MOODY'S INVESTORS SERVICE

RATING METHODOLOGY

Reverse Mortgage Securitizations Methodology

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This rating methodology replaces *Reverse Mortgage Securitizations Methodology* published in April 2020. We clarified how we apply our home price decline assumptions, and we made editorial updates to enhance readability.

Scope

This rating methodology applies to securities backed by reverse mortgage loans.

In this methodology, we explain our approach to assessing credit risks for reverse mortgage securitizations, including quantitative and qualitative factors that are likely to affect rating outcomes in this sector.

We discuss the asset and liability analysis, including associated modeling, as well as other considerations. We also describe our monitoring approach.

Rating Approach

In this section, we summarize our approach to assessing credit risks for securities backed by reverse mortgage loans, including quantitative and qualitative factors that are likely to affect rating outcomes in this sector.

Asset Description

A reverse mortgage is a mortgage loan – usually secured by a residential property – in which the main source of repayment is the proceeds from the sale of the underlying home or prepayment by the borrower. The reverse mortgage, which lenders typically market to older borrowers, is typically due and repayable either upon the death of the borrower or when the borrower moves out of the home. We refer to these as maturity events. The loans can feature a bullet repayment for the whole loan, or a series of repayments, or take the form of a revolving credit line. Interest usually accrues until the loan is repaid. For certain product types, the borrower agrees instead to sell a portion (or all) of the home at a discount in return for a lump sum payment. The lender or buyer then receives a portion (or all) of the proceeds when the home is sold.

Key Risks

The major risk for investors in a reverse mortgage securitization is a decline in home values such that when the homes underlying the securitized loans are sold, the proceeds are insufficient to pay off the original loan amount and any accrued interest. To account for this risk, the main variable that we consider in our analysis is the future price movement of the underlying homes in the asset pool. Since each loan's maturity is uncertain, the interest that can accrue and the exposure to home price movements are also uncertain. Consequently, we also analyze the factors that can affect the loan maturity dates, such as expected mortality rates for borrowers and the likelihood of moving out of the home before death.

In addition, cash flows are highly uncertain because reverse mortgages do not have regularly scheduled payments. Consequently, we assess the extent to which the transaction's assets or reserve funds provide sufficient cash to make the required payments on the securities and transaction fees. In our assessment, we incorporate any additional risk that might arise if the securities have a variable interest rate.

To analyze the risks, we stress each of the related variables to levels we deem consistent with the target rating on the securities, applying greater stress to the risk variables the higher the rating. We use a cash flow model of the transaction to determine whether investors would be paid in full in the stress scenario. The cash flow model generally represents how the transaction allocates cash flows from the assets, credit enhancement, and hedging vehicles among the various transaction participants, as well as how it allocates asset losses. It also models how triggers within the transaction change those allocations.

In determining our ratings, we may also consider the results from other stressed combinations of the risk variables to account for idiosyncrasies in a particular transaction, such as correlations across the variables or concentrations among the assets. Model outputs derived by our quantitative modeling are important considerations in our rating committee process. However, the ratings assigned by the rating committee also incorporate a variety of qualitative factors, including operational, counterparty and legal risks, as well as underwriting and servicing practices. As a result, the assigned rating may differ from the model output.

Asset-level Analysis and Related Modeling

In this section, we explain how we analyze the underlying assets that back reverse mortgage securitizations and how we estimate potential losses on those assets.

Home Price Risk

Repayment of a reverse mortgage loan depends on the net liquidation proceeds from the sale of the property,[1] and thus our home price assumptions play a key role in our approach. In our scenarios, we generally assume a decline in home prices occurs in the first year of the transaction and no decline for B2 (sf)-rated securities. Furthermore, we typically assume no price appreciation for Aaa (sf)-rated securities. For outstanding transactions, the decline occurs the year of the review date.

Home Price Decline Assumptions

Home price decline is a more critical assumption for reverse mortgage-backed securities than for standard residential mortgage-backed securities (RMBS) for two key reasons: unlike standard RMBS, where only defaulted properties are liquidated, all properties with reverse mortgages - if not prepaid - are eventually sold. In addition, the average life of a reverse mortgage transaction is much longer than an RMBS transaction.

As a starting point for our Aaa (sf) home price decline assumptions, we apply a stress similar to one applicable to a portfolio of residential mortgage loans under our country-specific asset modeling approach. In the US, we typically use a fixed home price decline assumption similar to the one described in our US RMBS methodology[2] and apply this assumption throughout the transaction's life. For countries where the home price decline assumption varies over time, we typically consider a "through-the-cycle" concept, i.e., an average stress decline over a long-term period, to maintain stability in that assumption. For B2 (sf)-rated securities, we typically assume no price decrease in the first year. For securities with ratings ranging from Aa2 (sf) to Ba2 (sf) as per the tables in Appendix A, the home price decline is typically based on an interpolation of the stresses applied in Aaa (sf) and B2 (sf) scenarios. Our home price decline assumption includes foreclosure costs.

