From traditional reverse mortgages to broader home equity participation

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Abstract

We present the structure and pricing of a home-equity-release product designed for senior homeowners with a more efficient risk-sharing than traditional reverse mortgages. The homeowner borrows against their home with the protection of a no-negative-equity-guarantee (NNEG), but the repayment is based on the return on a regional house-price-index and a fixed premium to cover the NNEG. This product provides greater access to equity release for retirement-age homeowners and a wider range of investment products for investors. The rearrangement of the payoff structures described in our model allows for higher upfront loan to value ratios than have traditionally been available in the industry. We illustrate the associated payoffs with the use of 20 years of home sales data from the United Kingdom (UK), up-to-date UK mortality data, and an updated UK morbidity study.

Key words: home-equity-release, no-negative-equity guarantee, reverse mortgages, securitization

EFM Classification Codes: 740, 780, 450, 370

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Introduction

Existing home-equity-release (HER) products that function as reverse mortgages with fixed or floating interest rates have been promoted as a potential source of financing for expenses in retirement. Unexpectedly low utilization of these loans has been examined by a wide range of stakeholders. Among the explanations for low uptake are perceptions that loan rates are high, and that the associated conditions on home maintenance and on loan-to-value ratios are unattractive.

We propose an alternative HER product targeted to seniors who wish to age-in-place, which is based on the return on a regional house-price-index (HPI) that permits the unbundling of risks and their allocation to investors and financial institutions having experience in managing such risks. Using a consistent set of UK data with respect to house sales' prices, mortality, and disability rates, we show that loan-to-value ratios higher than are readily available in the marketplace are possible without raising insurance costs.

There are two key motivations behind the product. First, there is a widely recognized unmet need for HER among seniors that represents a degree of market failure. This is particularly true for households at retirement age, especially those who have expenses linked to care needs and yet a desire to age-in-place. Second, home equity is a desirable asset class for many investors and it is these investors that would benefit from bearing average house-price-risk directly rather than charging a premium to insure it.

While our pricing illustration uses UK data, this proposal is widely applicable, including in the United States. The US is different from other countries because the Federal Housing Administration offers insurance on reverse mortgages. The HER market in the US is still arguably below its potential (see Consumer Financial Protection Bureau, 2012) although it has grown significantly in recent years, in an era of relaxed monetary policy. The proposal also speaks to the observed trade-off between loan-to-value ratios and insurance premiums.

Our proposal builds on existing suggestions for alternative reverse-mortgages, and on innovations proposed for the wider mortgage and home-ownership markets. Our goal is to combine various ideas into a workable structure, illustrate its pricing and advantages, and argue for its implementation with respect to retirement age homeowners.

The paper is organized as follows. In section 1 we describe the proposed structure and the product offering, explain the payoff to lenders and investors, the fee structure including the no-negative equity guarantee (NNEG) and the regional diversification feature. Then we review the literature to show how this product compares to others. In section 2 we describe the data and methodology. A contribution of this paper is to use UK sources for all data. This section provides a pricing illustration. Section 3 discusses the pricing and implications for market participants, both borrowers and investors. Section 4 concludes and section 5 acknowledges the contributions of others.

1. Proposed structure for HER

The proposed product involves a homeowner (referred to as a borrower) and a financial intermediary (referred to as a lender). It is structured to enable the creation of securities that could be pooled in various packages and sold to other investors if desired. The borrower, who may be a couple, is at or past retirement age and wishes to release equity built up in the home, but also wishes to age in place rather than sell and downsize. The lender may be a financial institution or a similar organization involved in the business of initiating loans against property, or an investment firm such as a pension fund that seeks to earn a return similar to equity investment in residential real estate. The cash flows and timing are described below, and summarized in Figure 1.

[Insert Figure 1 here]

In this section, we first describe the product structure in more detail. We then illustrate the pricing using UK data.

1.1 The product offering

The product offered to borrowers is a variable rate loan, which has a repayment rate equal to the change in a regional HPI (ΔS), plus an annual charge that is rolled up into the loan.

The loan is repayable when the borrower exits the home (mainly due to residential care needs or death). The borrower benefits from the protection of a no-negative equity guarantee (NNEG) insurance. Hence, the loan is settled by direct payment from the borrower, or from the proceeds of the sale of the home; but the amount owed is never greater than the value of the home. This structure involves the writing of a non-traditional put option by the lender.

The annual charge consists of a rent-replacement rate (m) and fees (c). We refer to the rate m as a rent-replacement because it provides a form of accumulated income that substitutes for the rental yield in direct real estate investments (viz. owning a portfolio of homes and renting them out). In standard derivative pricing models, such a yield is introduced to satisfy a no-arbitrage condition. The fees (c) cover the cost of administration (including monitoring or providing home maintenance) labelled c_1, and a premium to cover the NNEG (c_2).

There is also an initiation fee that may be introduced to cover initiation costs and a small upfront premium towards the NNEG. This initiation fee is rolled into the value of the loan from the start. The rent-replacement rate is charged at the end of a period and the fees are charged at the beginning.

Let the initial value of the loan be L. The total amount to be repaid by the borrower on (an uncertain) exit date τ will be $L \times \left[\exp\big((m+c)\tau\big) + \exp(\Delta S) - 1\right]$. Should the sum owed exceed the value of the home (V_τ) at the time of exit, the NNEG is invoked and the lender receives ownership of the home instead.

1.1.1 The payoff to lenders and investors and NNEG risk

The lender may retain the loans, or sell securities backed by the loans to investors, who will receive a rate of return equal to the HPI growth and the accrued rent-replacement charge. This payoff can be considered the total return on an average housing investment.

