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INSIGHTS

Reverse Mortgages
Risks and Costs of the NNEG

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AGENDA

- Product Types
- Option Characteristics
- Asset Models
- Assessing the “No Negative Equity Guarantee”
- Costing the NNEG
- Miscellaneous Aspects

Before We Begin…

- Peer Review
  - This presentation has been peer reviewed by Dion Russell of Tillinghast
  - However, the author is responsible for any errors that may remain
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Equity Release Product Types

- Reverse mortgages (RM)
  - Most common form of product in Australia at present
  - Interest roll-up mortgage
  - Provider usually offers a “no negative equity guarantee” (NNEG)

- Shared appreciation mortgages (SAM)
  - Bank of Scotland introduced in the UK in mid 90s
  - Media/ASIC commentary suggests that two SAMs are close to launch here
  - The provider takes a geared equity interest in the property
  - Homeowner pays no interest

- Home reversion schemes (not the focus of today)
  - Limited presence in Australia
  - House is “sold” upfront to a financer (precise sale structure varies)
  - Sale price is a substantial discount (varying by age) to property value
  - Homeowner retains a right of abode for their lifetime
  - Homeowner pays no interest

Key Features of RM with a NNEG

- Variable or fixed rates of interest
- Interest is rolled-up and is paid at maturity
- Lender lends up to a maximum initial loan-to-value ratio ("LVR") which varies by age e.g. 20% age 65, 30% age 75
- Duration of mortgage is inherently uncertain - death and "disability" will be major drivers

Property Price > Principal + Interest ?	Lender Receives
Yes	Principal + Rolled-Up Interest
No	Proceeds of Property's Sale

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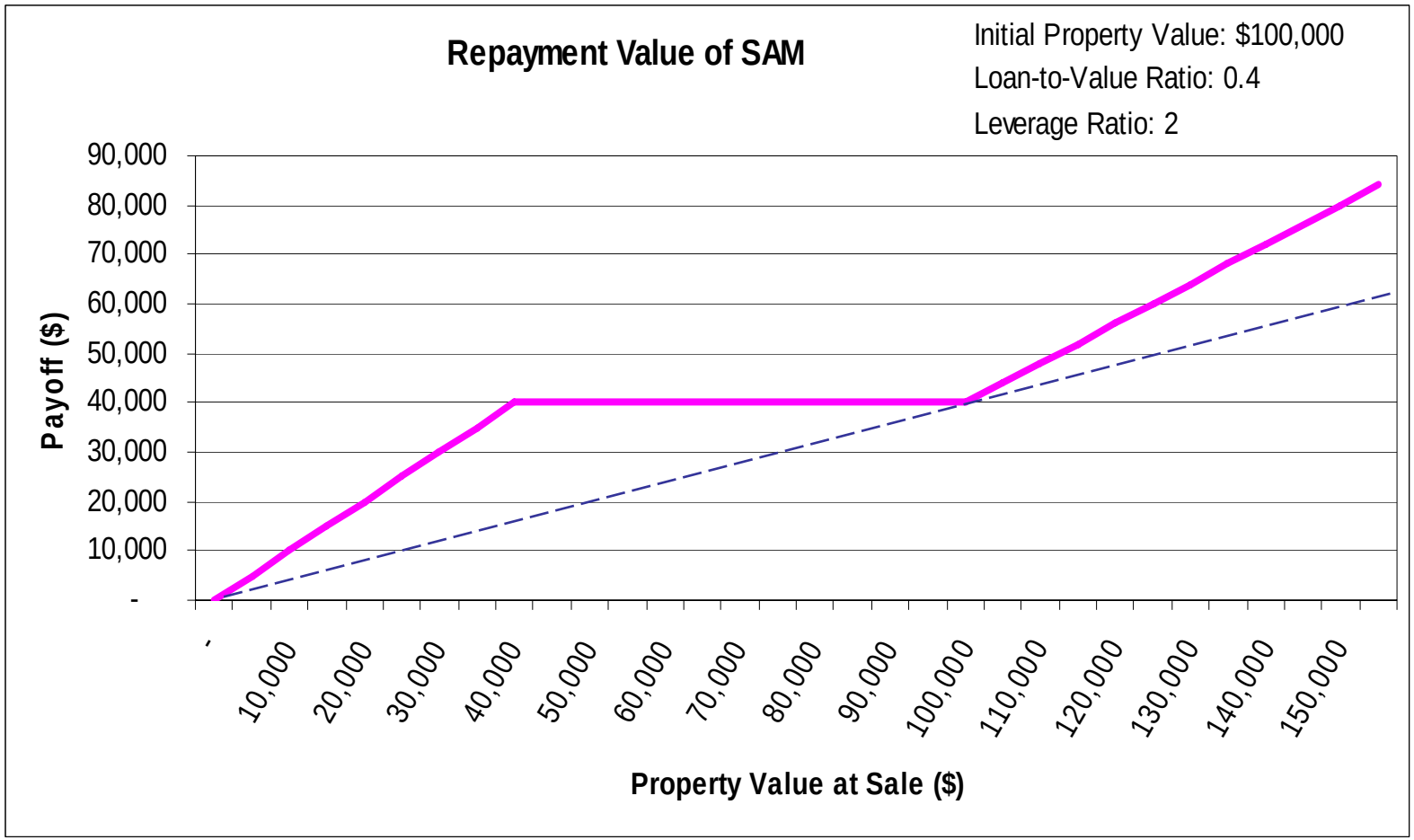
Key Features of SAM

