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How suitable are equity release mortgages as investments for pension funds?

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Abstract

This article examines the claim that equity release mortgages, the U.K. equivalent of reverse mortgages in the U.S., are suitable investments for pension funds. We present valuation, stress test and scenario analysis results that suggest that equity release mortgages are unsuitable for pension funds because: (i) they bear returns that are typically below the risk-free rate; (ii) they are not hedges for annuity books, let alone good hedges; and (iii) they are heavily exposed to house price risk, which annuity books are not. Our results suggest that equity release mortgages meet none of these criteria to be suitable for pension funds and are almost entirely dominated by risk-free government bonds. We offer an explanation for why investors appear to be unaware of the low returns on equity release mortgages.

Keywords Equity release · Equity release mortgages · No negative equity guarantee

Introduction

An equity release mortgage (ERM), also known as a lifetime mortgage (LTM), is a loan made to an older home-owning borrower that is collateralised by their home.[1] In the U.K., ERMs almost always embody a no-negative equity guarantee (NNEG)

[1] ERMs are commonly known outside the U.K. as reverse mortgages. Examples of earlier literature on ERMs in the U.K. context include Li et al. (2010) and Buckner and Dowd (2020).

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that stipulates that the amount due for repayment is capped at 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 permanent care. This obligation to repay the minimum of two future values implies that the NNEG involves put options granted by the lender to the borrower.[2]

ERMs have long been supposed to be a good investment for annuity providers:

> Against this background [recent Solvency II reforms to EU insurance regulation], the Equity Release Member Interest group has taken a look at why Lifetime Mortgages remain a good and appropriate investment for life companies with annuity liabilities (IFoA 2014).
> LTMs are a good match for our long term liabilities and are an appropriate asset for annuity providers to invest in (Just Group 2018).

It has recently been suggested that ERMs are also an attractive investment for pension funds:

> Over the last few years, Lifetime Mortgage ('LTM') assets have become a preferred investment used by annuity providers to back the liabilities they take on to pay pensioners. This is because the long dated cashflows produced by a portfolio of Lifetime Mortgages are a good match for pension payments. They also offer attractive returns with diversification benefits. For these very same reasons LTMs should be an attractive investment for pension funds[3] (Alpha Real Capital 2021).

Thus, for years the insurance industry has been sold the supposed benefits of ERMs, and now the same is being done to pension funds as well.

We suggest, however, that ERMs are anything but a good investment asset for pension funds. We suggest that for any investment asset to be suitable for a pension fund, it needs to meet the following criteria: (i) it should bear a reasonable return that is at least equal to the risk-free rate; (ii) it should function as a good hedge for an annuity book; and (iii) it should not be highly exposed to other risks to which annuity books are not. We present results that suggest ERMs meet none of these criteria. Therefore, pension funds should not invest in them.

This article is organised as follows. The "Years to exit" section examines the number of years to house exit or loan repayment. The "ERM valuation" and "Model calibration" sections look at ERM valuation and model calibration. The "ERM returns" section presents some results on projected ERM returns. The "Stress tests and scenario analyses" section presents some results of stress tests and scenario analyses. The "Conclusions: ERMs are not suitable investments for pension funds" section concludes by offering an unambiguously negative answer to the question with which we started.

[2] The ERM loans we are interested in are lump sum loans in which there is a single loan payment made by the lender at the inception of the contract. These are known as lifetime mortgages.

[3] Given that both pension schemes and annuities are likely to be index-linked, we understand that indexation is achieved through the swap market, but we have no precise data on this issue.

