How Profitable are Equity Release Mortgages?

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Abstract

We obtain valuations of UK Equity Release Mortgages under the 'market consistent' approach consistent with conventional option pricing and the 'discounted projection' approach used by the industry. Projections of the profitability of these products have significant commercial implications.

Keywords: Equity Release, market consistent approach, discounted projection approach.

JEL Classification: G2, G3.

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1. Introduction

An Equity Release Mortgage (ERM) is a loan made to a property-owning borrower late in life that is collateralised by their property.[1] In the UK, ERMs typically embody a No-Negative Equity Guarantee (NNEG) that stipulates that the amount due for repayment is no more than the minimum of the rolled-up loan amount and the property value at the time of repayment, which would be the time of the borrower's death or entry into a care home. This obligation to repay the minimum of two future values implies that the NNEG involves put options granted to the borrower.

The valuation of these options is controversial, however. The approach recommended by economics and finance academics and some actuarial academics, the 'Market Consistent' (MC) approach, is to value them using standard option pricing theory, e.g., using the Black '76 put option model with the underlying variable being a forward contract on the mortgaged property. Equity release actuaries however use an approach known as the 'Discounted Projection' (DP) approach, which replaces the price of the forward contract in the option price equation with the projected future property price. Industry practitioners prefer this approach because it produces higher reported profits.

Over the last few years, the DP approach has been criticised, e.g., by the regulator, the Prudential Regulation Authority (PRA; see, e.g., PRA, 2016) and in reports by the Adam Smith Institute (Dowd, 2018) and BBC journalist Howard Mustoe (Mustoe, 2018). Critics suggest that the DP approach is inconsistent with accepted option pricing theory, is unsupported by any body of peer-reviewed academic literature and can produce valuations which contradict rational valuation principles.

This article outlines a simple framework that allows us to encompass both approaches within a broader model. Each approach is then characterised by the value it assigns to a single parameter, the deferment rate in a forward contract on the mortgaged property. The deferment rate can be defined as the discount rate applied to the forward price to obtain the spot price. In the MC approach, the deferment rate is based on a net rental yield on the property, but in the DP approach the deferment rate is driven by an assumed rate of house price inflation.

Leaving aside unrefereed earlier work, this article is the first to (a) give any quantitative comparison of alternative ERM valuation approaches in the current UK context, and (b) provide results for the profitability of alternative valuation approaches across the whole relevant age range (55 to 90) and for both males

[1] ERMs are commonly known outside the UK as reverse mortgages. Examples of earlier literature on ERMs in the UK context include Hosty et al. (2008), Li et al. (2010), Prudential Regulation Authority (2016), Dowd (2018) and Dowd et al. (2019).

and females. Point (b) is important because it is the profitability of alternative approaches that is the root issue in the current controversy.

Our results indicate that the different approaches produce considerable differences in projected profitability with significant commercial implications for the equity release sector. If the MC approach is correct, equity release is less profitable than is widely believed and loans to younger borrowers are not profitable at all.

The layout of this article is as follows. Section 2 sets out the key elements of an ERM valuation model. Section explains the alternative approaches to ERM valuation and projected profitability. Sections 4 and 5 discuss model calibration and results, and section 6 sets out the conclusions and implications for the equity release sector.

2. Key Elements of an ERM valuation model

The present value ERM of an Equity Release Mortgage loan is equal to the present value L of a risk-free loan, minus the present value $NNEG$ of the NNEG guarantee:

(1) $$ERM = L - NNEG.$$

The original loan amount grows at the loan rate l until the time when the loan is repaid. Therefore L is given by

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

where $exit\ prob_t$ is the probability of exiting the house in year t and r is the risk-free interest rate.

Excepting cases of early repayment, an ERM contract specifies that the loan is to be repaid when the borrower permanently leaves their residential property. Assuming away a prolonged stay in care, the borrower exits the house on death.[2] Under this simplifying assumption the exit probability for any future year t is the probability of death in t conditional on surviving to that year. The exit probability for t is therefore equal to $q_t S_t$, where q_t is the mortality rate for t, S_t is the probability that an individual alive now will survive to t and

(3) $$S_t = (1 - q_{t-1}) S_{t-1}$$

[2] Workarounds to this simplifying assumption are discussed in Buckner and Dowd (2020, pp. 74-76).

where $S_0 = 1$.

