On the Design of Reverse Mortgages
Core Issues of Structure, Marketing, Funding and Valuation

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Global Challenges of Funding Retirement

- Sources of potential non-sustainability of current retirement funding systems
  - Shifting demographics: US, Europe, Asia populations aging rapidly
  - Increasing longevity: population living longer
  - Economy shift from rural agriculture toward city industrial
  - Legacy of large unfunded liabilities of define-benefit and pay-as-you-go pension plans from inadequate contributions and overly optimistic return-earning assumption
  - Contribution and balance sheet risks too great for plan sponsors

- Only four ways to improve the chances for achieving a good retirement
  - Save more for retirement and lower lifetime consumption level
  - Work longer before retiring
  - Take more risk and be prepared for the consequences if the risk is realized
  - Improve the income benefits from the assets that are already available
    - Annuities, including “tail-insurance” for longevity
    - Reverse mortgage [aka “house pension”; “equity release”]
    - Goal-based investment strategies
    - Redesign employer contribution schedule, for fixed contribution cost

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Basic Implications of Increased Longevity

- Good news for all: we are expected to live longer lives.....but
- On average, each of us has to pay for our lifetime consumption from the years we work
- Work for 40 years and live 10 years in retirement means pay for 50 years of consumption by saving 20% (neglect interest) and consuming 80%.
- If life expectancy increases by 10 years and we keep the same retirement age, then we must pay for 60 years of consumption with 40 years of work by higher saving, 33% and lower consumption, 67%.
- To maintain the same consumption of the prior generation, we will have to work longer. To sustain the same 80% consumption level, we would have to work 48 years (an addition 8 years) and retire for 12 instead of 20 years.
- If one could earn a higher *expected* return on savings, then *expected* consumption could be improved without saving more or working longer. However, if to obtain that higher *expected* return, one must take more *risk*. One must be prepared to live with the consequences if that risk is realized.
- It is likely that we will work longer. Good news is that medical improvements have increased the age to which we can work. Simply raising the retirement age, with no other adjustments, may have significant distributional effects on lower-income people.
Global Challenge of Funding Retirement

- Bad news: people are living longer and therefore to fund their retirement, they will have to do some combination of:
  - save more and reduce their lifetime standard of living
  - work longer and therefore retire at a later age
  - take more risk and accept the potential consequences
  - use the assets that they have more efficiently to cover the cost of retirement
- Retirement funding sources are government, employer-sponsored pension plans and personal saving/family
- House ownership represents the main source of personal saving for working and middle class people
- A **reverse mortgage** is an innovation to make more efficient use of the house asset to help cover the cost of retirement, without increasing saving by the retiree.
On the role of the house asset in providing retirement funding

The house is typically the most-valuable asset that a family has at retirement (typically larger than pension accumulation). It will likely be a key asset to help fund working and middle-class retirements in the future.

The house which the owner-retiree will live in during retirement can be decomposed into two components as an asset:

- **An annuity-like asset** which provides the retiree with a stream of housing-services for life: An important component of the life annuity for the standard living in retirement and should generally be retained as a hedge of that part of retirement spending

- **A fungible financial asset**, which is the house value at the retiree’s death when the housing-services are no longer needed: The residual value of the house is available for either funding part of the non-housing expenditures during retirement or for making gifts/bequests. It is this second component which causes the house to be explicitly integrated into an effective planning and investment strategies of the overall funding of retirement. Because of the significant magnitude of the residual value, the house is likely to be a significant funding source for retirement annuities and bequests in the future.
Core Features of the Reverse Mortgage Contract

The reverse mortgage is a financial contract which permits the retiree to access the residual value of the house for funding both retirement and efficient bequests/gifts.

No interest or principal payments until the retiree’s death. Thus, taking out an reverse mortgage does not expose retiree to the risk of losing his stream of housing services because of inability to make interest or principal payments. There are escrow requirements for property taxes and insurance on the house.

Non-recourse loan. At the retiree’s death, his estate (aka beneficiary) has the option to either pay accumulated interest plus principal and retain ownership of the house or abandon the house (without penalty) in full payment of what is owed. In either case the house will be sold and converted into cash for the lender or for the estate which goes to the retiree’s beneficiary.
Core Features of the Reverse Mortgage Contract

(continued)

**Distribution of proceeds.** Some flexibility. The retiree can take the proceeds of the mortgage in a single lump sum at the time of origination or in a series of (monthly) payments as draw-down of the principal until the total amount of the mortgage has been distributed. By choosing the latter, the retiree has, in effect, invested in the mortgage of the undistributed principal amount and thus earns an implicit promised rate equal to the promised rate on the mortgage.

