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# **A Discussion Note on the Economic Valuation of Equity Release Mortgages as part of the PRA's Effective Value Test**

By the IFoA Equity Release Mortgages Working Party

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## **Introduction**

The PRA's Effective Value Test (EVT) requires insurance firms to perform an economic valuation of Equity Release Mortgage assets (ERMs)<sup>1</sup>. The valuation method and economic parameter assumptions used in the valuation of the No-Negative Equity Guarantee (NNEG) for this purpose are partly prescribed by the PRA and this note provides some commentary on these prescribed methods. It also provides some suggestions that may be useful in developing good actuarial practice in this valuation process.

The content of this note does not address the fair valuation of ERMs in other contexts such as financial reporting. Generally recognised fair value principles, however, are likely to be relevant to the economic valuation of ERMs for EVT purposes. This note focuses on some of the important topics that arise in the specific context of ERMs. The absence of explicit recognition in this note of other relevant principles should not therefore be taken as an indication that they are not viewed as relevant to the economic valuation of ERMs for EVT purposes. Furthermore, this note is especially focused on the financial and economic modelling assumptions required in the economic valuation, as these topics have been the focus of a significant amount of recent actuarial research. This does not imply that the actuarial assumptions for demographic and repayment behaviour are viewed as irrelevant for the purposes of this economic valuation.

## **The PRA Principles in the context of the Effective Value Test**

The discussion below of the economic valuation of ERMs in the context of EVT is generally consistent with the four principles set out by the PRA for the assessment of risks arising from No Negative Equity Guarantees (NNEGs)<sup>2</sup>. We would expect that these four principles would generally hold in most foreseeable economic circumstances.

The principles will be referred to again where relevant in the text below. However, we note here that Principle 3 implies that the deferment rate of a residential property is always positive. Section 3.21 of SS3/17 also stipulates a minimum value of 0% for the deferral rate used in the economic valuation in EVT. Whilst we would expect the deferment rate of a residential property to usually be positive, we note there is no logical necessity for this to always be the case. Possible approaches to assessing the deferment rate of residential properties are discussed further below in 13, 14, and 15.

The discussion below is somewhat more expansive than the PRA Principles and it considers some potentially important topics, such as the valuation impacts of mortgage and housing illiquidity, that are not addressed by the PRA Principles. However, this note is also not intended to provide an exhaustive guide to actuarial best practice. It will, of course, be incumbent upon individual actuaries and insurance firms to consider the specific assets and risks on their balance sheets and what methods are most appropriate to value and assess the specific risks associated with them.

The individual residential properties that represent the collateral of equity release mortgages are highly heterogeneous. Their idiosyncratic features may be material to the valuation and risk / capital assessment of the mortgage. The discussion below therefore does not take the approach of prescribing some uniform 'best estimate' or 'minimum' parameter values that should be applied to the modelling of all residential properties. But there are nonetheless some valuation principles that are likely to be present in good actuarial practice as applied to the economic valuation of any ERM and its specific collateral, and it is the purpose of this note to identify and describe some of these.

## **Expressing ERM Cashflows as the difference between non-NNEG and NNEG cashflows**

1. In valuing an ERM, the ERM asset can be considered as a probability-weighted cashflow stream, where the timing of the cashflows is determined by estimates of the mortgage's exit probabilities, as determined by appropriate mortality, prepayment and long-term care entry assumptions.

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<sup>1</sup> PRA (2019).

<sup>2</sup> Section 3.8, PRA Supervisory Statement 3/17 (September 2019).

The ERM cashflow stream may be usefully expressed as the difference between two cashflow streams: the cashflows that would arise in the absence of a NNEG; and the cashflows that arise as a result of the NNEG. In the absence of the potential illiquidity effects discussed in 5. 6. and 7. below, the economic theory for the valuation of both of these cashflow streams is straightforward (this is why expressing the cashflows in this way can be insightful): the cashflows that do not depend on the NNEG are 'zero-beta' cashflows that should therefore be discounted using a risk-free discount curve<sup>3</sup>; and the NNEG cashflows are put options on the residential property collateral.

In general, other reasonable approaches to the economic valuation of ERMs may be possible that do not require explicit modelling and valuation of the NNEG as a component of the ERM. However, SS3/17 requires an explicit NNEG valuation as part of the ERM's economic valuation for EVT purposes.

2. UK insurance firms and their actuaries have extensive experience of valuing put options using standard option pricing theory in the context of Solvency II technical provisions and the liability valuations required by its UK predecessor, the Realistic Balance Sheet. As such, they are familiar with the key theoretical concepts used therein, such as the concept that the risk premium of the underlying asset is irrelevant to the economic value of the option under specified theoretical conditions (which enables the risk-neutral valuation technique)<sup>4</sup> and the distinction between option-implied volatility and historical volatility.

