The Actuarial Profession
making financial sense of the future

Life Conference and Exhibition 2011

Mark Hutton and Russell Ward

Implementing Daily Solvency Monitoring

21 November 2011

© 2010 The Actuarial Profession • www.actuaries.org.uk

Agenda

- Key drivers of the project
- Example output
- Design and operation
- Challenges and solutions

© 2010 The Actuarial Profession • www.actuaries.org.uk

The Actuarial Profession
making financial sense of the future

Implementing Daily Solvency Monitoring

Key drivers of the project

© 2010 The Actuarial Profession • www.actuaries.org.uk

The value of good and timely MI

This slide is intentionally left blank

© 2010 The Actuarial Profession • www.actuaries.org.uk

Uses of DSM to support risk and capital management processes

- Regulatory requirement
- Realistic reporting / ICA
- Firms exposed to a wider range of risk drivers
- Firms operating closer to solvency thresholds
- Competitive advantage
- Early warnings of surprises / reaction to surprises
- Risks more actively managed

Key drivers for change

- External experience
- Management pressure
  - Timeliness
  - Accuracy
  - Understanding
- Investor demands
- Part of a wider software implementation
- … and Solvency II

Key design considerations

Design must balance many aspects:

- Supply of resource and particular skill sets
- Development cost/effort v ongoing maintenance in BAU
- Flexibility v robustness and control v cost
- Data quality and availability
- ETL as outsourced, co-developed, or interface-driven
- Public Cloud, Private Cloud, or in-house grid infrastructure
- Capital aggregation and reporting options

© 2010 The Actuarial Profession • www.actuaries.org.uk

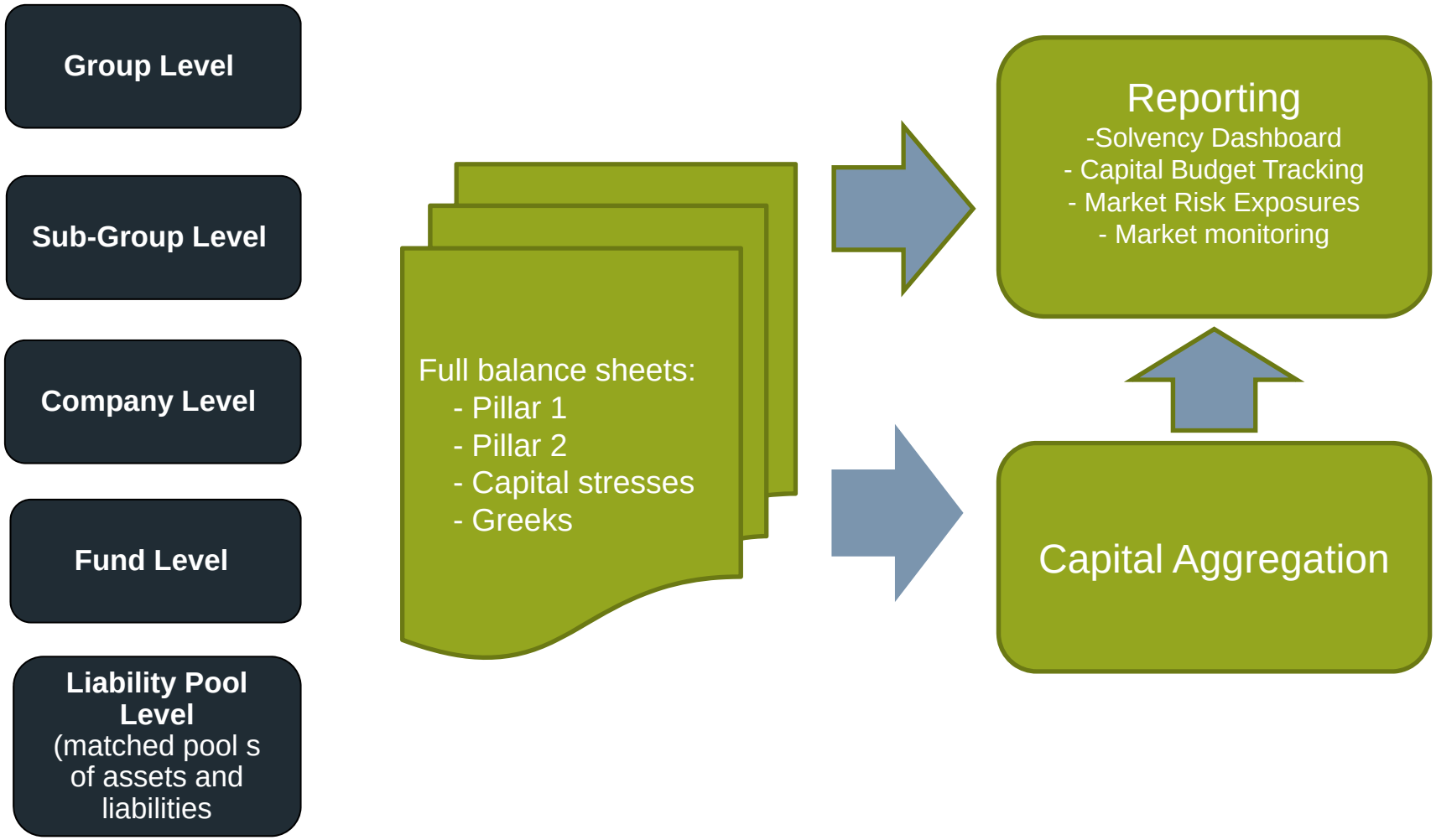
The Actuarial Profession
making financial sense of the future

