

On an Efficient Design of the Reverse Mortgage: Structure, Marketing, and Funding

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November 2016

Abstract

While aging population is a worldwide issue, it is more profound in Asia. Reverse mortgages are useful instrument to alleviate the continuous and steady consumption needs of retirees. The “puzzle” is why there has been rather modest uptake even in the US, UK, and Korea where it has been available for a considerable time. We propose a structural design for a reverse mortgage contract that works across geopolitical borders, including key design criteria, issues of education/marketing for both the retirees and their beneficiaries, and a feasible approach to funding reverse mortgage with reliable, cost-efficient supply of funds available consistently so that the reverse mortgages can be supported as a “standard” consideration for everyone considering for retirement. We will also examine the role of the government as regulator and as risk-bearing provider, in the reverse mortgage process. Our preliminary work suggests that an effective institutional means of funding reverse mortgages is likely to be considerable different from current practice. We also discuss how the possible obstacles, particularly Asian traditions, could be solved so as to allow reverse mortgage to be an instrument for improving retirement.

Keywords: Retirement, Reverse mortgage, securitization, tranching, core capital

JEL: D1, O3, R2

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1. Introduction

Accumulating enough savings for retirement has always been difficult, and takes a very long time, especially for the working and middle classes. It sometimes might not even work without mandatory requirement and large increases in the contribution rates to retirement, which however is usually politically difficult, and would surely reduce standards of living. Reverse mortgage contracts have been proposed globally as a way for addressing the retirement funding challenges as they provide a main, if not the only, source for increasing retirement benefits without a major change in saving behavior. This paper proposes a system of reverse mortgage plans that can justify both bigger demand and supply, and a more efficient market such that all stake holders are better off than the currently available system.

The United States, Europe, Australasian, and Asia are all experiencing rapid increase in longevity risk and therefore demographic change into generating aging population. Coupled with this is an economic shift from rural agriculture toward city industrial. There has been large unfunded liabilities of defined-benefit and pay-as-you-go pension plans from inadequate contributions and overly optimistic return-earning assumption. A good measure of how prepared the pre-retirement workforce is the replacement rate (gross or net) which is the pension entitlement as a percentage of pre-retirement earnings. Figure 1 shows the gross and net pension replacement rates from pension plans (both public and private) for various countries in 2014. Although shown are only the data for men, most of these countries have the same replacement rates for women. Those that have discrepancies, however, mostly have men's rates higher than those of women except Slovenia. It is clear from the Figure that people in a lot of the countries will have only 50% or less of what they earned before retirement to be consumed after retirement.

According to the National Retirement Risk Index (NRRI) issued by the Center for Retirement Research at the Boston College, 52% of the households in the United States are not ready to keep their living standards when they retire. Hence, good retirement can be achieved only by saving more and lower consumption level, working for longer period before retirement, or taking more risk in order to have higher possible investment return.

In the United States, the Government Accountability Office 2013 Survey of Consumer Finances documents that 29% of the households age 55 or more do not even have any retirement savings nor retirement plans.¹ Those households that have retirement savings still do not have sufficient assets ready for retirement. This implies that households have to save more, and work for longer period of time. The labor force participation rate released by the Bureau of Labor Statistics of the United States depicted in Figure 2 shows that the work force over the age of 55 is constantly increasing in time since 1994, notably the doubling percentage for the age groups of 70 or above from 1994 to the projected rate in 2024.² As Maestas and Zissimopoulos (2010) mentioned, changes in technology and skills have made older people more committed to participation in the workforce.

Studies have found that retirement decisions can be highly correlated with unanticipated change in financial wealth, such as big moves in equity markets, particularly during the recent Great Recession when both the financial markets and the housing markets crashed and unemployment rates surged (see for example, Coile and Levine (2011), Goda et.al. (2011), McFall (2011), and Gustman et.al. (2012)). During the same period, long-term interest rates fell globally, causing the cost of purchasing retirement income to rise dramatically. Hence, the importance of the problem of lack of wealth for retirement has expanded to the fact that more and more near-retirement group are less ready for retirement, particularly because more of this group are under defined contribution retirement plans rather than defined benefits plans, and a lot of the wealth has been swiped away after going through various financial crises all over the world in the recent decade.

What has been generally overlooked is that house ownership represents a main source of personal saving for the working and middle class families, and is the most valuable asset at retirement. In the US, about 80% of households aged 62 or above own their own homes

¹ “RETIREMENT SECURITY: Most Households Approaching Retirement Have Low Savings” (GAO-15-419), a report issued by the United States Government Accountability Office and published on May 12, 2015. (Publicly Released: Jun 2, 2015). Of the 29% households, 35% own their homes without loans and 24% own homes with some debts.

² Of course this increased labor participation for the group that should be, or would soon be, in retirement is not solely due to decreased wealth for consumption. For instance, academics still tend to be very active in their research and intellectual activities well after the age of 65. Nevertheless, this is also the group that would be more financially prepared for retirement.

(Poterba et. al. (2011)), which made up of over 50% of their wealth, hence dubbed the “house-rich cash-poor” group. Figure 3 provides a good reference of the level of wealth tied up in home equity. Being able to release equity from the housing units through some sort of home equity release programs, particularly for the low income group, who are nevertheless homeowners, can mitigate the problem of reduced consumption during retirement, while being able to continue to stay in their own homes. Thus, a housing unit is both an *annuity-like asset* that provides housing service during retirement and a *fungible financial asset* whose value is the (usually of significant magnitude) residual value of the housing unit, a significant funding source available for non-housing consumption during retirement and/or bequest upon death of the retiree. It is this second component which allows the house to be explicitly integrated into an effective planning and investment strategy of the overall funding of retirement.

On the other side of the globe, Japanese are famous for having high longevity, and ageing population in Japan has been long discussed. According to the estimates from the World Bank,³ the population of age 65 or above will grow from 34 million (or 26.86% of total population) to 39.1 million (or 36.31%) in 2050. In Korea, the estimates are 6.894 million (13.57%) in 2016 and 17.686 million (35.35%) in 2050. In Singapore, they are 0.691 million (12.29%) in 2016 and 2.19 million (33.92%) in 2050. As for the most populated country of the world, China’s situation is most alarming, with a population of 137.791 million of people aged 65 or above in 2016, representing 10%, growing to 368.237 million, or 27.55% in 2050. The pension schemes provided by the governments of these countries will not be able to provide enough pensions to such an increase in population needing the support very soon. Fortunately, owning their own homes is a tradition of Asian countries. Hence, many of the aging population are in fact “house rich cash poor”.

Equity release products have been available in several countries such as Australia, Canada, China (including Hong Kong), some European Union countries, Korea, New Zealand,

³ “Health Nutrition and Population Statistics: Population estimates and projections” of the World Bank, updated on 10/05/2016.

Singapore, and the United States (having the largest market so far).⁴ Existing literature on releasing home equity in the context of retirement saving puzzle (see, for example, Hurd (1989), Hubbard et. al. (1995), and De Nardi et. al. (2010)) include bequest motives, longevity risks, and medical expense risks. Nakajima and Telyukova (2014a) study saving in retirement in different countries and found that housing, as expected, makes up the dominating wealth of the household portfolios. In particular, selling a previously owned house to move to a smaller one is not common in many countries. However, in those countries with retirees having lower saving rates, the home ownership rate is not only lower at the beginning of the retirement age, but also the home-selling rate at the later part of the retirement life is faster, resulting in some countries having retirees in the 88-92 age group being renters.