**Regulatory issues.** In some states, it is required to obtain an opinion from an independent advisor that the reverse mortgage contract is understood by the retiree and is reasonable. In California, it may not be possible to have a “linked” origination of the mortgage in which the proceeds must go directly into a life annuity.
Benefit of Reverse Mortgage to Retiree and Beneficiary

Without reverse mortgage, the retiree gets the stream of housing services until death and the beneficiary gets the residual value of the house at the death of the retiree.

With the reverse mortgage, the retiree gets the stream of housing services and can use the mortgage proceeds to purchase additional life annuity income and/or to give his beneficiary an immediate cash gift at time of origination. Whatever the use of the proceeds, the beneficiary receives a call option to buy the house at the time of the death of the retiree at an exercise price equal to the principal plus accumulated interest on the mortgage.
Benefit of Reverse Mortgage to Retiree and Beneficiary

(continued)

The retiree will be considerably more focused on getting a high loan-to-value (LTV) ratio on a reverse mortgage than consumers getting a regular mortgage earlier in the lifecycle. Since the retiree makes no principal or interest payments while he is alive, his lifestyle is not affected by how much is owed on the reverse mortgage. But the larger the loan size, the more retirement benefits and/or bequests /gifts he can purchase.

In the extreme case of no beneficiary, the retiree gets a stream of additional income for life bought with all the proceeds from the mortgage. The retiree will want the terms which maximize the proceeds from the mortgage. The “deadweight loss” from not outright sale is the value of the call option to buy the house which goes to the retiree’s estate. Minimizing the deadweight loss would lead to maximizing the promised interest rate on the mortgage, which assures the lowest residual value of the call and maximizes the proceeds from the mortgage.
Benefit of Reverse Mortgage to Retiree and Beneficiary
(continued)

The retiree will be relatively insensitive to the promised interest rate than a consumer for a regular mortgage. The retiree never makes any payments on the mortgage during his lifetime, no matter how large is the promised interest rate on the mortgage. So his lifestyle is not affected. This also means that the retiree will be relatively insensitive whether the interest rate is nominal or inflation-indexed. This insensitivity offers design flexibility to meet investor preferences.

Versus a forward sale of the house, the retiree avoids realizing capital gains tax, retains the flexibility to sell the house before death, and has greater incentive to maintain the house, thus reducing moral-hazard cost. The other side to the transaction has less litigation risk.
In the extreme case of the retiree taking no additional annuity income, the beneficiary receives immediate cash in the amount of the entire proceeds from the mortgage plus a call option to buy the house instead of a “lottery ticket” to receive the market house value at a random time (at the death of the retiree) which could be 3 months or 30 years in the future. Note the unattractive non-pecuniary feature of the lottery choice is that for the beneficiary to win, the retiree has to die, which given the likely relationship between the two, is not something the beneficiary wants to be rooting to have happen.

Therefore, both retiree and his beneficiaries can almost always be made better off by taking a reverse mortgage than not. Its marketing needs to be designed to recognize that it is a “joint” sale to retiree and beneficiaries.
Efficient Funding of Reverse Mortgage

Contract design structure and placement of the risk efficiently

The function served by the reverse mortgage for retirees is materially different from the standard mortgage for earlier in the lifecycle households. It therefore has different risks and different sensitivities to both the supply and demand side than traditional mortgage. So it should not be considered simply “another “mortgage product to be designed, managed and regulated in the same fashion as traditional mortgages.

The financing availability for reverse mortgages must be deep and reliably available in all economic conditions if it is to become a mainstream systematic source of retirement funding. To achieve this, the risk-bearing financing base should not be “opportunistic” investors who are sensitive to the rate of return on the asset but instead be placed in the “core” [aka indexed] equity holdings of large institutions that are focused on diversification and accept market returns whatever they are. The focus on diversification ideally provides for a global base of investors. Relative to standard mortgages, the reverse mortgage characteristics could make it more attractive to international investors. In particular, its no-recourse feature makes it a pure asset-backed financing unlike standard mortgages that are a mix of personal credit and asset-backed which is more complex and require more local expertise.
Efficient Funding of Reverse Mortgage

Contract design structure and placement of the risk efficiently (continued)

Versus a forward sale or renting, there is lower moral hazard risk because the retiree/estate retains an equity stake and because the retiree doesn’t know how many years he will be living in the house.