- Provider advances up to a maximum initial “loan”-to-value ratio varying by age
- Duration of mortgage is inherently uncertain - death and “disability” will again be major drivers (in retiree sector)
- The provider has a geared participation in any capital gain (“geared upside”)
- The provider also has downside protection of part/all of principal originally advanced but on a non-recourse basis
- The pay-off to the SAM provider is very different from a RM

Option Characteristics of a SAM



Original LVR x Value of Underlying Property

Total balance owed to SAM provider

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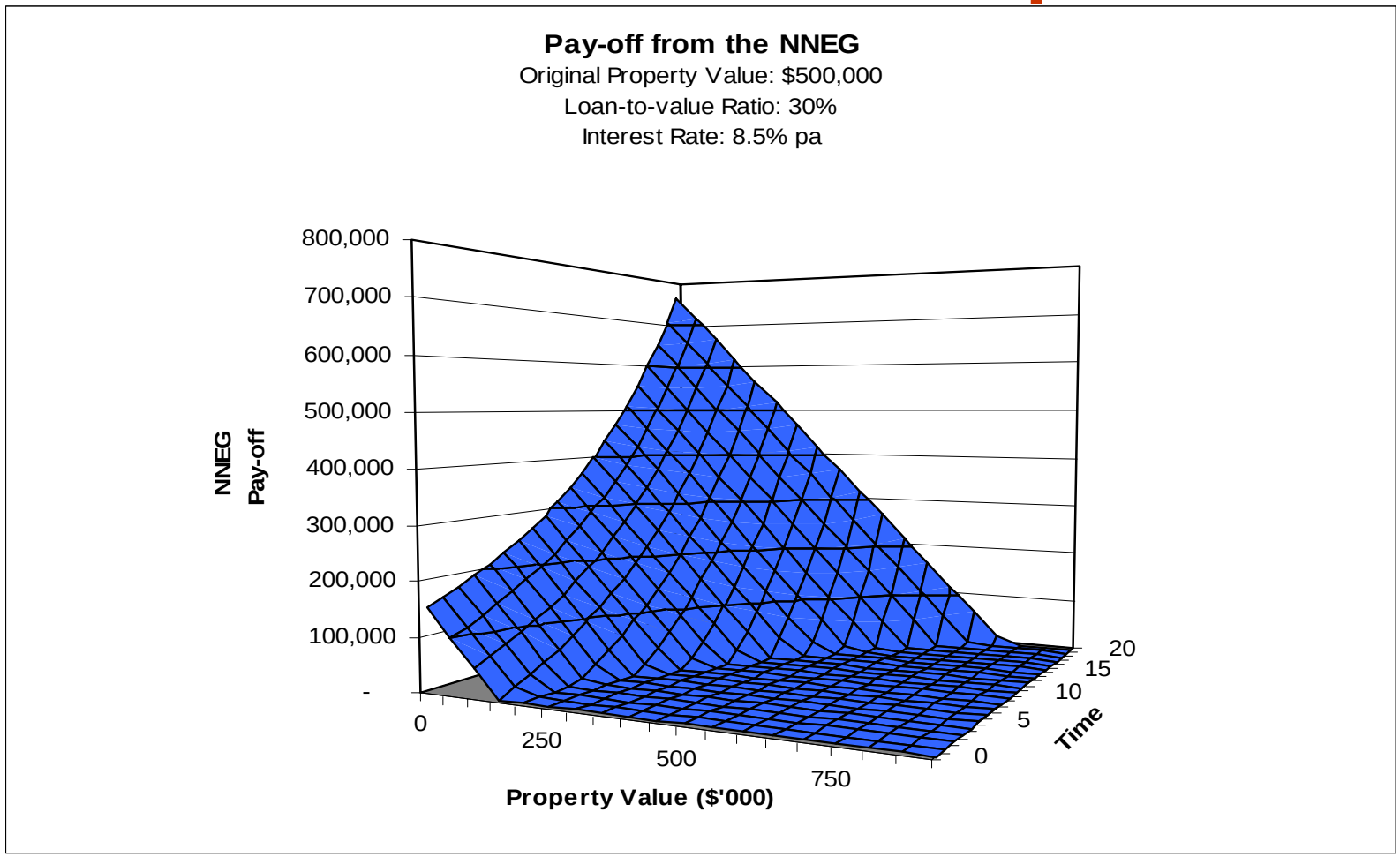
Deconstructing a RM

Property Price > Principal + Interest ?	Lender Receives
Yes	Principal + Rolled-Up Interest
No	Proceeds of Property's Sale

- A RM with a NNEG is a "package" of two component products
- The first component is an interest roll-up mortgage of uncertain term which always provides for the repayment of principal plus interest
- The second component is a put option sold by the RM provider
  - Put option pay-off = Max [0 , (Principal + Interest) – Property Value]
  - The option's pay-off represents an amount owed by the RM provider
  - The put option is also of uncertain term
- The combination of these components provides the lender's pay-off

The NNEG as a Put Option



NNEG Pay-Off = Max [0 , (Principal + Interest) – Property Value]

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Nature of the NNEG Risk

- Designed correctly, a SAM provider does not offer a NNEG guarantee (except where the property value falls below the original advance)
- However, a RM with a NNEG provides a substantive guarantee
- The NNEG is effectively an investment performance guarantee, which is contingent upon property market, interest rates and “longevity”
