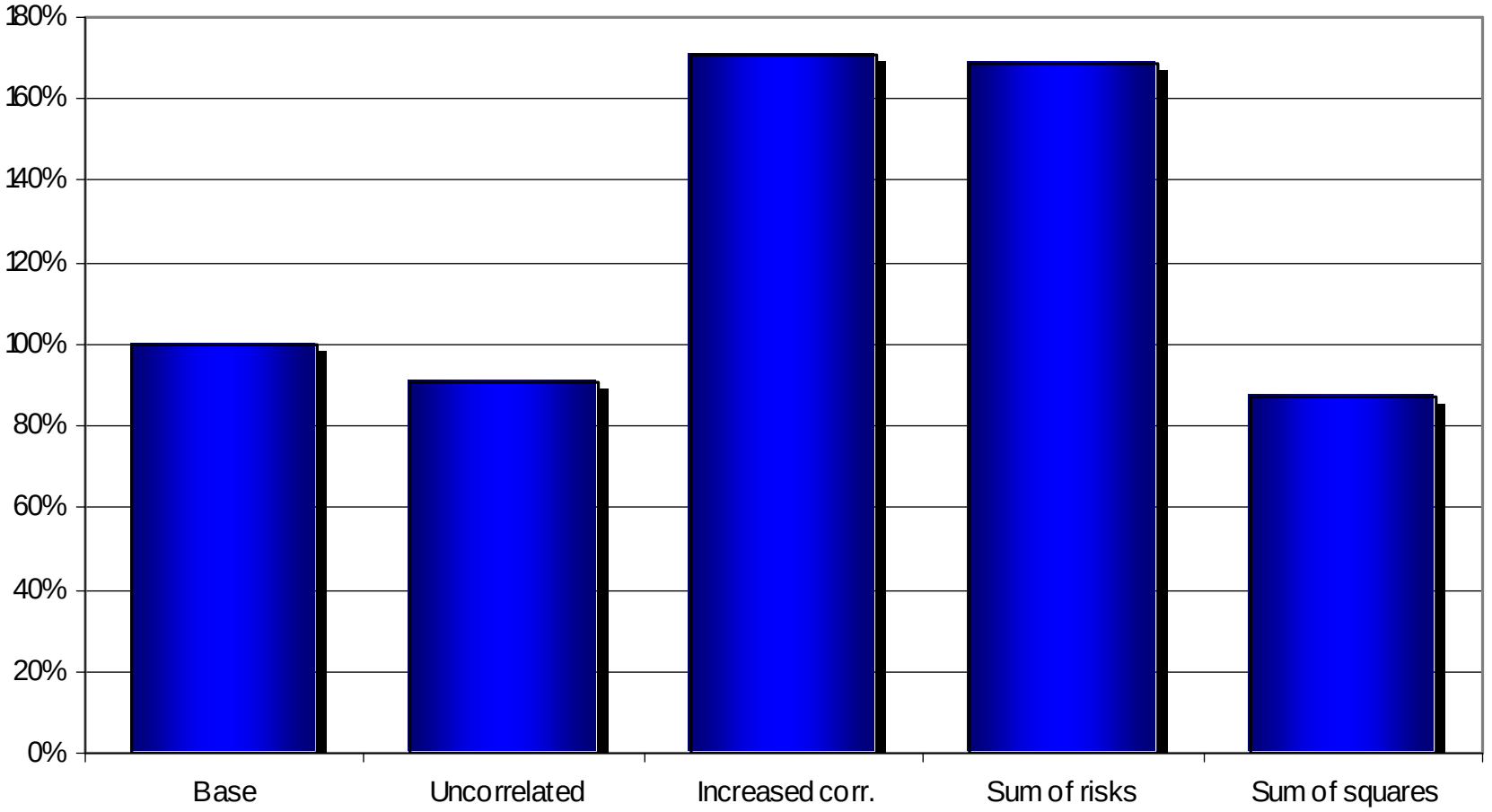
Risk aggregation and correlation

- Capital requirements respond to many risks in a non-linear fashion
- Combinations of risks can change the capital sensitivity e.g. mortality and yields in GAOs
- Asymmetric dependency of risks
- Correlation assumptions can have a big impact