The nature of the put option's underlying asset – an individual residential property – however, creates a number of calibration challenges for the NNEG option valuation. We note that it is the PRA's intention to prescribe the key parameter values for the NNEG valuation in the EVT economic valuation. Nonetheless, 8.- 15. below offer some suggestions as to how to develop appropriate parameter values in the absence of such prescription.

3. As noted in 2. above, the NNEG can be considered as a form of put option where the underlying asset is the individual residential property that forms the mortgage collateral. The current value of the NNEG is therefore a function of the current value of the individual residential property. Appropriate processes should be used to ensure that the assumed residential property valuation is appropriate for the time of the mortgage valuation. If the property valuation is based on a past transaction or past survey valuation, it should be appropriately updated. Desktop valuation approaches are likely to play a significant part in a practical approach to property portfolio valuation, but other forms of property valuation validation may also be appropriate (such as 'drive by valuations' or other forms of physical property inspection), for at least a sample of the portfolio and especially where the NNEG is (or at material risk of being) 'in the money' and/or to help monitor the exposure to idiosyncratic risks such as dilapidation, which are not captured within desktop valuation approaches.
4. There are forms of ERM-specific risk that may have a material impact on ERM valuation and which should therefore be considered carefully. In particular, dilapidation risk – that is, the risk that the houseowner is unable (for example, due to old age) or unwilling to adequately

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<sup>3</sup> This assumes non-property risks such as demographic uncertainty are uncorrelated with financial market risk. The cost of such risks would be captured in the 'Other' category of the economic valuation of the EVT.

<sup>4</sup> We note that the SS3/17 requirement (Section 3.20) to use the Black-Scholes formula with risk-free interest rates is consistent with Principle 4, which implies that there is a positive risk premium for bearing house price risk and that equity release mortgage values participate in this risk premium. We also note that the approach of valuing a NNEG by assessing its best estimate expected cashflow and discounting this at the risk-free rate or greater is not consistent with Principle 4. As the ERM has a negative exposure to the NNEG, the NNEG's value must be consistent with applying a discount rate of less than the risk-free rate to the expected ('real-world') cashflow in order to incorporate a positive house price risk premium into the ERM asset price.

maintain the property, which might be more likely when they have a diminished financial incentive to do so as a result of a significant ERM – may materially increase the value of the NNEG and hence reduce the economic value of the ERM. The prepayment behaviour of the mortgage holder, and the extent to which prepayment rates may vary dynamically over time with changes in the LTV of the mortgage and / or changes in interest rates can also materially impact on the value of the NNEG and, hence, the economic value of the ERM. To the extent that the PRA's valuation method precludes allowance for these effects in the NNEG valuation, allowance for them may be made in the 'Other' category of the economic valuation as per Section 3.13 of SS3/17. Appropriate allowance for the prospective drawdown behaviour of mortgage holders should be made where borrowers have an unused lending facility, taking into account relevant constraints such as the Terms & Conditions of the ERM, the lending policy of the firm and UK market TCF requirements where appropriate <sup>5</sup>.

### **Allowing for the Valuation Effects of Mortgage Illiquidity and Residential Property Illiquidity**

5. Like any retail mortgage, equity release mortgages are illiquid. There is a generally accepted economic valuation principle that an illiquid asset will have a lower economic value than an otherwise-identical liquid asset (implying an 'illiquidity premium' in the yield of the illiquid asset<sup>6</sup>). It is therefore reasonable for the economic valuation of the mortgage asset to make allowance for its illiquidity. Actuaries should understand the magnitude of the allowance for mortgage illiquidity that is incorporated into the firm's valuation processes. An economic valuation process should therefore be capable of producing a valuation both before and after allowance for the effect of mortgage illiquidity on the mortgage asset value. The economic valuation for the EVT as prescribed by the PRA does not make any explicit allowance for mortgage illiquidity. Given this, the impact of any mortgage illiquidity premium will be a component of the EVT's 'Day 1 gain' in SS3/17's Figure 1.
6. The direct estimation of the illiquidity discount (in asset value) or illiquidity premium (in asset yield) that is applicable to ERMs is a question of considerable practical difficulty. This is not, however, an ERM-specific issue, but one that arises in the valuation of any illiquid asset holding (such as other mortgages or other forms of illiquid lending). The implicit valuation adjustment for ERM illiquidity that is implied as part of the EVT's 'Day 1 gain' should therefore be consistent with the allowance for illiquidity made in the valuation of other illiquid assets (if any), and according to generally accepted economic valuation principles.
7. Residential property - the collateral that underlies the ERM – is also illiquid. In theory, this illiquidity can have two forms of effect on the valuation of the NNEG (and, therefore, the ERM), and these two effects work in opposite directions. The presence of an illiquidity premium in the underlying residential property price may reduce the cost of the NNEG (discussed further in 15. below). The transaction costs incurred in trading residential property theoretically increase the cost of the NNEG (discussed further in 12. below). Whilst some research literature exists on these topics, assessment of the appropriate allowance for these effects is not a mature area of option valuation practice. Given the opposite directions of these effects, it is reasonable to expect that, where an allowance for one of these effects is made, due consideration is given to allowing for the other.