- “Longevity” here means the propensity to keep the RM running
- Unlike LMI risk, the NNEG risk is a “back-end” risk
- The NNEG is a form of contingent, long term life/disability insurance
- To assess NNEG risk requires a price model for owner-occupied residential property as an asset class – a “house price model”

Asset Model Challenges

- Problems with historical house price series:
  - Limited observations (20 years or so only)
  - Timeliness of reporting (quarterly only, with varying degrees of lag)
  - Impact of quality improvements on transaction data
  - “Median price” indices can be distorted by compositional changes
  - “Repeat sale” indices are likely to have upwards bias for shorter resale periods

- Using last 20 years of price data needs care:
  - Represents a single path of house prices
  - Period of “once in a generation” or even “once in a lifetime” reversion from high interest/inflation rate to low interest/inflation rate environment
  - House price returns of the last 20 years have been “supercharged”
  - Best example of this is a simple regression fit model with a “fitted constant” – excellent model fit but of no practical use as a forecasting model

Asset Model Challenges cont'd

- Asset model structure should be rational from an economic theory perspective not simply an extrapolation of last 20 years' prices:
  - Do house prices conform to traditional "random walk with drift" stock price models?
  - In other words, is the housing market weakly efficient?
  - Even if you think the housing market is weakly efficient, what about the price series which are used to measure the market and to calibrate a model?
  - Should house price models be modelled as a function of underlying economic drivers (e.g. GDP, inflation, interest rates etc)?