Alternative approaches - illustrative



Impact of different correlation assumptions
An example



Aggregating results

- Simple methods exist
- May suffice for now
- Robust method must consider correlations

Aggregating results

- Estimating correlations is not easy
- Historical data is a possible starting point
  - Not as objective as might be suspected
  - Sparse for some risks

A case study

Products – non profit

- Annuity
  - Fixed annuity for life
- Term assurance
  - Level, guaranteed term assurance
- Linked
  - Endowment with death benefit
  - No surrender penalties

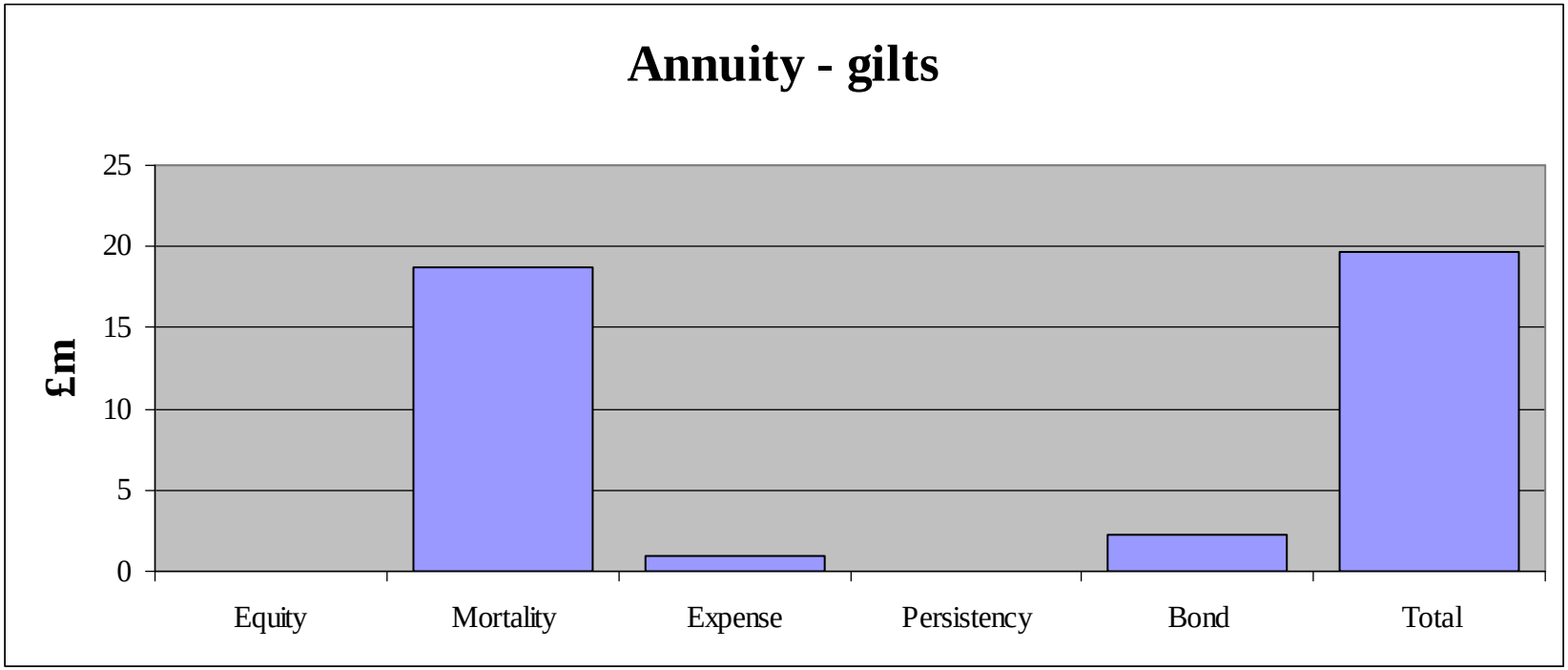
Assumptions – Non-profit

	Realistic basis	Reserving basis
Mortality	Ann = 125% Term = 75% UL = 75%	Ann = 100% Term = 100% UWP = 100%
Persistency	Ann = 100% Term/UL = 90%	100% or 0%
Expenses	Ann = £25 pa Term = £25 pa UL = £36 pa	Ann = £31.25 pa Term = £31.25 pa UL = £48 pa

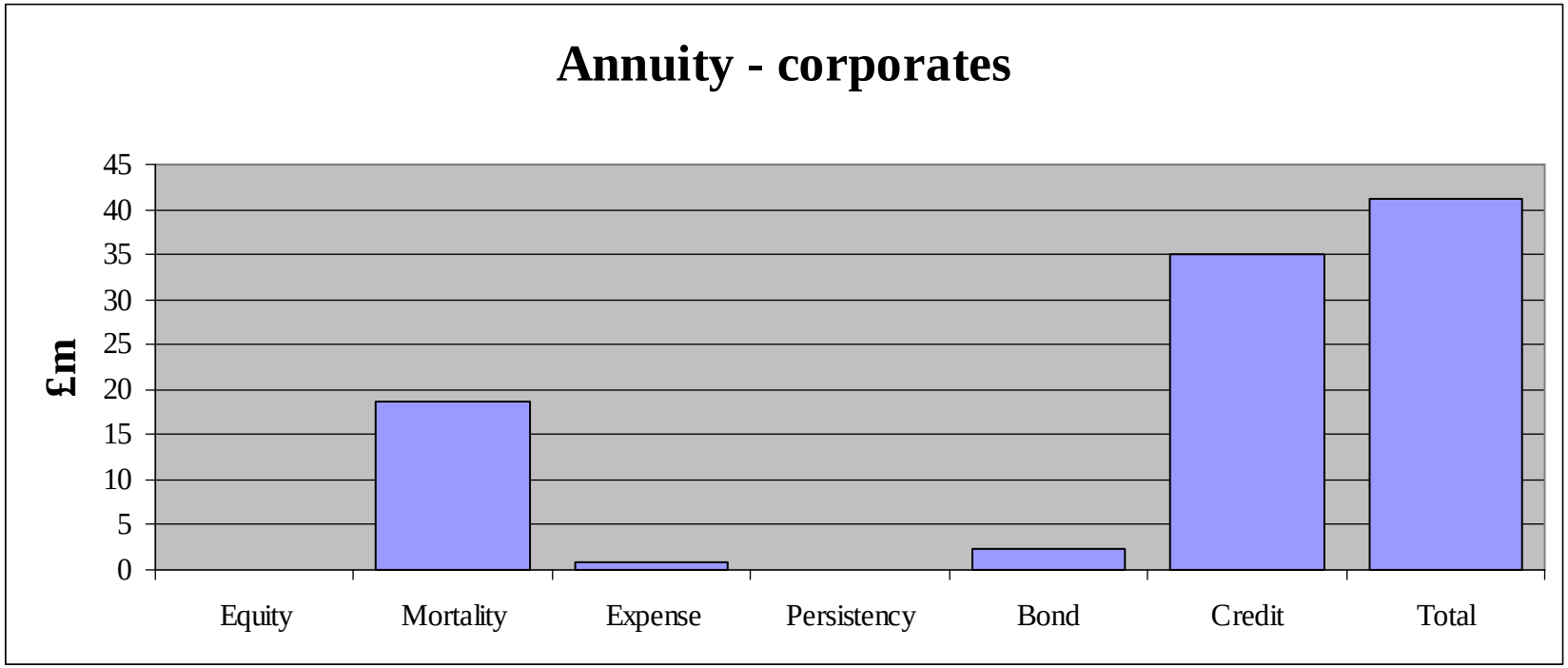
RBC stress tests

Risk factor	Stress test
Equity prices	-40%
Bond yields	+1%/-1%
Credit spreads	+100 bps
Mortality levels	+40%/+20% or -10%/-20%
Lapse rates	+80%/+40%
Expense levels	+20%/+10%