We assume an initiation cost of 50 basis points and a 25 basis point upfront premium on the disbursed amount L_0, but this is only for the purpose of illustration. There could be variation across intermediaries on these charges. The 50 basis point initiation fee is treated as an expense, while the 25 basis point charge is in respect of the NNEG. The initial loan value L, including the first maintenance fee and NNEG charge (c_1 and c_2), is $L_0(1.0075 + c_1 + c_2)$.

If the loans are securitized, the lender receives an initial investment from the investor of $I = L$. Thus, the difference between I and L_0 is retained by the intermediary. The initiation fee and first period maintenance/administration fee c_1 are immediately expensed, while the upfront premium and first annual NNEG charge c_2 are retained in the profit account.

Assuming that maintenance fees and NNEG fees are set at actuarially fair values, the repayment on the initial investment is $I[\exp(m\tau) + \exp(\Delta S) - 1]$. This final payoff is similar to that from owning an average residential property in the respective region, but without the typical difficulties such as maintenance, administration, or vacancy risks. The payoff is, however, rolled up within the security, producing an accumulated value rather than a regular cash flow.

NNEG risk arises from the basis risk between the index and the individual home and from longevity risk brought on by the uncertainty of the exit date τ. NNEG risk is offset by the standard approach of limiting the initial loan-to-value ratio, and charging an NNEG premium. The premium, as described above is composed of an upfront charge (25 basis points in our illustration) plus the ongoing annual NNEG charge (c_2).

The NNEG risk may also be transferred to a third party such as an insurer or a public-private partnership. The Federal Housing Administration system already insures traditional reverse mortgages in the United States. We do not specifically introduce an additional party in the structure, but such an arrangement is not precluded by the pricing illustration in this paper. However, moral hazard is likely to be reduced in a securitization structure when the lender retains an ongoing financial interest in the product.

The risk exposure in this arrangement is effectively separated into an insurance product and a home-equity exposure. As the home equity exposure offers investors an opportunity to earn the total return on the housing index, they do not require any extra compensation for house-price risk beyond the insurance. In other words, we can net out the HPI growth and the discount rate for HPI risk against each other. This makes pricing the NNEG risk much simpler than in the case of traditional reverse-mortgages. Essentially, we choose a value for c_2 given the agreed value for m and the initial loan-to-value ratio. A corollary is that a change in the formula for the initial loan-to-value ratio would lead to a change in the matching actuarially fair NNEG charges, but we do not explore this in the current illustration.

1.1.2 Regional diversification

A feature we recommend in the product is the use of a suitable regional HPI. This offers two potential benefits. First, it allows for regional selection from an investor's point of view, and recognizes the variation in price growth, expectations and yields across different regions at different times. Second, it does not penalize individual borrowers for factors affecting regional performance relative to that of a broader national index. The house-price growth since 1995 across the ten regions in England and Wales defined by the UK Land Registry is plotted in Figure 2.

[Insert Figure 2 here]

1.2 Comparison to other products

In this paper, we propose a specific structure for HER loans that involves a securitization and a new form of loan to be offered to homeowners, at an adjustable rate based on the regional house price index (HPI). The use of HPI based mortgages to alleviate basis risk was first proposed by Shiller and Weiss (2000). Our proposal involves the establishment of a centralized system that supports efficient sharing of risks and a transparent method for pricing HER loans. These objectives are achieved by independently pricing the NNEG consisting of basis and longevity risk, while offering HPI linked securities backed by physical homes. It is important to note that both elements work together more effectively than in isolation. For instance, the United States has a mechanism for providing NNEG insurance via an agency, but this has not been sufficient to increase the take up of loans due to limitations of pricing the long term fixed rate contracts.

Currently, most loans are offered as fixed-rate roll-up mortgages, whereby a fixed rate of interest is accumulated in the mortgage until the contract is settled. Long term variations in housing prices are sometimes characterized as very slowly reverting to a mean trend, so a fixed rate loan presents a further element of risk relative to house price growth. Recent literature has focussed on modelling the dynamics of index-level returns. For instance, Li *et al.* (2010) fit an ARMA-GARCH model to monthly returns on the Nationwide Index of house prices, and formulate a pricing model for the NNEG as a put option based on the estimated dynamic. By unbundling the loan into an NNEG and a floating rate loan, it would be possible to have more competitive pricing due to improved risk-sharing implications over longer time horizons.

Hosty *et al*. (2008), Ji *et al*. (2012), and Li *et al*. (2010) have developed models to price the NNEG that produce prices considerably less than those implied from rates available in the market. These pricing approaches must simultaneously model several sources of risk such as interest rate risk, house price risk, and longevity risk. This is also true for this product. However, because we see this product offering being targeted at seniors who wish to age in place, there is also a morbidity risk to be modelled, i.e., the risk that disability of one or both borrowers becomes so severe that they cannot remain in the home and it must be sold. We use data sources from the UK in our pricing model.

With respect to the investment market, we have proposed the creation of a security that would offer investors exposure to regional residential real estate prices. Given the significant variation over time of the regional distribution of house price changes (Dorling and Cornford, 1995), such securities would serve to fill an important gap in the portfolios of several investors, especially pension funds interested in long term real estate exposures. As these securities would be backed by actual homes, they could aid in a more efficient determination of prices by complementing the derivative contracts. The derivatives markets in residential real estate are still relatively limited compared to those for other assets such as equity and commodities. The absence of liquid and transparently structured securities backed by real estate implies that pricing models for derivatives, even those with linear payoffs, are complex and challenging to implement.[3]

There is also a question of wider applicability of the proposed structure. Our focus in this paper is on the provision of financing for LTC, as the issue will increasingly challenge policymakers. This focus allows us to suggest government involvement, a specific funding structure and policy response. Moreover, in the context of LTC considerations, it is more reasonable to model the behaviour of homeowners as seeking equity release in order to age in place and manage daily expenses, including care costs, and not for the purpose of seeking an additional way to invest in the future variability of house prices and of differences in their individual house's price and the index.

