Risk Based Capital and Pricing for Reverse Mortgages Revisited

David Sun and Michael Sherris
Australian School of Business, University of New South Wales

Background

- Funding retirement from savings – housing a major asset

- Increasing use of reverse mortgages and other equity release schemes

- Regulatory and risk requirements

- Credit crisis
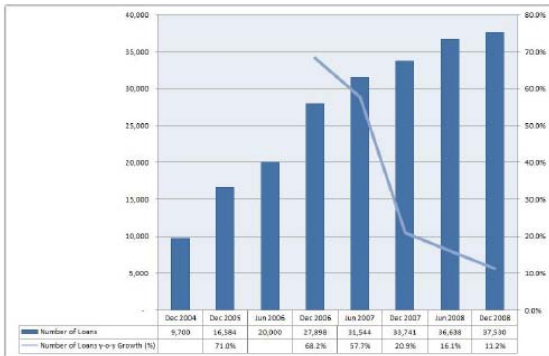
Australian Reverse Mortgage Market

Figure 1: Number of reverse mortgage loans on issue for Australia: Source SEQUAL
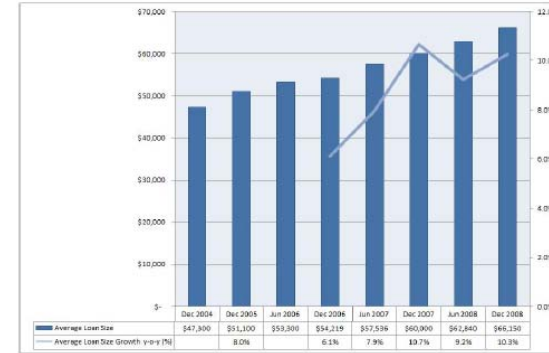

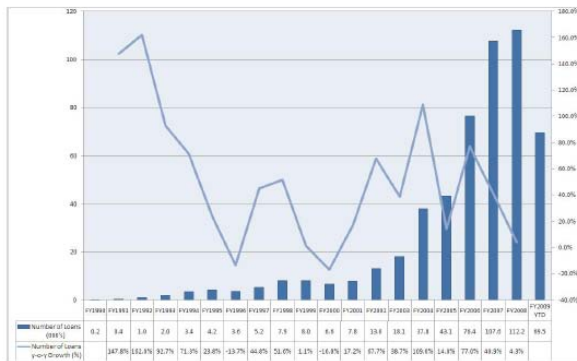Figure 3: Average Reverse Mortgage Loan Size for Australia: Source SEQUAL

Figure 6: US Reverse Mortgage Market. Source: National Reverse Mortgage Lenders Association

Market developing – similar factors to US market

Model for Risk and Pricing

• VAR (Vector Autoregressive, Multivariate)

$$\widehat{y_t} = \widehat{W} + \widehat{A_1}y_{t-1} + \widehat{A_2}y_{t-2} + \varepsilon$$

- dMR: Difference in standard variable mortgage rate
- $RlnH$: Return for Real Log Sydney House Prices
- $LnCPI$: Log change in NSW CPI Index
- $RlnR$: Return for Real Sydney Rental Index

$$y_t = \begin{pmatrix} dMR_t \\ RlnH_t \\ LnCPI_t \\ RlnR_t \end{pmatrix}$$

$$\widehat{W} = \begin{pmatrix} -0.0012 \\ -0.0042 \\ 0.0041 \\ 0.0019 \end{pmatrix}$$

$$\widehat{A_1} = \begin{pmatrix} 0.1958 & 0.0273 & -0.0235 & -0.0030 \\ -1.4206 & 0.2838 & -0.0298 & 0.0572 \\ 0.5124 & 0.0466 & 0.3191 & -0.0053 \\ -0.6814 & -0.0459 & 0.0095 & -0.2281 \end{pmatrix}$$

$$\widehat{A_2} = \begin{pmatrix} 0.4023 & 0.0488 & 0.0444 & -0.0006 \\ -0.8355 & 0.3898 & 0.6724 & 0.0239 \\ 0.1083 & 0.0123 & 0.2004 & -0.0049 \\ 1.0084 & -0.2407 & 0.2440 & 0.1000 \end{pmatrix}$$

