Reverse mortgages: a long-term view of risk

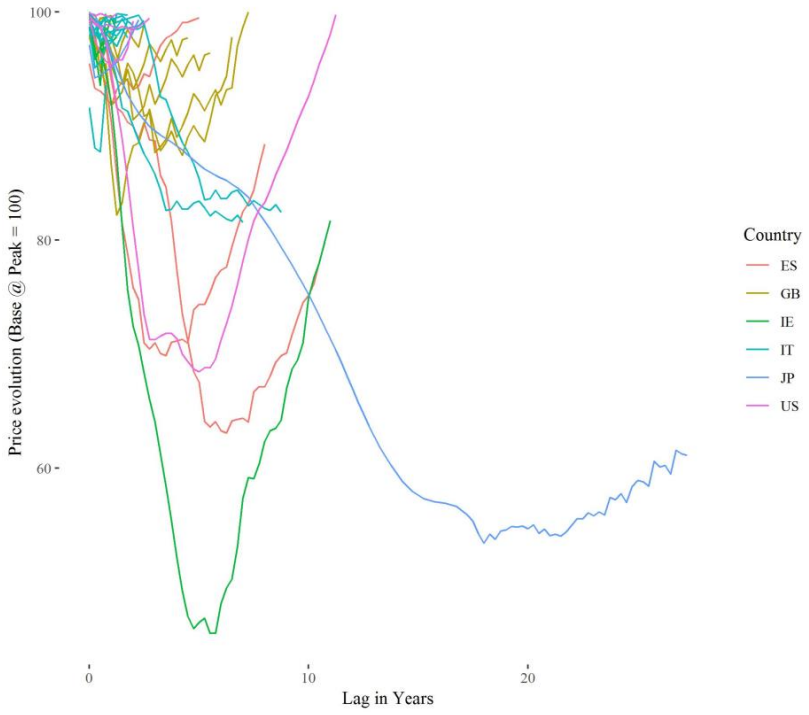
Reverse mortgages are common in Anglo-Saxon jurisdictions: EUR 3.6 bn of equity was released in the UK market in 2018, for example. Analysing the risk of these products typically includes the origination and servicer processes. However, this paper mainly focuses on two fundamental long-term risks: house prices and longevity risk.

Reverse mortgages, also called Equity Release Mortgages (ERM), allow relatively old borrowers to unlock the value of their properties and turn it into a cash lump sum provided by the lender. The loan is only repaid at the borrower's death from the proceeds of the real estate collateral seized by the creditor. These products are eligible to be securitised, allowing issuers to transfer economic risk, manage liquidity and stabilise long-dated cash flow variability to improve liability matching.

From an investor perspective, the risks associated with ERMs are generally product-specific and cannot really be captured using similar approaches to typical residential mortgage pools. The Non-Negative Equity Guarantee (NNEG) which represents the risk that the accrued mortgage value is not covered by the house proceeds, and involuntary pre-payment (i.e. if the borrower enters long-term care) are two examples of the uniqueness of ERMs. Along with those risks, investors and originators have to consider the phenomenon of improvement in death rates, defined as longevity risk.

In a context where the real estate collateral of the loans is set to be seized at some point in the future, an analysis of long-term house price developments is also essential. Scope considers historical residential real estate crashes in developed economies as a relevant proxy to forecast the extent of potential crises in the future, which could eventually affect the value of ERMs.

Figure 1: Typical evolution of House Price Index (HPI) in historical crises



Source: Scope Ratings, BIS

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The equity release mortgage market

A non-cash flowing product available to the elderly

ERMs are a non-recourse and first-lien instrument where a borrower owning a property can obtain a loan that is repaid when they die. Such loans have no interest or principal payments, and accrue until repayment date, even if pre-payments can occur for various reasons. The most common type of ERM is the Lifetime Mortgage, where the lender will provide cash to the borrower in exchange for a mortgage charge over the property.

