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Behavioral Models on Reverse Mortgages

Understanding Reverse Mortgages (Low) Demand

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1. Introduction

When studying the implications of population ageing on the sustainability of pension systems worldwide, it is apparent that pension systems are to be severely reformed. In fact, in lack of structural reforms, the expenditures burden that ageing will bring forth will cause the whole pension systems to be at risk of a collapse. Nevertheless, even though, from a theoretical perspective, pension reforms should be welcomed and embraced, implementing them is far from easy. This results from the fact that pension reforms involve actions that reduce the wellbeing of people in the short-run, such as increasing the retirement age or reducing the pension benefits of the retirees. As a result, politicians usually do not have the public support to pursue them. Moreover, this result is worsened by the fact that politics intrinsically implies a preference for short-term goals over long-term ones, a sort of myopia that is difficult to overcome. As a consequence, it would not be a surprise that the implementation of pension reforms will be partial or reforms will be continuously postponed, leading to detrimental consequences for intergenerational equity and a never-ending sense of urgency in the pension systems, due to budgetary deficits. There are, however, several developed countries that have already begun the reforming process of the pension systems. Even though the promptness of tackling the negative consequences of an ageing population will increase equity in the system by reducing intergenerational transfers, this will lead to a significant reduction of future pension benefits.

In this bleak picture, financial instruments that can expand the consumption possibilities of the retirees are of vital importance, as they can (partially) offset a fall in future pension benefits. Among such instruments, one that has come to existence in the recent past and that can prove to be extremely useful is the Reverse Mortgage. Reverse Mortgages are a financial instrument that gives elderly homeowners the possibility to borrow against their housing equity. Moreover, the loan repayment is due only when the borrower dies, moves out or sells the house. In other words, the Reverse Mortgage allows the borrowers to consume part of their housing equity while giving them the right to benefit from living in their house until they pass away (or decide to move out or sell the house). In this sense, Reverse Mortgages provide a means through which the elderly can improve their consumption possibilities at virtually no downsides.

More generally, we will see that Reverse Mortgages, if available in the market, can be welfare improving and Decision Makers should consider the possibility of buying this product. Furthermore, by taking into consideration the fact that pension systems are affected by inertia and that future developments might fall short in providing the elderly an appropriate pension benefit, Reverse Mortgages will be even more valuable to the retirees. In particular, to those whose

pension benefits fail in providing an adequate level of income. Under this perspective, Reverse Mortgages can be seen as a second source of pension benefits that derives directly from house equity.

As Reverse Mortgages can potentially produce a great impact on the economic sphere of individuals and therefore on their wellbeing, and also because of the fact that Reverse Mortgages might become even more significant in the future, it is essential to analyze this instrument more in detail. First, from empirical studies it is interesting to see what factors make individuals to be interested in the product. In the literature we can find such studies[1]. Second, from a theoretical point of view, it is also interesting to analyze the tradeoffs that an economic agent faces when deciding whether or not to buy a Reverse Mortgage. In particular, the theory predicts a significant interest in the product, while the demand for it is remarkably low. Therefore it is of interest to understand this fact from a theoretical perspective. To this aim, we will present simple theoretical models that will try to shed light on the interactions between the most relevant factors, both economical and psychological, that impact the Decision Maker's choice.

From a macroeconomic perspective, Reverse Mortgages' implications should not be neglected. In fact, this financial instrument, by increasing the income of the elderly and by allowing better consumption smoothing, can alleviate the burden of an ageing population on the public expenses. Think, for instance, of a reduction in public expenses due to poverty alleviation or minimum pension benefits that are related to income. As a consequence, governments will be incentivized to take action so as the Reverse Mortgage market expands and works appropriately. In particular, due to market frictions in this sector such as high transactional costs, moral hazard and adverse selection, regulation is crucial and might be a *condicio sine qua non* for the market to exist in the first place. In addition to this, policy advisors might not only limit themselves to regulate the market, but can also take action to increase the demand of the product. Framing effects and literacy are factors that might be taken into consideration to achieve a higher demand. More generally, the factors that influence demand for Reverse Mortgages will also be important from a policy perspective.

The remaining of the paper is structured as follows. The first part of section one presents a thorough analysis of Reverse Mortgages and the reasons why (or why not) this particular instrument can be welfare improving. The second part of section one focuses on demographic and institutional trends that will affect pension systems worldwide and how Reverse Mortgages can prove to be valuable in this new framework. Section two will present simple economic models so as to analyze the behavioral factors that lead people to demand this product. Finally, the last

[1] See Fornero et al. (2013) and Dillingh et al. (2011)

section will put forward, in light with its interconnectedness with pension systems, some normative considerations on Reverse Mortgages and conclusions will follow.

2. Section one: Reverse Mortgages overview

Unlike a traditional house mortgage, where an individual borrows money to buy a house and makes periodic loan payments to a lender, under a Reverse Mortgage, a homeowner borrows money against her house equity (collateral) and receives money from a lender. Furthermore, a key characteristic of Reverse Mortgages is that both the loan repayment and interest are to be paid only when the borrower dies, moves out, or sells the house. When one of these events comes about, the borrower or her heirs are responsible for repaying the loan plus the interest accumulated. In other words, the lender does not receive the house as repayment. The sum borrowed can be repaid with either the proceeds from the sale of the house and/or any other available source of funds. Another important feature of this financial instrument is the so-called "no negative equity guarantee", which insures the borrower as well as her heirs against the risk of the outstanding debt exceeding the value of the house. This can be represented mathematically as follows:

$$debt\ payable: \begin{cases} money\ borrowed\ if\ house\ value \geq money\ borrowed \\ house\ value\ if\ house\ value < money\ borrowed \end{cases}$$

2.1 Loan size determinants

The maximum loan amount that the homeowner can borrow depends directly on three factors:

1. The value of the home;
2. The expected average mortgage interest rate;
3. The age of the borrower.

The value of the house affects the maximum loan amount in a direct way: the higher the value of the house, the larger the loan the borrower can take. Note that the house's value that is relevant is the expected value of the house when the loan will be repaid. Therefore, its value is an expectation and is also referred to as "appraised value". Furthermore, there are limits to the amount of money that can be borrowed, and this depends on a country's regulation. For instance, in the USA, the value of the home used in computing the loan amount cannot exceed the Federal

Housing Administration's (FHA) insurance limit, which currently is set to up $625,000[2]. Therefore, homeowners with property values that exceed the FHA limit are constrained, as irrespective of the value of their properties, the maximum amount borrowed will be fixed. In the same vein, Italy's regulation puts a limit to the loan, which can be up to €450,000[3]. Moreover, country-specific regulations also determine the minimum loan amount. For instance, in Italy the minimum is set to €32,000.

The way in which the Reverse Mortgage works, implies that the borrower will face an interest burden every year until the loan is repaid. In particular, interest payments are summed up to the loan principal over time and are to be paid together with the principal when the debt is extinguished. Hence, in defining the size of the loan, interest payments will be taken into consideration. As a result, it follows that higher interest rates reduces the amount of money borrowed.

The age of the borrower is crucial since it influences the length of time that will be needed for the loan to be paid back, which in turn determines the interest payments. More specifically, the life expectancy at the age in which the Reverse Mortgage is undertaken is relevant, as this will determine the interest burden. Therefore, younger borrowers on expectation will receive the loan for a longer period of time, thus making the interest burden higher and so the value of the loan will be lower. Furthermore, regulation often determines the minimum age at which the Reverse Mortgage can be offered. In the United States the minimum age is 62 years, while in Italy, it was recently lowered from 65 to 60 years of age[4].

2.2 Reverse Mortgages loans payment

Borrowers can decide upon different formats for receiving the loan. The first option is that homeowners take a single lump sum of cash. The second option contemplates a "creditline" account of a specific amount (the value of the loan), and to which the borrower can attain to make cash withdrawals. In this way, the borrower decides when and how much to get from the account. One appealing feature of this option is that the creditline grows over time: the amount of cash available in the account increases at the same rate as the interest rate charge on the loan balance. For instance, if the creditline is set to €50,000 and the borrower withdraw €10,000, at period t=0, the next period, t=1, she will have in the account: €40,000+€40,000*0,05=€42,000, assuming an interest rate charge of 5%. A third option is to receive the loan in regular payments for a fixed

[2] HUD Mortgagee Letter 2013-43, December 6, 2013.
[3] *"Legge 248 del 2005"*, Italian Law 248 of 2005.
[4] *"Legge 44 del 2015",* Italian Law 44 of 2015.

term, or to receive regular payments for as long as the homeowner stays in the house (that is to say, until the borrower passes away or until she sells the house or moves out). The latter possibility implies that the borrower chooses to annuitize the loan. Furthermore, it is also possible to choose any combination of the above options and, if applicable, to modify previously made choices.

2.3 Reverse Mortgages Transaction Costs and Insurance Premium

Reverse Mortgages entail significant transaction costs. These costs, however, are generally paid from the proceeds of the loan. Thus, reducing the so-called "out-of-pocket cost", but also reducing the net loan amount borrowed. The main costs are: the origination costs, the closing costs, the servicing fee, and the mortgage insurance premium. These costs, either directly or indirectly, will result in higher interest costs.

The origination costs arise to refund the lender for preparing the paperwork and processing the new loan. These costs generally cannot exceed a certain amount by law. In the United States the origination costs cannot exceed 2% of the house value. Next to the origination costs, we can find the closing costs, which comprise a collection of services offered by third parties that must be paid. In this category we can find costs from services like appraisal, inspections, recording fees, credit checks and others. The servicing fee results from the costs that arise after "closing" the Reverse Mortgage. For instance, making or changing loan advances at request, providing account statements, monitoring the compliance of the borrower, among others.

The mortgage insurance premium derives from the fact that Reverse Mortgages require insurance in order to insure the borrower for a number of risks. First, it guarantees that the borrower receives the promised loan advances and that she does not have to repay the loan for as long as she lives in the house, irrespective of how long the borrower happens to live (particularly important for the case in which the borrower opts to annuitize the loan). Moreover, it insures for the value of the house at the time the loan is repaid. Finally, the insurance also guarantees the "no negative equity guarantee". This cost, usually financed with the loan, is charged as a percentage of the home's value (usually in the interval [1.5;3] percentage points).