Little mortality risk. Although the mortgage buyer is exposed to mortality uncertainty, the risk exposure is different than the one faced by an annuity issuer since the mortgage holder is compensated at the promised interest rate (which can be quite high) for every year the mortgage remains outstanding, and the annuity underwriter is stuck making payments with no further compensation than the original annuity purchase price.

Litigation and reputation risk is lower for reverse mortgage than standard mortgage for originator/buyer since no foreclosures with retirees being evicted and “no-fault” default where the estate has the choice of whether or not to repay the loan. With no direct equity participation and the retiree/estate retaining the call option, no litigation risk if housing prices should go up dramatically in value, ex post.
The placement of the risk would be greatly enhanced by securitizing the mortgages into a pool and issuing tranches tailored to specific investor habitats. Because no principal or interest is paid prior to the retiree’s leaving the house (at his death), the mortgages in the pool will have much longer duration than ordinary mortgages. If the mortgage promised interest rates are indexed to inflation, then these mortgages will have long-duration and be inflation-protected. Because a well-designed reverse mortgage will have significantly greater default risk than a regular mortgage, traditional credit-granting institutions may not be the best holder of the default risk, and it will improve efficiency to shift that risk to a better-suited holder of that risk.

A senior tranche which has virtually no exposure to the house asset prices underlying the mortgages in the pool would be very attractive to long-horizon investors such as pension funds and insurance companies as a hedge for their annuities and pension liabilities as well as for mutual funds used by financial advisors wanting long-duration, high quality, inflation-indexed fixed-income exposure for their clients.
An equity tranche which bears virtually all the house asset price risk should not be marketed to fixed-income investors. Instead it should be marketed to equity asset managers as a new and very large asset class which currently asset managers do not own. The asset class is owner-occupied residential housing, which has an enormous total market capitalization and thus should be held in significant amounts in any well-diversified “market” or core-asset portfolio. What would be viewed as “toxic risk” by the typical loan officer or fixed-income asset manager becomes attractive diversifying risk to a equity asset manager. By focusing on the diversification benefits for core [aka indexed] equity part of the institutional portfolio, the supply of risk-bearing funds is made most reliable [independent of market conditions] and the scale of funds available maximized.

A subordinated debt tranche could also be created to fill the niche currently filled by corporate and other credit-risky bonds, if insurance companies or other institutions have a habitat appetite for taking tail risk similar to corporate and hi-yield bonds.
Further Innovation

Customization for the retiree. The retiree could select to receive a stream of custom-tailored monthly payments of the proceeds of the mortgage for, as an example, 20 years from age 65 to age 85 and use a lump-sum from those proceeds at the origination to purchase a life annuity which begins payments at age 85 as a form of “tail” longevity insurance so the retiree does not “outlive” his assets.

Expansion of the Loan-to-Value (LTV) could be achieved by using a portion of the proceeds to pay for a life insurance policy on the retiree which pays to the holder of the reverse mortgage to cover part of repayment of principal and accumulated interest.
Residual value of house. Since the retiree receives the after-tax net (of property taxes, maintenance, insurance costs) benefits of housing services for as long as he lives in the house, the underlying asset value supporting either the reverse mortgage buyer or the beneficiary is the current value of the house minus the present value of these dividend-like benefits, the residual value.

The value of the reverse mortgage is equal to the residual value minus the value of a call option on the residual value with exercise price equal to the principal amount of the mortgage plus the accumulated promised interest at the (uncertain) time of the retiree’s death. The value of the beneficiary’s claim is that call option.
Valuation Principles for the Reverse Mortgage

(continued)

Alternative value of reverse mortgage. By put-call parity, the value of the reverse mortgage is also equal to the present value of the principal amount plus accumulated promised interest at the retiree’s death date, discounted at the risk-free interest rate, minus the value of a put option on the residual value with exercise price equal to the principal amount of the mortgage plus accumulated promised interest at the retiree’s death date.

Risk of the reverse mortgage relative to the underlying residential housing asset is calculated by standard delta method of derivative security pricing.
Summary  Reverse Mortgage Design

• The reverse mortgage can materially increase lifetime income in retirement for working and middle-class retirees in developed and some developing countries, without requiring changes in personal saving behavior during the accumulation work years. It makes more efficient use of the assets that retirees have to increase benefits instead of trying to increase the amount of retirement assets available.