However, the potential for a similar lending and securitization structure open to a wider class of borrowers is worth evaluating carefully. A more generally available HER product based on our proposed structure may not be appealing to policymakers and would thus require a different level of market co-ordination and more complex rules and modelling considerations that are beyond the scope of this paper.

Also, products such as home reversion agreements currently allow investors to purchase equity in individual homes, and to that extent they are similar to our proposals. In home reversion agreements, individual homeowners effectively sell a certain amount of equity in their home at a deeply discounted price that reflects their life expectancy and house price forecasts. The high discounts again reflect the idiosyncratic risks from individual properties and the combined risks built into the NNEG that affect traditional fixed rate HER products. Any alternative structure that would match our proposal would be based on the principle of unbundling and reallocation of risks, thereby attracting funders wishing to be exposed to residential real estate as an asset class.

Finally, a further possibility exists for policymakers to lay off more risk. In the United States, the FHFA has recently made successful efforts to pass some credit risk to private parties (Goodman *et al*., 2013). This shows that it may be further possible for the state to pass some risk from an NNEG to the private sector through the PPP's residual account.

[3] Fabozzi *et al*. (2012), for instance, rely on the assumption that the market price of risk is known.

2 Data and methodology

To illustrate the product structure, we apply a non-parametric pricing strategy similar to a historical simulation approach. As explained above, the pricing problem is reduced to determining the NNEG charge c_2, as a function of m and c_1, given the loan size (based on our maximum loan-to-value ratio rule). The value of m will be determined by the market and region, taking into account the benefits and costs of the structure. For a range of values of m we calculate the payoff from 10,000,000 exit scenarios for a sequence of values of c_2. We can then determine the break-even payoff and the corresponding value of c_2 for each level of m.

To generate the exit scenarios, we need data on individual house-price returns, HPI returns, and simulated paths-to-exit for borrowing couples. We use data from the United Kingdom's Land Registry, which contains all registered sales of residential real estate since 1996 in England, Wales and Northern Ireland. We separate the sales records into 10 regions, as defined by the UK Land Registry, and carry out a pricing exercise for each region in turn. The HPI for these regions is also provided by the Land Registry.

For each exit date, we sample from a pool of house-price returns matched with the HPI over the same period. Each pairing (of house price and HPI returns) is placed in a pool based on the time between transactions, so that the exit scenario is consistent. For example, if exit takes place after τ years, we only draw a return from a pool of transactions where the time between sales is τ years (rounded up to an integer).

2.1 Mortality and morbidity

To simulate exit dates, we first update the estimates of a modified version of the model in Rickayzen and Walsh (2002) using more recent data from the Continuing Mortality Investigation (Institute and Faculty of Actuaries, 2008, 2012). The approach is described in detail in Appendix A and summarized briefly here. The modifications made to the model are simplifications in keeping with the purpose of the exercise. Specifically, although the Rickayzen and Walsh (2002) model allows for transitions into 10 different health categories, we collapse the number of categories to 2 – either able to live independently or requiring care. We do this while matching the aggregate outcomes for mortality. Our pricing example is based on a healthy couple aged 65 at loan initiation. We make the additional assumption that all couples who have not exited the home by age 90 will do so in the following year.

2.2 Pricing illustration

For the purpose of this pricing illustration, we assume that applicants eligible for the HER loan through the PPP would be couples of approximately age 65 at a time when one of the couple has requirements for some form of care expenditure. We use a Markov model to estimate the likelihood of a change in status that would result in the home having to be sold and the loan repaid, in each year. Once a person requires care we do not permit the possibility of recovery. We consider the following end of year states of the healthy partner X and care-requiring partner Y:

1. No change in state of X and Y
2. X healthy, Y deceased
3. X requires care, Y requires care
4. X deceased, Y requires care
5. X requires care, Y deceased
6. X deceased, Y deceased

A change to states 3, 4, 5 or 6 would result in sale of the house and settlement of the loan. If the couple remains in state 1 the loan continues. If the transition is to state 2 we assume that the loan continues and calculate the probability that in subsequent years X will be in the states:

7. X healthy
8. X requires care
9. X deceased

Transitions to states 8 or 9 would result in sale of the home. An alternative assumption would have been to assume voluntary loan repayment on transition to state 2. We have not assumed any prepayments.

The expression for the calculation of the expected date of house sale is

$$\sum_{j=1}^{\omega} j \left[\prod_{m=0}^{j-1} C_m A_j + \sum_{k=1}^{j-1} x_k \prod_{l=0}^{k-j} C_l B_j \prod_{n=k+1}^{j-1} D_n \right]$$

$$with\ C_0 = 1$$

where *C* represents the probability that there is no change from the original state (i.e. remain in State 1); *x* represents the probability that the state changes to X healthy Y deceased (State 2); *A* represents the probability that both partners are deceased and/or require care at the end of the year (States 3, 4, 5, or 6); *B* represents the probability that the single healthy X dies or requires care by the end of the year (States 8 or 9); *D* represents the probability that the single healthy X continues in that state (State 7). The states are determined at the end of the year. The associated probability tree for the first four years is shown in Figure 3.