2.4 Potential Advantages of Reverse Mortgages

The main benefit that Reverse Mortgages offer is that it allows homeowners to take full advantage of the house. To see this, following Merton (2011), we can define the House Value as:

$$House\ Value = Housing\ Services + Residual\ House\ Value$$

From the above taxonomy, it can be seen that in the absence of a Reverse Mortgage, the homeowner will only benefit from the housing services linked to living in the house. On the other hand, in the presence of a Reverse Mortgage, homeowners will also monetize and consume part of their housing equity (residual house value).

The advantage is substantial, if we take into account the lifecycle hypothesis (Modigliani and Bruemberg, 1954), and see that in the portfolio composition of the elderly, illiquid assets are predominant, which makes the wealth decumulation phase an issue. In fact, other forms of depleting housing equity (such as selling the house and buying a smaller one) involve high transactional costs, which are both financial and psychological. An example of the former can be the costs of moving and agency costs, while an example of the latter are the costs resulting from moving out, due to a psychological attachment to the house. As a consequence of these costs, the elderly will end up in a situation of under-decumulation. In the case of a Reverse Mortgage, on the contrary, these costs are avoided and the decumulation of housing equity is made easier.

Another advantage of Reverse Mortgages and the increasing flow of income that results, is that prime-age homeowners, aware of the product, will anticipate this higher income in the old age, and thus can afford to save less during their working lives. This leads to an enhancement in consumption smoothing, that can be assumed to be welfare improving.

Contrary to widespread belief, Reverse Mortgages are not incompatible with the bequest motive. Actually, a higher stream of income to the borrowers, might improve the economical situation of the heirs as well. It is not implausible that the money obtained through the Reverse Mortgage can be used for the well-being of the heirs, either directly or indirectly. It can be directly if, for instance, the elderly homeowners financially support their children. Indirectly, on the other hand, if a higher stream of money leads the elderly to provide for their own expenses (health or living costs) and so reducing the burden the children have to face for looking after their parents. More generally, Reverse Mortgages can improve bequest timing and can reduce uncertainty about the time in which the heirs receive the bequest. This advantage, of course, does not come for free to the heirs: in fact, the bequest received by the heirs will be reduced, as the parents will most likely keep and consume part of the increased income for themselves.

Furthermore, Reverse Mortgages are a financial instrument that can aid in risk management. Holding house equity involves exposure to housing price risk, and a Reverse Mortgage can be used to better diversify the risk. For instance, this goal can be achieved by using the lump sum and investing it across asset classes (Pelizzon and Weber, 2009). Furthermore, the possibility of annuitizing the loan permits the homeowner to deal with idiosyncratic mortality risk.

Finally, the no negative equity guarantee makes Reverse Mortgages more attractive than alternative ways of borrowing in the market, inasmuch as, under a Reverse Mortgage, the borrower's house is not at risk. In particular, she will not lose her house even in the case in which her debt is greater than the house's value.

In conclusion, Reverse Mortgages extend the market possibilities of consumers. Therefore, they allow consumers to better trade endowments and risky factors in the market, which leads to more efficient markets and possibly to welfare gains.

2.5 Potential Disadvantages of Reverse Mortgages

In Economics, we are all aware of transaction costs and that they exist in every single market. In fact, transaction costs are not a prerogative of the Reverse Mortgages market. However, when dealing with Reverse Mortgages, transactions costs can be particularly high as compared to other forms of credit. Lending liquidity against home equity implies that the lender must gather relevant data, as the current value of the house, the expected value of the house in the future, the life expectancy of the borrower, and so on and so forth. Furthermore, the lender has to regularly check whether the homeowner's actions are in compliance with the agreed conditions of the contract. In most cases, borrowers are still responsible for paying property taxes, house insurance and for making essential property repairs. Therefore, lenders must keep track and make sure that the borrowers are fulfilling their contract obligations. All these actions imply that transaction costs will be particularly high, and which are ultimately borne by homeowner borrowers.

Another drawback of Reverse Mortgages is that they are complicated to understand. Even though consumers might have an intuitive idea of what a Reverse Mortgage is, it is very unlikely that they are able to discern and evaluate all the factors that are connected to the pricing of Reverse Mortgages. Factors such interest rates, the expected value of the house, idiosyncratic and macroeconomic longevity risks are either not known to the average borrowers or, in the case there are known, it is nevertheless almost impossible to assess them. Therefore, consumers will find it difficult to make up their minds in deciding whether they should buy the product or not. This can result in inertia and, therefore, in the demand of this product to be low.

Along with transaction costs issues, the contingent tax treatment might constitute a huge disadvantage to Reverse Mortgages. First of all, income taxes deriving from the amount borrowed might undermine the benefits from undertaking the loan. Moreover, it is important to establish the difference between Reverse Mortgages tax treatment with those of similar available financial options (other instruments that permit borrowings). For instance, whenever the government

subsidizes other options, Reverse Mortgages will be penalized. However, tax treatments differ across countries and across time, and therefore a thorough analysis must be computed in a case-by-case basis.

As we have seen in the previous section, Reverse Mortgages insure borrowers against many risks (house prices, mortality risk, etc.). These risks, however, do not disappear but are simply shifted to the lender. As a result, the credit institutions will charge homeowners for the risks they now bear. In addition to this, lenders face both adverse selection and moral hazard in the market. Adverse selection might be a problem as those people willing to undertake the mortgage, might be those who will happen to live the longest. Moral hazard, instead, arises as the homeowner, knowing that the no negative equity guarantee holds, will act in their best economic interest and will not spend appropriate funds in the maintenance of the house. All these risks imply that lenders will charge higher costs for the services they offer.

Since the first appearance of the product in the market, it has become apparent that the demand for the product is rather low. One explanation for this empirical evidence is the complexity of the product as well as the necessity to make potential consumers aware of the product. Marketing and publicity helps in this domain, but there is no free lunch: advertising implies costs, which make Reverse Mortgages costly.

Among the advantages of Reverse Mortgages we discussed earlier, we found that they can aid in protecting the consumer against different types of risks. Nevertheless, there are some risks that originate with Reverse Mortgages. For instance, if borrowers decide to annuitize their loan, they end up facing the counterpart risk, that is the risk that the credit supplier fails to meet the monthly payments.

Finally, psychological costs that Reverse Mortgages brings forth need not be neglected. They can be burdensome and can lead consumers not to buy the product. In particular, the financial instrument implies an origination of a debt, which continues to grow through time (however, the growth is limited to a certain maximum due to the no negative equity guarantee). Therefore, people who are debt averse will suffer psychologically. Moreover, allowing for the possibility of people being loss averse, it is possible that the borrowing makes homeowners feel a loss: in fact, annuitizing the loan and not living “enough” to be repaid from the investment, results in a potential high loss connected to a Reverse Mortgage. These psychological costs and risks will be analyzed in Section 2, as these factors can give a better understanding of Reverse Mortgages low demand.

2.6 Reverse Mortgages Brief History and Current Market

The history of Reverse Mortgages began in Portland (the United States) in 1961, when Nelson Haynes of Deering Savings & Loan designed this type of financial product to help Nellie Young, the widowed wife of Nelson's high school football coach. In 1987, the American Congress passed an insurance bill called the Home Equity Conversion Demonstration, which consisted in a Reverse Mortgages pilot program that insured Reverse Mortgages. One year later, the Reverse Mortgage government insured loan is established, as President Ronald Reagan signed the Reverse Mortgage bill into law. With this, the Reverse Mortgage market in the US started, and since then, the contract's volume had been increasing. For instance, according to Shan (2009), in the early 1990s only a few hundred Home Equity Conversion loans were originated each year, while in 2007, the number raised to over 100,000. The volume, however, is relatively low, as compared to the number of potential consumers (eligible homeowners).

In Europe, and in particular in the UK, Home Reversion offered the first reversion income scheme in 1965. In 1972, the first home income plan based on mortgage and annuity was offered (Fornero et al. 2011). It is not a surprise, therefore, that the UK market is better developed than other European countries. According to the "Study on Equity Release Schemes in the EU" (2007)[5], the total number of contracts closed in 2007 amounted to almost 40,000 units[6]. The only market with a considerable market size was the UK with 33,000 units. After the UK, Spain and Sweden totalized 3,600 and 2500, respectively. In other countries, the market was almost negligible or non-existent. For instance, in Italy 300 Reverse Mortgages were closed, in France 200, and in Germany 100. In 2007, the estimated total volume of Reverse Mortgages in the EU was estimated to be around 3.31 billion euros, representing less than 0.1% of the whole mortgage market (5714 billion euros).

Because of the lack of official EU statistics it is difficult, not only to track the current market, but it is also difficult to make predictions about future developments. Nevertheless, the upward trend experienced in the US market, which main cause is attributed to increasing awareness of the product, can give reason to think that a similar trend will occur in Europe. Moreover, governments have been active in improving the market for Reverse Mortgages by

[5] There are no Reverse Mortgages official statistics in EU. The Study on Equity Release Scheme in the EU is based on surveys to providers, stakeholders and regulators of Reverse Mortgages.

[6] This particular figure was obtained through information provided by Reverse Mortgages providers who participated in the study.

increasing transparency, reducing transactional costs and/or by offering tax incentives[7]. This *modus operandi* is likely to have a positive impact on the development of the market.

2.7 Demographic trends and pension schemes developments

In this section we have seen that the market for Reverse Mortgages is highly underdeveloped. Even though intermediary institutions have step in the market and have been offering the product to consumers, the number of Reverse Mortgages sold is dramatically low. In particular, consumers' demand is far below expectations. Therefore, it is of economical interest to analyze the factors that influence people to refrain from buying the product. This will be accomplished in the next section. Before that, however, we will present an analysis of current and future demographic trends and its implications on the current and future pension systems. In this manner, it will be possible to have a better understanding of the role that Reverse Mortgages can play in the long run.