One of the most common type of equity release products is a reverse mortgage, also called the Housing Pension in Korea, which 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. Both academics and practitioners have asserted that reverse mortgages are apparently a very useful solution for at least a portion of retirement funding. The “puzzle” is why there has been rather modest uptake of the product by retiree consumers, even in places like the United States, the United Kingdom, and Korea where it has been available for a considerable time. Reverse mortgage markets (even the “most established” one in the US called the Home Equity Conversion Mortgage, HECM) are still very small in part because of the high costs, high regulatory barriers, retirees’ relative illiteracy, bequest motives, and other usual problems such as moral hazard and adverse selection. In addition, on the supply side, the unique cash flow pattern (uncertain cash outflow under line of credit plans, periodic cash outflow in case of monthly payments, and uncertain cash inflow when the

⁴ According to the Study on Equity Release Schemes in the EU Part II: Country Reports (Project No. MARKT/2007/23/H) available from the European Commission website: http://ec.europa.eu/finance/finservices-retail/docs/credit/equity_release_part2_en.pdf, EU countries are divided into three groups, according to the types of equity release programs available. The most sophisticated programs (both loan model and sale model), in terms of size and history, are provided by the United Kingdom, Ireland and Spain. The other two groups either have loan model or sale model. The rest countries do not have any sort of equity release programs.

mortgages are finally terminated due to death or moving out of retirees) makes value calculations and mortgage securitization difficult.

Early studies on reverse mortgage markets include, for example, Venti and Wise (1991), Merrill et. al. (1992), and Mayer and Simons (1994). Most of them are on modeling and pricing the reverse mortgage plans. Miceli and Sirmans (1994) are one of the first few to model the optimal amount of mortgage that the lenders are willing to lend as reverse mortgage subject to both market risk and maintenance risk due to the (lack of) maintenance of borrowers. Shao, *et. al.* (2014) price reverse mortgages given idiosyncratic house price risk and longevity risk. Pfeiffer *et. al.* (2014) find that early establishment of reverse mortgage is always better than treat it as last resort if home occupancy is for longer period, if there will be higher withdrawal relative to home value, if the interest rates in the future will increase, and if there will be slower property value increase in the future. Some argue that HECM can be useful for investment strategies (for example, Salter *et. al.* 2012). Davidoff (2014a) studies the value of the “put option” in the HECM line of credit and concludes that the value of the put is actually about 15% of the home value at closing, which is much higher than the sum of all the costs incurred at closing; and the retirees can exploit all the value of the put option just before the termination of the mortgage, although this is rarely the case in reality. [See Lucas (2015)].

In this paper, we investigate the reverse mortgage puzzle. We propose a structural design for a contract that works across geopolitical borders, including key design criteria for the contract itself, issues of education/marketing for both the retirees and their beneficiaries, and a feasible approach to funding reverse mortgage with reliable, cost-efficient supply of funds available consistently so that the reverse mortgages can be supported as a “standard” instrument to consider for everyone approaching retirement. Our design goal is to encourage more investors to fund reverse mortgages such that the release of home equity could enhance smoother consumption pattern of the retirees, an agenda item for many countries where aging population will be a severe problem in the coming few decades. We also examine the role of the government as regulator and as risk-bearing provider, in the reverse mortgage process. Notice that unlike standard mortgages, a well-designed reverse

mortgage plan should be risky at origination in terms of chances of default because the retiree cares much more about the amount of home equity he/she can draw down than the promised interest rate charged (because he/she does not really need to pay interest until death). It is this feature, which traditional credit lending sources and governing bodies consider default as a big problem and therefore always try to avoid, that becomes a key driver of the need for an innovative source of private-sector funding. Our preliminary work suggests that an effective institutional means of funding reverse mortgages is likely to be considerable different from current practice. This new approach, however, employs existing market-proven technologies and does not require either new institutions or regulations. We believe that the proposed model would be able to overcome the issues and concerns, particularly in Asian countries, that hinder growth of reverse mortgages as a tool to help financing retirees all over the world, while relieving the burden of unsustainable care and holding large balance sheets of securities from the government.

2. Home Equity Release Products

To release the equity value of a housing unit, the owner who is going to retire can rent part of it to others, or sell it and then rent, or buy a smaller unit (i.e. down-sizing), or taking a second mortgage on the housing unit. Except for the last way, any of the above ways means that the retiree will have to change the living environment; whereas the last way means an exchange of a lump sum cash inflow for future periodic cash outflow in the form of repayment of the mortgage. A more ideal way of financing that allows the owner to continue to live in his/her own housing unit without any change in living condition and without periodic payment during retirement is through home equity release products.

Home equity release products can come in one of the following forms. A lifetime mortgage, mostly known as reverse mortgage, allows the borrower to live in his/her home until he/she leaves because of death or moving out. Unlike standard mortgages, the amount owed under the reverse mortgage, made up of the original loan amount plus interest owed, all compounded over time, gets big in time. A less usually offered type is the interest-only product with which interests are paid over the life of the borrower while the principal would

be repaid only upon death of the retiree. The third one, also mostly used, is the home reversion plan in which the retiree sells a percentage, or the whole, of home-ownership in return for a lump sum plus the right to live in the home until death or moving out.

Also called the Home Equity Fractional Interest, or HEFI, security in Leland (2016), home reversion plan is like the retired homeowner writing a call option to the investor who could, at the time of sale of the home, claim the increase in value of that portion of home sold net of initial mortgage principal, or simply the interest plus mortgage principal, at termination of the contract. While home reversion plan is desirable in that it makes the retiree debt-free, and it might be “portable” (although not all plans can be transferred from one housing unit to another), it also means the retiree is no longer the only owner of the housing unit (ownership can be bought back if the original deal was a partial ownership sale, usually however at a much higher amount due to increase in property value). A reverse mortgage, on the other hand, entitles the retiree ownership.

Providers of the home reversion products also bear the longevity risk, interest rate risk, and property value risk, which would on the other hand be borne by reverse mortgage borrowers, although these providers can also hedge the risks with a pool of home reversions.

Equity release products in general have the following common features:

- (1) The retiree can continue to live in his/her home until he/she dies or willingly moves out.
- (2) No periodic payment of either interest or principal will be paid to the lender until the retiree dies or sells the housing unit. The retiree has to make periodic payments for property taxes, insurance and maintenance, which would be made with or without the mortgage.
- (3) Funds from the products can be regular monthly payments or in one lump sum, either received at the beginning or upon needed (such as a line of credit in reverse mortgage),
- (4) Non-recourse products, or “No-negative-equity guarantee”, that is, neither the retiree nor his/her family members are liable for any balance of the loans that cannot be repaid by the value of the housing unit due to drop in property price; on the other hand, if the

property value is higher than the amount owed at the end, the retiree and/or his family will be entitled to the extra proceeds; analogous to the lender writing a put option to the borrower with an exercise price equal to the mortgage balance at the end.

- (5) The older the retiree is when applying for the product, the higher is the amount of loan he/she can obtain.
- (6) Costs at origination can be high; in the case of Home Equity Conversion Mortgage (HECM), which is the most common reverse mortgage in the US., mortgage insurance premium (MIP), closing costs, and origination fee, can add up to 5% of the home value; there can also be the monthly lender service fees for handling monthly payments and statements to the retiree

Hence, for the retiree, there is little risk other than high cost of origination with home equity release products.

3. Core Features of Reverse Mortgage Contracts

Reverse mortgages share the characteristics of the home equity products mentioned above. In particular, their core features include (1) no interest or principal payments until the retiree's death or moving away from the housing unit, (2) non-recourse loan, (3) some flexibility in distribution of proceeds such as in single lump sum at closing (i.e. origination), a line of credit to be withdrawn anytime in the future after the closing, or a series of payments as draw-down of the principal until the total amount of the mortgage has been distributed, and (4) the retiree has to comply with regulatory issues specific to the States where the retiree live in. In case of either a line of credit or periodic payments, the retiree is effectively investing in the mortgage of the undistributed principal amount and earns an implicit promised rate equal to the promised rate on the mortgage.

