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THE RETIREMENT-SAVINGS PUZZLE REVIEWED: THE ROLE OF HOUSING AND BEQUESTS

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Abstract. The so-called retirement-savings puzzle is a phenomenon by which, contrary to what the standard life-cycle model predicts, households do not run down their wealth significantly during retirement. In this review paper, we survey the literature on the retirement-savings puzzle and we connect it with the literature on housing equity during retirement. To establish a link between these two streams of literature, we use as a framework the work of Nakajima and Telyukova (2013a, Home equity in retirement, UCSD Working Paper) and Nakajima and Telyukova (2017, Reverse mortgage loans: a quantitative analysis, *Journal of Finance* 72: 911–950), who find that home-ownership interacts with factors that explain the retirement-savings puzzle, notably with the bequest motive. We complement the results by Nakajima and Telyukova by relating them to the literature on altruistic bequests, strategic bequests and housing as a commitment device, all of which give further insights on the connection between home-ownership and bequests. We complement our review of the literature with descriptive evidence using the Netherlands as a case study.

Keywords. Altruistic bequests; Bequest motive; Commitment; Housing; Retirement; Savings; Strategic bequests

1. Introduction

The standard version of the life-cycle model (without uncertainty and without bequest motive) predicts that households accumulate wealth throughout working life and they decumulate it during retirement to support consumption (Ando and Modigliani, 1963). However, there is a large body of evidence, extensively reviewed by De Nardi *et al.* (2016), pointing at the fact that older adults usually decumulate wealth at a slower pace than predicted by this basic version of the life-cycle model. This phenomenon is usually known as the retirement-savings puzzle (RSP).¹ It is very relevant to study the underlying motives behind the RSP since it is a key aspect of individuals' economic and financial behaviour during retirement. Especially in the present context of economic uncertainty and population ageing, studying the RSP becomes very relevant, so as to understand how prepared individuals are to face a decrease in the generosity of pension systems. In this paper, we review the RSP literature and focus specially on highlighting the role of housing as an asset that plays a major role in the portfolios of retirees, and which, we argue, is an important element to understand the RSP.

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We start out by briefly reviewing the general literature on the RSP, which can be classified according to the explanation given to solve the puzzle. We distinguish three main explanations: lifetime uncertainty, bequests and precautionary saving. Even though the evidence on the motives we discuss is rather mixed, depending on the context, and after controlling for the relevant factors, they all appear as relevant enough to be considered as meaningful additions to the basic life-cycle model. In parallel to the RSP literature, there is a stream of literature that studies the evolution of housing equity during retirement (HER). Since housing equity is usually a very important component in households portfolios, we pay special attention to this literature by reviewing it more in depth. The general conclusion of the HER literature is that home-owners are in most cases reluctant to draw down their HER, pointing at illiquidity and high transaction costs as the main reasons behind this phenomenon. However, most studies conducted so far are rather descriptive and the link with the RSP literature is generally missing. Therefore, this paper aims at emphasizing the connection between these two streams of the literature.

The RSP literature and the HER literature come together in the work by Nakajima and Telyukova (2013a), who introduce a model of retirement savings with housing. The model constitutes an extension of the previous work by De Nardi *et al.* (2010), who consider a model for single retirees which includes lifetime uncertainty, bequests and uncertain medical expenditures. The addition by Nakajima and Telyukova (NT) consists of extending the model to couples and analysing the housing asset separate from the rest of the assets in the portfolio, which turns out to have crucial consequences for the understanding of the RSP. The main conclusion of their work is that home-ownership interacts with factors that explain the RSP, notably with the bequest motive. We review the NT model and, furthermore, we review additional literature on three related topics, that is, altruistic bequests, strategic bequests and housing as a commitment device. These streams of literature contribute towards the understanding of the link between home-ownership, bequests and the RSP, and, in turn, provide potential extensions of the NT theoretical framework.

We complement our review of the literature with descriptive evidence, using the Netherlands as a case study. For this reason, we pay somewhat special attention to studies based on Dutch data when reviewing the literature. The Dutch case is particularly interesting since according to Van Ooijen *et al.* (2015) in the Netherlands there is large and substantial evidence of low withdrawals rates of net worth (specially of housing) among older households. To document our case study, we rely on data from the Dutch National Bank Household Survey (DHS), which is a panel survey that provides data on economic, financial and psychological aspects of household behaviour. It collects data from around 2000 Dutch households every year between 1993 and 2016. We use the last 10 waves, which provide a recent and large enough sample for our purposes. In line with the main takeaways of the NT's model, the evidence that we present mostly supports the idea that, in the Netherlands, housing as a bequeathable asset is potentially an important factor to take into account to have a better grasp of the underlying causes of the RSP. Since we rely on correlative evidence, we cannot entirely elucidate whether the causality runs from the bequest motive to home-ownership or vice versa. Nevertheless, we can clearly say that housing is an asset that cannot be neglected when studying bequests in the RSP context. Examining its role along the lines of the NT model more deeply is a fruitful venue for future research.