### **Setting volatility assumptions for the EVT's NNEG valuation**

8. We again note that the PRA currently prescribes the volatility parameter that is to be used in the EVT's NNEG valuation. Nonetheless, here we discuss approaches to estimating this parameter in the absence of such prescription. The value of the NNEG, and hence the

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<sup>5</sup> Section 3.20A (iv) of SS3/17 sets out the PRA's requirements for how allowance is made for drawdown risk in the EVT's NNEG valuation.

<sup>6</sup> Whilst the principle of the existence of an illiquidity premium is broadly accepted, estimation of its size is inherently difficult and empirical estimates vary widely. See, for example, Marcato (2015) and Blackrock Investment Institute (2019) for an illustrative range of views.

economic value of the ERM, will be a function of the volatility of the price of the individual residential property that forms its collateral. In assessing the volatility of the residential property price, appropriate allowance should be made for the idiosyncratic risks of the property. In doing so, it may be useful to set assumptions separately for the volatility of a diversified house market and for the idiosyncratic risks of the individual property<sup>7</sup>.

9. UK actuaries and insurance firms have considerable experience in estimating the volatility of diversified UK real estate markets for the purposes of economic valuations (for example, in the fair valuation of with-profit liability guarantees). There should be consistency between the approach to estimating the diversified residential property market volatility for ERMs and the approach to estimating property index volatility in these other cases (whilst recognising any material differences in volatility that may be reasonably anticipated between the residential property market and the property sectors that are modelled in other parts of the insurance balance sheet). Such approaches typically make allowance for any material positive serial correlation in property market index data. Where significant positive serial correlation is found in short-term holding period house price index returns data, an appropriate allowance should be made for its impact on the volatility of longer-term holding period returns when valuing longer-term NNEGs<sup>8</sup>.
10. The estimation of the level of idiosyncratic house price risk relies on the availability of individual house price transaction data and the public availability of such data for houses with ERMs is limited (though individual firms may hold significant private data generated from their own ERM experience). There is, however, significant publicly available data on individual house transactions in general, for example, from HM Land Registry<sup>9</sup>. Contemporary ERM research suggests that idiosyncratic volatility is a material element of the total volatility of an individual house price<sup>10</sup>.
11. Some mortgages, especially those with low Loan-To-Value ratios and relatively short expected remaining terms to maturity, may have deeply out-the-money NNEGs. The valuation of these NNEGs will be sensitive to whether 'fat tails' are assumed to be present in the probability distribution of individual residential house price changes. Fat tails can be generated by directly specifying a probability distribution for the house price (log) return that has greater kurtosis than the normal distribution, or by using standard stochastic simulation modelling approaches such as GARCH or other stochastic volatility processes<sup>11</sup> (or by simply varying the volatility assumption used in the Black-Scholes formula as a function of LTV). However, such approaches may be constrained by the lack of availability of relevant data. It is recognised here that obtaining the first-order estimate of the level of volatility of an individual house price is already quite technically challenging, and an estimation of the excess kurtosis of the house price return will inevitably involve even greater uncertainty.
12. Option pricing theory suggests that when transaction costs are associated with trading an underlying asset, this has the effect of increasing the option cost relative to the (usual theoretical) case where transaction costs have been ignored<sup>12</sup>. This suggests that the significant transaction costs associated with trading residential property will have the effect of increasing the cost of the NNEG. This effect can be captured as an increase in the assumed volatility of the house price in the put option valuation formula. The theory behind this argument is well-established and generally accepted, but such an adjustment is difficult to

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<sup>7</sup> This approach is proposed in Jeffery and Smith (2019), Section 4.4.

<sup>8</sup> See Simmons & Jones (2019) for some analysis of autocorrelation in short-term residential property price returns and adjusting the estimation of longer-term volatility assumptions.

<sup>9</sup> See Simmons & Jones (2019) for some analysis of the price volatility behaviour found in the HM Land Registry data.

<sup>10</sup> See Section 4.4.3, Jeffery and Smith (2019), which suggests an annualised house-specific volatility of 11%, although it should be noted that little direct empirical evidence is offered in support of this suggestion.

<sup>11</sup> See, for example, Section 3, Tunaru (2019).