3.1 Some Details

The largest reverse mortgage program in the United States is the Home Equity Conversion Mortgage (HECM) which is first offered in 1989. It can come in different forms, such as lump-sum at origination, line of credit, or lifetime annuity, of annuity for specified numbers

of years, or combinations of these. The principal limit factor (PLF) is the percentage of allowable home equity (named Maximum Claim Amount, MCA, which is the lesser of the property appraised value, the sales prices, and the FHA loan-limit – US\$625,500 starting in February 2009 – at the time of closing) that can be initially “borrowed” from the reverse mortgage, analogous to the loan-to-value (LTV) ratio in standard mortgages. It increases with age, translating into shorter duration of the mortgage, albeit still stochastic (longevity risk), and decreases with interest rates because the remaining home equity balance will be used to offset the interest costs throughout the life of the reverse mortgage. As of June 27, 2014, the maximum PLF a 62-year old retiree can enjoy is 52.6%, relative to 61% for an 80-year-old applicant.⁵

HECM are originated and serviced by private lenders, although all are insured by the Federal Housing Administration (FHA) of the US Department of Housing and Urban Development (HUD). Whenever the loan balance reaches 98% of the MCA, the lender can sell the mortgage to the FHA for the full value of any subsequent promised payments, thus protecting the lender from loss. This is effectively a put option written by the FHA for any home equity that is too low to cover the loan balance, implying that the FHA effectively takes up the risk of both the borrowers and the lenders.

Since it is difficult for lenders to predict the withdrawal patterns of the borrowers, all HECM fixed rate loans must be drawn in lump sums at closing (i.e. origination), resulting in borrowers withdrawing all their large proportion of home equity upfront. To improve this situation, the HUD launched the Saver option in 2013 which permits the withdrawal of a much smaller amount so that borrowers could maintain a higher home equity. The FHA also passed a rule that the maximum loan amount to be drawn at, or in the first year after, closing is 60% of the maximum loan amount (according to Mortgagee Letter 2013-27) so as to avoid the borrower from drawing down the home equity too fast too much, and therefore the equity runs out too soon.

⁵ Mortgagee Letter 2014-12 of the United States Department of Housing and Urban Development, available from <http://portal.hud.gov/hudportal/documents/huddoc?id=14-12ml.pdf>

In the past, retirees were often being advised to take reverse mortgage as the last resort. As consumption patterns changed, especially for those who retire around the latest financial crisis, near-retirees or retirees had to spend less and affected the living standard. Salter *et. al.* (2012) conclude that it is good to have the line of credit from reverse mortgage ready for times when their investments lost values, so that they could then draw down the money for consumption until the markets for their investments pick up, rather than being forced to sell the investment portfolio at the wrong time. A potential problem is some retirees tend to draw down the credit line too fast.

Bishop and Shan (2008) compare between HECM borrowers with other ordinary home owners at the same ages and found that HECM retirees in general have more expensive houses, live in areas with higher median income, and are from areas with more educated population. On the other hand, Mian and Sufi (2011) have shown that homeowners with low credit scores and/or high credit card utilization tend to extract more of their home equity, particularly taking advantage of the price boom before the financial crisis. In addition, Davidoff (2014b) find that HECM are more common in areas with more black and Hispanic home owners, and where income and property values are below the MSA averages. Moulton *et. al.* (2014) show with various simulations that defaults or foreclosures could be reduced by 45% if retirees below a certain level of FICO credit scores (580 in their study) are required to set aside enough money for property taxes and insurance premiums, while reverse mortgage participation would be reduced only by less than 5%. If lenders are able to ensure a high probability that the property taxes and insurance premiums would be paid, with the cheaper new type of HECM (allowing borrowers to access up to 60% of the home equity at closing), such mortgages will definitely be able to help a lot more house-rich cash-poor retirees to release some of their home equity for their consumption and/or emergency use. Haurin *et. al.* (2014) find that homeowners who are in states with volatile housing prices that are above the long term norm will rationally obtain reverse mortgages since they anticipate that the prices will drop in the future. However, it is still puzzling why not more reverse mortgages are written.

3.2 *Benefits from Reverse Mortgages*

Reverse mortgages are beneficial to the retirees and their beneficiaries in the following sense. In the absence of reverse mortgages, the retiree gets the stream of housing services until death while the beneficiary gets the residual value of the house. With reverse mortgages, the retiree not only gets the stream of housing services, but can also use the mortgage proceeds to purchase additional deferred life annuity and/or to give his/her 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 with an exercise price equal to the principal plus accumulated interest on the mortgage. The non-recourse feature also guarantees that even if the value of the housing unit is lower than the balance of the loan, the retiree does not have to worry about it.

Furthermore, since the retiree makes no principal or interest payments while he/she is alive, the lifestyle is not affected by how much is owed on the reverse mortgage, while the larger the principal amount at closing, the more retirement benefits and/or bequests can be purchased. If there is no beneficiary, the retiree gets a stream of additional income for life bought with all 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.

The retiree will be relatively insensitive to the promised interest rate than a consumer for a standard mortgage because the retiree never makes any payments on the mortgage no matter how large the promised interest rate is. This insensitivity, to the extent whether the rates are nominal or inflation-indexed, can offer design flexibility to meet invest preferences. Also, unlike home reversion plan with which the retiree sells the housing unit, the retiree can avoid the capital gains tax with reverse mortgage.

In the extreme case when the retiree takes 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”, which if “won” is to receive the market house value at a random time at the death of the retiree in the future, a situation that the beneficiary might not want to happen. Hence, in general, both the retiree and his/her beneficiaries can almost always be made better off by taking a reverse mortgage than not. So the puzzle is why the market is much smaller than expected, given the large number of baby boomers.

As studied by Szymanoski et al (2007), the potential of reverse mortgage could further be exploited if there is a more efficient secondary market, which should be supported by securitization of the reverse mortgages, the latter of which however would need information on the timing of terminations and payoffs for the purpose of price and duration estimations. In fact, efficiency can be further enhanced with market indices such as the Reverse Mortgage Market Index (RMMI) developed by the National Reverse Mortgage Lenders Association. Figure 4 plots the RMMI from Q1 of 2000 up to Q3 of 2015, which is based on the changes in senior population, changes in house prices, and changes in total mortgage debt.

3.3 Disadvantages of Having Reverse Mortgages

Currently available reverse mortgages are not popular because they are expensive. Lucas (2015) developed a stochastic model to verify that the net present value (NPV) of the gain of lenders can reach, for instance, 21.4% of the loan principal, while the borrower can have a negative NPV of 18.6%, and that of the government is 2.8% (other variations in assumptions also generate positive NPVs for the lender, while negative NPVs for both the borrower and the government); faster increase in loan balance in the early stage of the mortgage or longer life of the loan (particularly for younger borrowers) makes the NPV of the borrower more negative. Lenders fees at closing are not low, and they also charge interest rates on top of the LIBOR. Insurance from FHA not only takes up all the put option risk, but also interest rate risk in terms of shortening the duration of the loan once the put is exercised when the lender sells the mortgage to FHA.

Notice that the high cost of the insurance premium for HUD is high because it is not a result of pooling effect like ordinary insurance premium; loan balance from early termination does not subsidize another case of high longevity risk with late termination of mortgage. Interestingly, however, Nakajima and Telyukova (2014b) develop a model that shows a 73% increase in demand for reverse mortgage if the non-recourse insurance is taken away because borrowers do not value such put option value too much, and therefore find the insurance premium too high. However, as Rodda *et. al.* (2004) propose, because the initially written reverse mortgage is based on the appraiser's housing value, the retiree can only enjoy the appreciated value of the housing unit through refinancing, which is attractive only if the refinancing costs could be reduced, through perhaps reduction in the insurance premium to the FHA. Their simulations also show that the FHA would not lose much. Furthermore, standardizing contracts can eliminate the problem of getting an advisor and hence can reduce cost.