- Historical house price data for Australia appears to exhibit a material degree of autocorrelation

- As a consequence, the volatility measured from a single 20 year path of house prices is likely to understate the real expected volatility of the asset class

Asset Model Challenges cont'd

- The presence of autocorrelation in an asset model:
  - Increases the volatility of projected returns compared to the limited history of observable data
  - Gives rise to "runs" of good and bad years in projections, which has been an observed feature of house prices e.g. the "Japan" effect

- The asset model needed for assessing the risk of the NNEG is a model of individual properties, not a model of "the index":
  - Need to develop a view on how the volatility of individual properties compares with the volatility of the index

- The historical price series data implicitly includes the price effects of re-developments, renovations etc:
  - Need to exclude the effects of future capital improvements from the asset model

Residential Property Asset Models

Type of Asset Model	Observations
Mean/Variance	Simple but crude. Risk of extrapolating the past. Assumes that returns between periods are independent
Interest Rate driven	Not my preferred model. Historical price responses to interest rate changes unlikely to apply in the future. “Drift” term may be unresponsive to economic conditions being projected in the model
Inflation driven	A better model (in my view). Greater scope for capturing economic inter-relationships. Less risk of extrapolating the past. More responsive “drift” term.
GDP driven	Same comments as Inflation driven models

Summary of Asset Model Adopted

- A GDP-driven model
- Future growth rates for residential property modelled as a function of:
  - Real GDP
  - Inflation
  - Short interest rates
  - Equity prices
- Model also includes some auto-correlation i.e. the current period's projected growth rate is correlated to some extent with the previous period's growth rate
- Over the longer term, the model exhibits a drift characteristic based on projected nominal GDP (i.e. real GDP plus inflation)
- This does not mean that the average projected return is nominal GDP!