Equity release products are aimed at the elderly willing to benefit from the value of assets tied up in the equity of their homes. Those customers are aged c. 70 years old on average and can be either individuals, or most often couples (60% of the cases in the UK). They are typically asset-rich and cash-poor, with less desire to leave a big inheritance. Proceeds of the loans are used for various purposes, including home improvement, existing debt servicing, as well as leisure (holidays, gifts, etc.).

ERMs are particularly used in Anglo-Saxon markets

ERMs are particularly prevalent in the UK, North America and Australia, with the various domestic markets sharing similar trends such as the increase in pensioner numbers as potential buyers, and the increasing risk of liability under-valuation. Growth has been significant in the UK over the past years both in terms of new plans subscriptions and total amount released. Consequently, the volume of outstanding ERMs is estimated to be in the GBP 20bn range, supported by c. 45,000 new plans per year. Another similar product exists in the UK, namely Home Reversion Plans, which are not mortgages but involve the sale by legal conveyance of all or part of the property by the customer.

Low volume of securitisations since the financial crisis

Securitisations of ERMs are not necessarily publicly rated, and the Prudential Regulation Authority (PRA) allows UK insurance companies to use internal risk management and rating methodologies to assess the credit risk associated when investing in securitisations backed by a pool of ERMs. Consequently, only a limited number of transactions have been publicly rated since the financial crisis. Structures are complex and typically include one to four senior notes to reduce fundamental spreads and manage downgrade risk; notes which account for 75% to 99% of the total value of the notes issued.

Multiple credit risk drivers

The Non-Negative Equity Guarantee: resulting from both house price and longevity risks

The primary risk to investors arises from the Non-Negative Equity Guarantee (NNEG) provided within the reverse mortgage agreement, the possibility that the accrued amount of the mortgage might not be covered by the sale proceeds of the house. In such cases, the lender has no other recourse against the borrowers or their heirs. The date of repayment of the mortgage can be either at the death of the borrower (or the last borrower in case of a couple), or at a pre-payment date. The latter can be either voluntary (akin to a classic mortgage) or triggered by the start of long-term care for the borrower, defined as morbidity risk.

Peculiar pre-payment risks linked to a move into long-term care

The voluntary pre-payment will be generally linked to a refinancing of the initial mortgage or a move into a new home. The involuntary pre-payment is due to the entry of the borrower into long-term care, which is a specific feature of these pools and not in any way linked to the evolution of interest rates. The occurrence of a higher-than-usual pre-payment rate will accelerate payments from the pool, lowering excess spread to the transaction while suppressing any future uncertainty from house-price risk for such properties.

Potential interest-rate mismatch between mortgages and securitisation pool

In addition, depending on the exact composition of the portfolio and of the liability structure of a securitisation, investors may be exposed to interest-rate risk in case of asset-liability mismatches. Another specific feature of these transactions is the liquidity risk arising from the lack of scheduled payments, particularly acute during the initial phase of the transaction if the pool is not sufficiently seasoned.

Underlying the NNEG risk, Scope identifies two major risks with regard to ERM: i) the evolution of house prices which directly affects future sales proceeds; ii) the improvement in longevity, increasing the frequency of the NNEG.

Understanding house price effect on ERMs

Historical house-price crashes form the basis of our long-term HPI scenarios

Looking specifically at pools of reverse mortgages, several features require a careful study of house prices, due to the specific context of these transactions versus the universe of other securitisations linked to residential real estate:

- The price of all properties matters for ERMs whereas only the price of the defaulted borrower's property is relevant in classic RMBS;
- The duration of the transaction is generally long (except for very seasoned portfolios), requiring a long-term analysis of HPI and less reliance on the initial housing market conditions;
- The likely independence of the date of property sale relative to the conditions of the housing market.

Scope approaches house price developments using specific scenarios corresponding to target ratings. Each scenario considers multiple variables, including i) observed historical house-price crashes across developed countries and ii) a minimal sustainable growth rate providing a minimal evolution of prices outside recession periods.

(Oust, et al., 2017) have analysed the largest house-price declines in developed economies since 1970[1] both in terms of duration and maximum drawdown.