The paper is structured as follows: Section 2 reviews the RSP literature which we classify according to the explanation given for the puzzle; Section 3 reviews the HER literature which we classify according to the origin of the data, that is, US studies, international studies and Dutch studies; Section 4 summarizes the NT model; Section 5 reviews the literature on alternative bequest motives, that is, altruistic bequests and strategic bequests; Section 6 reviews the literature on housing as a commitment device; Section 7 contrasts the main takeaways of the literature reviewed in this paper with descriptive evidence coming from the DHS data; Section 8 closes the paper by giving a short conclusion and some general policy recommendations.

2. The Retirement-Savings Puzzle

The literature on the RSP shows that, in general, households do not decumulate their wealth during retirement in the way the basic life-cycle model suggests. In addition, it attempts to determine the reasons behind this phenomenon. Poterba *et al.* (2011), Van Ooijen *et al.* (2015) and De Nardi *et al.* (2016) provide thorough reviews of this literature. In this paper, we limit ourselves to a brief summary, which we use as a stepping stone for the rest of the paper.

Most of the literature on the RSP can be classified into three branches according to the explanation given as a key to solve puzzle. First, there is a branch of the literature, initiated by Yaari (1965), which investigates the role of lifetime uncertainty as an explanation for the RSP. Recent contributions to this literature are De Nardi *et al.* (2009), Cocco and Gomes (2012) and Post and Hanewald (2013). A life-cycle model without lifetime uncertainty implies that households are perfectly aware of their time of death. Therefore, they can plan with full accuracy to gradually draw down their wealth and deplete it completely just before they die. With lifetime uncertainty in the model households do not have full certainty about their time of death, and thus they generate an expectation about it. If households die earlier than expected, their wealth will not be totally depleted and involuntary bequests will result. On the other hand, the risk of outliving their net worth induces households to deplete their wealth more slowly compared to the case without lifetime uncertainty.

Second, there is a branch of the literature, initiated by Becker (1974), Bernheim *et al.* (1985) and Hurd (1989), which explores the role of voluntary bequests as an explanation for the RSP. More recent contributions are Laitner (2002), Kopczuk and Lupton (2007) and De Nardi and Yang (2014). In the basic life-cycle model, households aim at dying with zero wealth. Introducing a bequest motive implies that they derive utility from dying with positive net worth, which flattens the wealth trajectory during retirement. Kopczuk and Lupton (2007) classify the literature according to three different types of bequest motive: the *egoistic* motive (Hurd, 1989; De Nardi and Yang, 2014), in which households leave a bequest simply to increase their own utility; the *altruistic* motive (Becker, 1974; Laitner, 2002), in which the effect of the bequest on the utility of the recipient(s) plays a role in determining the transferred amount, and the *strategic* motive (Bernheim *et al.*, 1985; Perozek, 1998), in which, besides being altruistic, older adults use the bequest to strategically influence the quantity of services provided to them by the recipient(s). In addition to the literature on intentional bequests, there is a related branch of the literature that focuses on inter-vivos transfers (e.g. Cox, 1987; Norton and Van Houtven, 2006; Alessie *et al.*, 2014), which are expected to have an effect on the saving behaviour of older adults similar to the bequest motive.

Third, there is a more recent branch of the literature (e.g. Palumbo, 1999; Coile and Milligan, 2009; De Nardi *et al.*, 2010; Dobrescu, 2015) that considers the role of uncertain out of pocket medical expenditures (OPMEs), i.e. non-insured medical expenses, as an explanation for the RSP. The basic life-cycle model does not include health as a determinant of saving and consumption. The introduction of the health status allows for considering the role of uncertainty regarding OPMEs. If individuals are risk-averse and are not able to attain insurance against health risk, they will engage in precautionary saving and, as a result, they will retain a buffer-stock of savings that will flatten the wealth trajectory during retirement.

Even though the empirical evidence on the different explanations discussed in this section is rather mixed, depending on the context, and after controlling for the relevant factors, they all appear as relevant enough to be considered as meaningful additions to the basic life-cycle model. However, note that the different explanations need not be incompatible. It can well be that households rank them according to their preferences. In this case, the unfolding of exogenous events will crucially determine which purpose is eventually given to the savings of a retired household.