Financial illiteracy of retirees is another most common problem. This is why the HECM plans require retirees to meet counselors to understand more about the product, their obligations and benefits before closing the contracts. Another common issue is bequest motives. Mortgagors are already self-selected in the sense that they are free from loans by the time the mortgages are written. However, having the currently available HECM may very likely result in the retirees having nothing left for their beneficiaries. This is true even in housing market boom, particularly if the retirees live long enough so that the balances of the mortgage loans cum interests have accumulated as much as the equity value of the housing units at the end when the retirees die or move out.

On the supply side, the hurdles are the high regulatory barriers, and other usual problems such as moral hazard and adverse selection. The issue of adverse selection comes from retirees whose family history tend to have high life expectancy rates will favor such plans more than others with shorter rates. Longer term mortgages almost guarantee lenders losses when the interest rates are higher than the growth in housing value (although they have the put option of selling the mortgages to FHA). Moral hazard comes for diminishing housing value due to lack of maintenance. Although retirees, or their family members, in general

could enjoy any residual sales value upon termination of the mortgages when the sales proceeds exceed the mortgage balance, on individual loan, a retiree might not invest enough for maintenance of the home because of shrinking equity, and their increasing age. At aggregate pool level, although certain degree of diversification could be maintained, reverse mortgages from the same geographical region might still be highly correlated. Integrated Financial Engineering, Inc. (2013) shows that FHA insurance has already considered undermaintenance, meaning that FHA has assumed that it is really a moral hazard problem.

Reverse mortgages are risky to lenders. Typical risks are longevity risk or termination risk, interest rate risk, house price risk. Substantial capital is needed. It offers diversified pool of interests, but income over time is uncertain and the funds are liquidity. A report issued by Towers Watson in 2013 suggests that insurance companies are natural financiers for equity release products.⁶ However, due to the Solvency II requirements for insurance companies, similar to the Basel II Accord for the banks, the high uncertainty of these products cannot be easily used to back up long-term insurance liabilities, and therefore hinders the expansion of such product in European countries. Notice nevertheless that although the lender is exposed to mortality uncertainty, the risk is different from an annuity issuer since the mortgage holder is compensated with mortgage interest for every year that the mortgage remains outstanding. Furthermore, litigation and reputation risk for reverse mortgage lenders are lower even when the housing prices subsequently go up dramatically because there is no direct equity participation and the retiree's beneficiary or the estate of the retiree retains the option to claim the residual value.

To date a lot of people, financial planners included, are skeptical about the use of reverse mortgage, and think that they should be considered as last resort. In their opinions, retirees are better off selling the housing units to live in other more affordable places than to get a reverse mortgage with high cost at closing and the amount is mostly not enough for their

⁶ "Equity Release – Accessing Housing Wealth in Retirement", issued by Towers Watson in 2013

problems, typically health care costs.⁷ Given all these risks while releasing the home equity should be a plausible solution for smoothing consumption for retirees, it seems that there is a need for government involvement in order to facilitate the availability of such products. In the following section, we will discuss if this is an optimal setting.

4. A Simple Model of Reverse Mortgage

Unlike what is currently available in the literature, we propose customization for the retiree, who could select to receive a stream of custom-tailored monthly payments of the proceeds of the mortgage for certain number of years such as from age 65 to 85 and then use a lump-sum from those proceeds at origination to purchase a deferred life annuity which begins payments at age 85 as a form of “tail” longevity insurance so the retiree does not “outlive” his asset.

Furthermore, different from the low amount of principal limit factor (PLF) times the Maximum Claim Amount (MCA), the available fund, or the loan-to-value (LTV) ratio as in standard mortgage, could be expanded when the retiree uses some of the proceeds to buy a life insurance policy on him/herself so as to cover part of the repayment of principal and accumulated interest. 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 housing unit, the underlying asset value supporting either the reverse mortgage lender or the beneficiary is the residual value, which is the current value of the unit minus the present value of these retiree’s dividend-like benefits.

For simplicity, we assume only one reverse mortgage deal in the market. Suppose death occurs at time T such that the retiree’s beneficiary (or the estate, if there is no beneficiary) pays the accumulated interest plus principal and gets the residual value (i.e. a call option), or abandons the housing unit if the housing value is not enough to pay the interest plus

⁷ See for example the news article “Rethinking reverse mortgages: Bad move or bright ideas?” from Financial Advisor Playbook of CNBC.com, Thursday, 2 April 2015, available from <http://www.cnbc.com/2015/04/01/rethinking-reverse-mortgages-bad-move-or-bright-idea.html>

principal (non-recourse, a put option). Note also for simplicity sake, we do not consider the randomness of T , which have been addressed in a major portion of the current literature. We also assume a flat term structure. The housing value at any time t , $H(t)$, should be the sum of the life annuity of the housing services of allowing the retiree to live in it, $LAHS(t)$, and the residual house value, $RHV(t)$. If d is the dividend yield of the housing services to the retiree net of costs (including property taxes, maintenance costs, and insurance costs), then the residual house value is

$$RHV(t) = H(t)e^{-d(T-t)}$$

and

$$LAHS(t) = H(t) - RHV(t) = H(t)(1 - e^{-d(T-t)}). \quad (1)$$

Suppose the principal of reverse mortgage at closing/origination is $RM(0)$, the interest rate charged on the reverse mortgage is R , and the risk-free rate is r . Then the value of the reverse mortgage at T is

$$RM(T) = RM(0)e^{RT}.$$

Next suppose $CRHV(t)$ is the value of the call option on the residual house value, $RHV(t)$, with expiration date T and exercise price of the value of the reverse mortgage at T . This call option is also the value of the beneficiary's claim. Then the value of the reverse mortgage at any time t will be equal to the residual value minus the value of a call option on the residual value, that is

$$RM(t) = RHV(t) - CRHV(t). \quad (2)$$

By put-call parity, the value of the reverse mortgage in expression (2) is also equal to the present value of the principal amount plus accumulated promised interest at the retiree's death, discounted at the risk-free interest rate, minus the value of a put option on the residual value with exercise price equal to the value of the reverse mortgage at the retiree's death, $PRHV(t)$. Hence, expression (2) becomes

$$RM(t) = RM(0)e^{(R-r)T+rt} - PRHV(t). \quad (3)$$

From the above derivations, it is clear that the retiree gets only $LAHS(t)$ in expression (1) without reverse mortgage. But with reverse mortgage, the retiree can use the principal, $RM(0)$, to get an additional deferred life annuity income with value $LA(0)$ during his/her retirement, while the beneficiary receives an immediate cash gift, $G = RM(0) - LA(0) > 0$ if valid, at time of closing, $t = 0$, and the call option, $CRHV(t)$.

In one extreme situation when there is no beneficiary, the retiree can purchase a life annuity stream of additional income for life using the proceeds from the whole reverse mortgage value, $RM(0)$, maximized with R . The “deadweight loss” is the value of the call option. And the largest value for the reverse mortgage is

$$RM(0) = RHV(0)$$

and $R = \infty$.

At the other extreme when the retiree gives the entire proceeds from the reverse mortgage to the beneficiary, then the beneficiary gets immediate cash $RM(0)$, plus the value of a call option on the house (the right to the value of housing unit in excess of the accumulated interest and principal) that would be exercised at the death of the retiree, time T in the future where T can be 3 months or 30 years or more.

Hence, relative to the sale of the housing unit for retirement purpose, the retiree avoids capital gains tax and retains the flexibility to sell the house before death. And because he/she still lives in it, there is incentive to maintain it.