We may apply a higher stress (at each rating level) for home price decline assumptions if there are specific risks in the transaction or unusual concentrations in the reverse mortgage pool, such as geographic concentrations, which make it more likely that a regional downturn could cause a significant decline in the overall pool performance.

Our home price decline assumptions for reverse mortgages in a severe stress scenario could be higher than the assumptions we use to rate standard RMBS transactions because of (1) the higher sensitivity to home price declines in a reverse mortgage transaction since all of the properties need to be sold - if not prepaid; (2) the potential selection bias in terms of borrower (borrowers who expect to live longer) and property type (higher value properties); and (3) the uncertainty regarding the level of property maintenance. However, a strong mitigant to the above factors is the lack of correlation in reverse mortgages between the timing of a sale and the home price cycle. This contrasts with the correlation between severe home price declines and higher defaults and subsequent foreclosures among residential mortgage borrowers. In addition, in reverse mortgage transactions we conservatively apply the home price decline to the whole portfolio in the first year of the transaction for the Aaa to Ba2 scenarios.

[1] We typically index the property value at the analysis date.

[2] For more information, see our methodology for rating US RMBS. A link to a list of our sector and cross-sector methodologies can be found in the "Moody's Related Publications" section.

Home Price Appreciation Assumptions

We set the long-term assumption for home price appreciation at zero for Aaa (sf)-rated securities. For B2 (sf)-rated securities, we typically apply a growth rate which is a stable approximation of our expected long-term growth rate. For securities with ratings ranging from Aa2 (sf) to Ba2 (sf) as per the tables in Appendix A, the growth rate is typically based on an interpolation of the appreciation applied in Aaa (sf) and B2 (sf) scenarios. We may apply lower home price appreciation assumptions (at each rating level) if there are specific risks in the transaction or in the reverse mortgage pool.

Our home price appreciation assumptions incorporate an expectation that the homes of reverse mortgage borrowers will appreciate less on average than those of the population as a whole because of the following factors:

» Reverse mortgage borrowers are relatively unlikely to repair or refurbish their homes given that part or all of the upside in value will mostly benefit the reverse mortgage provider. A decline in the value of the home will also not leave the borrower's estate with unpaid mortgage debt (the debt would be extinguished).

» In contrast with a traditional mortgage, the balance on a reverse mortgage rises over time, which increases the likelihood that the homeowner's equity stake will be wiped out, reducing the incentive to maintain the home.

See Appendix A for our typical country-specific home price decline and appreciation assumptions. When relevant, we may also consider alternative home price appreciation assumptions.

Reverse Mortgage Maturity

Reverse mortgages mature when the borrower dies or, in the case of co-borrowers, when both die (mortality event). When the borrower moves into long-term care (morbidity event) or when the borrower repays the loan (prepayment or mobility event), the reverse mortgage will also mature. For each mortgage in the pool, we estimate the probability of maturity in each year after origination, taking these types of events into account.

Timing of Mortality Events

We establish baseline assumptions for the timing of mortality events using the mortality rates compiled in the country of the securitization, typically by the life insurance industry, to the extent that they are available. Typically, the mortality rates are stratified by gender and age, allowing us to distinguish broadly among types of borrowers in the pool. If data in a particular country are not available, we may use data from comparable countries and adjust accordingly for possible discrepancies.

In light of their sociodemographics, we assume longer life expectancy for the population of borrowers that use reverse mortgages than for the general population, but reasonably equivalent to that of a life insurance annuitant population. Therefore, we may also adjust the data to account for likely differences between the population reflected in the historical data and the borrowers in the pool.

Another factor that we account for is whether the mortgage has a single obligor or joint obligors. A reverse mortgage maturity event caused by mortality is triggered by the death of the second individual in a couple. Therefore, when there are joint borrowers, we calculate the mortality rate for the couple, which is the joint probability of both obligors' death. Consequently, near-term mortality rates for couples are considerably lower than the mortality rates of individuals.

Our analysis of the likely mortality rates of the pool also incorporates expectations of changes in life expectancies resulting from improvements in living standards and in healthcare technology and availability.

We typically assume in our analysis more improvement for higher-rated securities than for lower-rated securities, resulting in greater longevity and, thus, a higher stress. See Appendix B for more information. In addition, we may apply different improvement factors if the pool is concentrated in a specific cohort (for example, in cases where all borrowers have similar ages).