Population ageing, which consists of an increment in the share of older people in the population, results from demographic developments. In particular, population ageing derives from lower fertility rates and higher life expectancies. This leads to smaller proportions of children and larger proportions of older people in the population**.** An ageing population, due to low fertility rates and higher life expectancies, imply that, ceteris paribus, the current pension systems will not be sustainable in the future. On the one hand, PAYG pension systems are directly affected by demographic shocks and therefore by the ageing of the population. In fact, in the presence of higher life expectancies, the overall amount of pensions paid out to the retirees increase, which results in the middle-aged facing a higher tax pension burden. Next to this, lower fertility rates imply a reduction of the size of younger generations relative to that of older generations, making the middle-aged per-capita burden of pension costs even higher. On the other hand, funded systems are also touched by demographic shocks. In particular, funded pension schemes are vulnerable to increased longevity. Higher life expectancies mean that retirees will need to spread their retirement savings over a longer timespan. As a result, in order not to face a cut in pension benefits, people will need to save more during their working lives. If longevity is a common trend worldwide, this also implies a reduction in the return on capital, additionally hurting the funded pension schemes. Even though low fertility rates do not affect funded pension schemes directly, because every agent is responsible for her own pension, and thus do not rely on a social contract

[7] For instance, see *"Legge 44 del 2015",* Italian Law 44 of 2015, which aims at cutting transactional costs and increasing tax incentives of Reverse Mortgages.

where younger generations pay for the pensions of the older generations, they are indirectly affected as well. The economical intuition behind this statement is that ultimately the old will depend on the young, as they are the ones who ultimately produce the goods and services. Therefore fewer workers imply a reduction in good and services available to the old.

Population ageing, therefore, implies that pension systems, both PAYG and funded schemes, need to be reformed in order for them to be sustainable in the future. Basically, there are three ways in order to deal with demographic shocks. First, it is possible to reduce the future costs of ageing by increasing the retirement age or reducing pension benefits. Second, governments willing to maintain the current pension system as it is, might find it appealing to increase savings through other channels and use this funds to sustain future pension costs. Finally, apart from reducing future costs or increasing revenues, improvements in the sustainability of pension schemes can be achieved by increasing labour force participation (e.g. increasing woman and/or old age labour force participation). In developed economies, pension reforms involve a combination of these three measures, and so, a reduction in pension benefits is the rule rather than the exception. In this context, Reverse Mortgages can be even more valuable to pensioners who can offset pension cuts through entering this market.

The phenomenon of an ageing population is a worldwide trend, even if the extent and speed vary across countries. We are mostly interested in demographic trends that take place in developed countries[8]. Thus, to have an idea of the phenomenon, we will shortly discuss population ageing in the Eurozone countries[9]; after that, we will see how this trend will affect the pension system in the area. To this aim, we will refer to the study "2012 Ageing Report of the European Commission". This report predicts that in the EU, fertility rates will remain constant at around 1.6-1.7 percent points in the next five decades, well below the replacement rate of roughly 2.1. Moreover, it is anticipated that life expectancy, that had been rising in the last decades, will continue to increase in the near future: by 2060, woman life expectancy will increase by 6.5 years, while men's will see a 7.9 years rise. In light of the current and future trends in fertility rates and life expectancy, it can be concluded that the age structure of the EU population will be shaped significantly. Even though the overall size of the population will slightly increase (from 501 million in 2010 to 517 million in 2060), the population will grow considerably older as there will be an increase in the older age groups at the expense of smaller younger groups. As compared to 2010, in 2060 the elderly (+65 years of age) will become an increasing share of the total population (will rise from 22% to 44% of the total population). This arises from two facts: first,

[8] Developed countries are considered in this section. In fact, we are interested in understanding the implications of population ageing on the demand of Reverse Mortgages in these countries.
[9] Furthermore, we will see how population ageing in the EU will affect the pension systems.

the baby boom generation will become old by that time and, together with this, an increased life expectancy will make the share of the elderly higher; second, below replacement fertility rates make the youngest group to become relatively smaller.

Demographic trends will unquestionably have a huge negative impact on pension schemes sustainability. As pension systems are traditionally at the core of the welfare state of almost all developed countries, public finances, directly or indirectly, are and will be under pressure. That is the reason why a major part of national governments in the EU have (partially) reformed their pension systems and will continue to do so in the future. This explains why pension expenditures are projected not to increase abruptly in the next decades. The burden, however, of making the pension schemes sustainable will drastically affect the generosity of the system[10]. Keep in mind, however, that the concrete impact of ageing in the pension systems will depend on the particular characteristics of the scheme taken into consideration.

Hence, it is of interest to study the implications of pension reforms on future pension benefits, and in particular, to analyze the pension adequacy of future pensions. Future pensions adequacy can be addressed by studying two variables: the benefit ratio and the replacement rate at retirement. The former is defined as the ratio between the average pension benefit and the economy-wide average wage. Therefore, the ratio gives a comparison between the pension income and the labour force income. The replacement rate is defined as the average first pension as a share of the economy-wide average wage at retirement. Both indicators taken together can explain whether a projected reduction in pension benefits is due to lower newly pensions or due to an steady decline of pension benefits during the retirement age, mainly caused by a lower indexation of pension benefits.

The European Commission Ageing Report 2012 has computed projections of these two variables. Regarding the benefit ratio, it can be acknowledged that in almost all countries, benefit ratios of both public pensions and all pensions (public plus occupational pensions and private schemes) will decline. In particular, the average decrease in public pension benefits for the EU will be of 19%. It is also expected that the replacement rate will decline for both public and all pensions in the EU. For public pensions, the average drop in the EU is thought to be around 18%.

[10] To learn how the generosity of the EU pension schemes will be reduced in a country-by-country basis, see the "2012 Ageing Report of the European Commission".

2.8 The Role of Reverse Mortgages in an Ageing Population

In this scenario of future cuts in pension benefits, it is therefore necessary to find other ways to offset the detrimental effects of pension reforms on retiree's income. First of all, it is possible to increment pension entitlements. For instance, countries could offer flexible retirement ages. In this way, workers would deliberately increase their working lives, and so their contributions to the scheme will rise. This in turn would result in pensionable incomes increments. Moreover, it is also possible for Member States to shift pension accumulation from public first pillar to second pillar (occupational) schemes, which are, to some extent, less vulnerable to population ageing. Finally, people could also be sensitive to future pension developments and begin saving for themselves in their working lives and decumulate these savings during retirement age. As we will see in the next section, there are (psychological) reasons to think that this alternative is unlikely to be taken. Hence, financial instruments as Reverse Mortgages would allow those homeowners, who did not save enough for retirement, to increase their pension income. Apart from this, however, even when people do save for retirement, it is vital that the market offers financial products that allow people to decumulate this wealth. Therefore, also in this situation, Reverse Mortgages are valuable, since they aid in decumulating illiquid assets (house equity).

So far, we have discussed qualitatively, only, the impact that Reverse Mortgages have on elderly homeowners income. On the one hand, it is straightforward to realize that Reverse Mortgages do increase the consumption possibilities of the elderly; on the other hand, it is not trivial to assess the quantitative impact of a Reverse Mortgage as a percentage income increase for the buyer. Nevertheless, it is noteworthy to study the accurate impact, so as to understand to what extent Reverse Mortgages can increase the well-being of the elderly and to see whether this financial tool can offset the future negative effect that ageing will cause on pension benefits.

In the literature we can find some studies that appraise the monetary value of Reverse Mortgages. One of the first studies to accomplish this objective is that of Mayer and Simons (1994a; 1994b). They found that American elderly homeowners would significantly increase their income with a Reverse Mortgage. In particular, it was found that one-third of the elderly homeowners could expand their income by more than 20 percent points by taking up the product.

A similar study conducted with UK data by Hancock (1998a) underlined that meaningful income increments due to Reverse Mortgages is restricted mainly to the oldest age groups. In the same vein, Ong (2008) examined the extent to which Reverse Mortgages can improve the economic wellbeing of elderly Australian homeowners. She found that elderly homeowners would increase,

on average, their income by 71 percent. The range of potential income gains goes from 20 percent to more than 100, depending on the housing equity value. The results, in contrast to those found in Hancock (1998a), can be explained by the fact that elderly Australian homeowners posses high levels of housing equity. Moreover, the simulation exercise in the Australian market took into account that the income from Reverse Mortgage is non-taxable and non means-tested, whereas in the UK, the income generated through a Reverse Mortgage is taxable and it has a negative impact on means-tested benefits to which older homeowners are entitled. Fornero et al. (2011), analyzing Italian data, estimated an 11% percentage gain in income from Reverse Mortgages. By subdividing the housing equity in quintiles, they pointed out that elderly with housing equity in the first quintile have an average income increase of only 5 percentage, while the elderly with housing equity in the last quintile have a 24 percentage increase in income. Moreover, the income increase can easily surpass 30% if the homeowner undertakes the Reverse Mortgage when she is +80 years old.

All in all, it is estimated that Reverse Mortgages have a considerable positive income increase in elderly homeowners. And this is true for all countries examined above. The effective impact, however, will depend on the housing equity value of the elderly and on the country-specific tax treatment.

3. Section two: Understanding savings decisions and Reverse Mortgages (low) demand

Mainstream Economic Theory assumes that economical agents have stable and consistent preferences. Furthermore, it is assumed that agents are optimizers, meaning that they are able to rationally optimize these preferences perfectly. In other words, agents are able to discern what the optimal choice is and to choose it no matter how complex the task is. Even though many economic models based on these assumptions are successful in explaining how some markets work and in making predictions, this is not always the case. In fact, economic choices are also shaped by psychological factors, which are not captured by the standard economic models. For what pension decisions are concerned as well as Reverse Mortgages demand, we argue that these psychological factors can contribute in having a better understanding of the empirical evidence. Moreover, these insights can be of help in dealing with the current pension systems and in predicting how ageing will affect the economic welfare of the future retirees. Therefore, in this section, we will analyze pension decisions by taking into account psychological factors that influence them. To this aim, the concepts and tools put forward by Behavioral Economics will be used.