From expressions (2) and (3), the risk of the reverse mortgage value comes from the standard delta from the derivative security pricing. That is, from (2)

$$\delta RHV(t) - CRHV(t) \tag{4}$$

or from (3)

$$(1 - \delta)RHV(t) + \text{risk free zero-coupon bond} \tag{5}$$

where δ is the delta of $CRHV(t)$ and the risk-free zero-coupon bond that matures at time T is because the retirees will pay only when he/she leaves the house. Hence, the risk from the reverse mortgage for both the retiree and the lender comes from the option risk and the residual house value which depends on retiree longevity and the house value.

5. Further Discussions

The idea that funds and interest rates are solely determined on the retirees' age does not make sense because reverse mortgages are basically backed by the values of the houses, although some initial income screening on the retirees or covenants should be required to ensure property-tax and insurance could be met. The bigger challenge however is to market the reverse mortgage products cost effectively and efficiently with better communication and marketing. Another challenge is funding. In terms of bequest motive, as shown above, children will get the value of the housing unit when the retiree dies, although this is probably not what the children would hope for. Nevertheless, even if there is reverse mortgage, the children are effectively holding a call option and thus can still benefit from the value of the housing unit. Ultimately, smooth consumption of the retiree should be of higher priority than bequest motive.

5.1 Who can be Lenders?

Since reverse mortgages serve very different functions from standard mortgages, risks and sensitivities to both supply and demand are also very different from the standard ones. The financing availability 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" (i.e. indexed) equity holdings of large institutions that are focused on diversification and accept whatever market returns. Relative to standard mortgages, the reverse mortgage characteristics could make it more attractive to international investors. In particular, its non-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 requires more local expertise.

There is actually lower moral hazard risk because the retiree retains an equity stake and because he/she does not know how long he/she would be living in it. And although the mortgage provider is exposed to mortality uncertainty, the risk exposure is different from that of annuity issuer since the mortgage provider is compensated at the high promised interest rate for every year the mortgage remains outstanding. With no direct equity participation and the retiree retaining the call option, there is no litigation risk if housing prices should go up dramatically in value.

Notice that even though there is no payment before the death or moving out, the retirees still have to pay periodic costs associated with the housing units and the mortgages, such as the property tax, insurance premium, and minimum maintenance costs as stipulated in the contracts, if any. Therefore there is still a likelihood that the retirees will default whenever they run out of cash to pay these costs. Hence, default risk is still too high for traditional credit-granting institutions. Placement of the risk could be enhanced by securitizing the mortgages into a pool and issuing tranches tailored to specific investor habitats. Notice that the duration of these mortgages are much longer than standard mortgages because there will not be any payment before the retirees die or leave the housing units. If the promised mortgage rates are indexed to inflation, then these mortgages will be inflation-protected.

5.2 A Model of Securitization

A good solution to boost up funding is to securitize the products and allow the private sector to come in rather than dominated by the government (like HUD in the US HECM). Securitization is essential to the efficient funding to allow proper bifurcation of the risk. The non-recourse nature makes the value of the mortgage insensitive to the characteristics of the mortgagee (the retiree) and thus more uniform in risk properties to a non-originating mortgage investor. Examples of research on securitization products for reverse mortgages are Wang *et. al.* (2007) and Yang (2011), both of which suggest securities to deal with

longevity risk. In particular, the latter proposes the use of some form of collateralized obligations to capture longevity risk and house price risk with different tranches.

A better solution is for the mortgage provider to obtain capital with securities of different tranches. That is, a typical over-simplified balance sheet of the provider will look like the following:

Asset	Liability
Reverse Mortgages	Senior Debt
	Equity Tranche

Starting with the best design that in an ideal situation, the LTV ratio to be obtained from the reverse mortgage should be as high as possible, which however implies that it would be a very risky deal, albeit not necessarily high return, because the maximum the mortgage provider can get is the value of the house at the end when the retiree dies. On the other hand, if there is enough cushion, such as $x = 20\%$ debt that is truly bankruptcy remote, and $1 - x = 80\%$ equity, then the financing of reverse mortgages, as illustrated below, will be very safe.

As before, the principal of reverse mortgage at closing/origination is $RM(0)$. There are two types of claims, debt (senior tranche) and equity. The high-quality fixed-income instrument debt, D , would be paid B^* , which is less than the residual house value, $RHV(T)$, at maturity, T . For simplicity, we drop the time variable and denote RHV as the residual house value at time T . Denote the equity as E . The value of the reverse mortgage at origination, $t = 0$, is the current housing value minus the value of a call option on the residual value, RHV , maturing at T given the current housing value,

$$RM(0) = H(0) - CRHV_0(H(0), RHV)$$

which according to put-call-parity should be

$$\begin{aligned} RM(0) &= H(0) - CRHV_0(H(0), RHV) = RHVe^{-rT} - PRHV_0(H(0), RHV) \\ &= D + E \end{aligned} \tag{6}$$

where $PRHV_0(H(0),RHV)$ is the corresponding put option. This gives

$$D = H(0) - CRHV_0(H(0), B^*) = B^* e^{-rT} - PRHV_0(H(0), B^*) \quad (7)$$

and

$$E = CRHV_0(H(0), B^*) - CRHV_0(H(0), RHV). \quad (8)$$

Notice that the option values in here, $CRHV_0(H(0), RHV)$ and $PRHV_0(H(0), RHV)$, are the call, $CRHV(t)$, and put, $PRHV(t)$, respectively, where $t = 0$ in Section 4, except that we attempt to add clarity as to what variables can affect the option value. The decision is to select a level B^* such that $PRHV_0(H(0), B^*) \approx 0$ in expression (7) such that the debt is

$$D = B^* e^{-rT} \quad (9)$$

and hence almost bankruptcy free, and therefore is a high-grade, long-duration debt. On the other hand, the equity piece has a value only net of the debt and the call option held by the beneficiary of the retiree; that is

$$E \approx H(0) - CRHV_0(H(0), RHV) - B^* e^{-rT} \quad (10)$$

which bears almost all the housing price risk of the reverse mortgage. The expression above is only “approximately equal” because the debt value is not exactly the last term, but expression (7).

The bankruptcy or default remote senior tranche debt in expression (9) can be seen as a risk free zero-coupon bond equivalent with duration T . With an optimal selection of B^* , it would be promised payment at maturity of $B^* = xRM(0)e^{rT}$, where x is the share of each reverse mortgage deal to be given to the senior tranche (e.g. 20%), plus the first claim against the proceeds from the underlying mortgage if not paid, that is, expression (7). Hence, the question for the mortgage provider is to choose the level of x at time 0.

Inferring from expression (6), the risk of the reverse mortgage at any time t comes from the effect of the call on the residual house value (which is δ per dollar value of the residual

house value) plus the call option itself on the left-hand-side of (6), which is equivalent to the risk on the right-hand-side, made up of only the risk from the put. That is,

$$\delta RHV(t) - CRHV_t(H(t), RHV) = \text{riskfree bond} + (1 - \delta)RHV(t) \quad (11)$$

As mentioned above, the senior tranche will get the risk-free bond as on the right-hand-side of expression (11). The equity tranche, bearing all the house price risk of the reverse mortgage, is equivalent to a leveraged ownership of $(1 - \delta)$ of the residual house value, or the last term in expression (11). Investors of this tranche would receive $Max[0, RMV(T) - xRM(0)e^{RT}]$. Hence, securities on the reverse mortgage deals can be tailored with different durations for different investors to fund the reverse mortgage deals the mortgage provider wants.