Implementing Daily Solvency Monitoring

Example output

© 2010 The Actuarial Profession • www.actuaries.org.uk

Core daily output



© 2010 The Actuarial Profession • www.actuaries.org.uk

Daily solvency dashboard report - example

Available Capital - Pillar X
Assets:
- Participations
- Equities
- Gilts
- Corporate bonds
- Properties
- Derivatives
- Collective investments
- Other investments
- Deferred Tax
- Value of reinsurance recovery
- Intangible Assets
- Other Assets
Total
Liabilities:
- Gross premium reserve
- Unit reserve
- Sterling reserve
- Asset share
- Cost of guarantees (cash)
- GAO
- MEP
- Guarantee charges
- Value mgt actions
- Planned enhancements - policyholder
- Manual reserves
- Contingent loan
- Stocklending
- Illiquidity premium (Pillar 2)
- Other liabilities
- Risk margin
Total

Entity	Fund	Total
XXX	With-Profit Fund	
Available Capital		
SII - Pillar 1		**33,670**
- Tier 1		25,000
- Tier 2		6,000
- Tier 3		2,670
SII - Pillar 2		**29,900**
- Tier 1		24,000
- Tier 2		5,000
- Tier 3		900
Required Capital		
- MCR		10,000
- SCR (standard formula)		20,000
- SCR (internal model)		21,000
- OCR		22,000
- Internal Capital Policy (MCR)		18,000
- Internal Capital Policy (SCR - SF)		26,000
- Internal Capital Policy (SCR - IM)		27,300
- Internal Capital Policy (OCR)		26,400
Capital Coverage		
- MCR (Tier 1 ratio)		250.0%
- MCR (Total ratio)		336.7%
- SCR SF (Tier 1 ratio)		96.2%
- SCR SF (Tier 1+2 ratio)		119.2%
- SCR SF (Total ratio)		168.4%
- SCR IM (Tier 1 ratio)		91.6%
- SCR IM (Tier 1+2 ratio)		113.6%
- SCR IM (Total ratio)		123.3%
- OCR (Total ratio)		135.9%
- ICP MCR (Total ratio)		187.1%
- ICP SCR - SF (Total ratio)		129.5%
- ICP SCR - IM (Total ratio)		123.3%
- ICP OCR (Total ratio)		113.3%
- ICP Biting Metric		OCR

Required Capital / Capital Budget	
	Capital Metric X
Market Risk	
- Interest	4,000
- Equity	8,000
- Property	1,000
- Alternatives	-
- Swaps	-
- Currency	2,000
- Credit spreads	4,000
- Illiquidity	4,000
- Inflation	-
Other Market Impacted Risks	
- Longevity	3,300
- Persistency	2,100
Other Risks	
- Total	4,150
Total (gross)	32,550
- Diversification	- 12,550
Total (net)	20,000

Note: Numbers are purely illustrative

© 2010 The Actuarial Profession • www.actuaries.org.uk

Daily market risk exposures report - example

Entity	Fund	Fund Total					
XXX	With-Profit Fund	Δ Liabilities	Δ Assets	Δ NAV	Amber Threshold	Red Threshold	Status
1. Market Risk							
1.1. Equities (Down)		-5,000	-6,000	-1,000	5,000	10,000	GREEN
1.2. Equities (Up)		3,000	4,000	1,000	5,000	10,000	GREEN
2.1. Properties (Down)		-1,200	-700	500	850	1,700	GREEN
2.2. Properties (Up)		1,500	800	-700	850	1,700	GREEN
3.1. Hedge Funds (Down)		-3,000	-1,000	2,000	1,000	1,500	RED
3.2. Hedge Funds (Up)		2,000	300	-1,700	1,000	1,500	RED
4.1. Growth Assets (Down)		-9,000	-8,000	1,000	7,000	14,000	GREEN
4.2. Growth Assets (Up)		8,700	7,400	-1,300	7,000	14,000	GREEN
5.1. Equity Volatilities (Up)		1,500	700	-800	500	750	RED
6.1. Nominal Interest Rates (Low Stress Down)		12,000	8,700	-3,300	3,000	6,000	AMBER
6.1.1. GBP		9,300	3,300	-6,000	1,000	2,000	RED
6.1.2. EURO		2,200	1,900	-300	1,000	2,000	GREEN
6.1.3. USD		1,000	3,400	2,400	1,000	2,000	RED
7.1. Nominal Interest Rates (High Stress Down)		20,000	18,000	-2,000	5,000	10,000	GREEN
8.1. Nominal Interest Rates (High Stress Up)		-22,000	-17,000	5,000	5,000	10,000	GREEN
9.1. Interest Rate Volatilities (Up)		450	200	-250	300	400	GREEN
10.1. Inflation (Up)		150	90	-60	100	200	GREEN
11.1. Illiquidity (Down)		-600	0	600	400	750	AMBER
12.1. Credit Spreads (Up)		-4,300	-5,200	-900	500	1,000	AMBER

Note: Numbers are purely illustrative

© 2010 The Actuarial Profession • www.actuaries.org.uk

Validation reporting

- Daily – market data validation report
- Daily – run validation report
- Daily – market monitoring report
- Quarterly – performance of new calibration
  - Replicated values v full MG-ALFA cash-flow ALM
  - Breakdown into product and cash-flow type dimensions
- Quarterly – performance of prior calibration
  - DSM estimates on prior calibration v full MG-ALFA cash-flow ALM