Data - Model for Risk and Pricing

Data Period	Mar-1982 to Dec-2008	
Variable	Source	Series Name
Standard Variable Mortgage Rate	Reserve Bank of Australia	F05
NSW CPI	Australian Bureau of Statistics(ABS)	6401.01
Sydney House Median Rental Index	Real Estate Institute of Australia	REMF5
Female Mortality Rates	ABS	Life Tables 2005-2007
US Termination Rates	Szymanoski (2007)	N/A

Economic variables jointly modelled
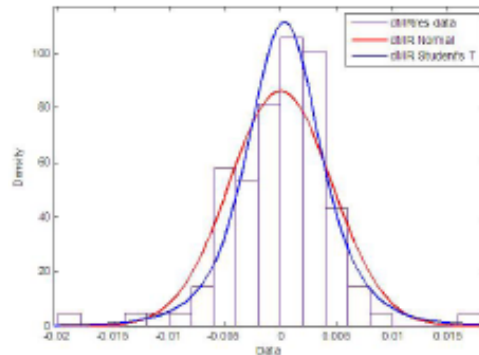Survival curve for termination and mortality rates
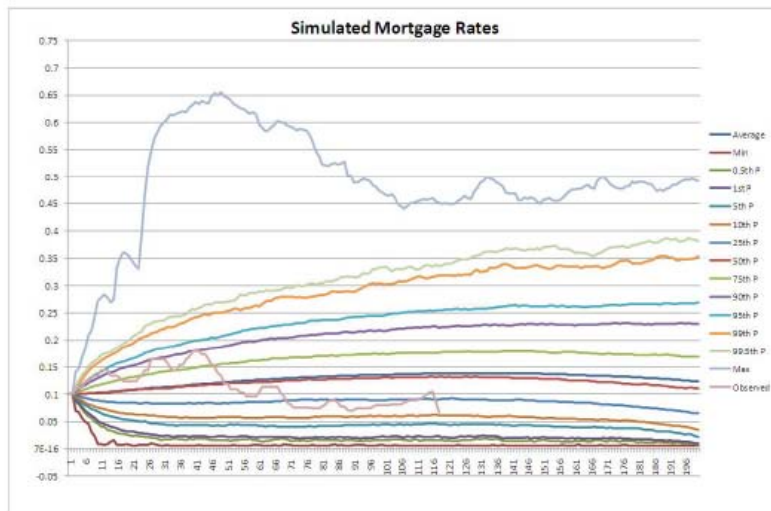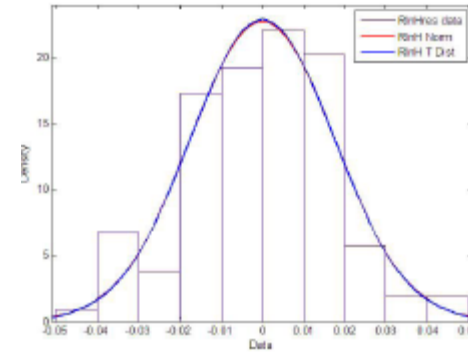