The senior tranche that have virtually no exposure to housing price risk will be very attractive to long-horizon investors such as pension funds and insurance companies that want high quality long-term debt as a hedge for their annuities and pension liabilities. Mutual funds used by financial advisors wanting long-duration, high quality, inflation-indexed fixed income exposure for their clients can also tie the return to inflation such as the Treasury Inflation-Protected Securities (TIPS) in the US. This echoes the Towers Watson 2013 report, albeit not completely.

The underlying asset class of the equity tranche is the owner-occupied residential housing, which has an enormous total market capitalization bigger than the stock market due to increasing aging population getting into retirement (see for example the increasing trend in Figure 3). As a result, the potential market size for such equity tranche can be significant. Given its high risk, the equity tranche should be marketed to big financial institutions such as sovereign funds which have core indexed equity on the asset side of the balance sheet. This core equity is a large fraction of the market portfolio, not currently investable, held for diversification, and should not be sensitive to the rate of return. Hence, the type of equity tranche deals considered as “toxic” by typical loan officers or fixed-income asset managers will become attractive to these big institutional equity investors for their

diversification benefits. This in turn diversifies away the housing risk in the reverse mortgages.

Finally, a mezzanine tranche in between the two above can also be created to fill the niche currently filled by corporate and other credit-risky bonds, with a clientele made up of insurance companies or other institutions having appetite for taking tail risk similar to corporate and high-yield bonds. In any case, since the market can be potentially very large, liquidity could be enhanced as long as securitization of reverse mortgages is made right for investors with different needs. And more activities in the markets means more trading, and thence more efficient market. A very good outcome of such proposal is that the effective system can be immediately formed with existing financial institutions; no new innovative institutions have to be created. Finally, especially for investors of the equity tranche whose goal is diversification, if local housing supply is not enough to fill the appetite, there is always the global market for further international diversification.

5.3. The Role of the Government

The government is rarely the best institutional provider in such a market. For instance, relatively few have gained much from the current system because it is inefficient. The government's role in the financial system such as the Federal Reserve in the US is to ensure that the banking system is sound, not to insure against losses from banking activities or determine whether any investment instruments are optimally designed. As Davidoff (2014a, 2014b) study, the FHA lost money because of the (underpriced) guarantees of HECM written during the recent housing market boom, which then went bust. Government not involving is also supported in Lucas (2015) that the private sector would do a better job in terms of efficiency in providing such products because of higher profit incentives.

Nevertheless, the government still has a role in the reverse mortgage market for regulation improvement. There should be coordinated, regulation including consumer and usury law exemptions, to permit high *promised* interest rates – both inflation-protected as well as nominal. Contracts should be standardized to allow for exemption from costly third-party review or counselor as a legal requirement. There should be exemptions from dysfunctional

tax code provisions such as phantom income to retirees and their estates who “turn in the keys” rather than making the promised interest and principal payments. There should be intelligent exemptions from current restrictions on having reverse mortgage and annuity purchase with the proceeds linked in a seamless transaction.

6. Asia as Biggest Potential Demand for Reverse Mortgage

As mentioned in the Introduction, ageing population is very serious in Asia. In China, a country with 1.4 billion people, the situation of 1 in every 5 persons over 65 in 2016 will be changed to every 2.5 persons will have to take care of 1 retiree in 2050 (note that the retirement age in China is 60, and not 65, which means the group of retirees is even bigger than the numbers shown here). In contrast, the changes in the US and UK are only from 15.16% and 17.97% to 21.41 and 23.05%. Still, there will be 1 in 5 persons reaching 65 or above by 2050. Also mentioned in the Introduction are the population statistics of Korea, China, Singapore, and Japan. This is because these countries are the few Asian countries that have offered reverse mortgages to their people, although the popularity is very low.

Reverse mortgage products in Japan may be less effective for most Japanese under current conditions. First, almost all condominiums are not eligible for application. In fact, only land, not the house, is valued for the purpose of reverse mortgage. Second, there is no option for life time payments. Third, in some cases, interest has to be paid even during the course of borrowing, rather than waiting until the reverse mortgage is terminated. In some cases, decline in general land price will even trigger repayment of principal in order to avoid negative equity. Finally, some products are not non-recourse. Hence, reverse mortgage products in Japan are far more risky for the retiree and not much different from conventional mortgages, and so are likely to not be attractive to home-owning retirees. However, design features can be changed to make them more retiree-friendly to use. With proper design changes therefore home ownership of 60% of total financial assets in Japan means that releasing home equity should be a highly feasible solution for retirees.

In the case of China, even though people think that the purpose of the government advocating reverse mortgage is because of its intention to lessen support to elderly care, the burden is just too big for the government to carry on if there is no other alternative such as reverse mortgage. China had underfunding of its pension funds by 18.3 trillion yuan in 2013, according to Bank of China and Deutsche Bank.⁸ A pilot program of the “House for Pension” program started in 2003 in Beijing, Shanghai, and Nanjing. It has not been well received for the following reasons. First, laws and regulations cannot accommodate the development. For instance, housing is under a 70-year leasehold; the law states that it could be extended lacks details of how much is needed for the extension. Furthermore, the current regulations governing the product are not sufficient to guarantee its soundness. Second, risks to investors of these instruments are high. Chinese financial institutions worry about the very volatile housing price will mean the financiers will be subject to high risk of loss. In Shenzhen (a city in the South, next to Hong Kong), for example, applicants must have at least two properties in order to apply for reverse mortgage simply for the fear from the lender’s side of significant price drop. In addition, existing housing units in China tend to have low quality that would last for only about 25-30 years before major renovation, if possible, has to be done. This significantly reduces the value of the units. As a result, high mortgage rates are charged, resulting in too expensive mortgages for the retirees. This also reflects the relative immaturity of the financial market in China. Third, there is still lack of professional counselling and consulting to help people understand the benefits of such product.

Finally, though bequest motive is everywhere in the world, it is of higher priority in general in Asian countries. It is very difficult to educate both the seniors and their offspring that the home equity could be consumed by the elderly, while leaving less to the younger generation. Even those who know that their children are financially very sound, are still reluctant to consider transforming the home equity into monthly pension. Furthermore, if housing price increases in the future, and the current unit has been used for reverse mortgage, the retirees fear that their children might not be able to afford other housing units

⁸ “House-for-pension stirs debate”, Xinhua Daily, available from http://www.china.org.cn/china/2013-09/17/content_30055566.htm.

in the future. What people do not understand is that, with some changes in the setting of the reverse mortgage, the proceeds from the reverse mortgage can actually be used by the children and not the retiree, at the choice of the retiree. Besides, while the children get the benefit of any rise of the house price in the future, with or without the reverse mortgage, the cash from the reverse mortgage can help the retirees with their life expenses when they need it the most, rather than in years later when their children are grown up.

Hence, the “House for Pension” program in China is perceived to be useful only to childless elderly. In addition, the amount of money that the elderly can extract for the housing units depends very much of their values. The fact that housing units in third tier cities or villages, are not very valuable, and there is no liquid second-hand housing market (certainly for the villages), implies that elderly cannot get much from reverse mortgage, if exists. Interestingly, elderly in villages are the ones that would have much bigger need for financing after retirement than those in big cities who might have already accumulated certain level of wealth.

Korea is perhaps the Asian country that has a relatively successful reverse mortgage program called “Housing Pension”. Its success is not only due to the high home-ownership of 81%, coupled with the ageing population, but mainly because of the flexible payment methods. In addition, the program is guaranteed by the government; and the interest rate is capped low, coupled with tax benefits. With strong promotion and encouragement from the government, 73% of Korean elderly prefer not to live with children, 25.7% do not plan to leave bequest to their children, and 87% do not want to increase financial burden to their children.⁹

In Singapore, home-ownership amounts to 90%, mostly housing provided by the Housing and Development Board (HDB) of the government, which implemented the Lease Buyback Scheme (LBS) in 2009. Before this, NTUC Income, an insurance company, introduced reverse mortgage in 1997, and OCBC Bank in 2006, both of which however terminated the product in 2009 because of no demand due to complicated products and few eligible

⁹ “2013 Residential Annuity Demand Condition” by the Korean Housing Finance Corporation.

mortgagors. The idea of LBS is for the retirees to sell part of the 99-year leases back to the government to unlock their home equity. However, the government is the active participant in providing finance in this case.