© 2010 The Actuarial Profession • www.actuaries.org.uk

The Actuarial Profession
making financial sense of the future

Implementing Daily Solvency Monitoring

Design and operation

© 2010 The Actuarial Profession • www.actuaries.org.uk

Paradigm shifts

Enterprise Scale

- Monitoring across the group corporate structure and providing MI at the different levels of granularity
- Impact of all market risks to be monitored
- Full balance sheet, SII available and required capital
- Stress and scenario analysis
- Extensible to MCEV and IFRS metrics

Speed

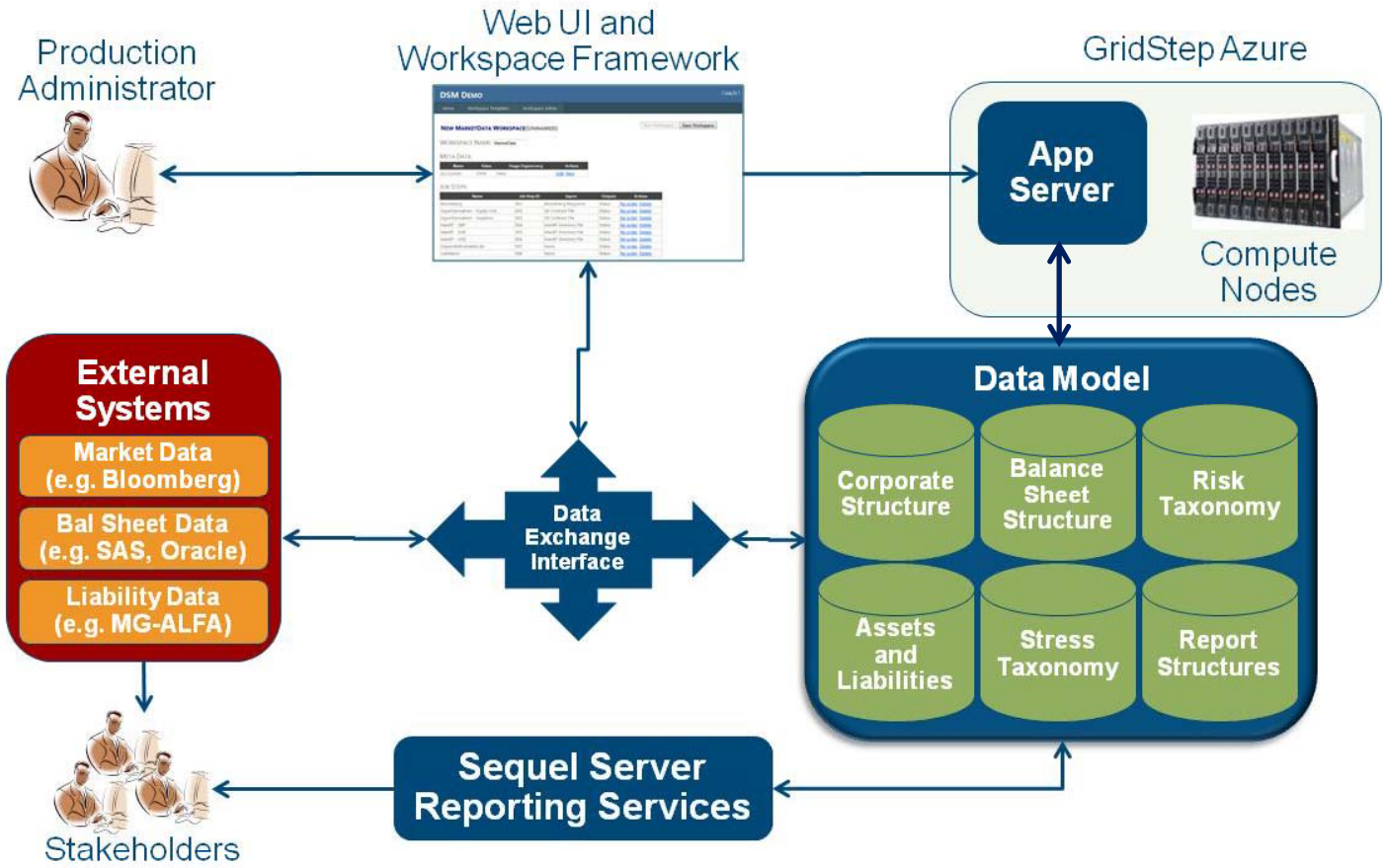
- Overnight recalculation
- 90 valuation scenarios - so far!
- Highly efficient valuation software and RP approach delivers results over 200X faster than full cash-flow ALM
- Flexible provision of multiple compute nodes
- Updated MI disseminated for start of business each day

Automation

- Daily process fully automated – no manual intervention
- Market data pulled from external data vendors
- Runs commence automatically on fulfilment of all dependencies