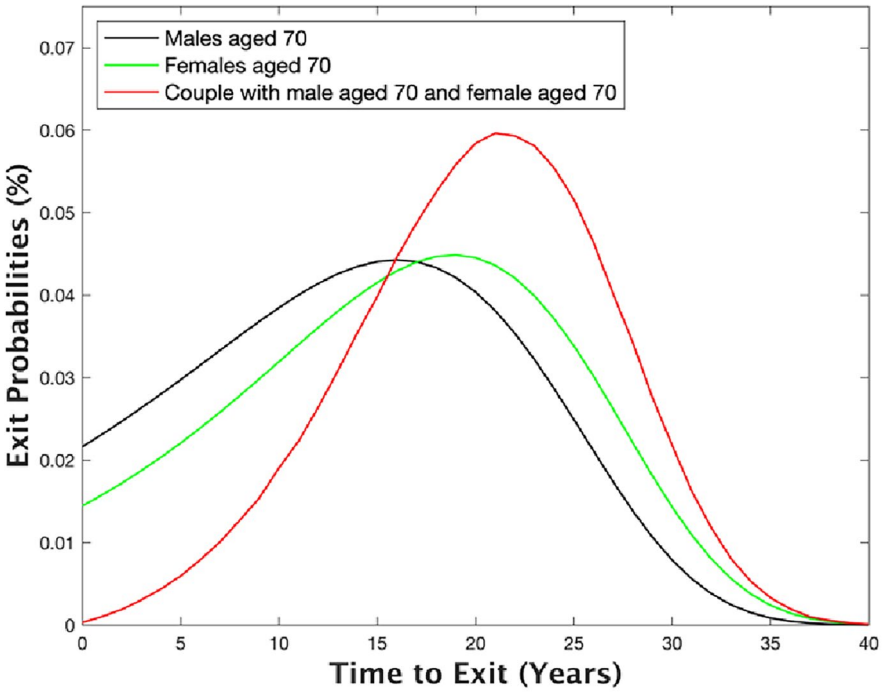

Fig. 1 Density functions for the years to house exit. Obtained from 10,000 Monte Carlo simulations of the mortality rates using the M5-CBD stochastic mortality model (Cairns et al. 2009) calibrated on Life and Longevity Markets Association death rates data for England and Wales spanning years 1971–2017 and ages 55–89

Years to exit

We consider loans to a single male, a single female and a male–female couple. Excepting early repayment, an ERM contract specifies that the loan is to be repaid when the borrower permanently exits their home. Assuming away for convenience any prolonged stay in care,[4] exit occurs when a single borrower dies or when the last surviving member of a borrower couple dies.

Figure 1 shows the density functions for the time to exit.

The expected years to exit for the couple is longer than that for single borrowers because house exit for the couple occurs when the second surviving member dies but house exit for a single borrower occurs after only the one death.

Table 1 gives expected years to exit for single males and single females aged 70 and for couples both aged 70.

Table 1 shows that a male aged 70 can expect to exit in 15 years' time, a female aged 70 can expect to exit in 17.1 years' time and a couple of the specified ages can expect to exit in 20.7 years' time.

[4] Workarounds to this assumption are suggested in Buckner and Dowd (2020, pp. 74–76).

Table 1 Expected years to house exit

Borrower	Expected years to exit
Male aged 70	15.0
Female aged 70	17.1
Couple male aged 70, female aged 70	20.7

As per notes to Fig. 1

ERM valuation

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

$$ERM = L - NNEG \tag{1}$$

L is given by

$$L = \sum\nolimits_t [exit\,prob_t \times amount\,loaned \times e^{(l-r)t}] \tag{2}$$

where $exit\,prob_t$ is the probability of exiting the house in year t, r is the risk-free interest rate and $amountloaned \times e^{lt}$ is the rolled-up loan amount.

NNEG is given by

$$NNEG = \sum\nolimits_t [exitprob_t \times NNEG_t] \tag{3}$$

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

Each 'nneglet' $NNEG_t$ involves a put option on the value of the property in year t, struck at the rolled-up loan amount in t. $NNEG_t$ is valued using a Black '76 option pricing model (Black 1976), where the underlying price, F_t, is the forward house price for t, given by

$$F_t = Se^{(r-q)t} \tag{4}$$

where S is the current spot property price, r the risk-free interest rate and q, known as the deferment rate, is equal to the net rental yield.[5] We calibrate q from an estimate of the net rental yield as the ratio of the net nominal annual rental to the current property price.

Model calibration

We build an ERM valuation model based on the following parameter values:

[5] The Black 76 option pricing model is appropriate for the case, as here, where the underlying is a forward contract. The deferment rate and the net rental rate are defined differently but are mathematically identical (see Buckner and Dowd 2021, pp. 34–36).

Table 2 ERM/amount loaned

Borrower	ERM/amount loaned (%)
Male aged 70	95.3
Female aged 70	89.9
Couple male aged 70, female aged 70	84.0

Calibrations given in the text and in the notes to Fig. 1

- $r = 1\%$ p.a.
- $l = 4\%$.[6]
- $q = 4.2\%$.[7]
- We assume that the loan-to-value ratio (LTV) follows an 'age minus 30' rule of thumb, i.e. the LTV ratio will be the difference between the borrower age and 30 divided by 100. Where the borrower is a couple, lenders typically determine the loan amount by applying this rule to the younger member of the couple. We believe this rule approximates the LTVs applied in the U.K.[8]
- Each 'nneglet' $NNEG_t$ has its own volatility and in principle each of these volatilities is different, i.e. one should not use the same volatility parameter in each $NNEG_t$. To explain, recall that the underlying 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 Eq. 9.2). The impact of a 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. More details (including on volatility calibration) are provided by Buckner and Dowd (2020, pp. 50–63).