Learning from the pros and cons of reverse mortgage programs in the various countries described above, the involvement of the government in terms of motivating both financiers and retirees to engage in reverse mortgage market and establishing effective regulations and laws are very crucial. On the side of participants, there should be a variety of methods of payments to facilitate flexibility of extracting funding by the retirees. There should also be a liquid second-hand market to complement the product in terms of valuation and when the housing units are sold. Furthermore, our proposed model solves the issue of more efficient risk management of reverse mortgages for funding providers, which should be borne by the equity part of insurance companies and pension funds and not the credit lenders part of those institutions or banks because they are not equipped to handle the high risks of a well-designed reverse mortgage. The costs of such products should also be kept low. It is important that the government does not fund or otherwise take the credit risk of reverse mortgages and instead help by improving liaising laws, regulations and governance; the global financial markets provide the largest and most reliable funding base so that these products could be properly and fairly priced. Demand should be boosted up once the products are fairly priced, and their continued supply assured even in tougher economic environments. Traditional thinking about bequests should be changed among retirees and their beneficiaries. In this modern age, the younger generation, particularly those from the single-child policy in China, often tend to choose their own ways and conditions of living. The alternative of living in housing units left by the parents might not be a favorable choice. Furthermore, most of this younger generation would have already reached the age with decent jobs and therefore likely their own decent homes, which means there is no need for their parents' homes. On the other hand, this young generation should also realize that the reverse mortgages could actually relieve them from financial burden of taking care of their parents. More importantly, generally agreed to be a good hedge against inflation, housing units can be perceived as call options for the children in the sense that the extra proceeds from selling the housing units, and upon paying the reverse mortgage principal plus interest,

could all be cashed. Perhaps more and better educated people, both the young generation and the elderly, in time would increase the demand for reverse mortgage when they realize that home equity is a much valuable alternative for financing retirement.

7. Conclusion

A reverse mortgage plan 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 can increase benefits instead of trying to increase the amount of retirement assets available.

However, reverse mortgages are currently not widely used as a systematic part of retirement funding. A reason could be simply that currently retiring working- and middle-class workers have adequate retirement funding from the Social Security system and defined-benefit employer-plan and hence there is no need of tapping their home equity value for a good retirement. An alternative reason, however, is that the design of the reverse mortgage is materially flawed because of the small size of loan-to-value offered, the ways the product are marketed, the costs of acquiring a reverse mortgage by the retiree, and the dysfunctional, albeit well-intentioned, regulations. In the US, there is no pure private-sector reverse mortgage market (the only one is the government-guaranteed HECM), and traditional credit institutions are not the most efficient risk-bearing supplier of a well-designed, albeit very high risk, reverse mortgage 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.

We propose two main ideas in this paper. First, improvement to the design of the reverse mortgage should facilitate large initial loan-to-value ratios. Second, 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. Then, using current institutions and institutional practices, the reverse mortgages could be packaged with simple tranches of senior bankruptcy-remote debt and the junior equity tranche. 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, which are always invested in all the market asset classes for diversification reasons, independent of market conditions. This assures stability and scale of finance.

Currently in the US and other places, 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. A private-sector reverse mortgage market, ideally with a global funding base, is essential.

Although the proposed changes in design 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 the better designed reverse mortgage is feasible for practical implementation without enormous institutional changes. Even though there might be less incentive to push reverse mortgage forward as a solution to retirement spending in places like the European countries with high social benefit and low ownership ratio, particularly in Asian countries where the population is rapidly ageing. In sum, reverse mortgages can be promoted both for retirees who are eligible and for the financial institutions thirsting for new investment products with enormous supply.

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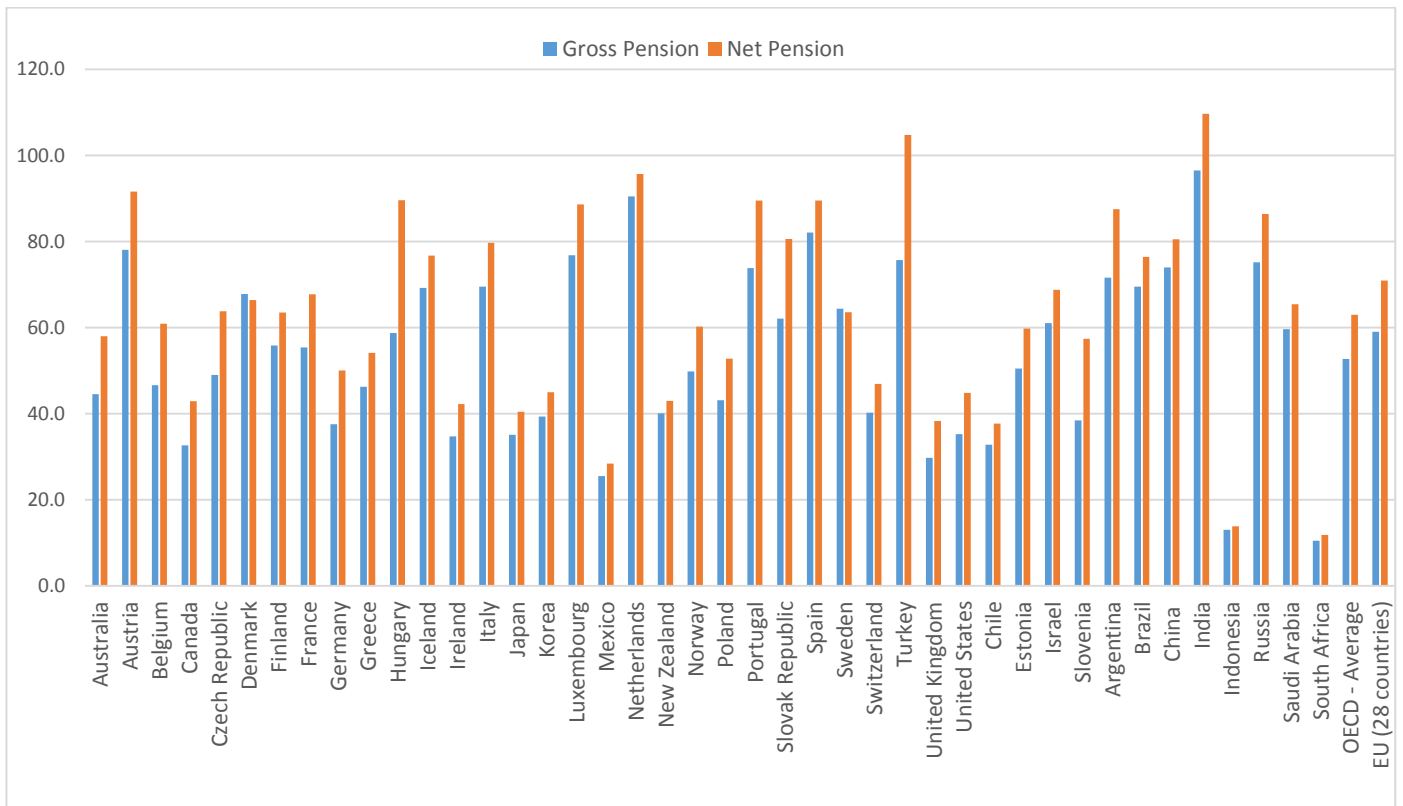
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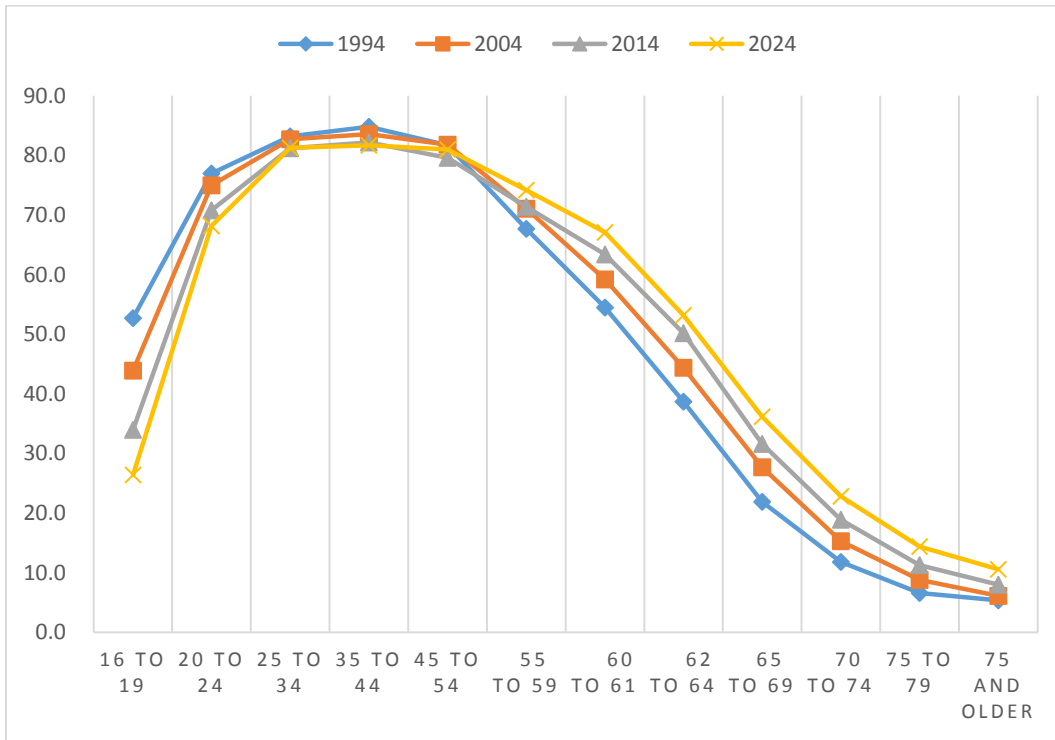
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Figure 1 Gross and Net Pension Replacement Rates in 2014