3. Home Equity in Retirement

Parallel to the literature on the RSP, there is a stream of literature that studies the evolution of HER. Housing is an asset that deserves special attention due to its dual role as consumption and investment good, and due to its associated transaction costs which make adjustments in housing rather infrequent. Furthermore, it is very often the most important asset in household portfolios.² In general, the HER literature aims at answering the question of whether retirees regard housing equity as a source of funds for general consumption. According to Venti and Wise (2004), answering this question is important for two reasons. First, it can help assess the potential demand for releasing the wealth locked in illiquid housing, which has implications for the development of financial products such as reverse mortgages. Second, it contributes to understanding the adequacy of saving for retirement. If financial wealth and housing wealth are used interchangeably to finance consumption, then the latter might as well be given the same treatment as financial wealth when evaluating whether households save enough for retirement.

3.1 *US Studies*

One of the first to tackle the question of whether retirees use housing equity to fund general consumption were Venti and Wise (1990), who using the Retirement History Survey (RHS) find that on average older adults who move do not downsize their housing equity. They conclude that older adults are in general not willing to use housing equity for consumption. On the contrary, Sheiner and Weil (1992) find, using the Panel Study of Income Dynamics (PSID), that average levels of home-ownership among the older adults decline significantly with age and conclude that housing wealth is used for consumption. However, even though the results are statistically significant, their economic significance is questionable since the observed decline in home-ownership is rather small. Hurd (2002) confirms, by exploiting a panel data set derived from the Asset and Health Dynamics among the Oldest Old (AHEAD), a modest decline in housing wealth and home-ownership rates among older adults. In addition, he points out that households experiencing a health shock or a widowhood event display larger declines in housing equity and are more likely to terminate home-ownership.

Following on the work by Hurd (2002), Venti and Wise (2004) perform a comprehensive analysis of the evolution of HER, paying special attention to the effect of precipitating events, i.e. widowhood and nursing home entry. They combine the Health and Retirement Study (HRS) with the AHEAD survey and consider two ways by which home-owners can change their housing equity: by discontinuing home-ownership or by selling and moving to a newly purchased residence. By means of cohort-specific analysis, they find that households who experience a widowhood event or nursing home entry display considerable declines in home-ownership and in housing equity; while for households who do not experience any of these events housing equity remains almost intact throughout retirement. Overall, they find that older adults are rather unlikely to move or to terminate home-ownership.³ They conclude that housing equity is generally not used for consumption, which has two implications: first, the demand for reverse mortgages is low, and, secondly, housing wealth should not be counted when assessing retirement savings, since it is not interchangeable with financial wealth. Instead, it might be suited to think of housing equity as a consumption good that, at the same time, provides a buffer against for adverse shocks.

In contrast to Venti and Wise (2004), Sinai and Souleles (2007) study the evolution of housing equity in retirement but do not consider home-owners that move. Instead, they look at home-owners that stay in the same residence and study how they react to the remarkable increase in house prices experienced in the US market between 1983 and 2004. Using the Survey of Consumer Finances (SCF), they report that households, especially the youngest among the older adults, have offset the rise in housing equity by increasing their housing debt through housing equity loans. However, they point out that the offset effect is rather small and that it could be larger were there less restrictions to borrow against housing wealth. Contrary to Venti and Wise (2004), Sinai and Souleles conclude that households are potentially willing to

liquidate housing wealth to finance consumption. Therefore, only the share of housing wealth that cannot be borrowed against should be considered as not interchangeable with financial wealth.

3.2 *International Studies*

Moving away from only US-based studies, Banks *et al.* (2012) compare downsizing among retirees in Britain and in the USA. Similarly to Venti and Wise (2004), they focus on households that move to a new location, for which they use PSID data for the USA, and British Household Panel Survey (BHPS) data for Britain. They find that there is more downsizing in the USA than in Britain even though in both countries the vast majority of older households do not actually move. These comparative results hold when controlling for marital status, family size and employment transitions. In addition, Banks *et al.* argue that it is a mix of geographical – in the USA there is more climate diversity and variation in environmental amenities – and institutional factors – in Britain there are more transaction costs due to taxation of home sales – that explains the higher share of moving households in the USA. These results suggest that, in Europe in general, moving house during retirement might be even less popular than in the USA due to higher institutional restrictions and less within country variation in geographical amenities.