ERM returns

Table 2 provides results for the ratio of *ERM* to *amount loaned*.

The *ERM/amount loaned* ratio is 95.3% for a male borrower aged 70, 89.9% for a female borrower of the same age and 84.0% for a couple of the specified ages.

The amount $1+ERM/loanamount$ gives the projected return on the loan over its lifetime. The projected annualised returns are then obtained from the projected internal rates of return on the loan.

Projected annualised returns for the borrower age range up to age 90 are given in Fig. 2.

We see that loans to single males have positive projected returns only for borrowers aged 71 or older, those to single females have positive projected returns only for borrowers 77 or older, and loans to couples have positive projected returns only if the couple members are 83 or older.

[6] The Equity Release Council (2021) reports that the average loan rate fell to 4.01% during 2020Q4. This point made, there is considerable variation in loan rates.

[7] See Buckner and Dowd (2020, pp. 36–37).

[8] This rule is based on recommended LTVs by age from a major U.K. provider.

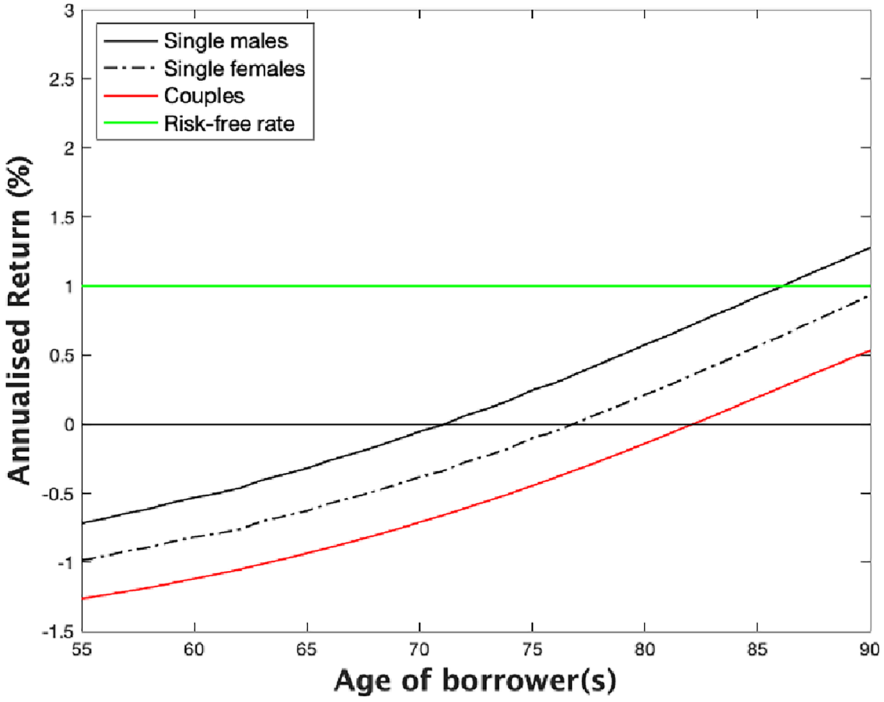

Fig. 2 Projected annualised returns. As per notes to Table 2

We also see that, except for male borrowers older than 87, projected returns on ERM loans are lower than the risk-free rate.

Note also: (i) a comparison of Figs. 1 and 2 shows that a longer period to exit (or a higher longevity) is associated with a lower projected return to ERM lenders i.e. 'longevity is bad' for lenders; (ii) if there were no NNEG, then the return to an ERM would simply be $l - r = 4\% - 1\% = 3\%$. That the plots in Fig. 2 are well below 3% indicates that the valuation of the NNEG has a considerable impact on ERM valuation and highlights the importance of getting the NNEG valuation model and its calibration 'right'.

Stress tests and scenario analyses

House price stress test

Stress tests are useful tools to gauge the vulnerability of a financial position to some shock event. One possible such test is to model the impact of an immediate one-off house price fall on ERM valuations. We assume that house prices fall five minutes after the ERM loan has been made. This exercise is easy to carry out. We first value the ERM at the initial house price value. We then re-value them immediately after the house price fall using the new house price and the new LTV. For example,

Table 3 Impact on *ERM* of an immediate fall in house prices

House price fall (%)	Male	Female	Couple
25	− 14.2	− 15.3	− 17.9
50	− 34.5	− 36.1	− 40.4

Male aged 70, female aged 70 and couple aged 70. Otherwise as per notes to Table 1

Table 4 Impact on *ERM* of an increase in expected future lifetime

Expected future lifetime increase	Male	Female	Couple
3 years	− 5.5%	− 6.4%	− 8.3%

As per notes to Table 3

if the initial LTV = 40% and house prices fall by 50%, then the new LTV will be $0.4 \times 1/(1 - 0.5) = 80\%$.[9] For this type of stress test we do not make any projections of future variables, e.g. future house prices, other than that house prices fall immediately after the ERM loan is made.