(a) Simulated Mortgage Rates
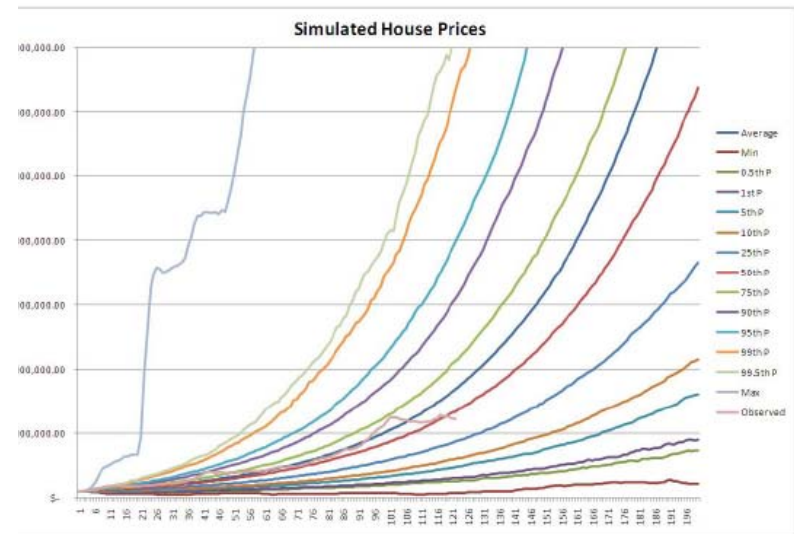
(b) Simulated House Prices
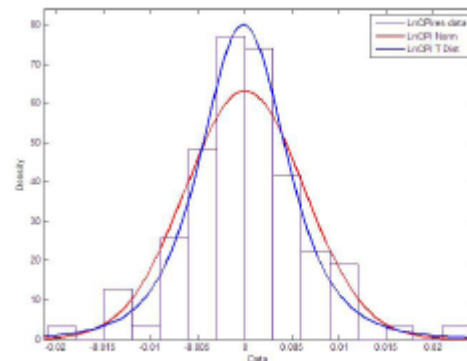
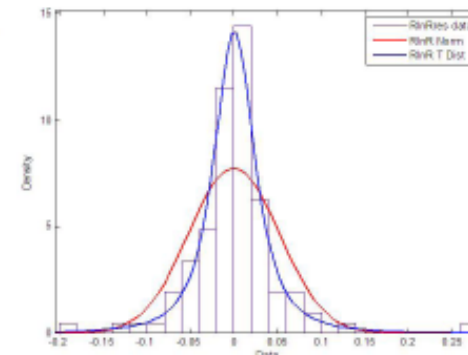# Model Fit – t versus Gaussian