Timing of Morbidity and Mobility Events

In our analysis, we distinguish between two sources of prepayments, which are influenced by different factors and treated differently in reverse mortgage contracts. Borrowers who move to a long-term care facility or nursing home due to health reasons (which is usually referred to as a morbidity event) typically do not incur a prepayment penalty (i.e., properties are sold without additional costs) on a reverse mortgage, while borrowers who move out for other reasons (usually referred to as a mobility event) can incur a prepayment penalty. In addition, borrowers who prepay the reverse mortgage outside of these circumstances can also incur a prepayment penalty. The most important factors determining the likelihood of a health-related morbidity event are the age of the borrower(s) and whether there is a single borrower or joint borrowers. For example, older borrowers are more likely to need the services of long-term care facilities or nursing homes, and there is a higher likelihood that a single person will need those services than both people in a joint-borrower mortgage. In contrast, older borrowers are less likely to move for non-health-related reasons.

There is often little incentive for reverse mortgage borrowers to prepay their loans, causing a mobility event. Typically, prepayments are highest in the early years of a transaction in instances where the borrower decides that the reverse mortgage product was unsuitable. In addition, borrower mobility typically declines with age. Higher home price appreciation rates can also result in higher prepayment rates as borrowers look to withdraw equity from their homes to repay debts. Conversely, prepayments could fall as home prices decline. Interest rate changes can also affect prepayment rates, with interest rate declines inducing some fixed-rate borrowers to prepay their loans as they start shopping for lower rates.

We derive the prepayment and morbidity rates, which are typically low single-digit numbers, based on the portfolio's characteristics, the rating scenario and available market data. In our analysis, we may reduce the prepayment and morbidity rates to zero when considering high rating scenarios and in cases where there is not sufficiently reliable data or prepayment penalties are high.

Interest Rate Risk

Transactions with variable interest rates on either assets or liabilities or both are subject to interest rate risk. For example:

- For transactions with floating-rate bonds and fixed rates on the mortgages, there is a risk that the interest rates on the liabilities will rise.[3]
- For transactions with variable rates on both assets and liabilities, there is a risk that the spread between the interest rate on the assets and the rate on the securities will move adversely. In addition, even if the spread between the rates remains constant, increases or decreases in the overall interest rate can positively or negatively affect the credit quality of the transaction, depending on how home prices move and the transaction structure.
- For transactions with variable rates on the assets (mortgages) and fixed rates on the securities, the risk is that the interest rates on the assets will decline.

[3] For more information, see our methodology for assessing counterparty risks in structured finance transactions. A link to a list of our sector and cross-sector methodologies can be found in the "Moody's Related Publications" section.

Consequently, in transactions with variable rates, we review the results of the cash flow model assuming various levels of interest rates to capture the appropriate risk.

In the base case, we generally assume an interest rate level based on the applicable home price growth rate for each rating stress, while typically maintaining a fixed differential between long-term interest rates and home price growth rates after the initial home price decline. For example, in our Aaa scenario where we assume a severe home price decline with no recoveries, we generally assume a low interest rate of 1% throughout the transaction's life. See Appendix A for our typical country-specific interest rate and home price growth rate stresses.

We use our stress assumptions for home price changes, the timing of maturity events, and interest rates on the mortgages to estimate the probability-based cash flows that would be generated by each reverse mortgage in the asset pool. We use the interest rates on the loans to generate the loan balance in each future period and the timing of maturity events to calculate the probability-based portion of the loan balance paid down each period. See Appendix C for an example of how we determine the cash flow from a single hypothetical reverse mortgage.

Data for Collateral Analysis

To perform the collateral analysis described above, we typically receive loan-level data on loan balance, borrower(s) age, gender, latest available property value, valuation type, property location, property type, interest on the loan and other information specific to the loan product type.

Structural Analysis and Liability Modeling

In this section, we explain how we analyze the structural features of reverse mortgage securitizations, including how we model and allocate cash flows to different classes of securities, taking into account asset cash flows and available credit support.

Cash Flow Model

We combine the cash flows generated by the reverse mortgages in the asset pool with any cash flows generated by hedging instruments in the securitization. We then use a model of the transaction that incorporates how it allocates cash flows and losses, the triggers that change those allocations, the interest rates on the securities, and the credit enhancement (including guarantees)[4] to determine whether those cash flows would be sufficient to pay investors in full and on a timely basis. The model output corresponds to the rating consistent with the most stressful scenario the security could withstand without any losses. Additionally, we also account for the potential loss severity of a tranche in relation to its thickness when determining the rating.