Assessing NNEG Risk

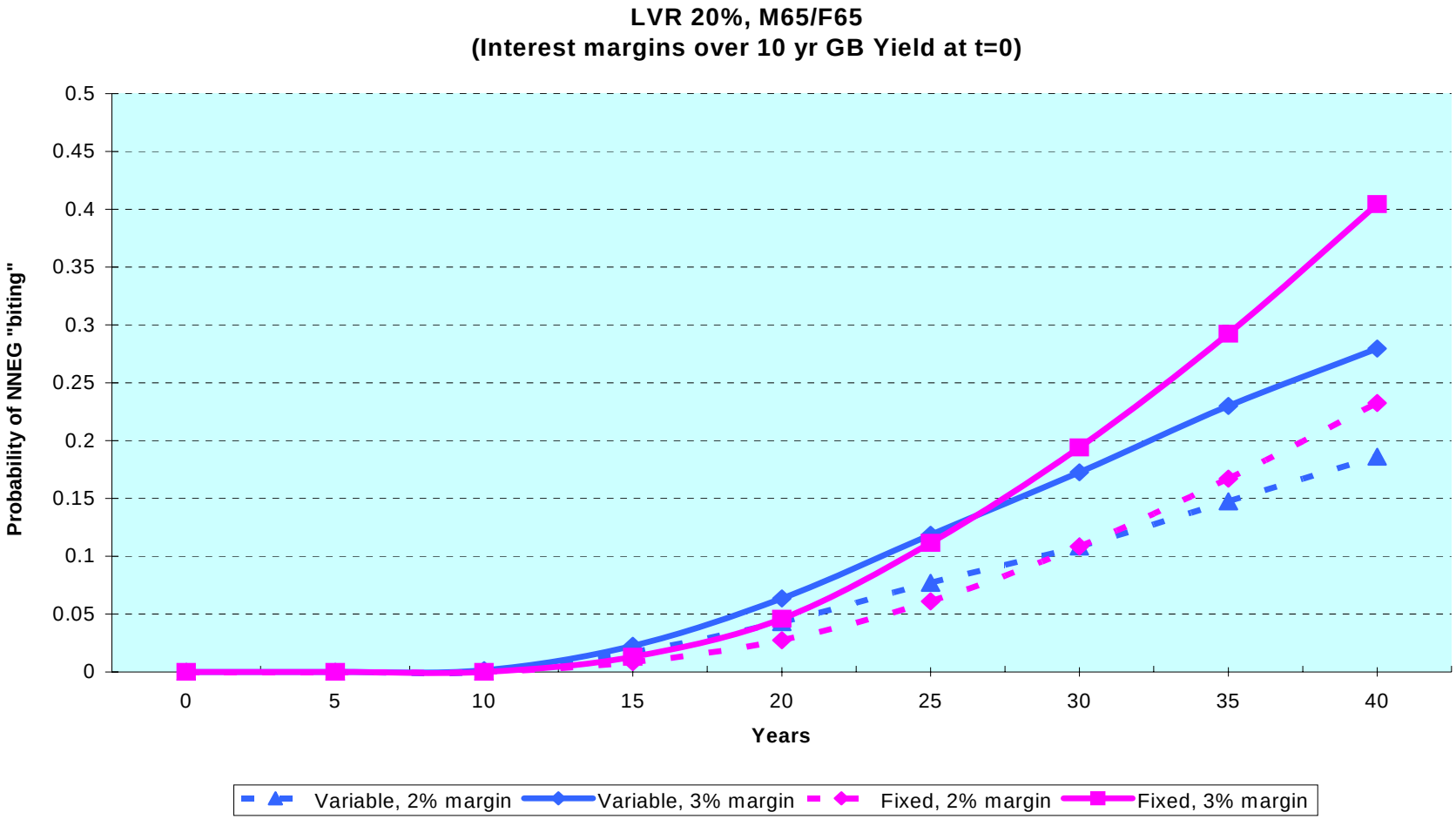
- Example considered:
  - Reverse Mortgage sold at 20% LVR
  - Joint mortgagors - male 65, female 65
  - Contract provides a NNEG against the full property value

- Examine for various mortgage interest rates:
  - The risk of the NNEG biting by duration i.e. that the reverse mortgage balance exceeds the projected property value at various durations

- Examine fixed interest RM charging cost of funds + 3% gross margin:
  - The amount of NNEG loss in scenarios where the NNEG bites
  - The present value cost of the NNEG at the outset of the reverse mortgage
  - The cost of the NNEG expressed as a per annum charge against interest margins

- It should be stressed that the figures shown in subsequent slides relate only to the specific joint mortgagor example set out above

Risk of NNEG "Biting"