[Insert Figure 3 here]

The results are shown in Table 1.

[Insert Table 1 here]

Even with a rent replacement charge as high as 4% per annum, the break-even NNEG charge is consistent with loan-to-value ratios above 50%, with the exception of the West Midlands region. The loan-to-value ratios are close to 70% in many cases, and typically about 60% with m at 3%. At these levels, the NNEG charge is very low or even negligible, suggesting that further increases in the maximum loan-to-value ratio may be acceptable to market participants by considering, *e.g.*, a weighted average of expected time to exit. With respect to the result for the West Midlands region, we have used the data received, but our sense is that there are some inconsistencies in the data for the earlier years reported.

Numerical example

Suppose a home is valued at £200,000 in London. Then, m = 3% and c_1 = 0.25% gives c_2 = 0.03% (see Table 1). The expected time to exit τ_0 for the couple based on our data is 16 years. The initial loan disbursed would be £118,334 and the loan balance (including initial charges) would be £119,554. In 16 years, the loan balance would grow to £202,060 *plus* the change in the HPI. Suppose the HPI grew at 4% per annum, the total loan balance would be £309,238. The amount received by the lender would be the lower of £309,238 and the value of the house. The house price would have to have grown by 1.28% per annum lower than the index for 16 years, or a total difference of 35 percentage points for the NNEG to be invoked. If the house price grows at the same rate as the index, the homeowner will have £70,059 left over after repaying the loan. over after repaying the loan.

3. Discussion of pricing and implications for market participants

In the previous section, we have used consistent data across the various risk exposures, drawn from a single market. We have updated a mortality model based on UK data and used it in conjunction with a database of all home sales over the past twenty years in England and Wales. The total house sale dataset contains over 20 million observations, providing us with a rich source of repeat transactions over varying durations and also allowing us to obtain the HPI growth over the same dates as the underlying transaction. By then matching the durations to exits in our pricing simulation, we have provided a realistic non-parametric pricing structure that demonstrates the advantages of the proposed product. We now consider the product from the perspective of the participants.

3.1 Borrower perspective

From the borrower's perspective, the most obvious attraction is the higher loan-to-value ratio. In this regard, the product would fill a market gap. Although equity-release plans have been available in the UK for many years, they have not received as much take-up as might be expected. In a 2011 press release, Andrea Rozario of Safe Home Income Plan (SHIP) states that it is estimated that there is £250 billion of equity that could be released immediately, yet the market is just under £1 billion a year (SHIP, 2012). Burgess et al. (2013)

state that among those aged 55 and older there is an estimated £2,000 billion of equity that might be released. The existence of unfulfilled potential in other countries is echoed by, for instance, Alai et al. (2014) and Consumer Financial Protection Bureau (2012).

According to the SHIP website (2012), an applicant might expect to receive equity release of 35 per cent to 60 per cent of the market value of the home, depending on the ages of the applicant and the applicant's partner. Undoubtedly this provides a barrier to those considering borrowing against their home. We argue that with an appropriately defined product targeted at the seniors' market higher loan-to-value ratios are possible, as shown in Table 1.

However, the economic benefits go much deeper than that. The product fulfils an expressed need. The borrower's housing investment retains its character - borrowers may remain in the home and retain some upside in the home in excess of the total index returns. They are charged a fairly priced NNEG. This is possible also because the house-price risk has been unbundled from the interest rate. In addition, as we envisage it, the fixed rate component of charges and fees would be based on initial appraisal, and hence protected from variation caused by changes in market prices.

There is a substantial literature that studies the optimal life-cycle exposure of households to residential real estate. Tracy et al. (1999) showed that although households increase their ownership of corporate shares over their lifetime, their portfolio continues to be dominated by real estate. Similarly, Turner (2003) finds that only the wealthiest of home-owning households are able to adequately diversify their portfolio and low-to-moderate income households and first-time homeowners are exposed to significant portfolio risk. Accordingly, she suggests that there is an opportunity for policies designed to help homeowners lessen the risk they bear.

Kraft and Munk (2011) show that, if a household can separate the link between housing consumption (rental space) and investment (ownership of housing as an asset through a financial security), the household would steadily decrease its housing asset ownership in later age and yet continue to consume the same level of housing. In other words, exposure to house-price risk is suboptimal in later age for some households. The HER product provides a vehicle to help reduce this exposure to real estate further through the retirement years, while remaining in the home.

Using UK micro data, Campbell and Cocco (2007) find that fluctuations in house prices have the largest effect on the consumption decisions of older homeowners. The HER product also offers an opportunity to smooth consumption by transferring house-price risk to more appropriate parties.

Lopes and Cocco (2015) suggest that their model of reverse mortgages matches observed patterns when utility derived from remaining in the home is high. Thus, there is a potential for gains to society if those wishing to take more house-price risk can do so, while still allowing retirees to derive utility from continuing to occupy their homes.

Hanewald et al. (2016) examine the decision problem of the optimal choice between HER products from a retired homeowner's perspective in the presence of longevity, long-term care, house price, and interest rate risk. Higher utility gains found for reverse mortgage are explained by product features that allow for higher lump-sum loan values and provide downside protection for house prices.

3.2 Investor perspective

One of the largest asset classes in the world is residential real estate. Investors seeking exposure to residential real estate may gain from the availability of this product. Goetzmann (1993) showed that this asset class offers important diversification potential, suggesting that it should play a larger role in some portfolios. Currently, investment in homes is quite difficult without direct ownership as relatively few securities cover this asset class, unlike commercial real estate typically accessed via REITs. As a result, investors would be attracted to a hassle-free equity-like exposure to residential real estate if this were properly structured.