Liquidity Risk

There are no regularly scheduled payments on reverse mortgages, but the payments of interest and sometimes principal on the structured securities are due regularly. Consequently, in our analysis, we assess the extent to which there will likely be sufficient cash flow from the assets (in the stress scenarios) and from other sources (such as reserve funds) to pay interest and mandatory scheduled principal when relevant on the securities. To assess the other sources of cash required in the transaction, we consider the consequences of missed payments for each class of securities, as well as the likelihood and potential length of interest payment deferral. In addition, we consider in our analysis whether there are mechanisms in place to

[4] For special considerations regarding home equity conversion mortgages (HECMs) guaranteed by the Federal Housing Administration (FHA), see Appendix D.

replenish such reserve funds, if necessary. For securities with floating interest rates, we incorporate into our analysis the risk that interest rates may rise over the life of the transaction to test that interest is paid regularly even if the pool has not generated any cash.[5]

Other Considerations

Along with our asset, structural and liability analysis, we consider other quantitative and qualitative factors in our credit analysis such as transaction counterparties, legal risks, reliability and completeness of historical and portfolio data, and environmental, social and governance (ESG) considerations.

Counterparty Risks

We consider various counterparty-related risks at different stages throughout our credit analysis. More specifically, the risks we consider include hedge counterparties and operational risks.[6] Based on our review, we may adjust our assumptions, inputs or model results. If information is limited, we may also adjust the rating level.

Hedge Counterparties

We analyze the rating impact of exposures to hedge counterparties including assessing the probability of a transaction becoming unhedged and deriving additional potential losses. As part of our analysis, we may conclude that we adjust the ratings to reflect the linkage and additional loss.

Operational Risk

Operational risks can arise from various potential sources, including disruption to cash flows caused by the financial distress of a service provider to a reverse mortgage securitization. As part of our analysis, we consider the financial disruption risk and the roles of relevant transaction parties.

Similar to other RMBS asset classes, our servicer quality analysis in reverse mortgage transactions addresses the impact of servicer practices on the performance of the mortgage pool.[7] Reverse mortgages also pose unique servicing challenges. Unlike traditional mortgage transactions, reverse mortgage transactions do not require the servicer to process payments or make collection calls. Its responsibilities instead generally include determining each property's occupancy status (to determine if a maturity event has occurred), updating the property values using a desktop or indexed valuation (generally when the borrower defaults) and ensuring that payment of insurance is current. We update this assessment as necessary as we monitor transactions and incorporate our views on the servicer's quality.

Legal Risks

We assess legal risks that may affect the expected losses posed to investors. In particular, we consider the potential legal consequences of whether the issuer is bankruptcy remote. We review legal opinions at closing to inform our views on the key legal risks identified in a transaction.

Our legal analysis focuses on the risks posed by the potential bankruptcy of the transaction originator, securitization entity, servicer and other relevant parties. We also consider the consumer protection laws and regulations applicable to the reverse mortgage loans, the obligors and the originators. For example,

[5] For more information, see Appendix A.

[6] For more information, see our methodology for assessing counterparty risks in structured finance transactions. A link to a list of our sector and cross-sector methodologies can be found in the "Moody's Related Publications" section.

[7] For more information, see our methodology for assessing counterparty risks in structured finance transactions. A link to a list of our sector and cross-sector methodologies can be found in the "Moody's Related Publications" section.

borrowers or heirs could challenge mortgage agreements, and aggressive cross-marketing of other financial products, such as long-term annuities, could pose legal or reputational risks.

Data Quality Evaluation

We assign ratings to securities issued by reverse mortgage securitization when we have sufficient information from reliable sources. Data quality is also important throughout the life of a reverse mortgage transaction.[8]

Environmental, Social and Governance Considerations

Environmental, social and governance (ESG) considerations may affect the ratings of securities backed by a portfolio of reverse mortgage loans. We evaluate the risk following our cross-sector methodology that describes our general principles for assessing these ESG issues[9] and may incorporate it in our analysis.

Monitoring

In this section, we describe our approach when monitoring transactions.

We generally apply the key components of the approach described in this methodology when monitoring transactions, except for those elements of the methodology that could be less relevant over time, for example some elements of a legal risk.

We receive periodic information for the purpose of monitoring the transaction. More specifically, we track portfolio and loan-level information as well as information relating to the capital structure and credit enhancement.[10] We may also gather updated information on other factors such as annual life improvement factors, changes in house prices and foreclosure costs. The starting point is typically the monitoring of the collateral performance relative to our initial expectations.

Our monitoring analysis may also include ongoing assessment of any entity whose ability to fulfill its contractual obligation to the transaction could affect the cash flows that investors receive. Typically, those entities would include the servicer, swap counterparties and credit support providers. Changes in the financial stability of an entity could affect the credit quality of the securities. As pools season and borrowers become older, the servicer's role, in particular, becomes more important; for example, through active monitoring of the properties' occupancy status. We will reassess servicer quality as necessary as we monitor transactions.