t-distribution
improves fit

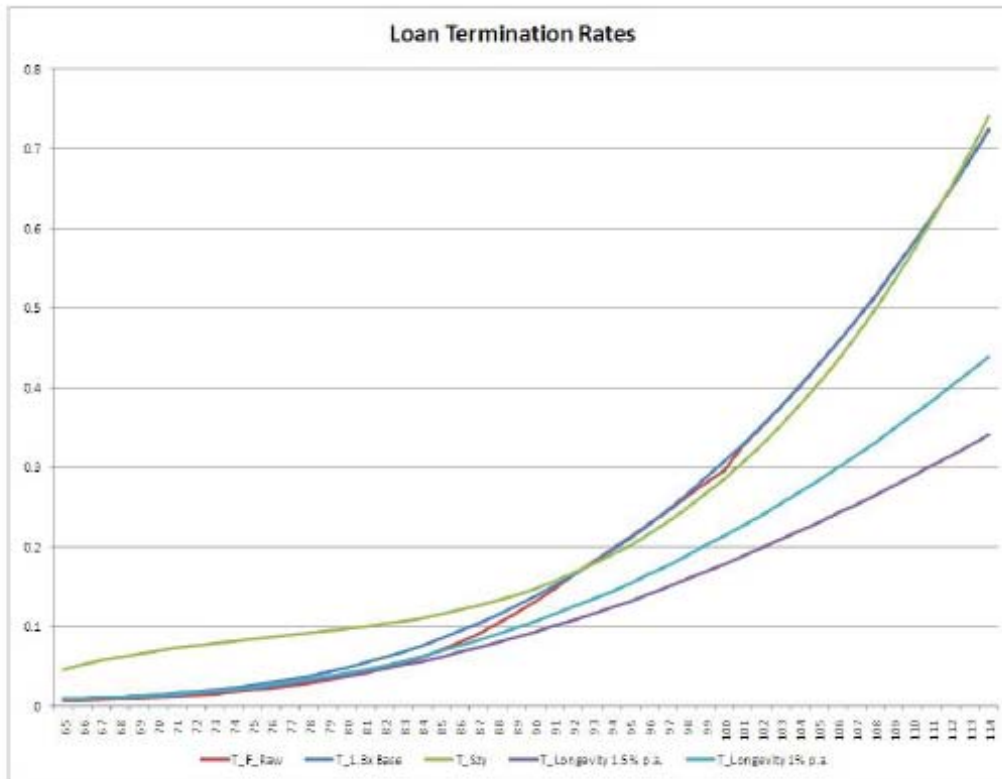(b) dMR Residuals PDF

(d) $RlnH$ Residuals PDF

(f) $LnCPI$ Residuals PDF

(h) $RlnR$ Residuals PDF
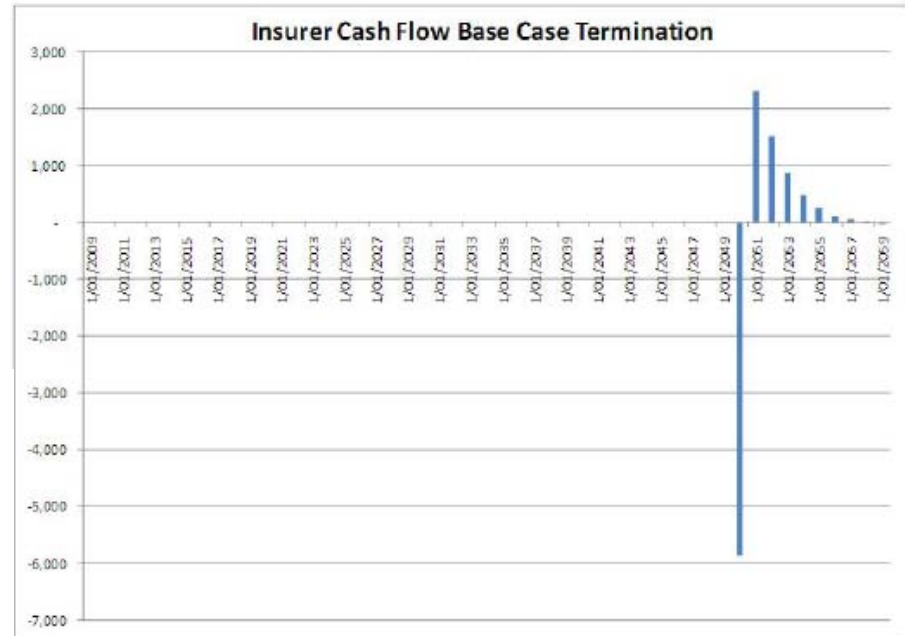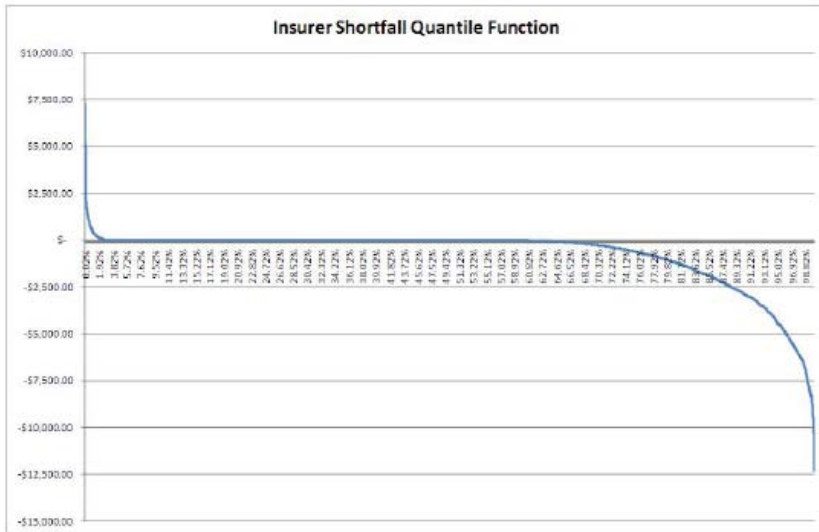
Loan Termination rates