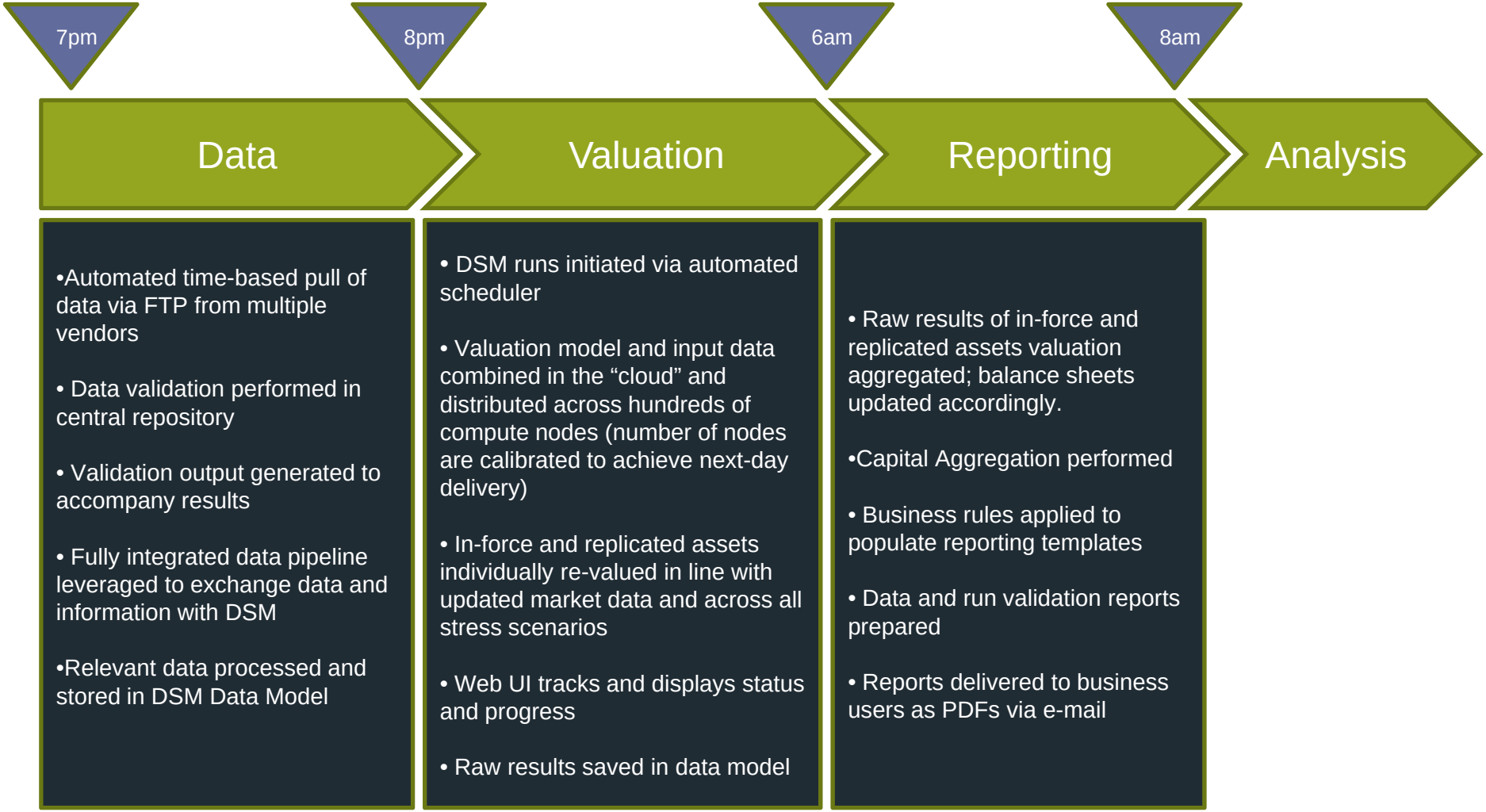
© 2010 The Actuarial Profession • www.actuaries.org.uk

DSM system overview



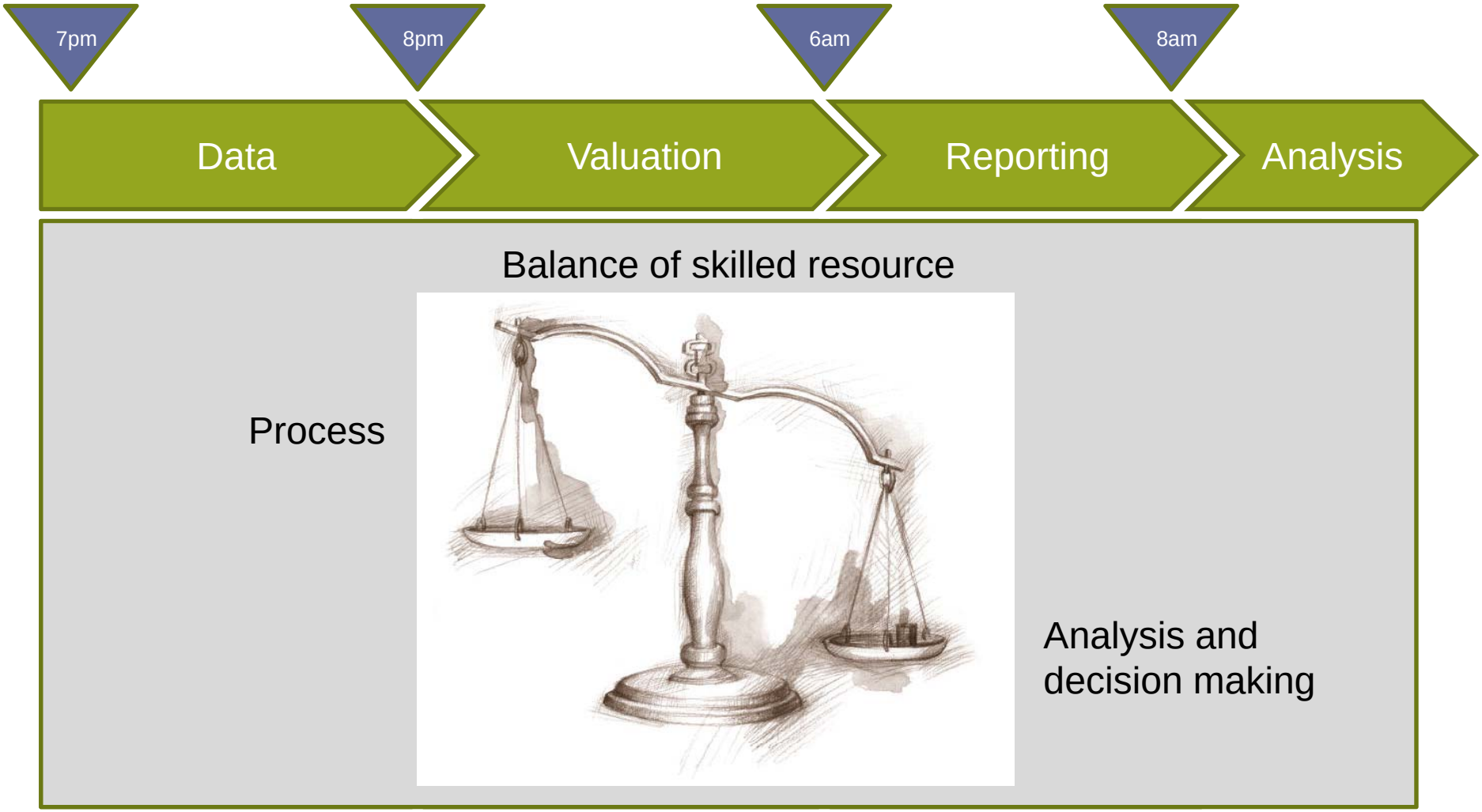
© 2010 The Actuarial Profession • www.actuaries.org.uk