We may, at times, ask for additional information to adequately monitor our ratings.[11]

[8] For more information, see our approach to evaluating date quality in structured finance transactions. A link to a list of our sector and cross-sector methodologies can be found in the "Moody's Related Publications" section.

[9] For more information, see our methodology that describes our general principles for assessing ESG issues. A link to a list of our sector and cross-sector methodologies can be found in the "Moody's Related Publications" section.

[10] For example, in methodologies where models are used, modeling is not relevant when it is determined that (1) a transaction is still revolving and performance has not changed from expectations, or (2) all tranches are at the highest achievable ratings and performance is at or better than expected performance, or (3) key model inputs are viewed as not having materially changed to the extent it would change outputs since the previous time a model was run, or (4) no new relevant information is available such that a model cannot be run in order to inform the rating, or (5) our analysis is limited to asset coverage ratios for transactions with undercollateralized tranches, or (6) a transaction has few remaining performing assets.

[11] For more information on our guidelines for assessing data quality in global structured finance transactions, a link to a list of our sector and cross-sector methodologies can be found in the "Moody's Related Publications" section.

Appendix A: Assumptions for Home Prices and Interest Rates

The following tables illustrate the home price decline, home price growth rate and interest rate assumptions we typically apply in the US, UK and Australia for different rating categories.

EXHIBIT 1

UK Assumptions for Home Price and Interest Rates

Target Rating	Aaa (sf)	Aa2 (sf)	A2 (sf)	Baa2 (sf)	Ba2 (sf)	B2 (sf)
Home price decline over 1 year	35%*	25%	20%	15%	10%	0%
Growth rate after 1 year	0%	1.5%	2.0%	2.5%	3.0%	3.0%**
Home price returns to level at the time of analysis	Never	20.5 years	12.5 years	8 years	5 years	N/A
Interest rate level	1%	2.5%	3.0%	3.5%	4.0%	4.0%

* This is based on the country-specific home price decline assumption we use when analyzing residential mortgage loan portfolios, although considering a "through-the-cycle" concept. The assumed home price decline of 35% over 1 year may be adjusted if deemed appropriate (e.g., to reflect portfolio concentrations or transaction-specific risks). For securities with ratings ranging from Aa2 (sf) to Ba2 (sf), the home price decline is typically based on an interpolation of the stresses applied in a Aaa (sf) and B2 (sf) scenarios.

** For securities with ratings ranging from Aa2 (sf) to Ba2 (sf), the growth rate is typically based on an interpolation of the stresses applied in a Aaa (sf) and B2 (sf) scenarios.

Source: Moody's Investors Service

EXHIBIT 2

US Assumptions for Home Price and Interest Rates (Active Reverse Mortgages)

Target Rating	Aaa (sf)	Aa2 (sf)	A2 (sf)	Baa2 (sf)	Ba2 (sf)	B2 (sf)
Home price decline over 1 year	30%*	25%	20%	15%	10%	0%
Growth rate after 1 year	0%	1.5%	2.0%	2.5%	3.0%	3.0%**
Home price returns to level at the time of analysis	Never	20.5 years	12.5 years	8 years	5 years	N/A
Interest rate level	1%	2.5%	3.0%	3.5%	4.0%	4.0%

* This is based on the country-specific home price decline assumption we use when analyzing residential mortgage loan portfolios. The assumed home price decline of 30% (for a diversified portfolio) over 1 year may be adjusted if deemed appropriate (e.g., to reflect portfolio concentrations or transaction-specific risks). For securities with ratings ranging from Aa2 (sf) to Ba2 (sf), the home price decline is typically based on an interpolation of the stresses applied in a Aaa (sf) and B2 (sf) scenarios.

** For securities with ratings ranging from Aa2 (sf) to Ba2 (sf), the growth rate is typically based on an interpolation of the stresses applied in a Aaa (sf) and B2 (sf) scenarios.

Source: Moody's Investors Service

EXHIBIT 3

Australia Assumptions for Home Price and Interest Rates

Target Rating	Aaa (sf)	Aa2 (sf)	A2 (sf)	Baa2 (sf)	Ba2 (sf)	B2 (sf)
Home price decline over 1 year	40%*	32%	24%	16%	8%	0%
Growth rate after 1 year	0%	1%	1.5%	2%	2.5%	2.5%**
Home price returns to level at the time of analysis	Never	40 years	19 years	10 years	4 years	N/A
Interest rate level	1%	2%	2.5%	3%	3.5%	3.5%

* This is based on the country-specific home price decline assumption we use when analyzing residential mortgage loan portfolios, although considering a" through-the-cycle" concept. The assumed home price decline of 40% over 1 year may be adjusted if deemed appropriate (e.g., to reflect portfolio concentrations or transaction-specific risks). For securities with ratings ranging from Aa2 (sf) to Ba2 (sf), the home price decline is typically based on an interpolation of the stresses applied in a Aaa (sf) and B2 (sf) scenarios.