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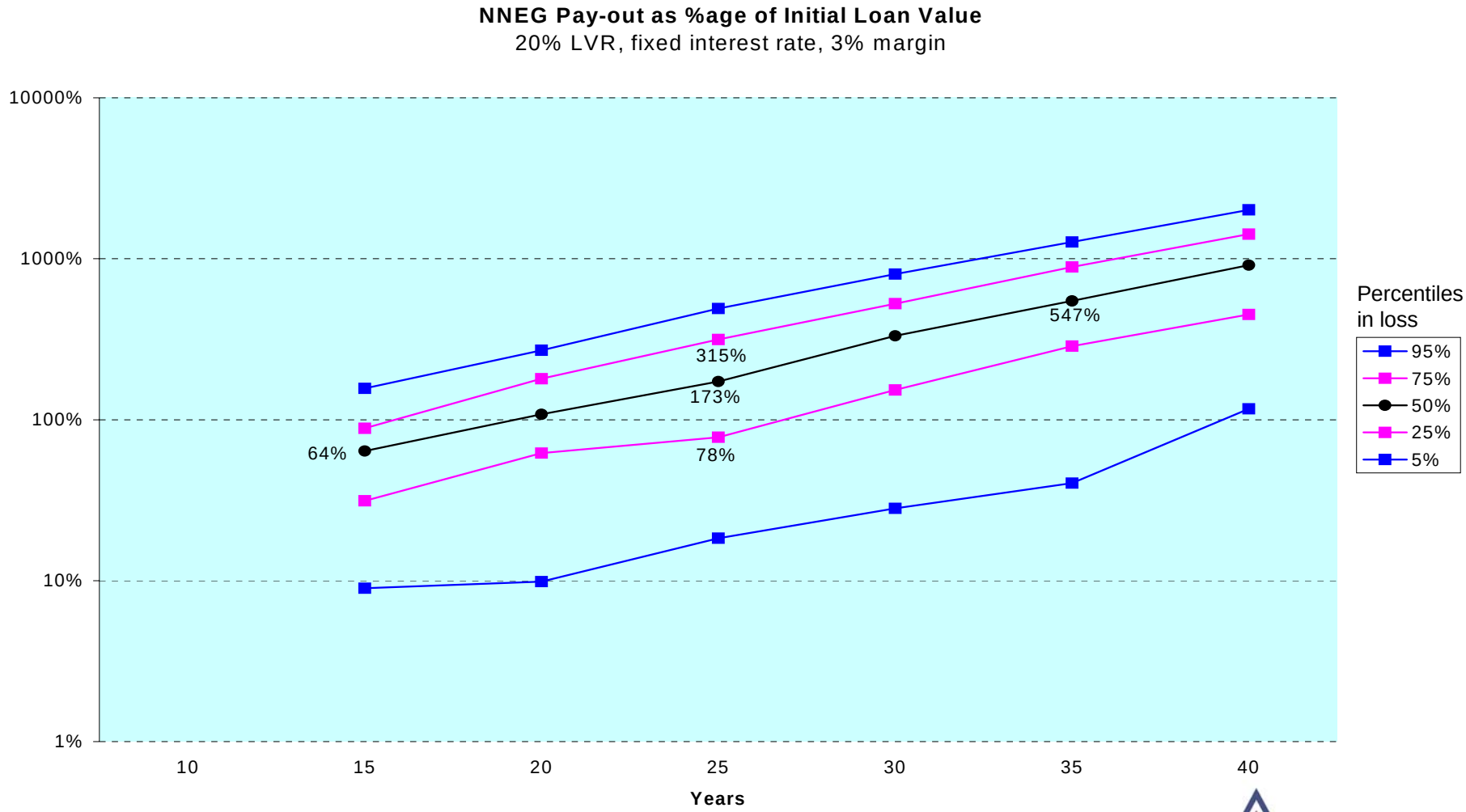
Loss When NNEG "Bites"



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Reserving for NNEG

- The NNEG is a very long term guarantee with a potentially large tail risk
- The NNEG is arguably more of a market risk than a credit risk event
- Need to model interaction of property market, interest rates and the forces of “decrement” that drive repayment of a RM
- What “reserve sufficiency” level is appropriate for prudential reserving purposes – what likelihood over what duration?
- What allowance for correlation effects e.g. between individual RMs?
- Reserving at a level sufficient to sustain “A” rating (say) for the life of the portfolio may imply a significant reserving cost

Multiple “forces” of decrement

Decrement Type	Importance for NNEG
Mortality, including allowance for selection effects and future mortality improvements	High
Disability (Aged Care Admission) – depending on product design	High
Disability (Retirement Village Admission) – depending on product design	Medium trending to Low (as retiree ages)
Relocation (Other)	Medium trending to Low (as retiree ages)
Voluntary Early Repayment	Probably Low
Default	Probably Low

Definitions

- "Real world" asset models:
  - Median/mean return broadly equates to a "best estimate" view future returns
  - For residential property, this is a capital-only return
  - Volatility of returns aims to reflect the expected distribution of future returns