We obtain these exit probabilities using Monte Carlo projections from the M5 parameterisation of the CBD mortality model (Cairns *et al.*, 2009).

$NNEG$ is the sum of the products of the exit probabilities and the present values of the NNEG guarantee for each future year t:

$$(4) \qquad NNEG = \sum_t [exit\ prob_t \times NNEG_t]$$

where $NNEG_t$ is the present value of the NNEG guarantee for t.

Each $NNEG_t$ involves a put option on the future value of the property. Each put option is granted to the borrower and will be exercised if the borrower exits in t and if the rolled-up loan amount in t exceeds the property price in t.

We now consider two alternative approaches to the valuation of these puts.

3. Alternative Approaches to ERM Valuation and Projected Profitability

The first is the MC approach, which is associated with the use of a Black '76 option pricing model to obtain values for each $NNEG_t$. The underlying is F_t, the forward property price for horizon t:

$$(5) \qquad F_t = Se^{(r-q)t}$$

where S is the spot property price, r is the risk-free interest rate and q is the deferment rate, which is also equal to the net rental yield.[3] A calibration of the deferment rate is then obtained from an empirical estimate of the net rental yield.[4] In a very low interest rate environment, we would expect $q > r$.

The second is the DP approach, which is the approach used by UK ERM actuaries.[5] The essence of this approach is to replace the forward house price in the MC approach with the projected future house price $Se^{hpi \times t}$, where hpi is the projected rate of future house price inflation.

The parameters q, hpi and are linked as follows:

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[3] A proof of the equality of the deferment rate and the net rental yield is given in Buckner and Dowd (2020, pp. 34-35).

[4] More details on ERM valuation are provided in Dowd et al. (2019, pp. 2-3) and Buckner and Dowd (2020, pp. 17-21, 36-37).

[5] The manual for the DP approach is Hosty *et al*. (2008), which was published in the *British Actuarial Journal*, which is the actuarial profession's own house journal.

(6) $hpi = r - q$.[6]

Rearranging (6) we then obtain an implied q for the DP approach:

(7) $q = r - hpi$.

Note that this implied q will be negative if $hpi > r$.

Thus, from an implementation perspective, we can treat these approaches as equivalent, except for the inputted q values.

We then obtain the profitability of each ERM loan as the annualised return on the capital invested by the lender. This capital is the original loan amount,[7] so the ratio $ERM/loan\ amount$ gives the (approximate) return on capital over the expected lifetime of the loan. The annualised returns on capital are then given by the internal rates of return.

4. Calibration

We now build an ERM valuation model based on plausible input parameter values:

- The risk-free rate r = 0.5% p.a.
- The ERM loan rate l = 4.5%, which is in line with recent empirical loan rates.
- The deferment rate is $q = 4.2\%$ for the MC approach[8] and $q = -3.75\%$ for the DP approach.[9]
- We consider both male and female borrowers.
- We consider borrower ages from 55 (the minimum age at which a borrower can apply for an ERM loan) to 90.
- We assume that the Loan to Value ratio (LTV) follows an 'age minus 30' rule of thumb, i.e., LTV in percent = borrower age minus 30, which approximately describes the LTVs used in the UK equity release industry.

We calibrate the volatility parameter σ using

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[6] To obtain the implied q under the DP approach, we replace the forward rate $(r - q)$ by hpi.

[7] This notion of capital is not to be confused with accounting (e.g., IFRS) or regulatory (e.g., Solvency II) notions of capital, which refer to the equity capital held by the lending firms' shareholders.

[8] A justification for this calibration is provided by Buckner and Dowd (2020, pp. 36-37). However, depending on local and national market conditions, there could be a range of reasonable q rates that might vary from, say, 3% to 5%. It is important to choose a reasonable q calibration because this parameter is the main driver of the NNEG valuation.

[9] This value comes from a well-known hpi calibration of 4.25% by one ERM lender, combined with $r = 0.5\%$. See Buckner and Dowd (2020, pp. 137-140).