3.1 People do not save (enough) for retirement

In most developed countries, the major source of old-age income comes from either the first or the second pillar. The public pension schemes are managed directly by the government and therefore there is little room for individual choices. In most second pillar schemes, the social partners are responsible for setting up the scheme and making reforms. Again, individuals do not have a direct involvement in the decision-making process. Moreover, participation in public and occupational schemes is usually mandatory. As a result, one could think that, in developed countries, individual pension planning is non-existent. This belief, however, is not correct, as individuals still have to make determinant decisions that shape their future old-age pension income either directly or indirectly. First, third pillar or private pension schemes are a relevant fraction of pension income[11], implying that part of the population thinks it is necessary to supplement the pension benefits that derive from the combination of the first and second pillars. Second, private savings and house equity decisions can potentially influence old-age income. For example, private savings can be annuitized, while house equity can be used to buy a Reverse Mortgage. Moreover,

[11] According to Börsch-Supan (2004) third pillar income as percentage of total retirement income is approximately around 20%. For instance, third pillar income represents 25% of total income, while in the Netherlands it is of 10%.

considering that the generosity of the pension systems is to decrease, individual pension planning will become even more relevant and possibly unavoidable. Consequently, even in the presence of first and second pillar pension schemes, individuals might not find these schemes sufficient, and might find it optimal to increase their future pension benefits by taking direct action.

Under the standard economics assumptions, pension planning does not pose a problem at all. Perfect rationality guarantees that individuals will not only be able to realize what is, ex ante, the perfect decision to make (no matter how complex the task is) but will also assure that this decision will be put into action. In real life situations, however, the issue with individual pension planning is that it is indeed problematic to realize what is the right amount that should be saved during the working life, so as to have a level of pension benefits that is satisfactory in the old age. Moreover, the fact that this decision is, to some extent, irreversible, creates further issues. In fact, pension provision can be made only during the working age, and once this period of life has passed, it is not possible to accumulate further pension benefits. Hence, if for some reason, people choose not to contribute as much as they should to their pension schemes, this would lead to insufficient pension benefits in the old age. A circumstance that cannot be reversed: it is only possible to create pension benefits during the working age.

We would like to present a simple model that tries to capture one reason why individuals do not save enough for retirement. To this aim, we drop the assumption that individuals will always choose the option that is ex ante best to them. In fact, from a psychological perspective, there are some factors that might lead an agent to choose those actions that do not lead to the highest utility. Intuitively, this idea can be easily seen with an example. Ex ante a young man is conscious of the fact that smoking is extremely noxious to his health. Therefore, he knows that he should not smoke at the party and decides not to smoke at all (optimal choice). Nevertheless, when he is at the party and looks that other people are smoking, he feels tempted and starts smoking (sub-optimal choice). More generally, Behavioral Economics have shed light on the fact that decision makers with intertemporal utility functions might be affected by time-inconsistency preferences (a possibility that is ruled out in standard models). That is to say, we are in presence of this bias whenever someone plans to do something in the future but successively changes her mind. This is a bias as the original decision is being modified as time goes on. One reason for this to happen is that we put more weight to the present relative to the future (see example above), which alters the way we weigh benefits and costs that are spread over time.

First, we will shortly describe how a standard model would look like. A standard model of intertemporal decision-making is characterized by constant discounting, i.e., the factor by which the

future is discounted relative to the present depends only on the length of the delay period. The discounting function that captures this idea is the exponential discounting model. Below we will qualitatively analyze how this model works in the setting of saving for retirement.

We imagine that there are three periods: in the first two periods the agent works and with her earnings consumes and saves for retirement; while, in the third period, the person is retired and enjoys the savings collected in the first two periods. The utility function reads as follows:

$$U(u_1, u_2, u_3) = u_1 + \delta u_2 + \delta^2 u_3$$

Therefore, the agent will maximize the utility function by choosing those levels of the consumption ($c_1, c_2 \; and \; c_3$) and saving ($s_1 \; and \; s_2$) variables that gives the highest utility, taking into account that the overall consumption cannot exceed the total wealth of the agent (in this case given by her wages in period one and two). Moreover, assuming that the level of consumption in that same period gives the utility in each period, the level of savings will directly depend on δ, the discount factor. The discount factor, in fact, represents the time preference of the individual, i.e., how much she values consumption in the present relative to the future.

One of the most important implications of exponential discounting is that the model leads to time consistency. That is to say, what is preferred at one period of time is also preferred at different periods of time. Thus, subjects never change their mind, so that they stick to their initial plan and corresponding course of action. In the context of pension planning and savings choices this model implies that the decision maker will not only be able to maximize her utility by choosing those levels of consumption and savings in each period that yields the highest utility, but will also act accordingly, in the sense that her consumption and savings choices will never deviate from the optimum. A result that is too good to be true: in fact, if exponential discounting were able to describe people's behavior, decision makers could optimally save for themselves and there would not be any need for social institutions (first and second pillar pension schemes): rational agents would undo what pension schemes do, as they can, already through the markets, achieve the optimum (sort of Ricardian Equivalence)[12]. Furthermore, due to the fact that agents will always act according to their best interest, which is time consistent, they will not need any commitment device so as to save appropriately. It is easy to see that in this environment Reverse Mortgages potentiality is greatly low, as the only advantage would be that of being able to eat up the housing equity.

[12] For the statement to hold, however, we still need complete markets and financial instruments that allow savers to successfully transfer their savings from the present to the future.

Nevertheless, empirical evidence has shed light on the fact that the exponential discounting model fails to describe actual human behavior[13]. Therefore, as the exponential discounting model is the only model that implies time consistency, it is necessary to highlight how time inconsistent preferences shape the savings decisions. To this respect, we introduce the quasi-hyperbolic model, which assumes that people are present biased. In other words, this model implies that relative to the current period, all future periods are worth less. From this follows that the model implies time inconsistent preferences. To see this, lets consider how the bias affects preferences. At the current period t, we tend to be patient about future periods of time (say, between t+1 and t+2), because the bias affects all future periods. However, when t+1 arises, the bias affects only the time period from t+2 onwards. Therefore, at t+1, we are impatient about waiting from t+1 to t+2 and prefer to get immediate pleasure. In conclusion, if at time t, the individual decides to consume at period t, and save at period t+1; at time t+1, she will change her mind and decide to consume more and save less. Therefore, changing her initial plan. Finally, at t+2 she would regret not having saved more in the past period.

The model above adjusted for quasi-hyperbolic preferences would look like:

$$U(u_1, u_2, u_3) = u_1 + \beta(\delta u_2 + \delta^2 u_3)$$

where present bias is captured by β, that lies in the interval [0,1]. Therefore, future utility is discounted relative to present utility. In this case, the decision maker at t=1, would choose the decision variables (consumption and savings) so as to optimize this function. In particular, she will prefer to consume more in the present than in the future due to β. This implies that, ceteris paribus, the savings level will be reduced as compared to the previous model. In particular, she feels that postponing saving at time t=1 is optimal, so she decides to save (more) in the second period rather than in the first one. The problem arises at t=2, as now the utility function reads:

$$U(u_2, u_3) = u_2 + \beta\delta^2 u_3$$

As a result, the decision maker will not save, in period t=2, as much as she had decided to do in the first period. This leads to the problem that the biased decision maker will not save enough in period t=2 and will make him to under-save for retirement. The intuition behind this result is that the decision maker is shortsighted: because she overweighs the present relative to the future, she thinks that present consumption is more valuable than future consumption. However, in the third period she will find herself with little savings and will regret not having saved more for

[13] See, for instance, Kirby (1997) and Benzion et al. (1989).

consumption in this period (time-inconsistent preferences). In conclusion, a simple model with quasi-hyperbolic preferences can easily explain the reason for people under saving and under accumulating pension benefits. Therefore, if agents are affected by this bias, it can be easily seen that Reverse Mortgages can help decision makers: the financial instrument will not only allow homeowners to eat up their housing equity, but can aid them in finding a way out in the circumstance they have not save enough for retirement and need additional old-age income.

Previously, we have assumed not only quasi-hyperbolic preferences, but also that the decision maker is naïve, in the sense that she does not anticipate that she puts more weight to the present relative to the future, making her to deviate from an optimal consumption behavior. Now, we assume that some people might be sophisticated and thus realize that their behavior is influenced by present-biased preferences, which leads to preference reversals. If this is the case, then the sophisticated agent might be willing to find a commitment device that binds him so as to transfer an adequate wealth level to the second period (retirement age). If we think of third pillar schemes, we can realize that they will not likely work as a commitment device, because agents can always stop contributing to the third pillar whenever they decide to. Moreover, contributions to the third pillar come from liquid wealth (say labour income), which is not protected from consumption splurges. Therefore, commitment devices have to be found in illiquid wealth. As the name already anticipates, illiquid wealth cannot be consumed or, at least, it is difficult to do; thus making it a powerful tool in dealing with quasi-hyperbolic preferences. For what households are concerned, the house equity represents the most consistent form of illiquid wealth, and therefore it can be used as a commitment device. This implies that sophisticated agents will see, in the first periods, the house equity decision not only as a function of the house services, but also as a way through which they can deal with present-biased preferences, by being able to shift resources from the first periods to the final ones. As a result, in the presence of sophisticated agents, the house equity will be significantly higher than that of naïve individuals. Hence, in the context of Reverse Mortgages, it follows that sophisticated individuals will find it more appealing to buy Reverse Mortgages than naïve ones. First, Reverse Mortgages allow sophisticated agents to under accumulate illiquid wealth that they have transferred to the last period with the aim of improving their consumption possibilities in the old age. Second, the income increase that results from this product is higher for the former group, which makes it more attractive for sophisticated agents to buy Reverse Mortgages. Finally, it is interesting to notice that the commitment device will only work if the sophisticated agents in the first periods expects/knows that it is possible to underaccumulate house

equity rather easily[14]. Therefore, it is necessary that the market offers instruments in order to achieve this, like Reverse Mortgages. Next to this, it is important to notice that thanks to national regulations on the minimum age at which a Reverse Mortgage can be taken up, this product does not undermine the usage of house equity as a commitment device.