<sup>12</sup> Leland (1985) provides an extension of option pricing theory to allow for transaction costs in trading the underlying asset. See Section 5.2.5, Jeffery and Smith (2019) for further discussion.

practically calibrate in the context of UK residential property. Allowance for this effect should therefore have regard to 7. above and 15. below.

### **Setting deferment rate assumptions in the EVT's NNEG valuation**

13. We again note that the PRA currently prescribes the minimum deferment rate parameter that is to be used in the EVT's NNEG valuation. Nonetheless, we discuss here approaches to estimating this parameter in the absence of such prescription. The deferment rate of a residential property is an important element of the economic valuation of an ERM as the pay-off from the mortgage cannot be greater than the value of deferred possession of the property. The deferment rate is a measure of the opportunity cost associated with not possessing the property during the deferment period. The deferment rate of a given residential property is generally not directly observable but must be estimated. Standard derivative pricing theory implies that the deferment rate of any given asset should be, to first order, equal to its income yield<sup>13</sup>.

The underlying asset of the NNEG is a residential property, and the assessment of its income should be considered net of allowances for the costs expected to be incurred in rental voids, and in maintaining the property, including the costs of dilapidation and costs of obsolescence. Both components of the deferment rate (gross income and allowance for costs) may have idiosyncratic features that should be considered where these are judged to be material to the valuation.

In the context of the discussion of PRA Principle 3 above, we would anticipate that the net rental yield of a residential property would normally be positive. However, it is possible to identify specific circumstances where the net income, and hence deferment rate, of a residential property could be expected to be negative for some period of time (for example, if significant investment was being made in the property, this investment could result in a negative net income during this investment period).

14. Contrary to the tentative suggestion<sup>14</sup> in Tunaru (2019), the loss of potential rental income that arises due to owner-occupation should not be deducted from the estimate of rental income for the purposes of assessment of the deferment rate for use in the NNEG valuation. Owner-occupiers choose to occupy their property because they are willing to bear the opportunity cost of the income foregone by owner-occupation. This does not imply the opportunity cost is zero. It seems self-evidently reasonable to assume the owner-occupier would prefer to own the property today rather than defer ownership of the property to some future date and thus be required to pay rent to the owner in the meantime. This suggests owner-occupation does not imply a deferment rate of zero, and that the deferment rate of owner-occupied properties is a function of the rental income that the property could generate if it were not owner-occupied.
15. There is a technical argument, presented in recent actuarial ERM valuation research<sup>15</sup>, that the presence of an illiquidity premium in the underlying house price should reduce the cost of the NNEG (note that the illiquidity premium of the residential property is distinct from the illiquidity premium of the mortgage). Specifically, the present value of the house price illiquidity premium that will be earned over the life of the option should be added to the house

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<sup>13</sup> Commodities derivative markets demonstrate that factors other than the asset's income yield can also have some effect on its deferment rate. One such potential factor for residential properties is discussed in 15. below. It should be noted that the existence of transparent house price derivative prices could allow an implied deferment rate to be inferred directly from these prices. The identification and use of such prices may be an interesting area of potential future ERM valuation research, particularly if transparent capital market solutions emerge for NNEG risk hedging.

<sup>14</sup> Section 4.5, Tunaru (2019). It should be noted that when making this suggestion, the paper describes it as a 'controversial debating point' (p. 32, footnote 16).

<sup>15</sup> See Section 5.3.5 and 5.3.6, Jeffery & Smith (2019).



price that is used in the NNEG valuation. This is equivalent to deducting the house price illiquidity premium from the deferment rate used in the NNEG valuation, implying<sup>16</sup>:

$$\text{Deferment rate} = \text{Net rental yield} - \text{house price illiquidity premium}$$

In the context of the above discussion of PRA Principle 3, it is again worth noting that there is no theoretical reason why this quantity cannot be negative. As noted in 7. above, the theoretical basis for this adjustment to the deferment rate for the house price illiquidity premium is not currently a well-established part of option pricing theory. Rather, this is a nascent field of research and further research on this topic is therefore welcomed by the Working Party. Moreover, the estimation of the size of a house price illiquidity premium is subject to considerable uncertainty (and, as in the estimation of any illiquidity premium, it should have regard to the likely costs associated with entering and exiting the asset, as may be required). Allowance for this effect should therefore have regard to 7. and 12. above.

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<sup>16</sup> Note this does not make an allowance for any *mortgage* illiquidity premium. The EVT prescribes a NNEG valuation method that uses the SII risk-free rate as the discount function, implying that the EVT NNEG valuation does not make any allowance for the effects of mortgage illiquidity. But this does not preclude allowance for a house price illiquidity premium in the assessment of the appropriate deferment rate for the NNEG valuation. Approaches to allowing for the mortgage illiquidity premium on the mortgage value should be consistent with 6. above.



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