Daily process overview



© 2010 The Actuarial Profession • www.actuaries.org.uk

Daily process overview



© 2010 The Actuarial Profession • www.actuaries.org.uk

Risk factors in DSM

Updated daily

Dynamic Risk Factors

- Equity market level
- Property market level
- Exchange rates
- Risk-free yield curves
- Illiquidity premiums
- Equity volatilities
- Interest rate volatilities
- Credit spreads
- Inflation rates

Updated monthly / quarterly

Semi-Static Risk Factors

- Concentration
- Counter-party credit
- Life underwriting risks
  - Mortality / longevity
  - Morbidity
  - Lapses
  - Expenses
- Operational

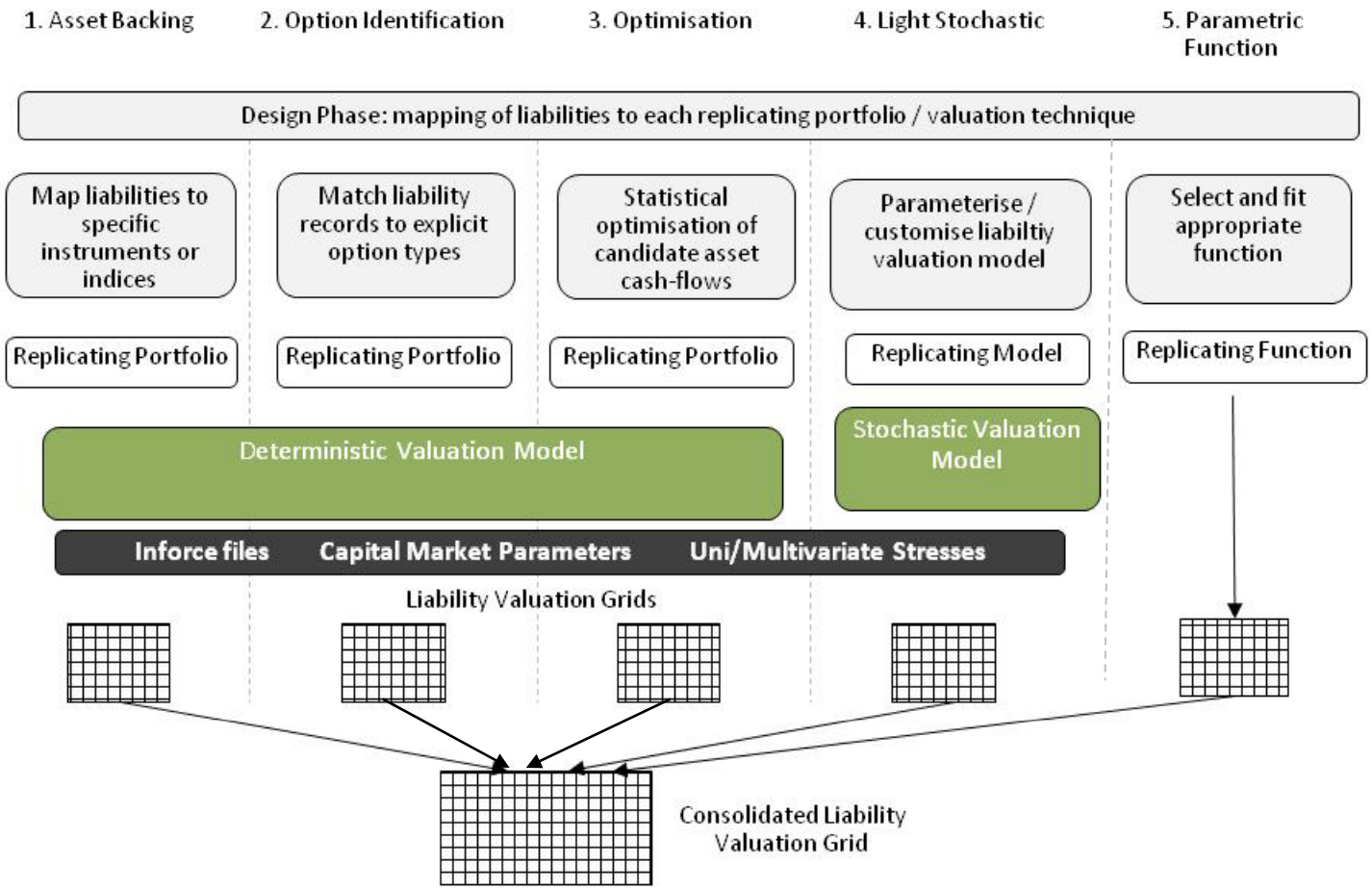
© 2010 The Actuarial Profession • www.actuaries.org.uk