We can now extend our analysis by studying the consequences of present-biased preferences within the context of housing equity. For simplicity of analysis, we consider how the difference in the timing of the benefits and the costs impact the housing equity decision as compared to the savings decision. As we have seen above, in the case of savings (or pension contributions) the costs are borne in the first periods, while the benefits in the final ones. Therefore, present-biased preferences induce the decision maker to underweight future benefits, leading to an under accumulation of pension benefits. For instance, this results in individuals not taking up third pillar pensions. Mathematically:

$$Individual\ pension\ plan \rightarrow\ Costs_1 + \beta Benefits_2 < 0$$

Housing equity decisions are affected differently by quasi-hyperbolic preferences. In fact, in the case of house equity (as opposed to savings for retirement), the benefits (housing services) are accrued not only in the future (final periods) but also in the initial ones. From this dissimilarity follows that the case of savings is more heavily influenced by present-biased preferences than the case of housing equity decisions. Thus, making it more likely that the overall result, of the house equity buying decision, is positive. Mathematically:

$$House\ equity\ buying\ decision \rightarrow\ Costs_1 + Benefits_1 + \beta Benefits_2 > 0$$

From this follows that, in the presence of quasi-hyperbolic discounting, people who have not saved enough for retirement would still have housing equity. In other words, the way in which present-biased preferences differently affects the savings and the housing equity decisions can easily explain why people, one the one hand, under-save for retirement; while, on the other, still decide to buy a house. Moreover, if we see the house equity buying decision not as simple choice of buying or not a house, but rather as a decision of how much to spend on the house equity, present-biased preferences makes it more likely that the house value in the old age is a significant fraction of total wealth (as savings are more heavily affected by these preferences). In this context, we can now realize that Reverse Mortgages might play a central role, by helping homeowners, who have

[14] The always available alternative of downsizing the house equity during the period might not be even considered by some agents due to both economic and psychological costs, see section one.

under-saved for retirement, to deal with this situation by eating up their house equity.

3.2 Prospect Theory and Reverse Mortgages

From a theoretical perspective, a substantial demand for Reverse Mortgages should exist, not only in case old homeowners have insufficient pension income, but also as a means through which to underaccumulate housing equity. Increasing, therefore, both the income and the consumption possibilities of the retirees. Moreover, Reverse Mortgages are able to shift both the equity price risk and the idiosyncratic longevity risk to the lender. Since the market for Reverse Mortgages, on the contrary, is very thin or even inexistent, it is crucial to study the causes for this piece of evidence. Among the disadvantages of engaging into a Reverse Mortgage, high transactions costs stand up. However, these costs do not seem enough to explain the low demand. Accordingly, we propose models that take into account some psychological insights that make people choose not to buy a Reverse Mortgage. The aim of which is to model some empirical evidence based on surveys put forward in the literature. In particular, we will try to capture, in turn, some of the factors that influence Reverse Mortgages demand found in Fornero et al. (2011) and Dillingh et al. (2013). To this respect, we introduce Prospect Theory (Kahneman and Tversky, 1992) with loss aversion and narrow mental accounting. In particular, in the models we will compare the utility resulting from buying the Reverse Mortgage and the one of not buying it, so as to see which is the preferred option for the decision maker.

In the following models we assume that the income derived from the financial instrument is annuitized and that the agent faces mortality risk. Thus, the loss in welfare derives from the possibility of annuitizing the loan and dying before cashing in the investment (the so-called "hit-by-a-bus concern"). This assumption is a key ingredient in the following models. We argue that a model built upon this assumption, together with Prospect Theory, can better explain a low demand of Reverse Mortgages. Moreover, there is evidence that supports this assumption: according to Brown et al. (2008) industry market research has found that that decision makers conceive annuities as gambles. This insight is also supported by survey results (see Brown et al. 2008). In other words, we are assuming that the decision maker perceives the annuitization of the Reverse Mortgage loan as a risk rather than as an insurance: in theory, purchasing an annuity should allow the agent to deal with idiosyncratic longevity risk and this should allow him to consume more in retirement, as the annuity reduces the need for precautionary savings. Nevertheless, the agent will, on the one hand, think of Reverse Mortgages as risky instruments as they brings forward the possibility that the agent loses her "house" in the case she dies early; while, on the other, she will neglect the fact that Reverse Mortgages can serve as longevity risk insurance.

In Behavioral Economics, this phenomenon is called narrow framing, as opposed to broad framing: under broad framing, the decision maker evaluates a new lottery by considering all the risks and the potential outcomes in terms of total wealth (as is the case under Expected Utility); under narrow framing the decision maker considers the lottery as outcomes more narrowly framed within their own mental accounts (see Thaler, 1999). For example, a person considering a prospect which gambles €10, according to expected utility, should incorporate this risky lottery with her total wealth. Nevertheless, research underscores the insight that individuals are more likely to evaluate the €10 lottery in isolation. The intuition behind this process is that people simplify the tasks they face by adopting a narrow frame. Thus, in the context of Reverse Mortgages and loan annuitization, it is likely that the decision maker adopts a narrow frame. Moreover, as opposed to the case of simply annuitizing wealth, we argue that in the context of Reverse Mortgages, narrow framing do also incorporates (some of) the risks that the house equity brings forth. In fact, when thinking of annuitizing the Reverse Mortgage loan it is very likely that the decision maker does not neglect the risks, benefits and costs connected with the housing equity.

As stated above, a main assumption in this section is that the Reverse Mortgage loan is annuitized. This is assumed because annuitization is the most relevant loan payment fashion in the context of pension schemes and of financial instruments that support pension income. This assumption also implies a direct connection between Reverse Mortgages and annuities, which in turn relates the Reverse Mortgage-puzzle and the annuity-puzzle. In fact, even though there are still paramount differences between these two puzzles (think, for instance, of the fact that in Reverse Mortgage decisions, the agent has first to decide to "sell" her house, and only, after that, on how to receive the proceeds), there are also important similarities. To see this, consider that the annuitization of the Reverse Mortgage loan means that the decision maker will face similar benefits, risks and costs than those faced by a person that annuitizes her savings.

3.2.1 Risks involved in Reverse Mortgages

We consider a one period model: at the beginning of the period the decision maker decides whether to take up a Reverse Mortgage or not; while the benefits, costs and risks of this decision materialize in the course of this period. This decision involves risk because there are two possible states of the world that can arise during this period, for what the house price and the risk of buying the Reverse Mortgage and dying right after, are concerned. As a result, we propose a Prospect Theory based-model to analyze the risks resulting from either buying or not a Reverse Mortgage.

Hence, for now we do not model the income increase deriving from a Reverse Mortgage[15]. The reference point is assumed to be the level of wealth (House value (H)) at the beginning of the first period.

Not buying a Reverse Mortgage

Not buying a Reverse Mortgage means that the market house value risk is left completely to the retiree. In the good state, that happens with probability p_B, total wealth increases by X; in the bad state, which happens with probability p_B, total wealth decreases by Y. Hence, the lottery reads:

$$L_{NB} = (p_{GH}: +H + X; p_{BH}: +H - Y)$$

And under Cumulative Prospect Theory:

$$CPT_{NB} = w^{+}(p_{GH})u^{+}(X) + w^{-}(p_{BH})u^{-}(-Y)$$

Loss aversion is captured by the coefficient λ. For simplicity, assume CPT with linear probability weighting function and linear utility. Thus:

$$CPT_{NB} = (p_{GH}) * (X) + \lambda * (p_{BH}) * (-Y)$$

$$CPT_{NB} = (p_{GH}) * (X) + \lambda * (1 - p_{GH}) * (-Y)$$

Buying a Reverse Mortgage

On the other hand, if the agent takes up a Reverse Mortgage the market house value risk is shifted completely to the lender. Moreover, assuming that the loan derived from the Reverse Mortgage is annuitized, a different risk appears: the probability of dying early and therefore of losing the wealth annuitized. Again, we can imagine that there are two states of the world: the good state in which the agent survives, with probability ε_G; and the bad state, where the agent does not reach it, with probability ε_B. Moreover, if the agent gets to survive, her wealth will increase because she would get to receive part of the annuities of those who died during the course of the period ϕH (we assume a perfect annuities market). On the contrary, the agent has to face transactions costs, c. The lottery, therefore, reads:

$$L_B = (\varepsilon_G: +H + \phi H - c; \varepsilon_B: 0)$$

[15] We could imagine that the house equity good behaves as liquidity. Therefore, in this first model, Reverse Mortgages do not offer any advantage for what under accumulating house equity is concerned.

And under Cumulative Prospect Theory:

$$CPT_B = w^+(\varepsilon_G)u^+(\phi H - c) + \ w^-(\varepsilon_B)u^-(-H)$$

Again, loss aversion is captured by the coefficient λ. For simplicity, assume CPT with linear probability weighting function and linear utility. Thus:

$$CPT_B = \varepsilon_G * (\phi H - c) + \lambda * \varepsilon_B * (-H)$$

$$CPT_B = \varepsilon_G * (\phi H - c) + \lambda * (\ 1 - \varepsilon_G) * (-H)$$

The agent will prefer to buy a Reverse Mortgage in the case $CPT_B > CPT_{NB}$:

$$\varepsilon_G * (\phi H - c) + \lambda * (\ 1 - \varepsilon_G) * (-H) > (p_{GH}) * (X) + \ \lambda * (1 - p_{GH}) * (-Y) \qquad (\alpha)$$

The first insight is that both choices face the possibility of incurring a loss. However, the loss incurred in the case of buying a Reverse Mortgage is much higher: in fact, $H \gg Y$, under standard economic conditions. In other words, the loss component in the Reverse Mortgage option prevails. Therefore, it is very unlikely that, under prospect theory, the decision maker will prefer the Reverse Mortgage choice. In case loss aversion were absent (as is the case under expected utility) it would be more likely that the agent prefers taking up the Reverse Mortgage.