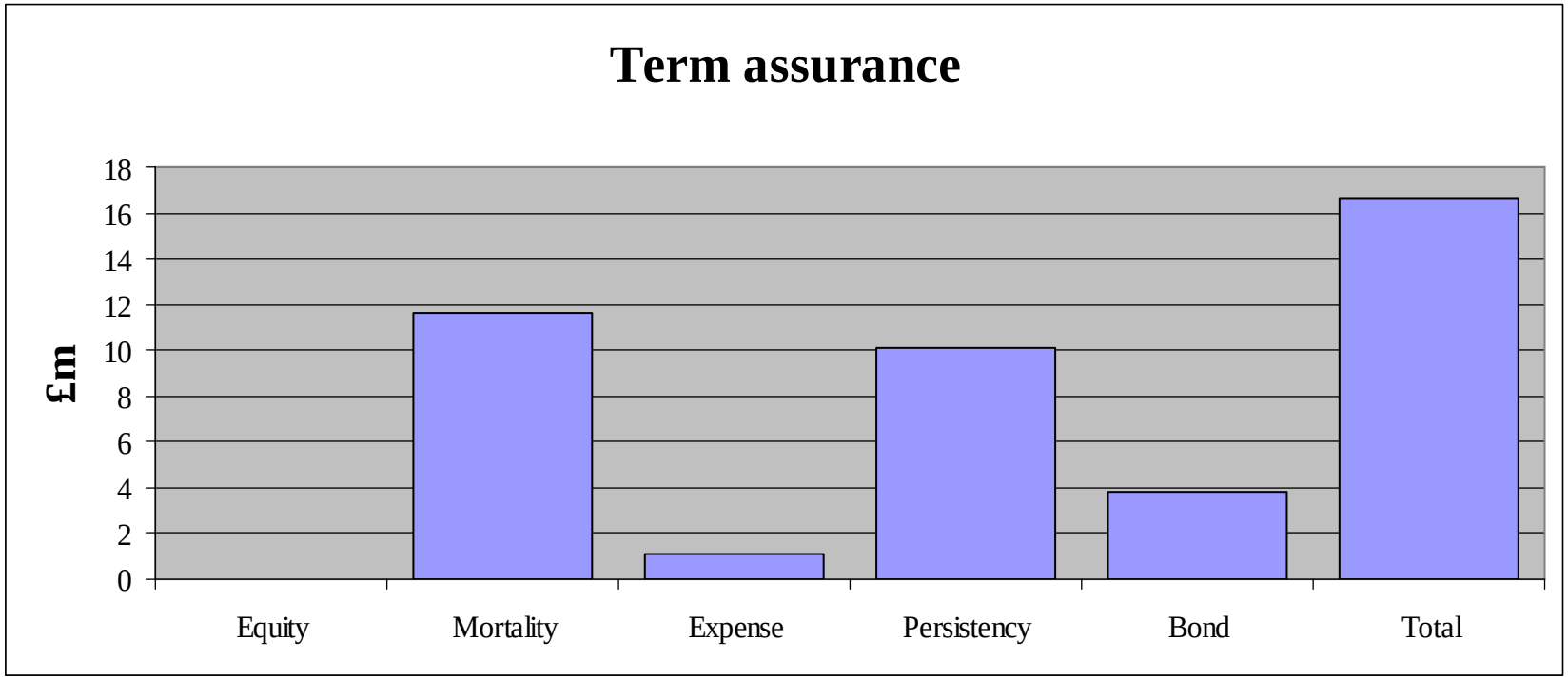
Non-profit stand-alone (1)



