

A Market Consistent Approach to the Valuation of No-Negative Equity Guarantees and Equity Release Mortgages

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Intro

- ERM: loan secured by home, older borrower, loan repaid on home exit
- Most ERMs also have a NNEG: repayment capped at max of rolled up loan amount or home value on exit
- NNEG is a put option
- **Big concerns** about option undervaluation
- Replay of Equitable Life

NNEG Valuation Controversy

- PRA concerns since at least 2014, e.g., DP1/16, CP48/16, CP23/17, CP24/17, SS 3/17, CP 13/18, PS 31/18
- A lot of fur flying publicly since 2018
- Covered on our [Eumaeus blog](#)

NNEG Valuation a 3 Horse Race

- NNEG/ERM valuation is a 3 horse race:
Market consistency vs Discounted Projection
vs Tunaru
- MC approach is a family of approaches but
we focus on Black '76
- DP and Tunaru approaches are **highly**
unreliable

Basic Equations

ERM = PV of Equity Release Mortgage loan

L = PV of a risk-free loan ignoring NNEG

$NNEG$ = PV of the NNEG guarantee

$$(1) \quad ERM = L - NNEG$$

$$(2) \quad L = \sum_t [exit\ prob_t \times current\ loan\ amount \times e^{(l-r)t}]$$

where l = loan rate, r = risk-free rate

$$(3) \quad NNEG = \sum_t [exit\ prob_t \times NNEG_t]$$

where $NNEG_t = put_t$ = PV of the NNEG guarantee for period/decrement t

Exit Probabilities

- Key driver of house exit is Grim Reaper, so need a mortality model
- We use M5-CBD mortality model (Cairns, Blake and Dowd, 2006, 2009)
- Complicating factors: morbidity/time in care, joint lives, early repayment

Black '76 Put Price Model

$$(4) \quad p_t = e^{-rt} [K_t N(-d_2) - F_t N(-d_1)]$$

where K_t is strike price for period t , F_t is the forward house price for period t

$$(5) \quad d_1 = [\ln(F_t/K_t) + \sigma^2 t/2] / (\sigma \sqrt{t})$$

$$(6) \quad d_2 = d_1 - \sigma \sqrt{t}$$

σ = volatility of the forward house price

$$(7) \quad K_t = \text{current loan amount} \times e^{lt}$$

$$(8) \quad F_t = \text{current house price} \times e^{(r-q)t}$$

where q = deferment rate = net rental rate

Calibrations

- Most calibrations straightforward
- Loan-to-Value: we use 'age minus 30' rule, e.g., age = 70, LTV = 40%
- Risk-free rate: we assume 0.5%
- Loan rate: high and coming down, we assume 4% but considerable dispersion
- These calibrations should be uncontroversial, but two others are not

Deferment Rate / Net Rental Rate

- Deferment rate $q = y - v - c - m$
- $y =$ gross rental: we go with Tunaru's $y = 5.6\%$
- $v =$ void rate: we go with 1/12 rule of thumb
- $c =$ management costs: assume 10% of y
- $m =$ maintenance costs: assume 7.5% of y
- Hence we get $q \approx 4.2\%$
- Can prove deferment rate = net rental rate

Controversy over Value of q

- Some actuaries have attempted to argue that q might be < 0 . Details/rebuttals in our paper
- Common sense suggests that since $q =$ net **rental rate**, then we would not expect $q < 0$
- Exceptions to $q > 0$ are extreme (e.g., Chernobyl) and irrelevant - **Chernobyl is not an ERM asset class**

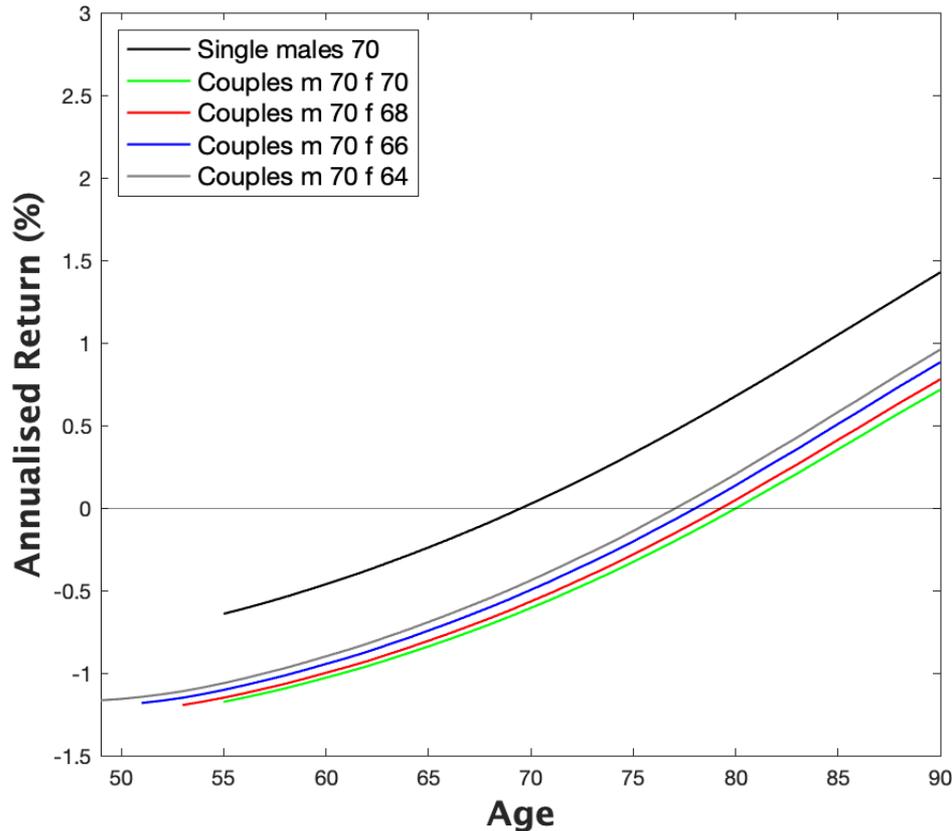
Volatility: Traditional Approach

- Use HPI from e.g., NW
- Most firms use 10%-15%, CP 13/18 central estimate 13%, Tunaru recommends 3.9%
- **But problem here** is that forward is also impacted by uncertainty about r and q
- This implies a volatility **term structure**
-> different vols for different decrements