(8) $$\sigma = \sum_t exit\ prob_t \times \sigma_t,$$

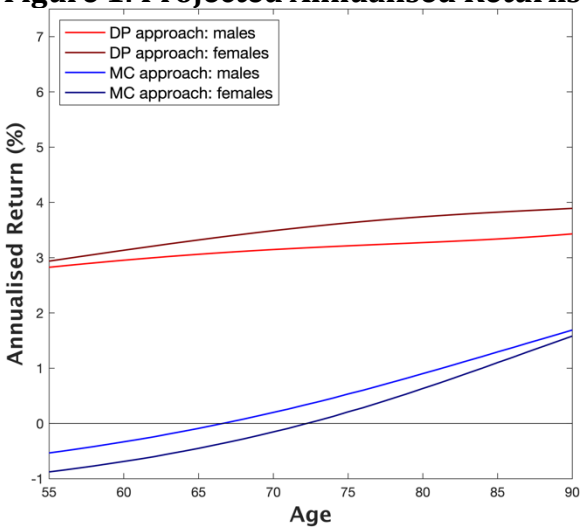
where σ_t is a volatility term structure that will be dependent on both the age and gender of the borrower. More details on the estimation of this volatility term structure are provided by Buckner and Dowd (2020, pp. 50-63).[10]

Estimates of the exit probabilities are obtained using Monte Carlo simulations of the mortality rates q_t calibrated on Life & Longevity Markets Association death rates data for England & Wales spanning years 1971-2017 and ages 55-89.

5. Results

Projected annualised returns are given in Figures 1.

Figure 1: Projected Annualised Returns



The reddish lines give results for the DP approach ($q = -3.75\%$) and the blueish lines give results for the MC approach ($q = 4.2\%$).

Figure 1 shows that annualised returns are negatively correlated with inputted q rates. For the DP approach ($q = -3.75\%$), annualised returns are a little below 3% for age 55 and rise a little with borrower age. For the MC approach

[10] To provide some intuition, recall that the underlying in the contract is a forward contract. It can then be shown (see Buckner and Dowd (2020, pp. 64-65) that the return on a forward contract is a linear function of *T*, the period to maturity of the contract (see their equation (9.2)). The impact of a given change in the interest rate or deferment rate will then depend on *T*, from which it follows that the volatility of the forward price has a term structure.

($q = 4.2\%$), annualised returns rise from below 0% for age 55, to around 1.7% for age 90. There are small differences between results for males and females.[11]

6. Conclusions and Implications

The results presented here suggest that the projected profitability of ERM loans varies considerably with the valuation approach used: the DP approach gives considerably higher annualised returns on capital than the MC approach. The MC results are particularly striking, in that they suggest that ERM loans to younger borrowers are loss-making. An implication of this latter finding is that ERM lenders should consider refocussing their marketing efforts towards older borrowers. A second implication is that investors in the sector might wish to reconsider their ERM investment strategies. For example, they might consider reducing their investments in the sector if it appears that their investments will not meet their performance targets. Thus, our findings have important implications for the optimal borrower-age composition of a lender's ERM portfolio and the optimal size of the sector.

References

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[3] Cairns, A. J. G., Blake, D., Dowd, K., Coughlan, G. D., Epstein, A., Ong, A., Balevich, I., 2009. A quantitative comparison of stochastic mortality models using data from England and Wales and the United States. North Am. Actuar. J. 13, 1-35.

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[6] Li, J. S-H., Hardy, M. R., Tan, K. S., 2010. On pricing and hedging the no-negative-equity guarantee in equity release mechanisms. J. of Risk and Insur. 77, 499-522.

[11] Why the male curve lies below the female curve for the DP approach but above it for the MC approach is not obvious to us, but presumably relates to some curvature in the valuation model. Note that EU gender neutrality rules do not apply here because NNEG guarantees are not separately sold to borrowers, but are instead rolled up into the mortgage loans themselves.

[7] Mustoe, H., 2018. Home equity release may cost pension firms billions. BBC blog (7 August).
[8] Prudential Regulation Authority, 2016) “Equity Release Mortgages.” London: Prudential Regulation Authority Discussion Paper *DP1/16*, March.