- "Risk neutral" asset models:
  - Median/mean return broadly equates to the "certainty-equivalent" rate
  - Volatility of returns aims to reflect the market's pricing of equivalent risk

- "Certainty equivalent" rate of return for residential property:
  - Expected return on the risk-free asset class minus a yield adjustment
  - Yield adjustment needs to reflect (among other things) that the property will only generate a capital return and the homeowner will forgo a rental yield
  - Using the "total return" risk-free rate will overstate the CE rate
  - Financial markets might think of this as a "cost of carry" adjustment

Costing the NNEG

- Use of deterministic DCF techniques is fundamentally inappropriate
- Use of “real world” stochastic valuation techniques is appropriate for risk of ruin and economic loss purposes
- But “real world” stochastic valuation techniques have inherent problems when costing the NNEG:
  - Capitalise future investment risk margins which is inconsistent with market-consistent pricing principle of “no arbitrage”
  - Difficult to determine an appropriate risk-adjusted discount rate (“RDR”) that makes proper allowance for the risks associated with the NNEG
- Since the NNEG is essentially a put option, option valuation techniques offer an alternative approach
- The following slides illustrate the extent to which these various techniques provide differing outcomes

Costing the NNEG

Valuation Method	Commentary
Deterministic with RDR	Inappropriate methodology - not examined
“Real world” stochastic	Examined using risk-adjusted and risk free discount rates
“Scaled” real world stochastic	Scaled each RW scenario in a crude attempt to remove the capitalisation of investment margins. Then examined outcomes using risk-adjusted and risk free discount rates
Option valuation technique	Examined using a range of volatility assumptions
Credit risk technique	Estimation of cost by reference to market cost of “equivalent” credit risk

PV Cost of NNEG

(as percentage of original loan amount for the example considered)

	Discount Rate Adopted			
Valuation Method	**Constant risk free + 5%**	**Constant risk free**	**Stochastic risk free**	
"Real world" stochastic	1%	4%	4%	✘
"Scaled" real world stochastic	2%	7.7%	8.5%	✘

	Base - 4%	**Base - 2%**	**"Base" Vol**	**Base + 2%**	
Risk neutral option valuation	10%	14%	19%	24%	✓

The "base" option valuation result uses volatility assumptions which are equivalent to the volatility implied by the "real world" stochastic method

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Cost of NNEG (approx)

(as bps per annum charge against interest margins)

For illustration purposes only	Base - 4%	Base - 2%	"Base" Vol	Base + 2%
Risk neutral option valuation	45 - 50 bps	65 - 70 bps	85 – 90 bps	110 – 120 bps

- For the example considered, the per annum NNEG cost represents a significant portion of the additional interest margin charged
- And this is before allowing for any additional costs associated with holding prudential capital above the "fair value" of the guarantee
- The NNEG cost derived from the option valuation method is materially greater than the cost derived from using "real world" stochastic method
- The option valuation method provides an estimate of "fair value" cost
- A "real world" stochastic valuation method is likely to materially understate the real cost of the NNEG

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A Credit Risk Approach (simplified)

- Weighted probability of NNEG biting for the example shown is c. 6%
- The “weights” used in this calculation are the probabilities of the reverse mortgage being repaid in the year of projection (M65/F65 combination)
- This result could be thought of as implying a 6% chance of default on principal plus interest repayment obligations over 40 year life of the RM
- A credit risk approach to costing the NNEG might be as follows:
  - What credit rating would be assigned to a 40 year bond with a 6% risk of default over the 40 year period?
  - Possibly a AAA rating at this level of default (based on S&P historical CDO data), but the lack of interest payments on the RM might imply lower rating
  - What is the market cost today of credit with that credit rating and that term
  - AAA credit spread for >30 year term is c. 85 - 90 bps per annum (estimated by extrapolating Bloomberg data as at Dec 2005 for terms of up to 30 yrs)
  - Implies a NNEG cost of c. 85 – 90 bps per annum as at Dec 2005 for the example shown (or higher if rated less than AAA)