** For securities with ratings ranging from Aa2 (sf) to Ba2 (sf), the growth rate is typically based on an interpolation of the stresses applied in a Aaa (sf) and B2 (sf) scenarios.

Source: Moody's Investors Service

When relevant, we may also consider alternative scenarios to determine the sensitivity of our ratings to various assumptions.

We may also review the results of liquidity stress scenarios assuming higher interest rate levels. In such scenarios, we assess the extent to which the transaction characteristics and other cash sources can provide sufficient cash flow to pay interest on the securities.

Appendix B: Application of Ratings-Based Longevity Improvement Stresses

We established the following approach to estimating future mortality improvements in the US, UK and Australia from their historical mortality improvement rates and based on the opinion of external longevity experts. We will develop similar approaches for other countries as the need arises, based on the information available in those countries.

Base-Case Scenario: Annual Improvement Factor Approach

We apply annual mortality improvement factor stresses based on rating levels and current age. Exhibits 4 and 6 illustrate the typical improvement factor stresses. For the Aaa (sf) scenario, we generally assume a 5% annual mortality improvement in the US, while in the UK and Australia, we assume a 7.5% mortality improvement for ages 60-69 and 5% for ages 70 and higher. We also cap the borrower age at 120.

EXHIBIT 4

US: Assumptions for Mortality Improvement Factor Stress

Age	Aaa (sf)	Aa2 (sf)	A2 (sf)	Baa2 (sf)	Ba2 (sf)	B2 (sf)
60-120	5.0%	4.0%	3.0%	2.0%	1.5%	1.5%

Source: Moody's Investors Service

EXHIBIT 5

UK and Australia: Assumptions for Mortality Improvement Factor Stress

Age	Aaa (sf)	Aa2 (sf)	A2 (sf)	Baa2 (sf)	Ba2 (sf)	B2 (sf)
60-69	7.5%	6.5%	5.5%	4.5%	3.5%	3.5%
70-120	5.0%	4.0%	3.0%	2.0%	1.5%	1.5%

Source: Moody's Investors Service

Sensitivity Scenario: Age-Setback Approach

We may also apply an age-setback approach to determine the reasonableness of our baseline scenario for future improvement in expected life. In this case, we will not apply any improvement factor stresses. In the Aaa (sf) scenario, we typically use an age setback of 10 years, which effectively means that a 70-year-old is assumed to have the mortality rates of a 60-year-old, and hence increases the expected life.

EXHIBIT 6

Age-Setback Approach for the US, the UK and Australia

Aaa (sf)	Aa2 (sf)	A2 (sf)	Baa2 (sf)	Ba2 (sf)	B2 (sf)
10 years	8 years	6 years	4 years	2 years	2 years

Source: Moody's Investors Service

Appendix C: Illustrative Example of Determining Cash Flow for a Sample Reverse Mortgage

The following is an example of how we determine the cash flow from a sample reverse mortgage, taking into account expected improvements in mortality rates. We calculate the maturity event rate which represents the probability that a loan is repaid in a given year, with repayment triggered by the death of any remaining obligors.

Define:

» t as the number of years since the date of our analysis.

» $q(t)$ as the one year probability of death *t* years in the future for an individual who has survived through year *t-1*.

In our example below, the individual who is the remaining obligor has lived up to age 60, so q(1) is the probability of death in the 61st year of age (given that the individual has lived to age 60). Likewise, q(2) is the probability of death in the 62nd year of age, conditional on the individual having lived to age 61, and so on.

» IF as the improvement factor that represents the annual rate of improvement in mortality of an individual, or equivalently, the reduction in the conditional one year mortality rate *q(t)*.

» $s(t) = \big(1 - q(t)\big) * s(t-1)$ as the probability that the individual is still alive after a period of *t* years following the date of our analysis, with $s(0) = 1$.

» $p(t) = q(t) * s(t-1)$ as the maturity event rate, i.e., the probability that the individual will repay (by way of death) *t* years following the date of our analysis. We assume that Σ p(t) =1.

» $Q(t) = q(t) * (1 - IF)\text{^}(t-1)$ as the adjusted conditional one year probability of death $q(t)$ after accounting for the improvement factor *IF*.

» $S(t) = [1 - Q(t)] * S(t-1)$ as the adjusted probability that the individual is still alive after a period of *t* years following the date of our analysis, after accounting for the improvement factor *IF*, with $S(0) = 1$.