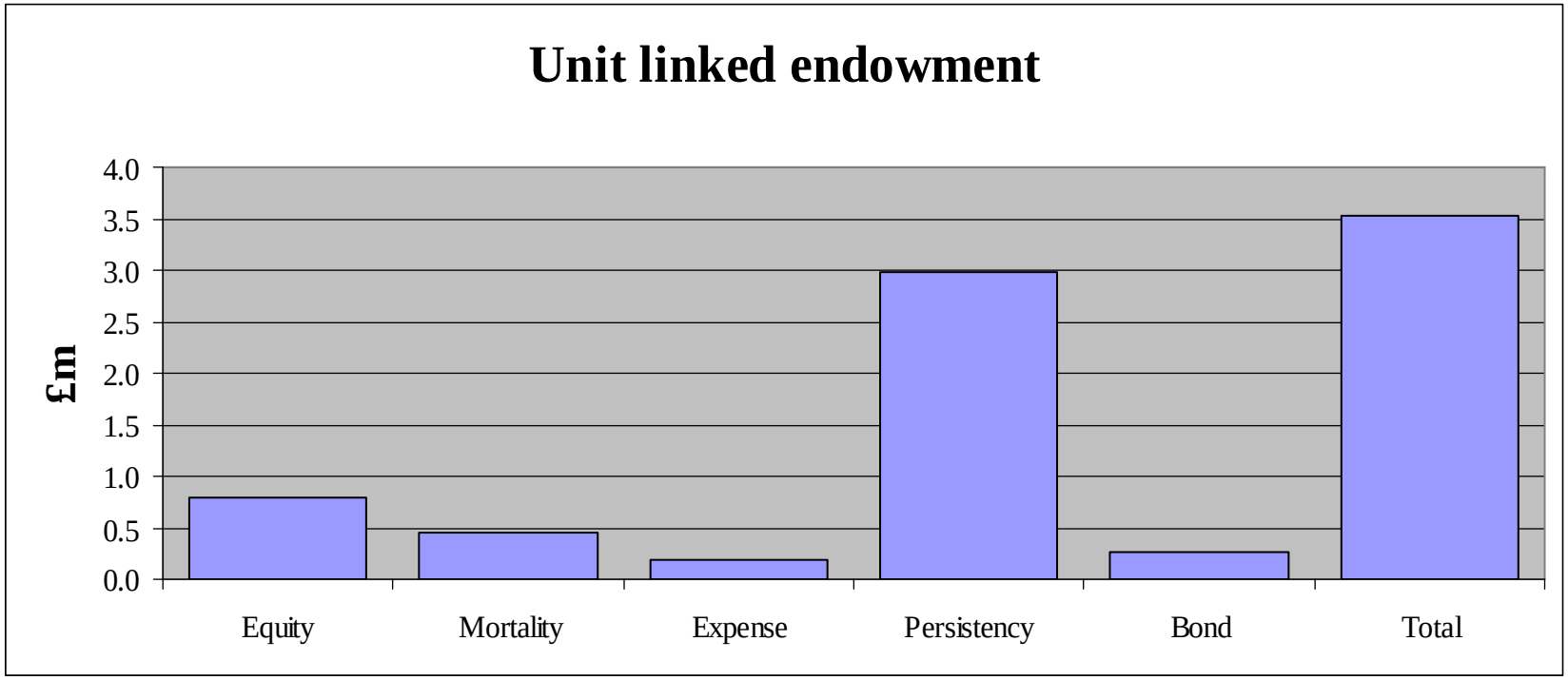
Non-profit stand-alone (2)