The closest that participants could come to achieving a similar investment profile as this product is a home reversion plan. However, home reversion plans in their various forms are exposed to large idiosyncratic variation in longevity risk and individual house-price risk. Instead, by participating in the proposed structure, investors benefit from diversification as well as from access to investment in particular regions, if suitable pools are created. Pooling helps cross-subsidize the basis risk and its interaction with longevity risk built into the NNEG. The pooling also offers a chance at enhanced liquidity, if a secondary market for the securities is developed. Besides, investors may seek returns on housing through a financial product, rather than ultimate ownership of the property.

In the case of a securitization, another benefit to the ultimate investor is that the intermediary has skin in the game. One of the problems with the recent housing crisis is said to be that insufficient due diligence was carried out by mortgage initiators. This type of moral hazard would be reduced under the proposed structure. At the same time, the arrangements would need to be designed with care. The timing of cash flows in this product implies that the intermediary could set up fee structures to receive a significant part of its income upfront, not unlike an insurer. While the administration fee can be assigned to expenses, the safe holding of the NNEG charge collected against future losses would need to be regulated or protected by a third party.

A significant benefit to investors is that the hassle-free equity-like exposure to residential real estate comes with significantly lower transaction costs than outright ownership. Owning and renting out a property may offer high gross yields, but is more risky and potentially more expensive than the product proposed. Compared to outright ownership, there are no periods of vacancy between ‘tenants’. In addition, the ‘tenants’ may be considered to be of the preferred variety. They live in the home for their enjoyment, share in its ownership, and thus have an incentive for good stewardship of the property. Shiller and Weiss (2000) reviewed several alternative structures for HER. One of their key recommendations was indexation of mortgages to a HPI to mitigate moral hazard linked to home maintenance.

A secondary market in traditional reverse-mortgage-backed securities is already growing (see Ginnie Mae), and is seen to benefit the smooth running of the reverse-mortgage market and to lead to improved pricing. Our proposal is structured so that securitization is quite straightforward to achieve, offering access to housing as an investment class for a broader range of investors. Securitization also implies that the uncertain time τ could become less important for the investor if a market for the securities develops. This is because the value of the securities is always associated with the HPI.

Financial institutions may also find the creation of this market attractive simply for the potential to enlarge overall market size. In addition, with securitization, the intermediary receives an upfront fee. This type of deposit is naturally attractive from an intermediation perspective in terms of the typical maturity-mismatches faced by financial firms.

The NNEG charge may also offer diversification benefits. As the population lives longer, the income from the NNEG charge offers an excellent hedge against longevity risk faced elsewhere by organizations such as pension funds. Further opportunities may be available from this perspective, as discussed in Andrews and Oberoi (2015).

The increase in the overall size of this market may have additional ancillary benefits. For instance, futures contracts on house-price indices are already traded on some exchanges. However, one of the difficulties with pricing these contracts is the incompleteness of the market. The availability of secondary market securities with the exposure profile of residential real estate ownership would be a potential way of improving pricing.

A key benefit of this product extends to the pricing method. We have a direct estimate of the basis risk, and can more easily separate it from HPI risk. As a result, there is no need to model the HPI, as the HPI risk is consequently priced on a market-consistent basis (as the discount rate applicable to the asset is reflected in the current market price of the home).

By focusing on retirement age homeowners, we address the issue of early opportunistic exit as there is significant evidence that the majority of borrowing seniors wish to remain in their homes rather than to time the markets. However, some simple safeguards can be introduced to address this risk. Specifically, the risk is that a fall in the HPI over a particular time could exceed the accrued charges (rent-replacement plus fees), making the value of the loan negative. In such a scenario, it could be stipulated that the loan can only be settled by transfer of ownership of the property to the lender. This would ensure that the lender is not called upon by the borrower to pay them to settle the loan if house prices crash.

Moreover by unbundling and disentangling the risks associated with the full product, we think the components are a better fit for the hedging and risk management requirements of intermediaries and investors. For example, an insurer as intermediary holding the NNEG might be willing to take longevity risk, especially when it is not associated with direct exposure to residential mortgages. Or for example, a pension fund as investor might be willing to participate in a diversified pool of roll-up residential mortgage loans that did not include longevity risk, to which it is already exposed significantly. In addition, the pricing of

the NNEG at a fixed rate would assist in more favorable classification of assets under Solvency II regulations.

Solvency II capital requirements are front-of-mind with lenders and insurance firms. The unbundling of the product to enable lenders to take lending risk, insurers to take the NNEG risk, and investors to participate through a securitization, will reduce the capital requirements of any single party and create greater liquidity. A paper by the IFoA Equity Release Member Interest Group (2014) explains why Lifetime Mortgages (a type of HER product) are useful in meeting the Solvency II matching adjustment. A potential advantage to an intermediary who only retains the NNEG is that it is priced at a fixed rate that may reduce the capital requirements under the Solvency II regulations. This is a topic of current interest, with regulators developing more detailed guidelines for capital reserving with respect to HER.

4. Conclusion

We have proposed an alternative HER product targeted to seniors who wish to age-in-place, which is based on the return on a regional HPI that would enable the creation of securities that could be pooled in various packages and sold to investors. For illustrative purposes, we have priced this product using a consistent set of UK data with respect to house sales' prices, mortality, and disability rates. We show that loan-to-value ratios higher than are readily available in the marketplace are possible, along with relatively low insurance charges.