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Conclusions from NNEG Costing

- The NNEG is a put option written by the RM provider
- The NNEG should be costed using option valuation techniques
- “Real world” stochastic techniques are very unlikely to provide the “right” cost but are still essential for assessing capital requirements
- A credit risk approach to costing the NNEG has important drawbacks:
  - The NNEG is arguably more of a market risk than a credit risk event
  - The creditworthiness of the RM borrower is arguably irrelevant
  - There is no risk of failing to maintain interest repayments
  - The NNEG risk is f^n (property markets, interest rates and “longevity”)
  - The characteristics of losses and recoveries in the event of default could be very different for a NNEG than for an equivalently rated corporate bond
  - Are credit spreads a reasonable proxy for residential property price risk
- In my view, option pricing techniques are the best approach

Using Non-Option Techniques to Cost the NNEG

- Do not use traditional deterministic “best estimate” valuation techniques

- If you use “real world” stochastic techniques:
  - Need to remove the capitalisation of future investment risk margins
  - Need to ensure volatility is unaffected by the first step
  - Probably need to give different weights to favourable and unfavourable scenarios
  - But, doing all of the above is a complex and roundabout way of seeking the same outcome as applying option valuation techniques
  - So why not apply option valuation techniques directly?

- If you use credit risk techniques:
  - Don’t use the best estimate per annum cost of default
  - Need to make appropriate allowance for market cost of equivalent credit
  - But therein lies the problem because of the differences in implied risk
  - How does loss in default compare between RM and corporate bonds?
  - How should other differences be adjusted for?
  - Should a change in the market cost of credit necessarily change the fair value cost of the NNEG?

Laying off the NNEG Risk

- Will some retain while RM portfolio remains small vs total loan book?

- Will life insurers be interested in underwriting the NNEG risk?
  - Is an indemnity basis too risky?
  - What about a partial hedge?

- At least one reinsurer has been prepared to underwrite NNEG risk
  - Capacity limitations?
  - Would a reinsurer be willing to accept 100% risk transfer?

- Investment/banking specialists
  - Lack of traded instruments for the banker to hedge its book
  - Pricing is therefore “inefficient”

- Securitisation
  - Deep capital markets look very attractive to writers of reverse mortgages

Securitisations

- Equity release products are very capital intensive
- Ideal candidates to be securitised from an issuer's perspective since they enable the issuer's capital to be recycled for further lending
- Other markets have seen securitisations of both RM and SAM portfolios
- Key differences between conventional mortgage-backed securitisations and reverse mortgage securitisations (RVMBS)
- The earlier illustration of a 6% weighted risk of RM default suggests that default risk might not be considered unduly onerous
- But NNEG is a very long term exposure with a potentially large tail risk
- This suggests the need for careful design of securitisation "layers"

Is the NNEG a life insurance product?

- Arguments against:
  - It's clearly written as a mortgage
  - The provider is not paying out a benefit as such
  - If the provider defaults, the homeowner should not miss out on a benefit payment
- Arguments for:
  - A RM contract is really 2 products bundled together
  - By late 70s and older, death and aged care admittance are the material drivers of RM repayment and of whether a NNEG loss crystallises
  - Thus, the NNEG is in the nature of an insurance benefit where the incidence and (indirectly) cost of this benefit is materially dependent on contingencies of human life
- "Form" might suggest not a life product but what about "substance"?
- Consider an analogy with a conventional mortgage example
- What if a RM provider is laying off NNEG risk by purchasing protection
  - The NNEG is being underwritten on a standalone basis - is this now a life product?
  - If so, should bundling this risk within a mortgage change its character?

Possible Discussion Points

- Asset models in use
- Techniques for NNEG reserving
- Techniques for costing the NNEG
- Life product or not, and does it matter anyway?
- Advice process and regulations
- Macroeconomic impacts and consequences
- Roles for actuaries