» $P(t) = Q(t)*S(t-1)$ as the maturity event rate adjusted for the improvement factor *IF*.

The exhibit below shows how we calculate the maturity event rates p(t) and P(t) using both 0% and 2% improvement factors:[12]

[12] For this example, we will use $q(t)$ based on the years 2015-2017 from the UK Office for National Statistics. We typically use individual annuity mortality tables from the Society of Actuaries for the US and from the Bureau of Statistics for Australia.

EXHIBIT 7

Maturity Event Rates

		No mortality improvement: IF equal to 0%		Adjusted conditional prob of death assuming IF equal to 2%	Mortality improvement: IF equal to 2%	
t	*q(t)*	*s(t) = [1- q(t)] * s(t-1)*	*p(t) = q(t) * s(t-1)*	*Q(t) = q(t)* (1-IF)^(t-1)*	*S(t) = [1 - Q(t)] *S(t-1)*	*P(t) = Q(t) * S(t-1)*
1	0.7955%	99.20%	0.80%	0.80%	99.20%	0.80%
2	0.8614%	98.35%	0.85%	0.84%	98.37%	0.84%
3	0.9324%	97.43%	0.92%	0.90%	97.49%	0.88%
4	1.0484%	96.41%	1.02%	0.99%	96.52%	0.96%
5	1.1447%	95.31%	1.10%	1.06%	95.51%	1.02%
6	1.2244%	94.14%	1.17%	1.11%	94.45%	1.06%
7	1.3496%	92.87%	1.27%	1.20%	93.32%	1.13%
8	1.4599%	91.51%	1.36%	1.27%	92.14%	1.18%
9	1.5607%	90.09%	1.43%	1.33%	90.91%	1.22%
10	1.7228%	88.53%	1.55%	1.44%	89.61%	1.31%

Source: Moody's Investors Service

Assuming the following property and loan characteristics:

» Loan balance on the date of our analysis (LB(0)) = £ 150,000

» Property value on the date of our analysis (PV(0)) = £ 300,000

» Fixed interest rate (r) = 5%

» HPI growth rate (HPI rate) = 2%

The exhibit below shows a simplified example of how we determine the probability-based cash flows from a reverse mortgage:

EXHIBIT 8

Reverse Mortgage Cash Flow Calculations

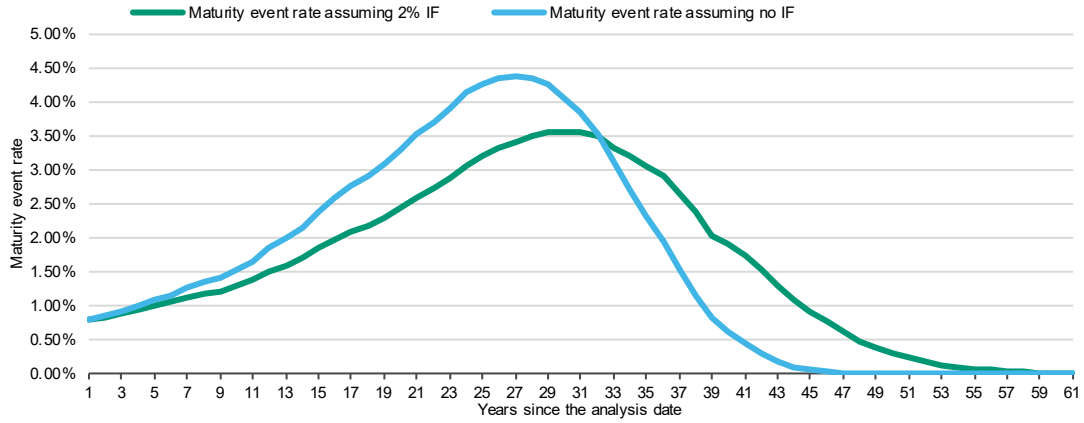
t	Property Value	Loan Balance	Cash flow assuming IF 0%	Cash flow assuming IF 2%
	*PV(0) * (1+HPI rate)^t*	*LB(0) * (1+r)^t*	*min(PV(t), LB(t)) * p(t)*	*min(PV(t), LB(t)) * P(t)*
1	£306,000	£157,500	£1,253	£1,253
2	£312,120	£165,375	£1,413	£1,385
3	£318,362	£173,644	£1,592	£1,530
4	£324,730	£182,326	£1,862	£1,754
5	£331,224	£191,442	£2,113	£1,951
6	£337,849	£201,014	£2,346	£2,125
7	£344,606	£211,065	£2,682	£2,383
8	£351,498	£221,618	£3,005	£2,621
9	£358,528	£232,699	£3,324	£2,847
10	£365,698	£244,334	£3,792	£3,191

Source: Moody's Investors Service

The two exhibits below show the maturity event rates and the cash flow per period, with and without the improvement factor.