Table 3 gives the impact of an alternative immediate one-off house price fall.

For the given set of calibrations, these results indicate that ERM valuations are sensitive to house prices, more so for the females than the males, and especially so for borrower couples.

Longevity stress test

In a longevity stress test, we posit some shock to expected future lifetime and consider the impact of that change on ERM valuations. In the following, we posit that expected future lifetime suddenly increases by three years. We can then approximate the impact of this scenario by reducing by three years the age of the individual inputted into our valuation model, whilst keeping other parameters (and especially the LTV) the same.[10]

Table 4 gives the results of such an exercise.

The results in Table 4 show that the longevity shock has a notable *negative* impact on ERM valuations. Consider that the principal liabilities of pension funds are their annuity books, the values of which increase with expected longevity. A hedge for an annuity book would also increase in value with expected future lifetime. So the fact that the values of ERMs fall with expected future lifetime means that they are unsuitable assets to use as hedges for annuity books.

[9] A 50% house price fall might appear implausible, but falls of such magnitude (or more) occurred in Hong Kong over 1990–2001 and in Dublin during the noughties, and Japanese house prices have been in a long slow decline since 1990.

[10] An alternative would have been to shock the q rate rather than the expected future lifetime, but we do not carry out that exercise here.

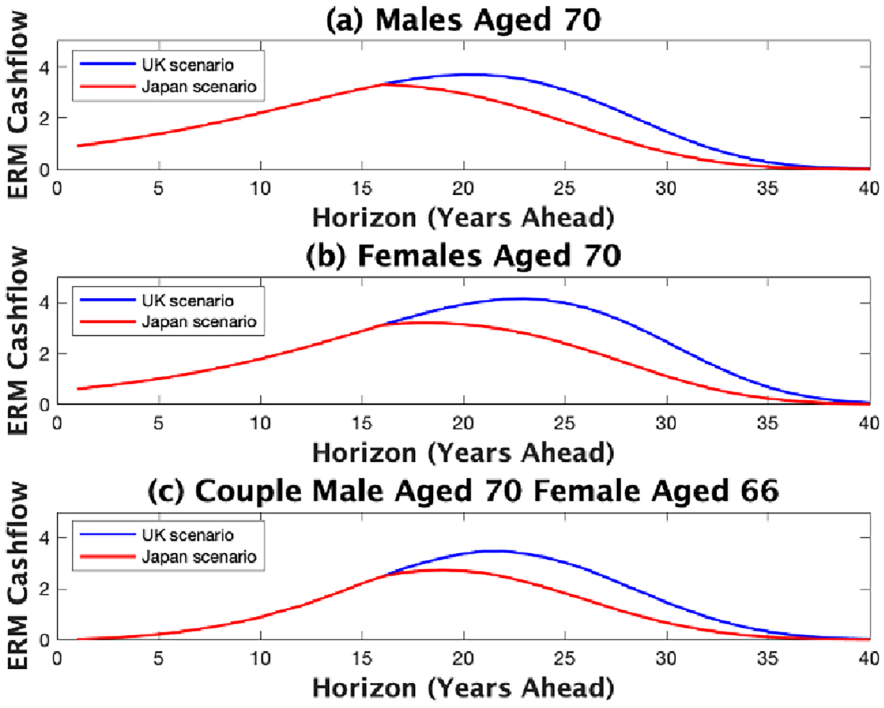

Fig. 3 Projected ERM cashflows under U.K. and Japanese house price growth scenarios. As per notes to Table 3

House price scenario analysis

In a second type of exercise, we might project how ERM cashflows would evolve over time under alternative house price inflation (HPI) scenarios. For example, we might posit an optimistic scenario such as the continuation of the average U.K. HPI growth rate of 5.8% p.a. from the past couple of decades and compare it to some pessimistic scenario such as one based on the Japanese negative HPI growth since 1990, which averages out to about − 1.7% p.a.

Figure 3 shows a plot of these two scenarios:

The 3 plots show projected cashflows under each of the two posited scenarios for male borrowers, female borrowers and couple borrowers, respectively. In each case, we see that the U.K. scenarios entail considerably higher cashflows than under the Japanese scenario. The explanation for the smaller cashflows under the latter scenario is that the lower the HPI growth rate, the more quickly the NNEG will bite and the bigger will be the NNEG-related loss to the lender.