Volatility: Our Approach

- In principle, should use a vol term structure that reflects the term structure of the forward rate – different vol for each decrement
- But can use a single expected vol obtained by summing $\text{exit prob}(t) \times \text{vol term structure}(t)$
- This will depend on age and gender
- **Cannot** use same single vol for all ages and genders

Many ERM loans are Loss-Making



ERMs to couples are *loss making* for borrowers aged < late 70s

Discounted Projection Approach

- DP approach is what the industry uses
- Boils down to Black '76 with forward house price replaced by exp. future house price
- This replacement reflects an **egregious intellectual error – confuses forward and future prices**
- Leads to an implied q rate that is implausibly and sometimes impossibly low

Tunaru Approach

- ARIMA-GARCH model
 - Simpler model (e.g., B76) would do
- Assumes unduly low vol
 - Assumes vol = 3.9%, vs PRA central recommended = 13%, ours higher
- Does sensible q analysis, then divides by 5 because only 20% of residential properties are rented out.
- 'No perspective from which this makes sense'
- Low vol + low q → undervalued NNEGs

Implications

For firms

- Firms anticipate returns that will not materialise
- To increase profitability, firms should increase loan rates and/or decrease LTV ratios

For sector

- Has Ponzi-like features – expansion unsustainable
- Has expanded beyond its optimal size; will shrink

For investors in ER sector

- ERM share prices inflated
- Not a good long term investment

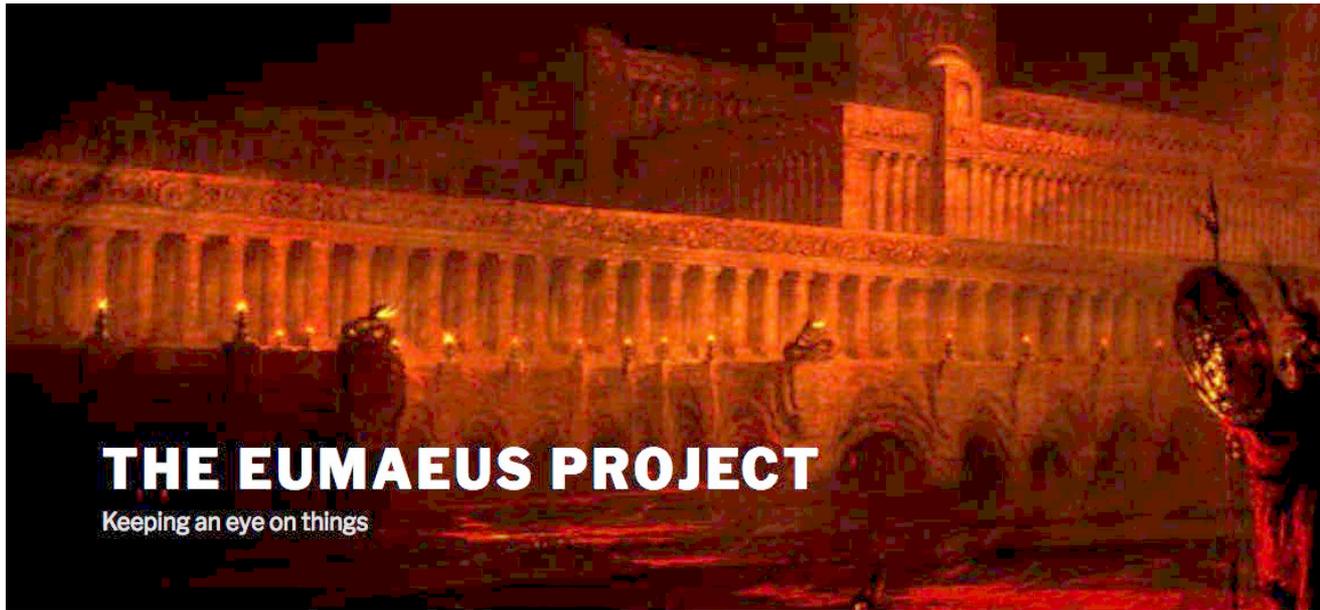
Shades of Equitable Life

- Undervaluation of opaque long-term options was the central issue in Equitable Life
- “the perceived failure [by actuaries] to adopt latest developments in financial economics and financial markets **was seen in large part to stem from the role played by entrenched commercial interests**” (Sir Derek Morris, 2005)
- IFoA response (Dec 2004): **“A lot of the events described in this report took place in the late 1980s and we are now almost in 2005 so we are a different profession”**

Kingman Review

- Independent review recently ordered by the Government after a number of high profile corporate collapses
- Salient points from IFoA submission to Kingman (6 August 2018):
 - **“The actuarial profession in the UK and the IFoA have developed significantly since the Morris Review in 2005”**
 - “The IFoA believes that the model of professional self-regulation subject to effective independent oversight **remains the most appropriate arrangement** for the regulation of actuaries in the UK”
 - “There is **no evidence** to suggest that current arrangements are **not serving to protect the public interest ...**”

Thank You!



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