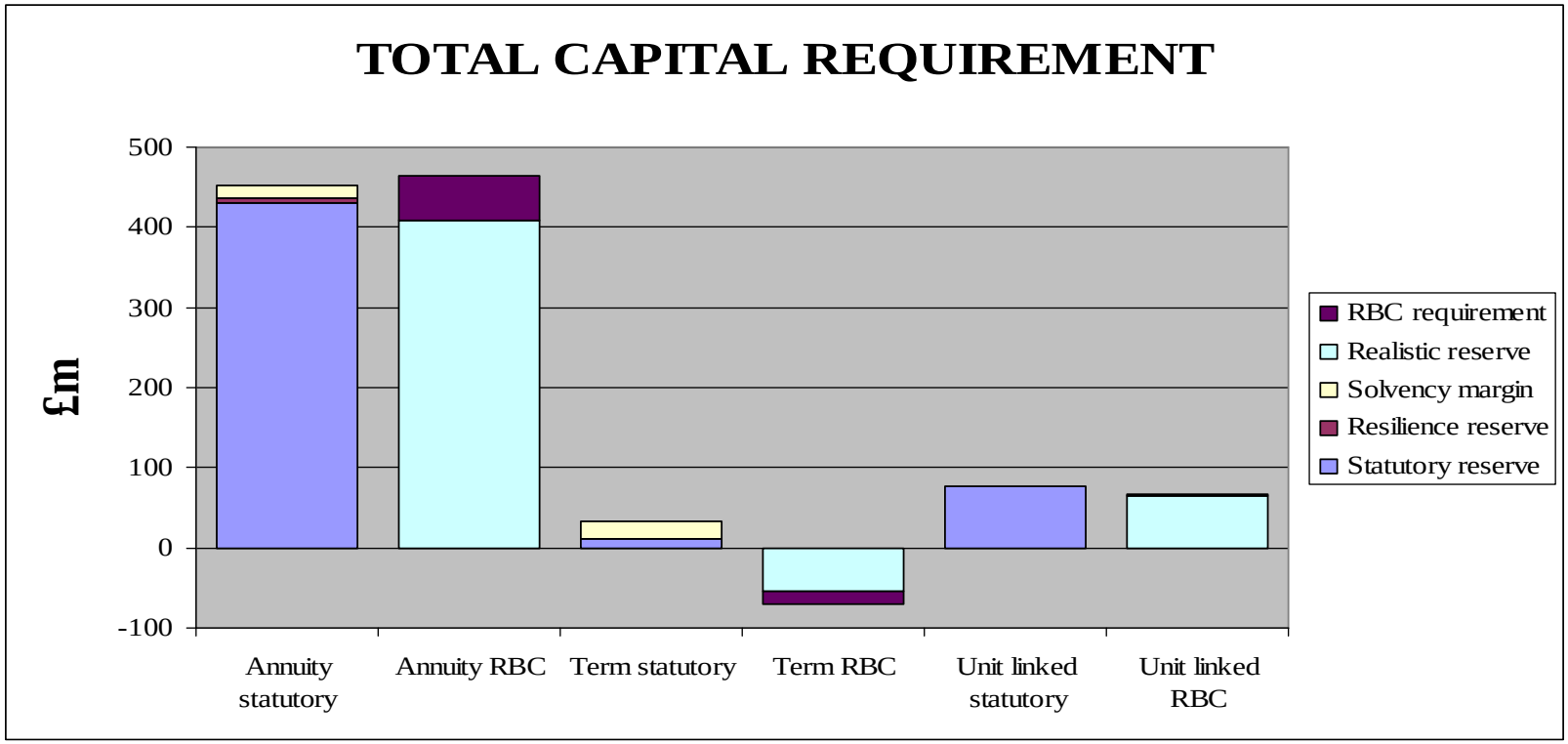
Non-profit stand-alone (3)