• The reverse mortgage is currently not widely used as a systematic part of retirement funding. The reason could be simply that currently retiring working- and middle-class workers have adequate retirement funding from Social Security and defined-benefit employer-plan to have a good retirement without having to tap their home equity value.
Summary  Reverse Mortgage Design (continued)

- An alternative explanation for the lack of widespread use is that the design of the reverse mortgage is materially flawed including the size of loan-to-value offered, the marketing of the product, the cost of acquiring a reverse mortgage, and dysfunctional, if well-intentioned regulations. In the US, there is no private-sector reverse mortgage market. Traditional credit institutions are not the most-efficient risk-bearing supplier of a well-designed contract.

- In light of the long-term reduction in employer-funded benefits, unlikely increases in Social Security, longer life expectancy, and the difficulty in materially increasing personal saving behavior in the absence of larger mandatory contributions, there will likely be an important global need for a much better-functioning reverse mortgage market with the capacity to fund mortgages for the vast majority of retirees, reliably under all economic conditions.
Summary  Reverse Mortgage Design (continued)

• Improvement to the design of the reverse mortgage should facilitate large initial loan-to-value ratios.

• Coordinated regulation including consumer and usury law exemptions, to permit high *promised* interest rates –both inflation-protected as well as nominal. Standardized contracts which allow for exemption from costly third-party review as a legal requirement. Exemptions from dysfunctional tax code provisions such as phantom income to retirees and their estates who “turn in the keys” rather than make the promised interest and principal payments. Intelligent exemptions from current restrictions on having reverse mortgage and annuity purchase with the proceeds linked in a seamless transaction.
Summary  Reverse Mortgage Design (continued)

• The core approach to financing reverse mortgages needs to be transformed away from traditional credit-institutions such as banks bearing the risk of default on the mortgages to institutions that take substantial equity-like risks. Banks could continue to be originators/distributors of reverse mortgages. Using current institutions and institutional practices, the reverse mortgages could be packaged with simple tranches of senior bankruptcy-remote debt and equity. The debt would have pension funds and insurance companies that write life annuities as natural demanders. The equity piece should be placed globally with the “core [aka indexed] equity” part of large financial institutions [pension funds, insurance companies, sovereign wealth funds, mutual funds], which are always invested in all the market asset classes, independently of market conditions, and do so for diversification reasons. This assures stability and scale of finance.
Currently in the US and Hong Kong the reverse mortgage market is almost entirely a government-provided market. This is probably not efficient if for no other reason than lack of competition. However, if the reverse mortgage becomes a systematic component of retirement planning and funding, then even government balance sheets will not be large enough to handle all the funding. So a private-sector reverse mortgage is essential.

Although the proposed design changes for financing reverse mortgages are very different from current practices, all the changes can be executed within existing institutions and with market-proven technologies and processes. Thus it is feasible for practical implementation without enormous institutional changes.
Appendix

Technical aspects of valuation and risk of reverse mortgage
Non-Recourse Mortgages: “No-Fault” Default

- Current design is a combination of asset-backed and personal loans
- Non-recourse design simplifies and makes the mortgage contract more uniform economically because the owner of the house does not affect the mortgage value
- Non-recourse information structure makes securitization more efficient and places the owner-specific information needs with the originator
- Non-recourse reduces negotiation costs in distress and may increase job mobility for owner
- “Second” mortgage could be done in non-recourse structure
- Reduce legal costs of foreclosures and bankruptcy
- Separate personal loan arrangements to increase LTV with bank retaining risk and preserving information bifurcation
- Some covenants needed such as property-tax and insurance escrow and some initial income screen
Efficient Partitioning of Mortgage Risk: Securitization

Create structure with mortgage $M$ as asset and two types of claims:

- debt, $D$ with principal amount $B^* < B$.

$C(A, B, T) = \text{call option with exercise price } B \text{ on house, } A$

$P(A, B, T) = \text{put option with exercise price } B \text{ on house, } A$

- $M = A - C(A, B, T) = B \exp[-rT] - P(A, B, T) = D + E$

- $D = A - C(A, B^*, T) = B^* \exp[-rT] - P(A, B^*, T)$

$E = C(A, B^*, T) - C(A, B, T)$

- Select $B^*$ to make debt "bankruptcy-remote,"

so $P(A, B^*, T) \approx 0$ and $D \approx B^* \exp[-rT]$ high-grade, long-duration debt

- If mortgage rate is inflation-adjusted, structure debt is too

- $E \approx A - C(A, B, T) - B^* \exp[-rT]$ bears (almost) all house-price risks

- Place equity with equity asset-managers as new asset-class diversification
Efficient Asset-Use for Retirement and Bequests: Reverse Mortgage [AKA “Home Pension”]