So if an investor invests in ERMs on the expectation that the U.K. high HPI scenario will occur, the investor will expect the cashflows given by the U.K. scenario plots in the figure. However, if the Japanese scenario occurs instead, then the investor will receive the lower cashflows given by the Japanese scenario. The investor is

Table 5 Present values of cashflows under U.K. and Japanese HPI scenarios

Scenario	Male	Female	Couple
U.K. PV	94.00	104.58	70.95
Japan PV	74.74	77.05	52.17
Difference	19.26	27.53	18.78
Difference as % of U.K. PV	20.49	26.32	26.47

As per notes to Table 3

thus exposed to HPI risk—the risk of loss if the actual HPI rate falls below the HPI rate that the investor expected.

Table 5 shows the present values of the different cashflows.

The present value of the U.K. male cashflows is GBP 94 and so forth. The female present values are higher than the male, and the couple present values are higher than the female. These present value differences reflect the longevity or years-to-exit differences apparent in Fig. 1. The present values under the pessimistic Japanese HPI scenario are lower than those under the optimistic U.K. HPI scenario for the reasons explained in our discussion of Fig. 3. The differences between the present values under the U.K. scenario and those under the Japanese scenario are quite considerable and of the order of 20–30% of the U.K. present values. From the perspective of an investor who expected the U.K. scenario to hold when the Japanese scenario unfolded instead, these differences are the expected cashflows that failed to materialise.

Conclusions: ERMs are *not* suitable investments for pension funds

The answer to our question is now apparent. A suitable investment asset for a pension fund should satisfy the following three conditions.

The first is that investment assets should bear a reasonable return. However, our results suggest that the projected returns of ERMs are very low, and below the risk-free rate except where borrowers are (at least) in their late 70 s. A pension fund would do better to avoid ERMs altogether and invest in government bonds instead. Indeed, the same goes for any other investor.

The second condition is that a suitable investment asset for a pension fund should also be a good hedge of the annuity book's risk exposure. However, our results suggest that an ERM is not even a hedge for an annuity book, let alone a good one. In particular, for an ERM to hedge an annuity book against a longevity shock, the putative hedge should rise in value when longevity increases, but the value of an ERM falls instead. From a hedging perspective, the obvious hedge asset would be a portfolio of government bonds that is duration or duration and convexity matched to a firm's annuity book, combined with a longevity swap to hedge the annuity book's longevity exposure.

The third condition is that a good investment asset for a pension fund should not be highly exposed to other risk factors to which annuity books are not. However,

the results of our stress tests and scenario analyses suggest that ERMs are heavily exposed to house price risk. By contrast, a portfolio of government bonds does not have such exposures.

We see then that ERMs do not satisfy any of these conditions and are close to being dominated by a well-chosen portfolio of government bonds. We therefore conclude that we see no good reason for pension funds to include ERMs among their investment assets.

An interesting question is why are ERM investors not aware that ERMs are such poor investments? A key part of the reason is that equity release actuaries use an unsound valuation approach known as the discounted projection approach[11] that makes ERMs appear to be much better investments than they actually are. This approach undervalues the NNEGs and is inconsistent with established option pricing theory. It is also based on the error of conflating the current forward price of a property and the future spot price of a property.[12] The valuations from the discounted projection approach then make their way onto the equity release firms' accounts so investors are typically none the wiser about the weaknesses in reported ERM valuations. Since this approach is known to undervalue the NNEGs, ERMs will not bring the returns that investors expect.

The equity release industry mantra, that ERMs are reasonable investment assets for pension funds, is a myth.

These points made, we can *imagine* a situation in which ERMs *might become* reasonable investment assets, including for pension funds. Imagine a situation in which the ERM sector abandons the discounted valuation approach and switches to a sound valuation approach based on Black'76. The losses entailed by the former approach would now be revealed to investors in the sector. They would reduce their investments and the supply of ERMs to the market would fall. If this fall were large enough, then the prices of ERMs would rise enough to make ERMs profitable and their returns would increase as well. Under such circumstances, it might then be reasonable for pension funds to invest in ERMs. But this scenario is merely hypothetical.

Data availability Data used in this article are available on request.

[11] The discounted projection approach was proposed by Hosty et al. (2008) who explicitly state that it is to be preferred because it produces higher (reported) profits than Black–Scholes-based approaches. It is truly astonishing that the discounted projection model is the U.K. equity release actuaries' preferred model 50 years after Black and Scholes first published their celebrated article.

[12] For more on the discounted projection approach and its flaws, see Buckner and Dowd (2021).

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