Standard assumption 1.3x female mortality

Recent US experience

Mortality improvement impacts termination assumption

Product Cash Flows and Risks

Illustrative risk analysis – loan at age 65, $100,000, Loan to value 15%

Insurer Cash Flow Base Case Termination

Insurer Shortfall Quantile Function

Risk of default or insolvency when house price exceeds loan

Risk measures

Risk Measures (Base Case Termination and Investment Return)
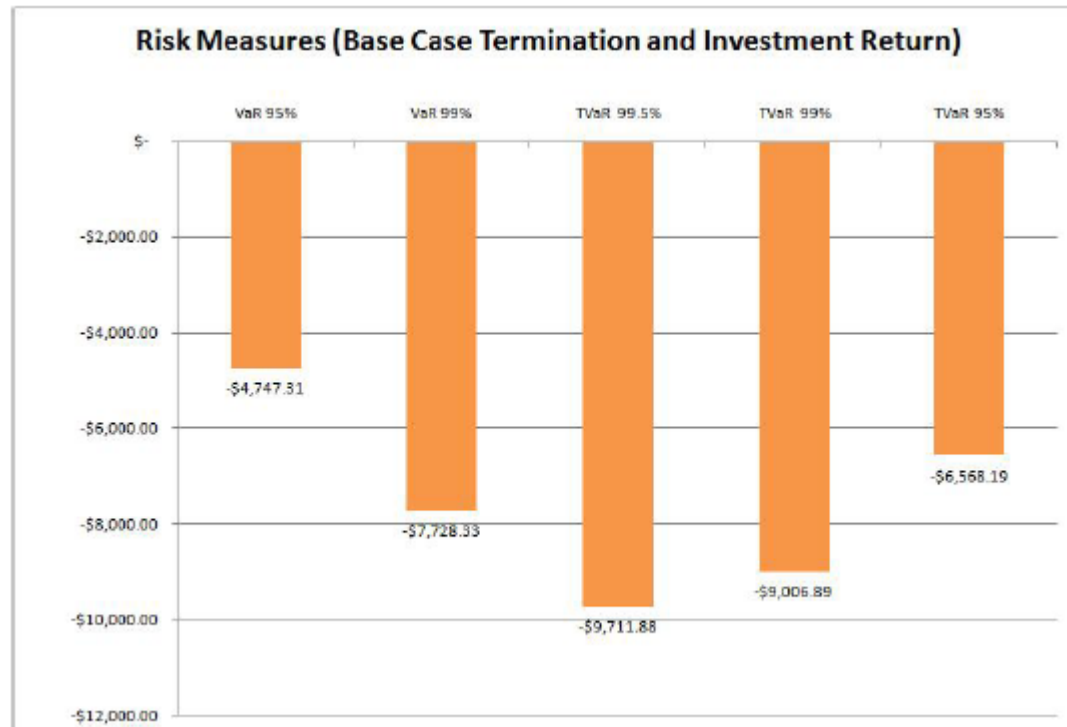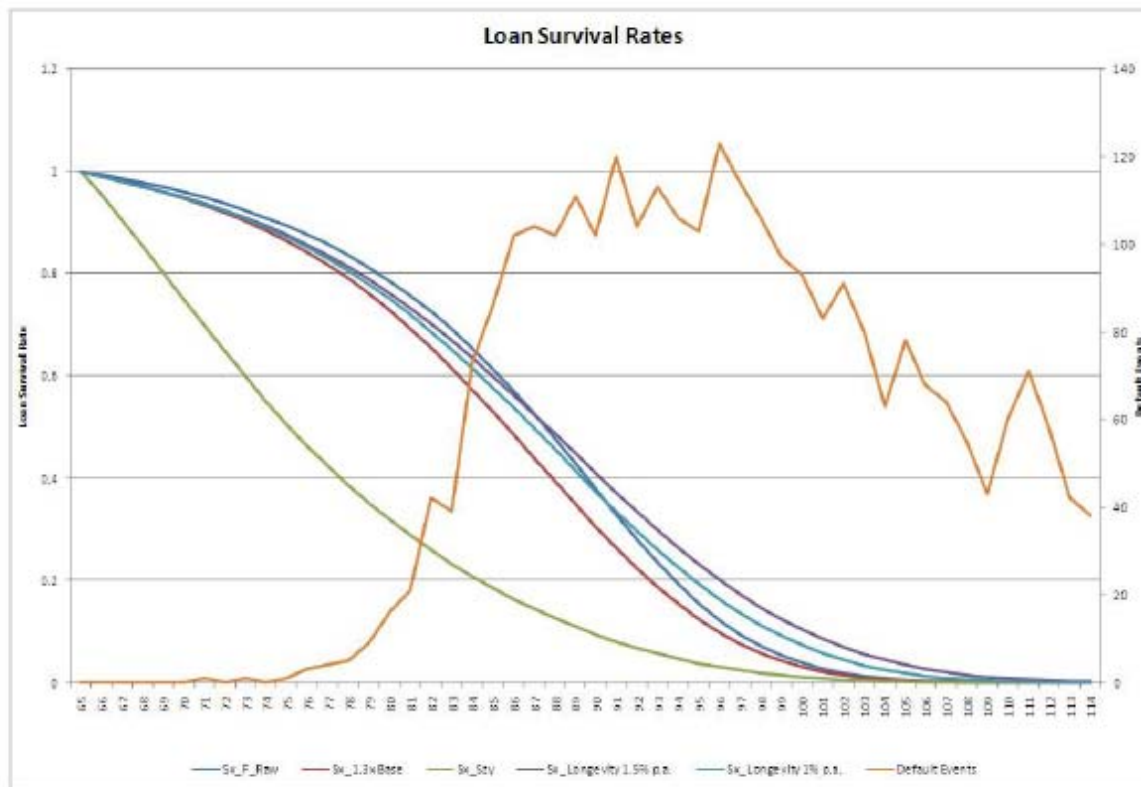
VaR and TVaR most common financial risk measures