- Reverse Mortgage \([RM(t)]\) : 1) No interest or principal payments until owner’s death at time \(T\);
  
  2) At \(T\), estate has option to either pay accumulated interest + principal or abandon the house (non-recourse)
- House \([H(t)]\) = Life Annuity Housing Services \([LAHS(t)]\) + Residual House Value \([RHV(t)]\)
- If \(d\) = “net” after-tax dividend rate of services to owner,
  \(RHV(t) = H(t) \exp[-d(T-t)]\) and \(LAHS(t) = H(t) (1 – \exp[-d(T-t)] \)
- \(RM(t) = RHV(t) – CRHV(t)\), where \(CRHV(t)\) = value of a call option on the Residual House Value with expiration date \(T\) and exercise price = \(RM(0) \exp[RT]\) with \(R\) = interest rate on the reverse mortgage
- By Put-Call Parity, \(RM(t) = RM(0) \exp[ (R-r)T + rt ] – PRHV(t)\), where \(PRHV(t)\) = value of put option on the Residual House Value
Benefit of Reverse Mortgage to Retiree and Beneficiary

- **Without Reverse Mortgage**, Retiree gets the stream of housing services until death and the Beneficiary gets the residual value of the house at death.

- **With the Reverse Mortgage**, the Retiree can have an additional life annuity income with value $LA(t)$ and the Beneficiary receives an immediate cash gift at time 0, $G = RM(0) - LA(t)$ and a call option to buy the house at exercise price $RM(0) \exp[RT]$ at time $T$, worth $CRHV(t)$.

- **Extreme case of no Beneficiary**: Retiree gets a stream of additional income for life with value $RM(0)$ at time 0 and picks terms [$R$] to maximize $RM(0)$. The “deadweight loss” is the value of the call option $CRHV(0)$. The largest value for $RM(0) = RHV(0)$ at $R = \infty$.

- **Extreme case of the retiree taking no additional annuity income**: Beneficiary receives immediate cash $RM(0) + \text{call}$ instead of a “lottery ticket” to get the residual house value at random time $T$ which could be 3 months or 30 years in the future.

- **Versus a forward sale of the house** the retiree avoids capital gains tax and retains the flexibility to sell the house before death, and has incentive to maintain it.
Efficient Funding of Reverse Mortgage: Contract Structure

- Litigation and reputation risk is lower for reverse mortgage buyer since no foreclosures with seniors being evicted and “no-fault” default where the estate has the choice. With no direct equity participation and the retiree/estate retaining the call option, no litigation risk if housing prices go up dramatically ex post.

- Versus a forward sale or renting, there is lower moral hazard risk because the retiree/estate retains an equity stake and because the owner doesn’t know how many years he will be living in the house.

- Although buyer is exposed to mortality uncertainty, the risk is different from an annuity issuer since the mortgage holder is compensated at rate R for every year the mortgage remains outstanding.

- Securitization is essential to the efficient funding to allow proper bifurcation of the risk. Non-recourse nature makes the value of the mortgage insensitive to the characteristics of the mortgagee and thus more uniform in risk properties to a non-originating mortgage investor.
Efficient Funding of Reverse Mortgage: Placing the Risk Optimally

- The risk of the Reverse Mortgage at time $t = \text{the risk of a portfolio owning } (1 - \delta) \text{ Residual House Value} + \text{riskfree bond} = \delta \text{RHV}(t) - \text{CRHV}(t)$, where $\delta$ is the standard call option delta.

- Create a Securitized structure with the Senior $[S(t)]$ promised a payment of $x\text{RM}(0)\exp[RT]$ at maturity and first claim against the proceeds from the underlying mortgage if not paid and the Equity $[E(t)]$, receiving, $\text{Max}(0,\text{RMV}(T) - x\text{RM}(0)\exp[RT])$.

- Choose $x$ at time 0 such that the Senior security is bankruptcy-remote and thus a high-quality fixed-income instrument with duration $T$ since it is zero coupon. The Equity will thus bear [almost] all the housing price risk of the Reverse Mortgage and is equivalent to a leveraged ownership of $(1 - \delta)$ Residual House Value.

- Because $T$ is generally 15-20 years, Senior has long-duration that fits the habitat of pension funds and insurance companies. Could be inflation-protected [like TIPS] if the Reverse Mortgage interest rate were inflation-linked.

- Equity provides institutional equity investors with an asset class which is a large fraction of the market portfolio and is not currently investable. Diversification benefit would create a natural and sustainable demand for the housing risk.