EXHIBIT 9

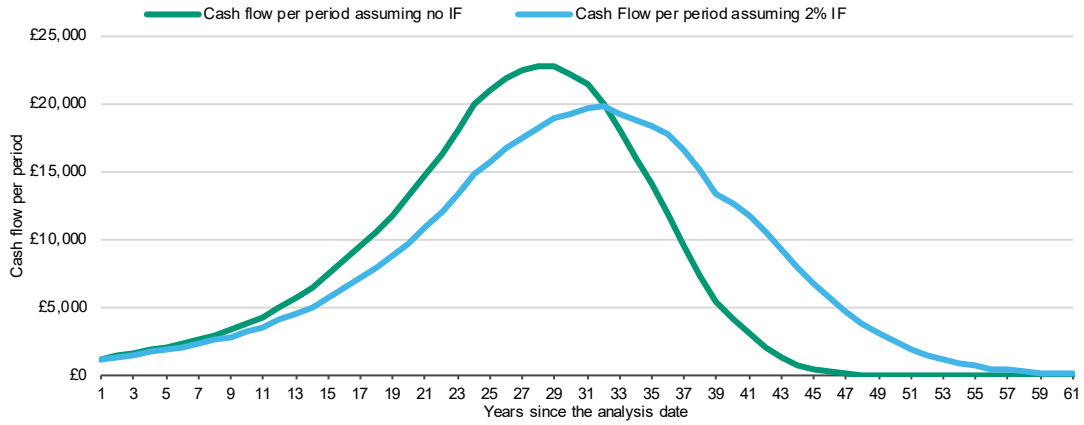
Comparison of Maturity Event Rates (with and without improvement factor)



Source: Moody's Investors Service

EXHIBIT 10

Comparison of Cash Flow per Period (with and without improvement factor)



Source: Moody's Investors Service

Appendix D: Special Considerations for FHA-Guaranteed HECMs in the US

Home equity conversion mortgages are a type of reverse mortgage in the US that is guaranteed by the Federal Housing Administration (FHA). The FHA guarantees any deficiency between the loan balance and the home value, as long as the home is sold within six months of entering real-estate-owned (REO) status.[13] If the servicer does not sell the home within six months of it entering REO status, the FHA requires that the servicers obtain an appraisal of the property from a Department of Housing and Urban Development (HUD) approved appraiser, and the FHA will only guarantee the deficiency up to the appraisal value. Therefore, if the home is subsequently sold for less than the appraisal value, the FHA covers the difference between the outstanding value of the loan and the appraisal value, but the securitization suffers a loss equal to the difference between the appraisal value and the actual sale price of the home.

Therefore, to analyze the loss potential of HECMs, we assess the following factors:

- The extent to which a home is likely to have positive equity in each period after origination, using our stress assumptions for the timing of maturity events, home price changes, and the interest rates on the mortgages
- The likelihood that a home will not sell within six months of entering REO status
- The likely shortfall between the appraisal value (determined in the HUD-mandated appraisal conducted six months after entering REO) and the sale price of the home
- One-third of the costs of foreclosure that is unreimbursed by HUD

Typically, we assume that 85% of HECMs with negative equity will not be sold within the six-month REO window and will therefore be subject to the FHA-mandated appraisal. Our assumptions regarding the likely shortfall between the appraisal value and the sale price of the home is ratings-based, as Exhibit 11 shows. We also generally assume that the cost of foreclosure on each liquidated property will be close to historical average values.

EXHIBIT 11

Assumed Shortfalls Between Home Sale Prices and Appraisal Values for FHA-Mandated Appraisals

Rating Level	Assumed Shortfall	Time Horizon
Aaa (sf)	20%	Until Maturity
Aa2 (sf)	20%	Until Maturity
A2 (sf)	20%	10 years and 0% thereafter
Baa2 (sf)	20%	5 years and 0% thereafter
Ba2 (sf)	20%	3 years and 0% thereafter
B2 (sf)	20%	2 years and 0% thereafter

Source: Moody's Investors Service

[13] A reverse mortgage typically enters REO status if it does not sell in a foreclosure sale, which usually takes place six months after the mortgage becomes due.

Moody's Related Publications

Credit ratings are primarily determined through the application of sector credit rating methodologies. Certain broad methodological considerations (described in one or more cross-sector rating methodologies) may also be relevant to the determination of credit ratings of issuers and instruments. A list of sector and cross-sector credit rating methodologies can be found here.

For data summarizing the historical robustness and predictive power of credit ratings, please click here.

For further information, please refer to *Rating Symbols and Definitions*, which is available here.

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