Default risk

Most defaults
occur at later
ages

Earlier
terminations
reduce default
risk

Spread risk

Spread between interest rate and mortgage rate is critical

Credit crisis highlighted this risk

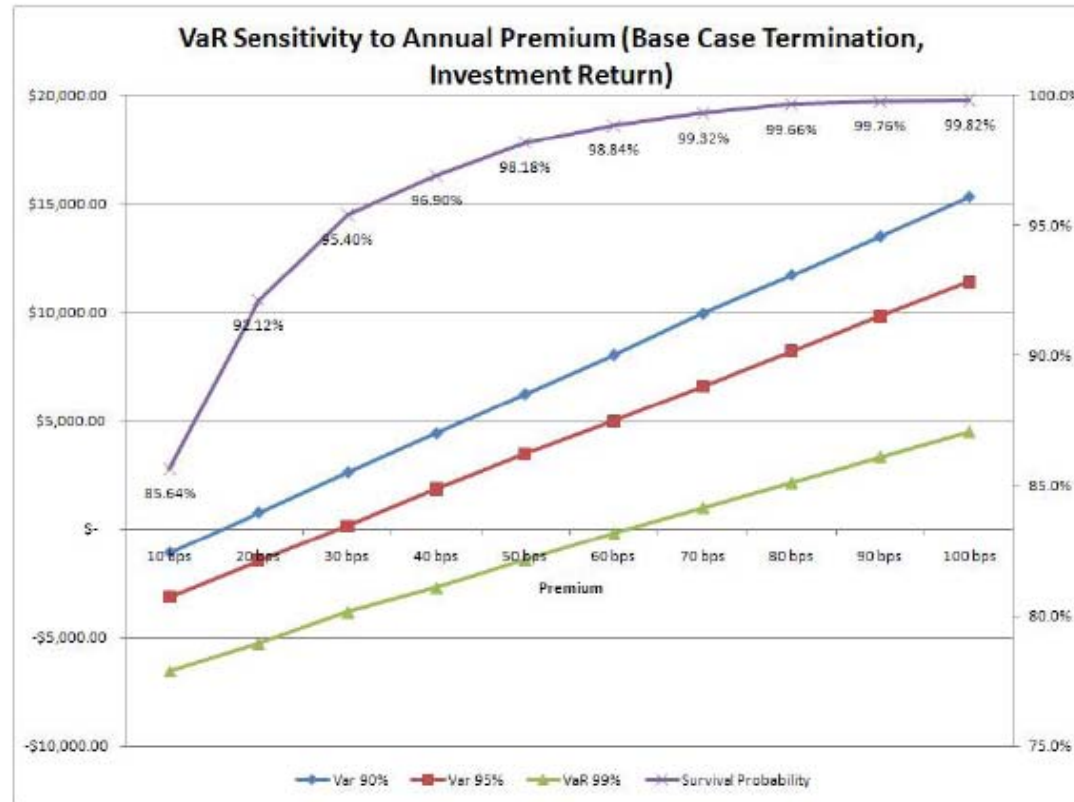# Sensitivity to Termination
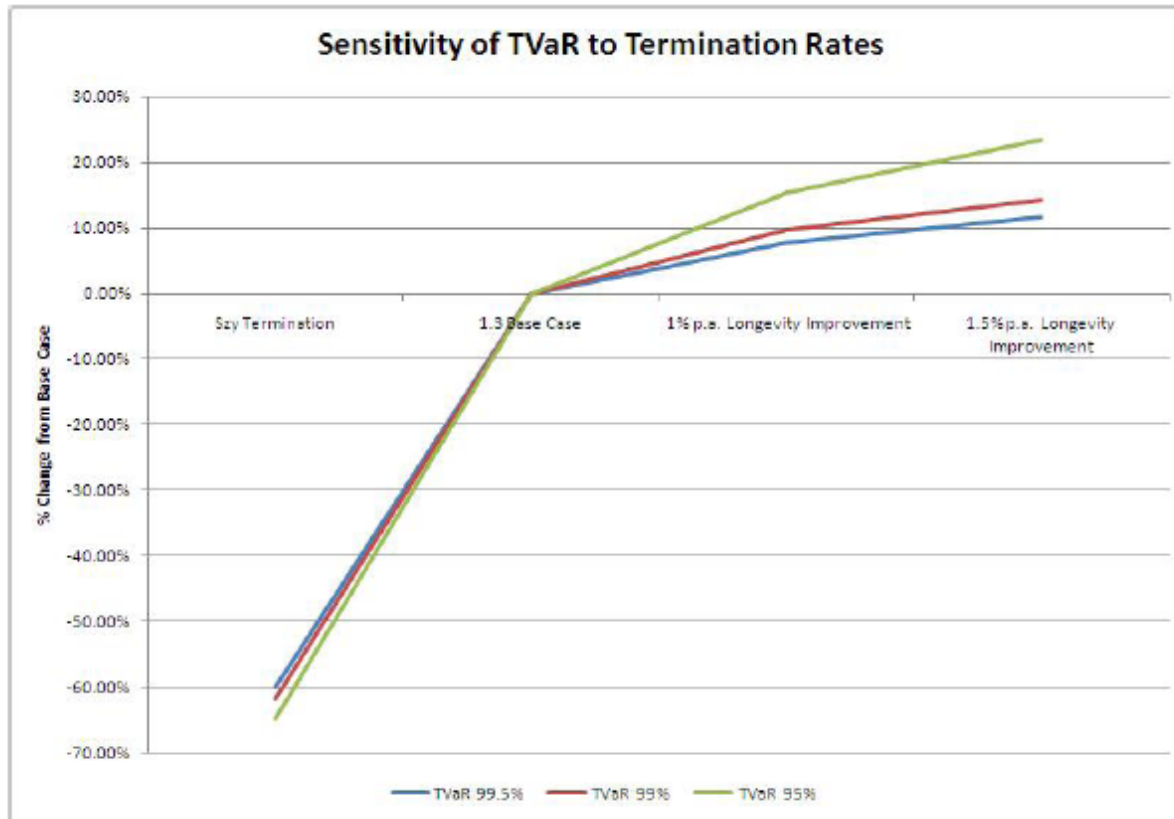
Termination rates are important