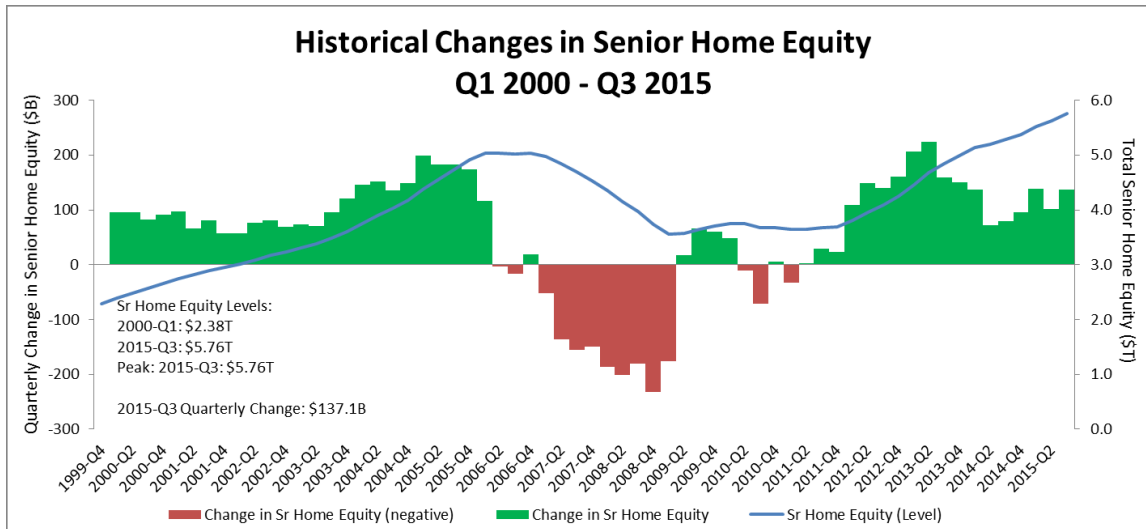
Source: OECD (2016), Gross pension replacement rates (indicator). doi: 10.1787/3d1afeb1-en, and OECD (2016), Net pension replacement rates (indicator). doi: 10.1787/4b03f028-en

Figure 2 Labor Force Participation Rate in the United States (in percentage)



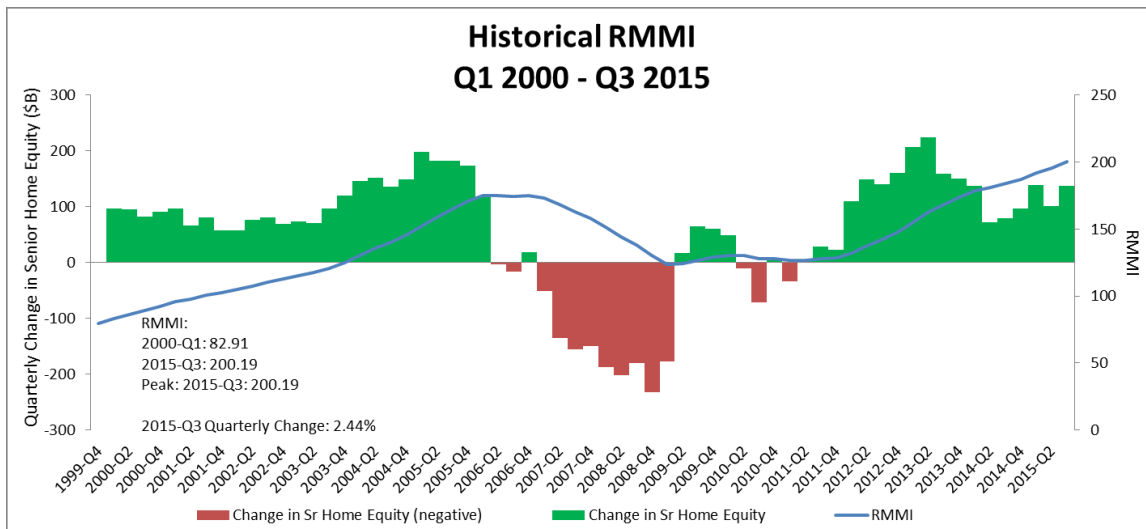
Source: The Bureau of Labor Statistics of the United States Department of Labor

Figure 3 Senior Home Equity for 2000-2015 in the United States



Source: Reverse Mortgage Market Index (RMMI) (Q1 2000 – Q3 2015) released on Dec 22, 2015 by National Reverse Mortgage Lenders Association and RiskSpan, Inc., available from <https://www.nrmlaonline.org/wp-content/uploads/2015/12/NRMLA-RMMI-Q3-2015-with-methodology.pdf>

Figure 4 NRMLA/RiskSpan Reverse Mortgage Market Index



Source: Reverse Mortgage Market Index (RMMI) (Q1 2000 – Q3 2015) released on Dec 22, 2015 by National Reverse Mortgage Lenders Association and RiskSpan, Inc., available from <https://www.nrmlaonline.org/wp-content/uploads/2015/12/NRMLA-RMMI-Q3-2015-with-methodology.pdf>