Figure 2: House price crashes in developed economies (1970-2015)

Process type	Through date	Duration (quarters)	Max drop
Finland	1995-Q4	26	50.5%
Ireland	2013-Q1	24	51.6%
Netherlands	1985-Q3	29	52.6%
New Zealand	1980-Q4	25	39.4%
Norway	1993-Q1	24	45.5%
South Africa	1987-Q1	12	44.1%
Spain	2014-Q1	27	45.5%
United Kingdom	1977-Q3	16	35.6%
USA	2011-Q4	23	39.6%

Source: Scope Ratings, BIS

Conservative AAA stress scenario

The same study examines a longer dataset related only to single cities, where duration of crises is much shorter (3-9 quarters) with similar drops in prices (37-55%), except for Amsterdam in the 30s, where the house prices went through a drop of c. 75%. Thus, on average, large historical crises have a duration of 23 quarters with an average drop of around 45%. Scope will stress house prices based on rating-conditional haircuts, similar to what is done in other asset classes. The AAA scenario would generally capture a drop level of at least this magnitude, irrespective of the country. In terms of timing, the most conservative assumption would assume a crisis occurs at the early stage of the

[1] Based on the BIS property prices

transaction. If, however, for specific countries short-term dynamics of HPI can be more easily inferred, the occurrence of the crash could be delayed in our scenario.

HPI Scenarios should capture geographical concentration

In case of concentrated portfolios within a single region, the volatility of HPI may be potentially greater. Accordingly, Scope would adjust the relevant scenarios by using an add-on on top of the standard scenario to account for differences in the borrower distribution of the specific portfolio versus the aggregate population. As an example, we note that c.25% of UK reverse mortgages are located in the South-East region (ex-London), where its population only represents 13% of the UK population.

Specific property depreciation

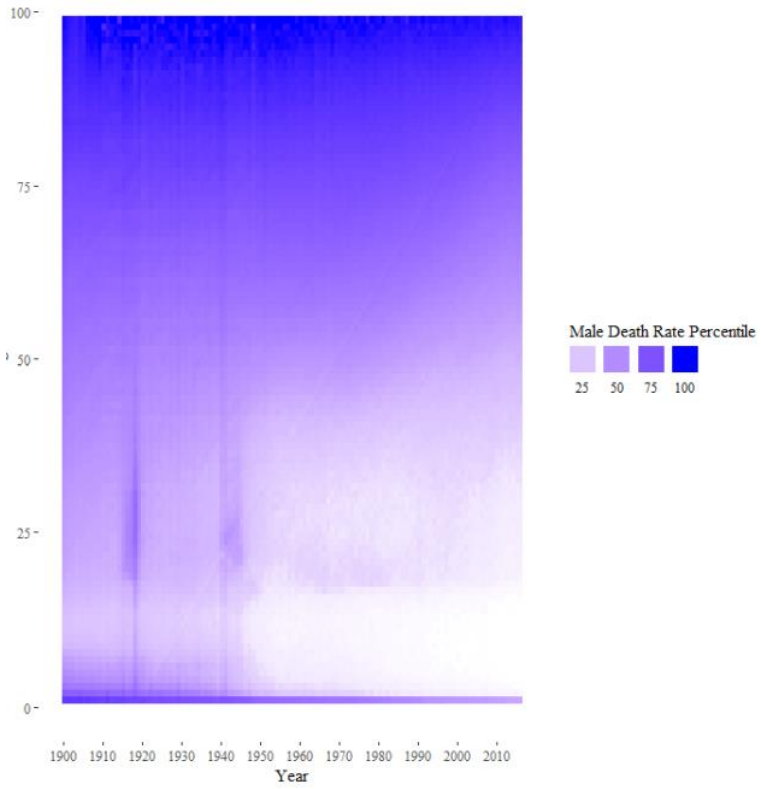
Due to its age, or to the existence of negative equity, borrowers could be inclined to reduce or stop maintenance of their homes, triggering a natural price decline. Looking at the recent US crisis, (Haughwout, et al., 2013) shows that households are spending on average 1.5% of the house price on improvements and in maintenance costs. However, such spending is reduced by 50-75% in the presence of negative equity. This risk should be captured by a property depreciation add-on computed from the deviation seen on the originator historical portfolio.