Asset valuation

- Milliman proprietary code based upon industry standard formulae
- Individual security level valuation with look-through of collectives
- Very broad asset type coverage (still subject to expansion)
- Extremely fast

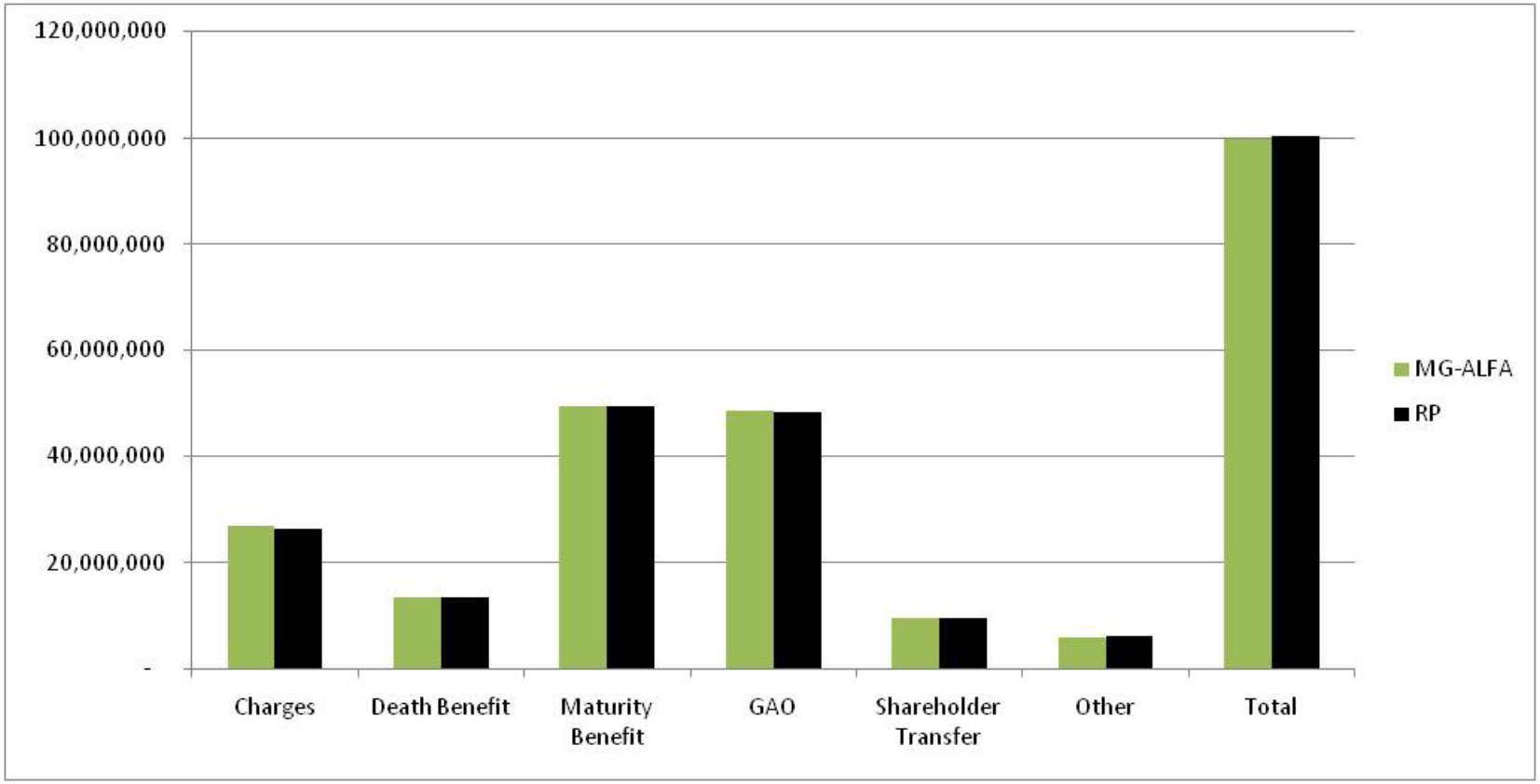
Bond Futures
Callable Bonds
Cash
CDO / CMO
Certificates of Deposit
Collective Investment Funds
Commercial Papers
Credit Default Swaps
Currency Forwards
Currency Swaps
Direct Properties
Equity Options
Fixed Rate Bonds
Floating Rate Bonds
GAO-Style Compound Options
Hedge Funds
Index Futures
Indexed Linked Bonds
Interest Rate Swaps
Listed Equities
Listed Property Funds
State / Municipal Bonds
Swaptions
Term Deposits
Total Return Swaps
Treasury Gilts
Treasury Index Linked Bonds
Two Asset Exchange Options
Unlisted Equities
Year-on-Year Inflation Swaps
Zero Coupon Bonds
Zero Inflation Swaps