There are two key motivations behind the product. First, there is a widely recognized unmet need for HER among seniors that represents a degree of market failure. This is particularly true for households at retirement age, especially those who have expenses linked to care needs and yet a desire to age-in-place. Second, home equity is a desirable asset class for many investors and it is these investors that would benefit from bearing average house-price risk directly rather than charging a premium to insure it. However, homes are a lumpy asset and involve significant degrees of idiosyncratic risk as well as requiring co-ordination and management in terms of their nature as a physical asset. Moreover, it is difficult to obtain exposure to housing as an asset class in societies that value home ownership and tend to eschew renting where possible. The current conundrum offers an opportunity for a new arrangement that might address the unmet needs of both groups of people.

We believe we have provided a workable framework to introduce an innovation in the field of HER that promises gains from better risk allocation. The risk unbundling also clarifies the role and significance of various risks in reverse mortgages, thereby resulting in a more transparent pricing approach. This in turn could be beneficial in establishing capital requirements under new regulatory standards. This is also because the HPI itself need not be modelled to determine the price of the product.

Built into the product's design, ease of securitization offers a positive example of financial innovation, especially in an era where the public is sometimes skeptical of financial institutions' objectives.

Over the recent years, several products have been launched to disintermediate banks in real estate investment, by promising investors direct access to returns on shared home ownership rather than on mortgages. The proliferation of such products suggests that there is demand for a product similar to our proposal.

5. Acknowledgements

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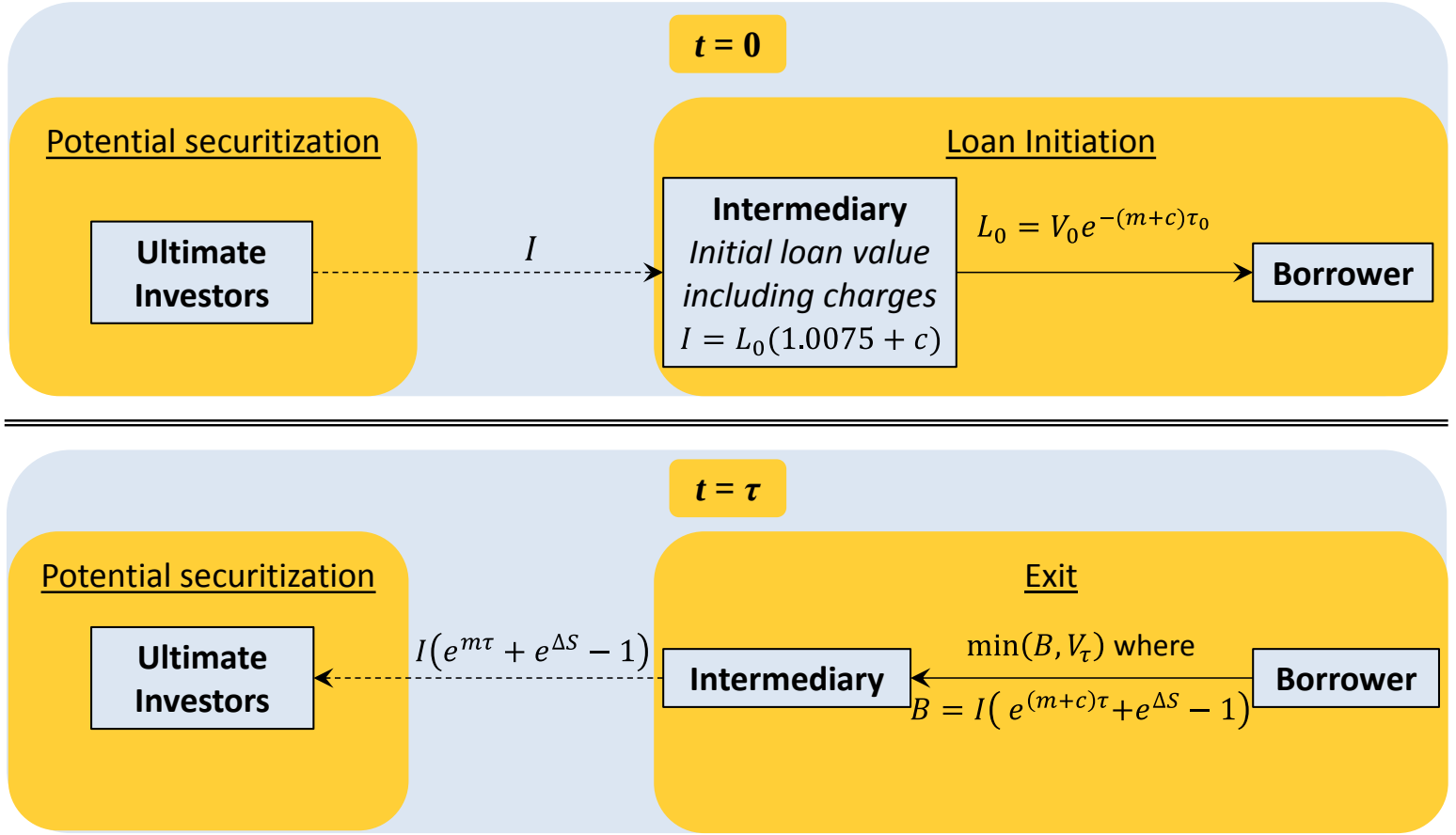
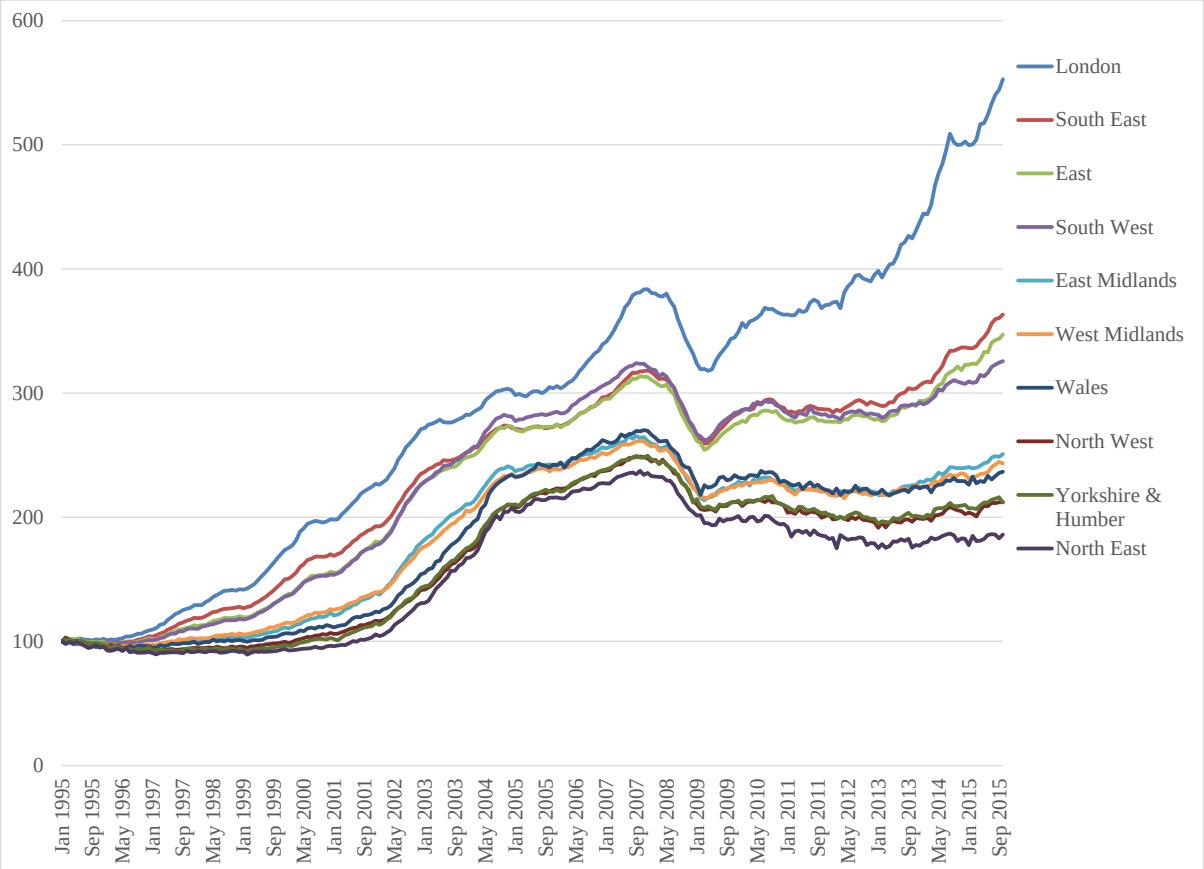
Tables and Figures