Probabilities (or expectations) about the states of the world also influence the decision choice: the higher the probability of surviving the entire period and the lower the probability of being in a good state in terms of house market, makes it more convenient to buy a Reverse Mortgage. To link this result with the fact that Fornero et al. (2011) found that the real state perceived risk increases the likelihood of people being interested in Reverse Mortgages, we can imagine that the probabilities of the state of the world are formed subjectively (the perception of risk relies also on subjective variables). Therefore, a high expectation that the bad real market state will arise, makes it more likely that the inequality above holds by reducing the value of the inequality's right hand side; thus, the likelihood of being interested in Reverse Mortgages increases, as it allows to transfer the house value risk to the lender.

In this model, the ageing of the population can be captured by an increase in the probability of surviving the full period ($\varepsilon_G \uparrow$). Implying a lower probability of incurring a loss, which makes the loss averse decision maker better off. If all agents face higher survival probabilities, then ϕH is likely to drop, as ϕ goes down in an ageing population. Thus, reducing the advantages of a Reverse Mortgage. All in all, however, the positive effect prevails and makes the likelihood of buying a

Reverse Mortgage higher.

Next to this model, lets analyze that case in which the decision maker does not consider the risks connected to the housing equity price. In other words, the decision maker evaluates the lottery in complete isolation and neglects that the Reverse Mortgage allows him to hedge the risk of the housing equity price. We argue that this type of narrow framing makes choosing to undertake a Reverse Mortgage even more unlikely: in this case it is even more unlikely to opt for a Reverse Mortgage, as the loss averse agent will face with probability $(1-\varepsilon_G)$ a huge loss and this is not compensated in the agent's mind by hedging house price risk. Analytically:

$$\varepsilon_G * (\phi H - c) + \lambda * (1-\varepsilon_G) * (-H) > 0 \qquad (\beta)$$

In particular, we argue that (α) is more likely to hold relative to (β). This results from the fact that it is very likely that:

$$(p_{GH}) * (X) + \lambda * (1-p_{GH}) * (-Y) < 0$$

In fact, considering past trends on house equity value[16] characterized by modest house prices increments (or no increments at all), once inflation is controlled, and by oscillatory movements of gains and losses, it can be conjectured that the loss aversion coefficient will make the inequality to be negative.

3.2.2 Reverse Mortgages Income Increase

Again we consider a one-period model: at the beginning of the period the agent decides whether to take up a Reverse Mortgage or not, while the benefits, costs and risks materialize in the course of the period. Now, a Reverse Mortgage allows agents to "eat up" their housing equity, which would not be possible without a Reverse Mortgage. This is certainly the chief advantage of undertaking a Reverse Mortgage. For instance, in both Fornero et al. (2011) and Dillingh et al. (2013), it was found that the likelihood of being interested in the product increases considerably with the income increase that results; and also with those factors related to income issues such as insufficient savings, big spending wishes and negative retirement expectations[17]. We assume a risk-free house price market, where the house value is constant across time. However, again there is a probability of dying, ε_B, at the beginning of the period. Here, we assume that the reference

[16] For instance, by looking at the Case-Shiller index.
[17] If theoretically it is straightforward to argue that future pension cuts will make Reverse Mortgages more appealing, here there is survey evidence that supports this claim.

point is the status quo, where individuals would see the income increase from a Reverse Mortgage as a gain, rather than feeling a loss from not buying it. Again, using Merton's definition:

$$House\ Value = Housing\ Services\ (HS) + Residual\ House\ Value(RHV)$$

Therefore, the reference point is HS. For now we assume that there are no bequest motives (agents are fully self-interested). Here and in the next models of this section (section 3.2), we are also assuming that in case the decision maker does not happen to live the full period, she experiences a loss that corresponds to HS. The idea is simple: dying early also brings a welfare loss, which is connected to not being able to take advantage of the house. To notice, however, that this assumption is not necessary: in fact, the risk of dying early is present whether or not the individual buys the Reverse Mortgage. Hence, when comparing both cases, this utility loss will disappear[18].

Not buying a Reverse Mortgage

As a result of the assumed reference point, the case for not buying a Reverse Mortgage is trivial. The lottery looks:

$$L_{NB} = (\varepsilon_G : HS\ ; \varepsilon_B : 0)$$

And under Cumulative Prospect Theory:

$$CPT_{NB} = w^{+}(\varepsilon_G)u^{+}(0) + \ w^{-}(\varepsilon_B)u^{-}(-HS)$$

Loss aversion is captured by the coefficient λ. For simplicity, assume CPT with linear probability weighting function and linear utility. Thus:

$$CPT_{NB} = (\varepsilon_G) * (0) + \ \lambda * ((\varepsilon_B) * (-HS))$$

$$CPT_{NB} = \lambda * (1 - \varepsilon_G) * (-HS)$$

Buying a Reverse Mortgage

In the case a Reverse Mortgage is bought, the agent benefits from the fact that she is able to get utility from the Residual House Value (RHV), as a higher income allows her to increase her consumption. Of course, Reverse Mortgages also imply transaction costs that cannot be neglected.

[18] This assumption, however, could be relevant in the case the decision maker is deciding whether to sell the house and renting (a feasible alternative to Reverse Mortgages).

Now, the lottery reads:

$$L_B = (\varepsilon_G : HS + RHV - c\,;\varepsilon_B : 0)$$

And under Cumulative Prospect Theory:

$$CPT_B = w^+(\varepsilon_G)u^+(RHV - c) + \ w^-(\varepsilon_B)u^-(-HS)$$

Loss aversion is captured by the coefficient λ. For simplicity, assume CPT with linear probability weighting function and linear utility. Thus:

$$CPT_B = (\varepsilon_G) * (RHV - c) + \ \lambda * (1 - \varepsilon_G) * (-HS)$$

The agent will prefer to buy a Reverse Mortgage in the case $CPT_B > CPT_{NB}$:

$$(\varepsilon_G) * (RHV - c) + \ \lambda * (1 - \varepsilon_G) * (-HS) > \ \lambda * (1 - \varepsilon_G) * (-HS)$$

$$\rightarrow (\varepsilon_G) * (RHV - c) > \ 0$$

$$\rightarrow RHV > \ c$$

As we can see, the Reverse Mortgage option will be preferred as long as the income increase due to this financial instrument is higher than the transaction costs. A condition that must be satisfied. In fact, otherwise, the product would not be bought and therefore it would not be in the market. It is interesting to notice that in this model loss aversion does not affect the decision. This is due to the fact that here the only way for the homeowner to eat up her housing equity is through a Reverse Mortgage. Therefore, a Reverse Mortgage income increase will only affect the gains domain; while buying a Reverse Mortgage and dying right after does not imply a loss: in the case the decision maker would not have bought the product, she would not had been able to benefit from the residual house value neither. More generally, keep in mind, however, that this result is obtained assuming a particular reference point and, most importantly, assuming that agents do not have bequest motives.

3.2.3 Reverse Mortgages Income Increase with bequest motive

As it is unrealistic that agents are completely selfish, now we relax the assumption of selfishness, and we allow for the possibility of people interested in the well being of their progeny. For simplicity, we can assume that the bequest objective of each agent is a fraction of the residual house value. Moreover, once this value is reached, any further increase in the bequest does not yield

utility. In other words, it is as if once the optimal level is reached, the curvature of the utility function becomes flat. Moreover, the reference point is slightly shifted, as now the status quo is that of leaving as a bequest the RHV, which yields a utility of ψRHV.

Not buying a Reverse Mortgage

With the bequest motive and reference point as above, the lottery looks like:

$$L_{NB} = (\varepsilon_G : HS + RHV \,;\, \varepsilon_B : RHV)$$

And under Cumulative Prospect Theory, utility function and weighting function as before:

$$CPT_{NB} = \big((\varepsilon_G) * 0\big) + \lambda * (1 - \varepsilon_B) * (-HS)$$

To notice that in the case the agent does not survive and dies at the beginning of period one, she will not incur a welfare loss of ψRHV, as she will leave as a bequest her house. Therefore, the only loss incurred whenever the borrower passes away is that of the HS.

Buying a Reverse Mortgage

Here, we need to consider how the bequest changes the lotteries. In particular, a Reverse Mortgage increases the utility resulting from the house, as now it yields a utility that results from the full residual value of the house, i.e., the Reverse Mortgage allows the consumer to take full advantage of the residual house value[19]. Hence, the lottery is:

$$L_B = (\varepsilon_G : HS + RHV - c \,;\, \varepsilon_B : 0)$$

And under Cumulative Prospect Theory, utility function and weighting function as before:

$$CPT_B = (\varepsilon_G) * (RHV - \psi RHV - c) + \lambda * (1 - \varepsilon_G) * (-HS - \psi RHV)$$

The agent will prefer to buy a Reverse Mortgage in the case $CPT_B > CPT_{NB}$:

$$(\varepsilon_G) * (RHV - \psi RHV - c) + \lambda * ((1 - \varepsilon_G) * (-HS - \psi RHV) > \lambda * (1 - \varepsilon_G) * (-HS)$$

$$\rightarrow (\varepsilon_G) * (RHV - \psi RHV - c) + \lambda * ((1 - \varepsilon_G) * (-\psi RHV)) > 0$$

[19] As explained in section one, we need not see a contraposition between a Reverse Mortgage and the bequest motive. Therefore, apart from the transactions costs involved, the Reverse Mortgage can only expand the welfare of the pensioner.

With the bequest motive, therefore, the Reverse Mortgage does not look so convenient after all. In fact, now buying it means that there is, with probability $(1-\varepsilon_G)$, the possibility of incurring a welfare loss of $\lambda * ((1-\varepsilon_G) * (-\psi RHV))$. The degree of the loss incurred, however, will depend on ψ, which captures the level of bequest that the decision maker finds it optimal. The higher ψ, the higher the loss incurred when the pensioner buys the Reverse Mortgage and passes away before reaching to the end of the period. Moreover, the higher ψ, the lower the welfare gain due to Reverse Mortgages. Furthermore, the final result is also going to depend on λ: the higher its value as compared to the case of no loss aversion ($\lambda = 1$), the higher the loss incurred. In conclusion, the bequest motive together with loss aversion makes the demand for the product to be significantly lower.