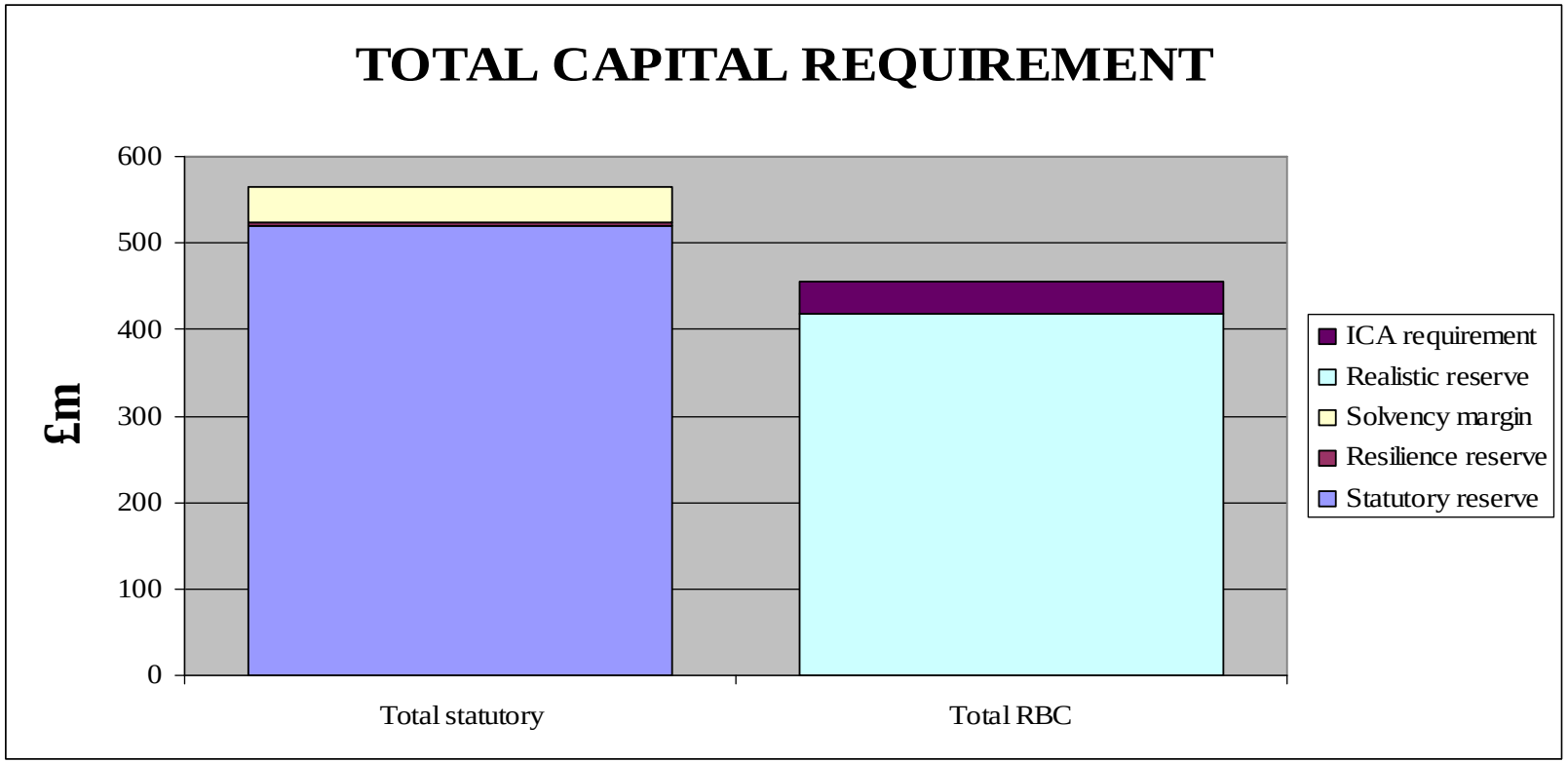
Non-profit stand-alone (4)



Non-profit comparison



Non-profit company



Conclusions

- Annuities
  - Mortality and credit risk important
  - RBC may be higher than statutory for annuity business backed by corporate bonds, switch round for gilts?
- Term assurance
  - Mortality and persistency risk important
  - RBC likely to be lower than statutory
- Linked
  - Persistency risk important (depending on design)
  - RBC likely to be lower than statutory

The journey is a long one

… but it is a journey worth travelling!