Little is known about termination experience

Sensitivity to Premium

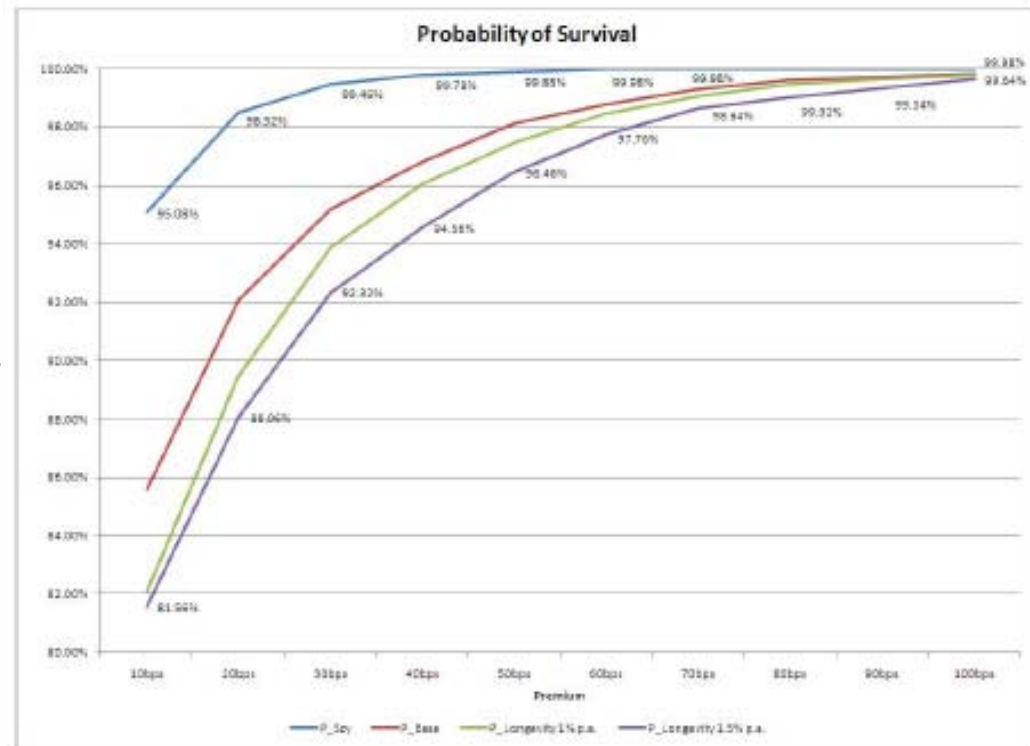Market pricing is critical to a profitable product and to the risk exposure

VaR Sensitivity to Annual Premium (Base Case Termination, Investment Return)

Sensitivity to Termination/Longevity

Premiums should reflect termination experience

Risk of misestimating

Conclusions

- Credit crisis has focussed attention on credit risk and margins

- Reverse mortgages growing in Australia (and internationally)

- Critical need for understanding of risks and risk management

- Models for market variables and termination/longevity and quantification of risks

Discussion and Q&A

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- **Longevity 6: 6th International Longevity Risk and Capital Markets Solutions Conference hosted by Australian Institute of Population Ageing Research, UNSW, 9-10 September 2010, Swiss Grande Bondi Beach, Sydney.** This is the major international conference bringing together leading international industry and academic minds as well as policy makers to meet and discuss the assessment of longevity risk, the market and government developments and responses needed by pension funds and insurance companies to manage this risk. Key themes are "Reinsurance and Financial Markets Solutions" and "Government Role, Public and Private Market Solutions".