This result is also able to explain the negative correlation found in Dilling et al. (2013) between the bequest wish and the likelihood of being interested in the Reverse Mortgage. Moreover, assuming that the bequest motive is directly influenced by the offspring, it can also explain the finding (Dillingh et al. 2013) that having children (offspring) decreases the chances that the agent is interested in the product.

3.2.4 Reverse Mortgages Income Increase and shift in the reference point (no bequest motive)

Now, lets assume that Reverse Mortgages become popular enough, and people know that it is fairly easy to "eat up" the Residual House value. Hence, the reference point is changed: in fact, now agents will feel as if not eating up the house to be a welfare loss. For instance, this changed in the reference point/status quo can be attributed to publicity and product awareness. In particular, the reference point is: $RHV + HS = HV$. To notice the fact that the transactions costs c are not considered in the reference point. The idea behind this choice is that individuals will not interiorize the transaction costs and will always frame them as a cost.

Not buying a Reverse Mortgage

With no bequest motive and reference point as above, the lottery looks like:

$$L_{NB} = (\varepsilon_G : HS\,;\, \varepsilon_B : 0)$$

And under Cumulative Prospect Theory, utility function and weighting function as before:

$$CPT_{NB} = \lambda\{((\varepsilon_G) * -(RHV)) + (1-\varepsilon_G) * (-HS - RHV)\}$$

Buying a Reverse Mortgage

With the bequest motive and reference point as above, the lottery looks like:

$$L_B = (\varepsilon_G : HS + RHV - c \,;\, \varepsilon_B : 0)$$

And under Cumulative Prospect Theory, utility function and weighting function as before:

$$CPT_B = \lambda\{((\varepsilon_G) * -c) + (1 - \varepsilon_G) * (-HS - RHV)\}$$

The agent will prefer to buy a Reverse Mortgage in the case $CPT_B > CPT_{NB}$:

$$\lambda\{((\varepsilon_G) * -c) + (1 - \varepsilon_G) * (-HS - RHV)\} > \lambda\{((\varepsilon_G) * (-RHV)) + (1 - \varepsilon_G) * (-HS - RHV)\}$$

$$\rightarrow ((\varepsilon_G) * -c) > (\varepsilon_G * (-RHV))$$

$$\rightarrow c < RHV$$

It is now clear that the financial product will be preferred. In fact, the Reverse Mortgage is preferred as long as $c < RHV$, which should be always verified. The result, however, is essentially the same as that in 3.2.2. The intuition is that the model only captures the income increase and, apart from Reverse Mortgages transaction costs, there are no other drawbacks. The only main difference, which is due to the shift in the reference point, does not change the result. The reason for this depends on the fact that the shift from the gains domain to the loss domain, affects both cases (buying and not buying the Reverse Mortgage). Therefore, the loss aversion coefficient drops out, since it affects both lotteries in the same way.

3.2.5 Reverse Mortgages Income Increase and shift in the reference point (with bequest motive)

Now, we will model the shift in the reference point by also taking into consideration the bequest motive and see how the result compares to that of section 3.2.3. Now, the model is more interesting as one the one hand, the Reverse Mortgage increases the income of the buyer, but on the other hand, annuitization of the loan means that there is a probability of not leaving any bequest. Therefore, we can understand how the change in the reference point shifts the weights given to these contrasting forces.

Not buying a Reverse Mortgage

With bequest motive and reference point as above, the lottery looks like:

$$L_{NB} = (\varepsilon_G : +HS + \psi RHV \,;\, \varepsilon_B : 0)$$

And under Cumulative Prospect Theory, utility function and weighting function as before:

$$CPT_{NB} = \lambda\{\big((\varepsilon_G) * -(HV - HS - \psi RHV)\big) + (1 - \varepsilon_G) * (-(HV - \psi RHV))\}$$

Buying a Reverse Mortgage

With the bequest motive and reference point as above, the lottery looks like:

$$L_B = (\varepsilon_G : HS + RHV - c\,;\varepsilon_B : 0)$$

And under Cumulative Prospect Theory, utility function and weighting function as before:

$$CPT_B = \lambda\{\big((\varepsilon_G) * -c\big) + (1 - \varepsilon_G) * (-HV)\}$$

The agent will prefer to buy a Reverse Mortgage in the case $CPT_B > CPT_{NB}$:

$$\lambda\{\big((\varepsilon_G) * (-c)\big) + (1 - \varepsilon_G) * (-HV)\}$$
$$> \lambda\{\big((\varepsilon_G) * -(HV - HS - \psi RHV)\big) + (1 - \varepsilon_G) * (-(HV - \psi RHV))\}$$

$$\rightarrow \big((\varepsilon_G) * (+HV - HS - \psi RHV - c\big) - (1 - \varepsilon_G) * (\psi RHV) > 0$$

$$\rightarrow \big((\varepsilon_G) * (HV - HS - c\big) > +(\psi RHV)$$

$$\rightarrow \big((\varepsilon_G) * (RHV - c)\big) > +(\psi RHV))$$

We can see that the Reverse Mortgage solution is preferred as long as the utility that derives directly from the bequest motive (ψRHV) is not higher than the ($RHV - c$) weighted by the probability of getting to live the full period. In particular, we can see that the right-hand side represents the costs of taking up the product: the utility loss in case of dying at the beginning of the period and not being able to leave a bequest; while the left-hand side represents the benefits of taking it up (income increase). If we compare this result to that found in 3.2.3, where the only difference is in the reference point, we can see that now it is more likely that the agent will prefer the Reverse Mortgage. In fact, now the loss aversion coefficient has dropped out, which implies that the disadvantages deriving from a Reverse Mortgages are not multiplied by the loss aversion coefficient, as was previously the case.

The literature underscores that product awareness and knowledge is a fundamental reason why Reverse Mortgages market has not taken off yet. One way through which product knowledge can influence the choice between taking up or not a Reverse Mortgage is through the reference

point, in the context of prospect theory as above. In both Fornero et al. (2011) and Dillingh et al. (2013), product awareness has not been analyzed, because Reverse Mortgages are quite unknown in both Italy and the Netherlands. Hence, the surveys administered contained a short description of the product and potential examples of how to use the loan. Nonetheless, one study that was able to analyze this relation is that of Davidoff et al. (2014), because it was done in the U.S. where Reverse Mortgages are better known to the average person. It was found that product knowledge is strongly and positive correlated to the demand of Reverse Mortgages.

3.2.6 Debt Aversion and Reverse Mortgages

An interesting finding in the study of Fornero et al. (2011) is that debt aversion, captured by a binary variable, taking the value of one for respondents who claim not to want to take on any debt, and zero otherwise, is a significant predictor of not being interested in the product. This is, however, very intriguing from a rational perspective. In fact, even though Reverse Mortgages are loans, which are backed up by the housing equity, they do not, *per se,* open a debt position. The loans allow homeowners to eat up their housing equity, and these loans will never exceed the house value (no negative equity guarantee). Consequently a debt position is not created and, on the contrary, the homeowner is a net creditor. However, from a psychological perspective, this might not be the case. It is likely that people see buying a Reverse Mortgage as engaging in a debt, which implies that, for debt averse agents, the product looks less appealing. The easiest way to model this intuition is by adding a negative component in the utility function that is proportional to the amount borrowed.

To see how it works, we can consider again the 3.2.3 model. It takes into account the bequest motive, which is a fraction of the residual house value and once this value is reached, any further increase in the bequest does not yield utility. Moreover, the reference point is assumed to be the status quo, which incorporates the utility deriving from leaving a bequest. Thus: $HS + \psi RHV$.

Not buying a Reverse Mortgage

With the bequest motive and same reference, the lottery looks like:

$$L_{NB} = (\varepsilon_G : HS + RHV\ ; \varepsilon_B : 0)$$

And under Cumulative Prospect Theory, utility function and weighting function as before:

$$CPT_{NB} = \big((\varepsilon_G) * 0\big) + (1 - \varepsilon_B) * \lambda * (-HS)$$

There are no changes as compared to the case in 3.2.3 as not buying a Reverse Mortgage implies not opening a debt position.

Buying a Reverse Mortgage

Here, however, the model changes as compared to 3.2.3, because we now assume that there is a psychological cost implied in the Reverse Mortgage, which arise due to the fact that people see this product as debt, and makes people incur a utility loss proportional (φ) to the amount borrowed. Moreover, this utility loss will come about in the case the individual happens to live the full period. If it is not the case, she will not incurred the debt aversion loss as she will not face any debt situation: purchasing the Reverse Mortgage and dying right after will only imply a loss connected to the annuitization of the loan.

Hence, the lottery is:

$$L_B = (\varepsilon_G : HS + RHV - c - \varphi d \,;\, \varepsilon_B : 0)$$

And under Cumulative Prospect Theory, utility function and weighting function as before:

$$CPT_B = (\varepsilon_G) * (RHV - \psi RHV - c - \varphi RHV) + \lambda * ((1 - \varepsilon_G) * (-HS - \psi RHV)$$

The agent will prefer to buy a Reverse Mortgage in the case $CPT_B > CPT_{NB}$:

$$(\varepsilon_G) * (RHV - \psi RHV - c - \varphi RHV) + \lambda * ((1 - \varepsilon_G) * (-HS - \psi RHV) > \lambda * (1 - \varepsilon_G) * (-HS)$$

$$\rightarrow (\varepsilon_G) * (RHV - \psi RHV - c - \varphi RHV) + \lambda * ((1 - \varepsilon_G) * (-\psi RHV)) > 0$$

Thus, debt aversion, captured by φRHV, reduces the advantage of a Reverse Mortgage. In fact, it reduces the income increase captured in the first term of the inequality, by φRHV. As a result, now it is more difficult for the inequality to be positive, which means that the likelihood of an agent to be interested in the product declines. However, the final result will depend on the value of φRHV, which in turn depends on the aversion to debt coefficient φ and the residual house value RHV that varies across individuals.