Figure 1: Product structure, illustrated for a single loan



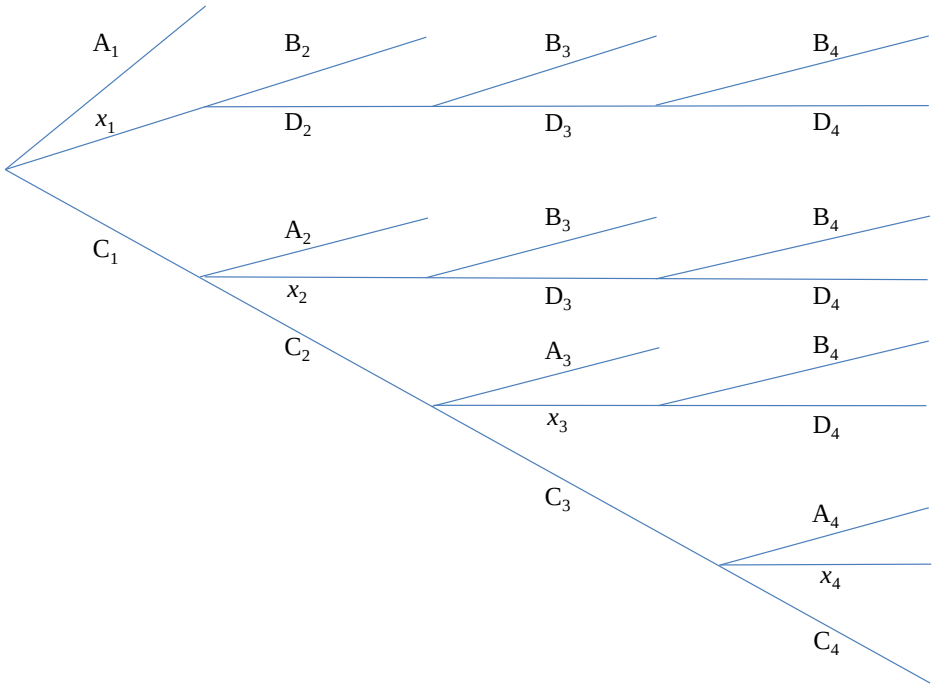
Notes: c is the composite charge $c_1 + c_2$, where the maintenance charge c_1 is considered to be spent at the same time as it is received (or charged to the loan). This illustration includes a 50 basis point initiation charge that is considered to be spent at the same time as it is received plus a 25 basis point charge in respect of the NNEG. Any cash balances grow at the risk-free rate.