Liability estimation – RP techniques

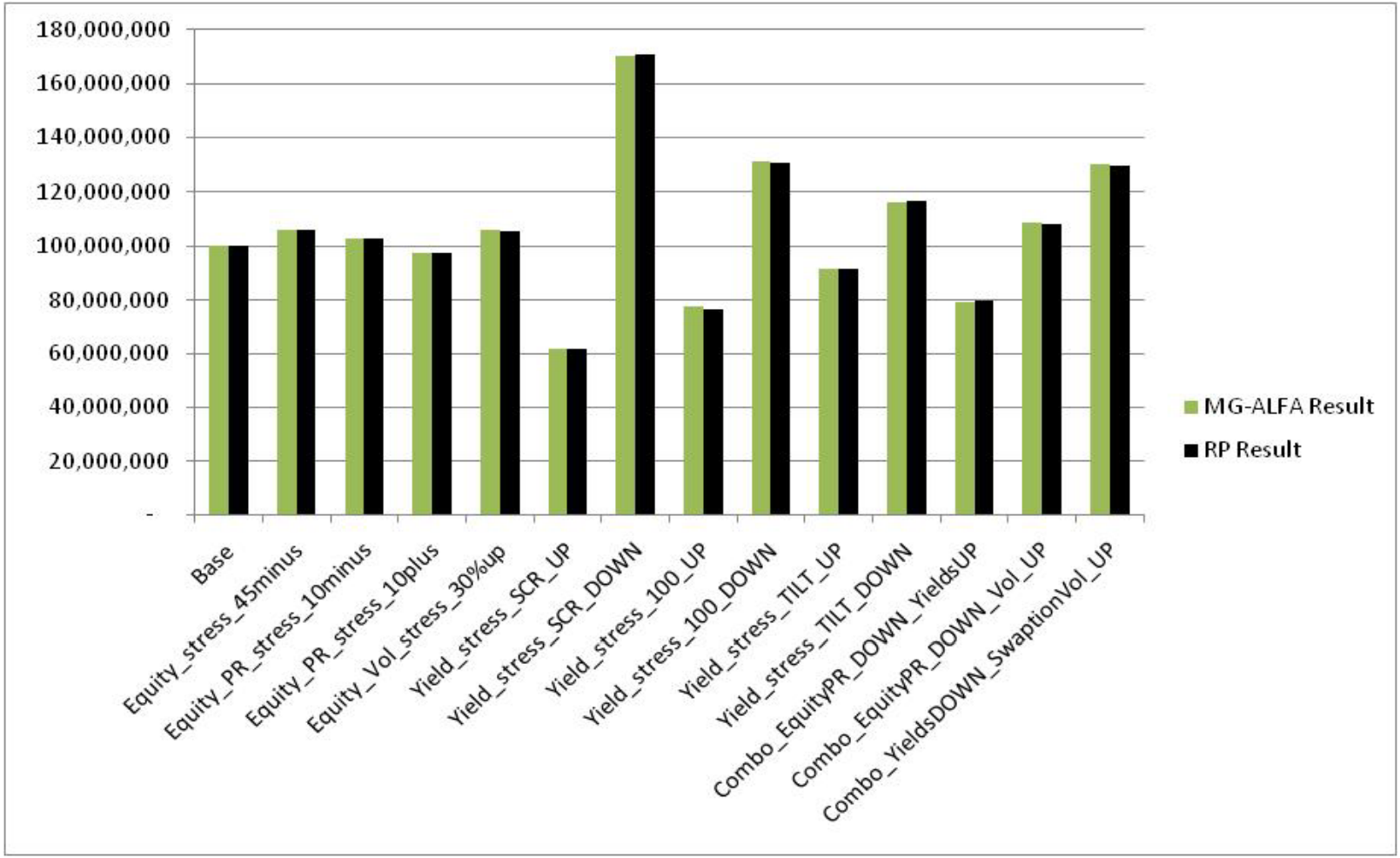


© 2010 The Actuarial Profession • www.actuaries.org.uk

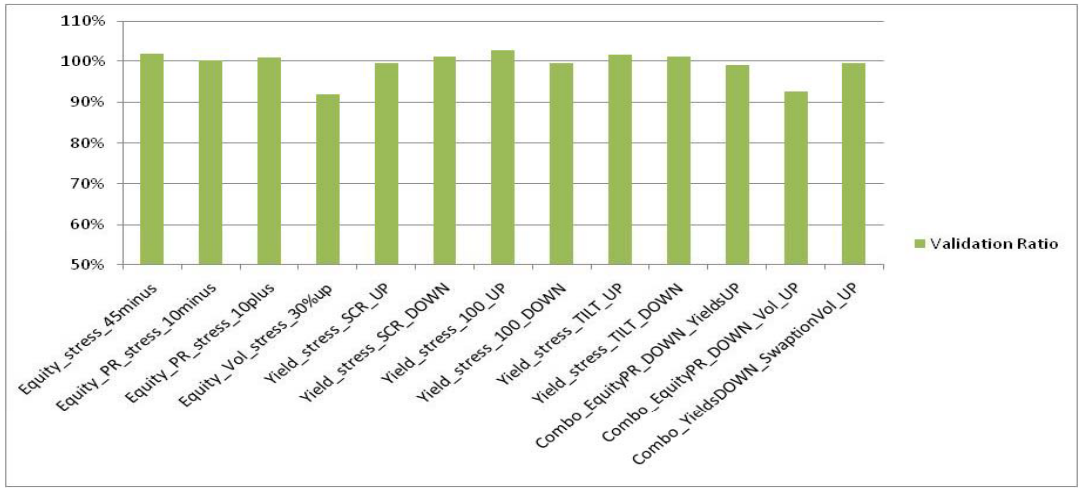
Illustrative results – base balance sheet