The fact that debt aversion is an empirical piece of evidence that works against a prosperous market for Reverse Mortgages gives hope that financial literacy together with a thorough understanding of Reverse Mortgages might help in expanding the market. In fact, it is possible to tackle debt aversion through these means, as they induce the decision maker to be aware that Reverse Mortgages do not imply debt. In top of that, the income increase deriving from this

financial product can even aid in avoiding debt positions. For instance, by being able to eat up the house equity, it is likely that reductions in credit card usage or other forms of credit will decrease. Implying that a debt averse agent, by not being forced to use them, thanks to the Reverse Mortgage will be better off.

3.3 Reverse Mortgages as a lump sum

Until now, we have assumed that the decision maker automatically annuitizes the Reverse Mortgage loan. In the environment of pension schemes, this assumption is not only relevant but it is also likely to hold: annuitizing the loan provides a constant stream of income that suits well with the willingness of complementing pension benefits deriving from the first and the second pillars. However, as we have seen above, the mortality risk together with loss aversion makes it very likely that the Reverse Mortgage is not a preferred option. Therefore it can explain already a low demand. Now, let us shortly analyze what are the economical and psychological drawbacks of taking the loan as a lump sum of cash that do not allow the market to take off.

First of all, keep in mind that the lump sum arrangement sits ill with the desire to increase the pension income of the retirees. In fact, the more flexibility resulting from a lump sum brings forth a number of risks that threatens a smooth income in the old age. Think for instance of the risk of spending the wealth right after the Reverse Mortgage is taken up in avoidable expenses (travelling, cars, etc). Leading not only to a lack of income increase but also to a reduction in housing equity (wealth). This possibility gives us already an insight of why a lump sum does not look so attractive after all. To see this, we can take into consideration time inconsistent preferences and sophisticated agents. Actually, they will see Reverse Mortgages with suspicion in the sense that they will realize that a lump sum will be spent in short term utility at the expense of long run welfare (a lack of pension income increase and a reduction in total wealth). Thus, sophisticated agents will not engage into a lump sum Reverse Mortgage. On the other hand, naïve agents might be indeed interested in them, but the product will not aid them in increasing their pension income in the very end.

Next, lets focus on another aspect of Reverse Mortgage as a lump sum. In particular, we should take into account the very structure of Reverse Mortages: the homeowner borrows money against her house equity (collateral) and the loan repayment and interest are to be paid only when the borrower dies, which can happen, on average, in 15 or even 20 years time. From this follows that the interest payment is high, implying that the loan given is much lower than the present market value of the house. For example, a 65-year-old borrower with a house equity of 250,000€, getting a

Reverse Mortgage at 7% interest rate, would receive around 105,000€[20]. More generally, the precise loan value will mainly depend on the borrower's age and the interest rate. Hence, it can range from 25% to 60% of the house value. Needless to say, this is the inevitable consequence of receiving the loan immediately and paying it back years later. However, this very structure can have great repercussions psychologically on a decision maker's mind: in fact, she might perceive that receiving today, say, 40% of the house value is not a fair deal, ignoring that 60% of the house value accounts for interest payments. To see this, consider the benefits and (psychological) costs deriving from a Reverse Mortgage: the benefits, of course, derive from the lump sum, which enhances the consumption possibilities; while the costs are those related to feeling a loss due to not being able to take a loan of the full value of the house. The decision maker will prefer not buying a Reverse Mortgage if this sort of action yields a higher utility than buying it. Thus:

$$U_{NB}(HS) > U_B(HS; Income; costs)$$

assuming a linear utility function in both benefits and costs and the values of the example above:

$$HS > HS + 0.4RHV - 0.6RHV$$

$$\rightarrow RHV > 0$$

As a result, the agent is better off not taking up the Reverse Mortgage at all, because she sees that the utility from the income received is more than offset by the psychological costs (due to interests). Next to this, we can see that as the homeowner ages, she will be more interested in the Reverse Mortgage, as the loan increases in size, while the psychological costs shrinks. Moreover, for those interested in decumulating house equity, they might prefer other options, such that of selling the house and renting or buying a smaller one, where all transactions occur at the same time and there is no interest burden. Furthermore, there might be other issues with lump sum loans, such transaction costs that are more apparent in this domain as opposed to the annuitizing option, or that the debt continue to grow over time, which make the lump sum Reverse Mortgage not to be chosen.

To sum up, the vision that we want to share is that psychological factors can also play a role in the setting of lump sums. However, we do not analyze these issues any further as we believe that lump sums are not well related to pension concerns for the reasons stated above. In fact, lump sums potentially fit best when the agent faces economic shocks and desires to continue living in her house. Therefore, the demand for Reverse Mortgages lump sums will be triggered by different

[20] We have also detracted the transaction costs: origination fee of 2% of the house value and other transaction costs of the value of 2,500€.

reasons and needs than that of annuitization Reverse Mortgage loans.

Policy Recommendation and Conclusion

In light of current and future demographic trends, pension schemes are under pressure and governments will inevitably respond by cutting pension benefits. Therefore, it is of major relevance to find new alternative ways in tackling the detrimental consequences that retirees will face due to less generous pensions. One innovative financial product that has enormous potentiality in this environment is the Reverse Mortgage, for both micro and macro reasons. From the micro perspective, Reverse Mortgages can increase income security in the old age and improve consumption smoothing. These advantages are even higher if we take into account that there are not many alternatives in the market that can provide these benefits by focusing on housing equity. In this fashion, retirees are able to deal and offset by themselves lower pension income resulting from an ageing population. This is the how Reverse Mortgages can be also linked to a macro perspective, as well. In fact, if pensioners take proactive part in taking care of themselves and in improving their welfare by using their own means, they will certainly not rely on public support. Think, for instance, of social policies such as social security checks, favorable tax treatments and health care aid programs. Therefore, the risk of a shift in the burden from the pensioners to the public finances is greatly reduced. Accordingly, governments should be interested in regulating the market so as to help it flourish.

The literature argues that, from a rational point of view, the advantages of Reverse Mortgages more than offset the disadvantages. Therefore, the empirical evidence of a low demand for this financial product is intriguing and it is of economical appeal to understand the causes that give rise to this paradox. This has been the motivating driver of this paper. In particular, we have moved away from the canonical economical theory so as to view Reverse Mortgages in light of psychological and behavioral factors that might influence their demand. A variety of studies have been accomplished with this objective; they are mainly empirical in the sense that they are based on surveys that try to disentangle the economical and behavioral factors that influence the demand for Reverse Mortgages, as in Fornero et al. 2011 and Dillingh et al. 2013. However, the novelty of this paper resides on the fact that our aim was to model the behavioral factors[21] brought forward in these surveys. To this aim, we have taken into account some concepts of behavioral economics (in particular quasi-hyperbolic preferences and prospect theory), as we believe that these notions do matter and can greatly influence an individual's interest in Reverse Mortgage.

[21] At least, to the best of our knowledge

We have initially seen that, even though the first and second pillars are prevalent in most developed countries, pension planning is still crucial and involves taking direct action: not only through savings but also through the housing equity. As agents are not fully rational, we have analyzed how time inconsistent preferences make people underaccumulate wealth for the old age. For this reason, Reverse Mortgages can be found to be extremely useful and this is even more true considering that the housing equity is less affected by inconsistent time preferences (than savings) and that sophisticated agents might contemplate housing equity as a commitment device. Then, we have moved to prospect theory so as to capture and analyze some risks and factors linked to Reverse Mortgages, by assuming that the loan is annuitized. Among the numerous findings, it stands out how a shift in the reference point can sharply change the likelihood of a person being interested in the product, and how this can well model the implications of awareness and knowledge of what a Reverse Mortgage is and how it operates. Moreover, by introducing debt aversion to our framework and seeing how this negatively affects the interest in Reverse Mortgages, it is possible to speculate how financial literacy can offset this detrimental effect: in fact, it helps individuals understand that Reverse Mortgages do not create a debt position by itself, but rather helps in decumulating equity and thus improving consumption smoothing.

The models in section two have tried to capture the main factors that influence the demand for Reverse Mortgages; however, we do not claim to have been exhaustive. There is no question that other factors are to be studied as well. For instance, ambiguity and risk attitudes are key ingredients that need to be analyzed more in detail. Moreover, for simplicity we have assumed both linear utility functions and linear probability weighting functions; nevertheless, introducing diminishing marginal utility of wealth as well as an inverse-S shape probability function (as in prospect theory) could have given some further insights of Reverse Mortgages demand. Finally, one can argue that the study is fragmented in the sense that there is no one single model that captures all factors analyzed. This is indeed the case but we claim that this is the sensible way to proceed as a first attempt to model Reverse Mortgage demand's determinants. In this way, in fact, it is more readily seen how these factors work and in which direction. We should not disremember that a study like this one is done ultimately to use our understanding of Reverse Mortgages (which is enhanced through theoretical studies) so as to increase the welfare of the retirees.

Throughout the paper, we have look at the micro aspect of Reverse Mortgages. However, the macro aspects are also relevant for their implications on public budgets. Therefore, policy makers need not neglect them. What is more, governments should embrace Reverse Mortgages and

incentivize the development of this market[22]. To achieve this result, there are many paths to be taken. However, a combination of them would be optimal. Firstly, it is necessary that public institutions regulate the market: in fact, as Reverse Mortgages are a complex product, consumers should be protected in the first place. That is to say, protected from unfair conditions such as high transaction costs or from restrictive clauses. Secondly, a favorable tax treatment can make the product more appealing as compared to other options for under accumulating house equity. Thirdly, as we have seen previously, product awareness and knowledge can greatly influence the demand. Therefore, Reverse Mortgage campaigns should not only be a prerogative of the supply side but also of policy makers. Finally, financial literacy might play an important role on the development of the market. It is difficult to argue that policy makers can easily improve the financial (il-)literacy of the population as it depends more broadly on the schooling system, culture, etc. However, as pension planning will become more important in the future, due to downsizing of first pillars public schemes, we can envisage that a service of public managed advisors should and will be offered to the population. *Ad hoc* education will certainly improve financial literacy and will likely have a positive effect on Reverse Mortgages demand.

[22] In particular, policy makers should put emphasis on Reverse Mortgages in the form of annuitization because it is the best loan option in the sphere of pension schemes. And this is more true considering population ageing and future cuts in pension benefits.

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