Figure 2: House Price Index by region in England and Wales



Notes: The legend is arranged in descending order of the final value of the indices.

Figure 3 Probability Tree for the First Four Years



Note: C represents the probability that there is no change from the original state; x represents the probability that the state changes to X healthy Y deceased; A represents the probability that both partners are deceased and/or require care at the end of the year; B represents the probability that the single healthy X dies or requires care by the end of the year; D represents the probability that the single healthy X continues in that state. The states are determined at the end of the year. The associated probability tree for the first four years is shown.

Table 1: Loan to value ratios and fees, by region

Region	Rent replacement charge (m)	Loan to value ratio (%)	Initial charges (%)	Annual NNEG fee (%)
East Midlands	*2.0%*	69.15	0.730	0.056
	3.0%	59.30	0.602	0.016
	4.0%	50.66	0.507	0.000
East	*2.0%*	69.15	0.730	0.055
	3.0%	59.32	0.601	0.014
	4.0%	50.66	0.507	0.000
London	*2.0%*	68.75	0.751	0.092
	3.0%	59.16	0.610	0.030
	4.0%	50.66	0.507	0.000
Northeast	*2.0%*	68.92	0.742	0.077
	3.0%	59.16	0.610	0.031
	4.0%	50.66	0.507	0.000
Northwest	*2.0%*	68.84	0.746	0.083
	3.0%	59.13	0.612	0.034
	4.0%	50.66	0.507	0.000
Southeast	*2.0%*	69.09	0.733	0.061
	3.0%	59.29	0.603	0.017
	4.0%	50.66	0.507	0.000
Southwest	*2.0%*	69.07	0.734	0.063
	3.0%	59.28	0.603	0.018
	4.0%	50.66	0.507	0.000
Wales	*2.0%*	68.84	0.746	0.083
	3.0%	59.13	0.612	0.034
	4.0%	50.66	0.507	0.000
West Midlands	*2.0%*	56.64	1.304	1.302
	3.0%	50.20	1.033	1.057
	4.0%	44.13	0.822	0.862
Yorkshire and Humber	*2.0%*	69.00	0.738	0.069
	3.0%	59.22	0.607	0.025
	4.0%	50.66	0.507	0.000

Appendix A – Morbidity and Mortality Modelling

This Appendix explains the methodology and checks performed to calculate the mortality rates for the disabled population. The primary methodology was taken from Rickayzen and Walsh (2002). Some modifications were made in the interest of simplicity and checks were performed to validate the results.

Following are the steps to calculate qx (disabled):

- Life annuitant mortality rates (LML08 and LFL08) were taken from CMI (Continuous Mortality Investigation) website which were published along with Working Paper 81. LML08 and LFL08 rates represent underwritten healthy lives and were therefore, selected as base tables for calculating the disabled mortality, as it is assumed that some type of underwriting would occur in the home-equity application. These rates given by CMI applied as at 1 July 2008 and therefore, mortality improvement to get rates as at 2012 was calculated using mortality improvement rates taken from CMI's website. *https://www.actuaries.org.uk/learn-and-develop/continuous-mortality-investigation/cmi-working-papers/annuities/cmi-wp-81*
- Next calculate the extra mortality for someone aged x in disability category n. Rickayzen and Walsh (2002) use 10 disability categories, 0 meaning healthy and 10 being the most severe disability. For simplicity, we assumed anyone in state 0-5 is healthy and 6-10 is disabled, in the context of being able to stay in and manage a home on one's own. Those considered disabled were assigned an extra mortality using the following formula.

$$ExtraMort(x, n) = \frac{0.20}{1 + 1.1^{50-x}} \cdot \frac{\text{Max}(n-5, 0)}{5}.$$

- Add extra mortality rates and LML08/LFL08 rates with adjustment (calculated previously) to derive the mortality rates for disabled.
- State 7 disability rates were used for females all ages. State 7 disabled rates were used for males up to age 89 and state 6 disability rates were used for males post age 89.
- To perform checks, average mortality rates were estimated using the weights Rickayzen and Walsh (2002) table 3 (M) and table 3 (F).

  *Estimated avg. mort. = qx (disabled in given state) * disabled_weights + qx (PML08/PFL08 updated for mort. Improv.) * (1- disabled_weights)*

  qx (PML08) were taken from CMI's data published along with working paper 81 and mortality improvement was applied in a similar way as LML08/LFL08 to get rates as at 2012. Note: PML08 rates are for Pension annuitants in payment. We used PML08 rates in the above formula for non disabled lives because pensioner data would likely contain a mixture of healthy and mildly disabled/unhealthy lives. Hence, the estimated average mortality could be compared against English Life Tables.
- Checks were performed by comparing Estimated Avg. Mort. against English Life Table (ELT17) as at 2012. Refer to col L and col V in "Calulations" sheet. ELT17 rates were taken from CMI website.
- Based on the checks mentioned above, for males age 89 and up using state 5 gave a better fit to ELT17. However, using state 5 results in lower average mortality rates than PML08.

Therefore, state 6 disability rates were used instead. For all males other ages and for females, disability state 7 was used as the proxy for disability severity.

- Probability of becoming disabled in a year was calculated using the following formulas from Rickayzen and Walsh (2002) and parameter values (A,B,C,D,E) were taken from table 9.

For females,

$$NewDisab(x) = A + \frac{D - A}{1 + B^{C-x}}$$

For Males,

$$NewDisab(x) = \left(A + \frac{D - A}{1 + B^{C-x}}\right) \times \left(1 - \frac{1}{3} \cdot \exp\left[-\left(\frac{x - E}{4}\right)^2\right]\right)$$