Mortality and longevity risks

Mortality tables are used to estimate the timing of repayment

The timing of repayment within a reverse mortgage pool is mostly defined by the death of the borrowers, thus triggering a requirement for the analysis to include assumptions regarding the date of occurrence of such, and their associated probabilities. Due to the granular nature of the pool, mortality tables can be used to compute the expected timing of disappearance. Such tables have been evolving through time, causing an increase in life expectancy for most developed countries. The ageing of the world population has been observed since the beginning of the 20th century (disregarding the impact of both WWs), mostly as a consequence of progress in medicines, cure and prevention.

Figure 3: Male mortality rates in England and Wales (binned by age percentile)



Source: Scope Ratings, Human Mortality Database

Bottom-up approach to adjust according to the market experience

Among available mortality tables, Scope believes the most relevant inputs are the pension annuity tables for males and females. However, we would adjust the starting point in order to account for:

- The specific experience of the originator (its own period mortality table if available);
- Any basis risk if the initial mortality table is based on products which are materially different from ERMs;
- The seasoning of the mortgages (potentially due to the selection process at origination) by decreasing the mortality rates in the few years following their origination[2];
- The longevity risk for which we would apply an improvement in mortality rates defined by age/year bands. Such improvements depend on the target rating of the tranche and are defined based on the historical development of general population mortality tables.

A conservative approach to pre-payments informed by the originator experience

In addition, we need to consider pre-payments: either involuntary (morbidity) or voluntary (classic pre-payments). The underlying assumptions for those will be mainly derived from the historical experience of the originator, having regard to other existing reference points such as i) for voluntary pre-payments, the ranges of 0.5%-2.5% provided by (Hosty, et al., 2008) and of 1.5%-4.5% observed on the ERMs securitisations; ii) for morbidity, rates could be defined as a percentage of mortality rates per age band, ranging from 6%-10% for males and 9%-26% for females, as per (Tunaru, et al., 2019). In both cases, the most conservative approach is to have 0% prepayments, leading to an increased shortfall and more potential negative equity.

Future mortality rates should account for longevity risk…

As has been observed historically, longevity risk is the risk that there will be further improvements in existing mortality tables. In case of reductions in mortality rates, this will only increase the duration of the mortgage leading to more frequent negative equity. This is particularly relevant for a portfolio of reverse mortgages as all loans would be affected.

.. where past improvements can be extrapolated

In order to capture the potential future development of mortality rates, it is relevant to analyse historical mortality tables to understand their dynamics per period and extrapolate those. Analysis of the historical dynamic is done using a Lee-Carter model, see (Lee, et al., 1992), to extract the recent evolution in mortality improvements from the aggregate population tables. This model decomposes mortality rates (or central death rates) into a static component depending on the age, along with a dynamic parameter depending on age and year through the product of a constant by a year index:

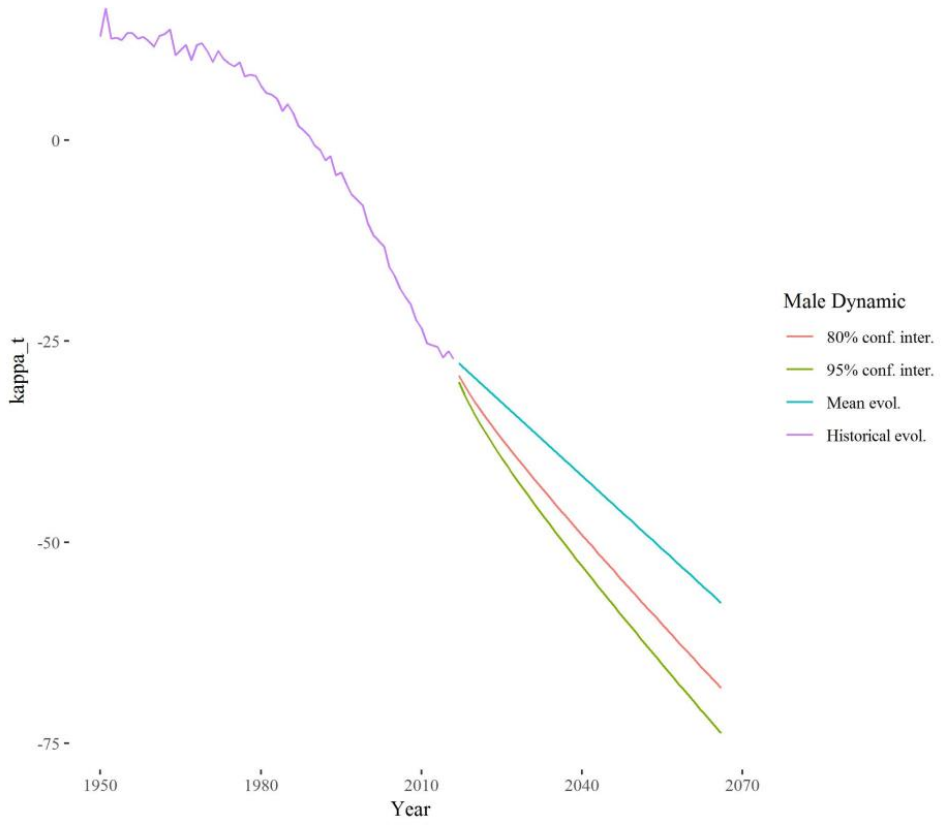
$$ln\ \mu_x(t)=\alpha_x+\beta_x\kappa_t+\epsilon_{x,t}$$

with x representing the age and t the year, $\epsilon_{x,t}$ being a random noise capturing the idiosyncratic effect not captured in the model.

Statistical analysis of historical data with regard to the existing general population returns the historical series κt. According to the target rating, we would then define a stressed scenario for such a parameter in the future, allowing us to compute a stressed evolution of mortality rates. Eventually, this allows us to derive assumptions on improvements of mortality rates according to the ages and years, to subsequently apply those on the current mortality tables.

[2] Depending on the underwriting criteria, the mortality following the underwriting date may be lower than the one implied by the table. However, this will be a short duration effect (2 years in the UK according to (Hosty, et al., 2008))

Figure 4: Evolution of the male death rate in the UK



Source: Scope Ratings, Human Mortality Database

Based on UK historical evolution, for a stressed scenario, we would define the most conservative path for the future evolution of κt, which is the only element required to capture longevity risk. This vector of future improvements allows us to define prospective annual improvements in mortality rates.

Figure 5: Longevity risk adjustment ranges

Year band	Age band	Range of annual improvement rates
2010-2030	50-70	-6.5% / -2.5%
	70-80	-6% / -2%
	80-90	-4.5% / -1%
	90-110	-2.5% / -0.5%
2030-2050	50-70	-5% / -1%
	70-80	-4.5% / -2%
	80-90	-3.5% / -0.5%
	90-110	-2% / -0.5%
2050-2070	50-70	-6% / 0%
	70-80	-5.5% / 0%
	80-90	-4% / 0%
	90-110	-2.5% / 0%

A look at death causes to draw the shape of future improvements

Our assumptions regarding future improvements are capturing two main effects, namely the facts that most of a decrease in mortality rates will be for lower age bands rather than for older ones, and that such improvements will tend to flatten over time. Those improvements should be compared to the major causes of mortality:

- For UK males, the main cause is heart disease accounting for 13.6% of deaths, followed by dementia with 8.3%;
- For UK females, the main cause is dementia accounting for 15.8% of deaths, followed by heart disease with 8.3%;
- For both sexes, focusing only on ages above 65, the main causes would be heart disease, dementia, lung cancer and chronic respiratory disease.

Thus, a scenario where the major cause of deaths disappear over a duration of three years would decrease mortality rates by c. 5% over the same period.

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