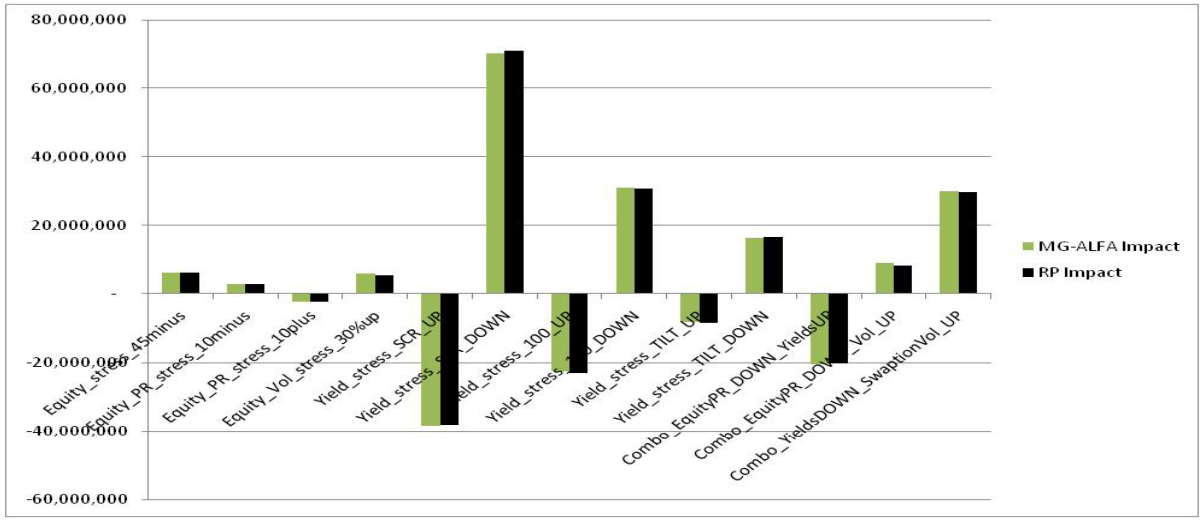
Illustrative results – stressed balance sheets



Illustrative results - stress impacts



Validation ratio = RP stress impact / MG-ALFA stress impact



The Actuarial Profession
making financial sense of the future

Implementing Daily Solvency Monitoring

Challenges and solutions

© 2010 The Actuarial Profession • www.actuaries.org.uk

Delivery challenges

- Clearly defined requirements
- Access to data
- Managing dependency with delivery of “truth model”
- Stakeholder engagement
- Acceptance criteria / tolerances
- Keep to scope

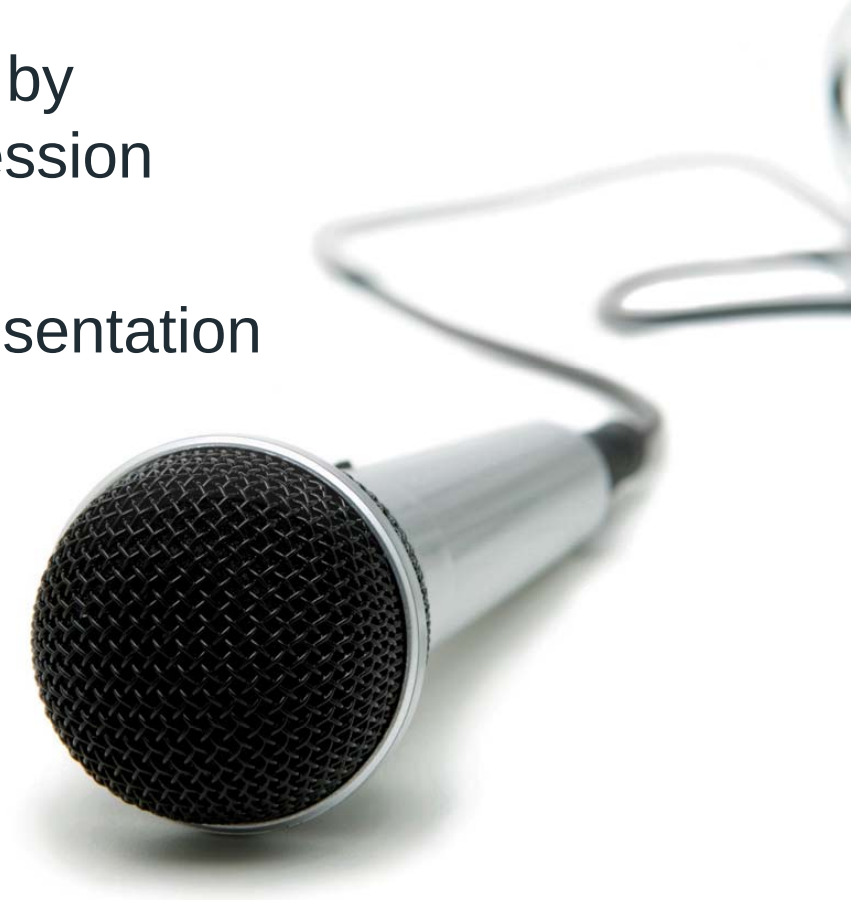
Technical challenges

- Inter valuation changes
- Non-market risks
- Tail dependencies
- Stress and scenario testing
- Management actions

Questions or comments?

Expressions of individual views by members of The Actuarial Profession and its staff are encouraged.

The views expressed in this presentation are those of the presenter.



© 2010 The Actuarial Profession • www.actuaries.org.uk