The results in Banks *et al.* (2012) have been recently confirmed by Blundell *et al.* (2016), who compare wealth trajectories for retirees in England and in the USA using the HRS and the English Longitudinal Study of Ageing (ELSA). They find that assets are drawn down more slowly in England than in the USA. In addition, and in line with the results by Banks *et al.* (2012) they observe that the lack of housing equity drawdown is a crucial element in explaining differences in wealth decumulation between the two countries. They suggest that this phenomenon is likely to be explained by a combination of factors such as the consumption value of housing, the financial and emotional transaction costs involved in releasing housing wealth and the risk-return mix provided by housing.

In some of the few fully international studies, Chiuri and Jappelli (2010) use data on 15 OECD countries, while Angelini *et al.* (2014) use data on 13 European countries. The former employ data from different country-specific surveys which allow them to construct a data set of repeated cross-sections over time. They look at the cross-sectional relationship between home-ownership and age, and find that home-ownership rates decline considerably after age 60. However, after controlling for cohort effects, the decline becomes much more moderate and it does not start until after age 75. In addition, they find that cross-country variation in terms of institutions, such as tax regimes and mortgage market regulations, have an impact on the degree to which housing wealth is withdrawn during retirement. On the other hand, Angelini *et al.* (2014) use life history data from the Survey of Health, Ageing and Retirement in Europe (SHARE) and, similarly to Venti and Wise (2004) and Banks *et al.* (2012), study the behaviour of home-owners and renters that move. Even though they assert that moves are rare all over Europe, they are likely to happen when there is a precipitating event, that is, divorce, widowhood and nest-leaving by children. In addition, they also find that economic reasons can play a role, since, after controlling for country characteristics and family transitions, retirees that are cash-poor and house-rich are the most likely to downsize their housing asset. These findings are also reflected in the study by Nakajima and Telyukova (2013b), who also conduct a European-level cross-country empirical comparison of the evolution of HER, and link it with the literature on the RSP.

3.3 *Dutch Studies*

Narrowing the focus to the Dutch case, Van der Schors *et al.* (2007) employ data from the Dutch Social Economic Panel (SEP) for the period 1990–2002 and find a strong negative cross-sectional relation between age and home-ownership among Dutch households around and above retirement age. However, a more detailed analysis indicates that this age gradient is mostly due to cohort effects, through which

younger generations of older adults are more exposed to housing. They find that higher lifetime income due to long-term productivity growth is the main factor explaining this generational effects in home-ownership. In addition, they find that changes in the supply of housing and relaxation of the requirements to obtain a mortgage also play a role in explaining this phenomenon. This evidence has been recently confirmed by Van Ooijen *et al.* (2015) who describe the saving behaviour and the portfolio choice of Dutch retirees by exploiting high-quality administrative data for the period 2005–2010. Like Van der Schors *et al.* (2007), they find strong differences between cohorts. However, within cohorts, both home-ownership rates and the amount of housing equity held by older households do not appear to decline significantly with age.

In a different study, De Graaf and Rouwendal (2012) investigate whether older Dutch households liquidate housing wealth by increasing their mortgage debt or taking a second mortgage. Using data from the Dwelling Research Netherlands (WoON) survey for the period 1985–2009 they find that older adults, although often they have not completely redeemed their mortgage yet, do not increase their mortgage debt, not even when house prices increase at considerably high rates. In consequence, they conclude that the vast majority of older home-owners do not use mortgage debt as a means to decumulate housing equity. More recently, Dillingh *et al.* (2015), investigate a similar issue by conducting a survey on the psychological and economic aspects of reverse mortgage attitudes of home-owners in the Netherlands. They explain to respondents what a reverse mortgage is and then they ask to what extent they would be interested in such a product.⁴ Even though they are optimistic about the potential demand for reverse mortgages, only 6% of respondents show a clear interest, while 21% show moderate interest.

4. Models of Retirement Savings with Housing

Even though the evidence provided by the HER literature surveyed in Section 3 appears to be somewhat mixed, it comes forth as a general conclusion that older households are reluctant to withdraw HER. The most recurrent explanation behind this phenomenon given in the HER literature relates to the illiquidity of housing, and the high transaction costs that derive from that. However, the HER literature is mostly descriptive and the link with the RSP literature is rather limited. While we do not deny the importance of illiquidity and transactions costs, in this survey paper we want to highlight the benefits of applying the lessons of the RSP literature to the question of why housing equity is not withdrawn late in life. Is it because of lifetime uncertainty? Is it because housing wealth is used as precautionary savings against unforeseen medical expenditures and long-term care (LTC)? Or is it because housing is regarded as an asset to be bequeathed? In this section, we start by reviewing the model by Yang (2009), which emphasizes the role of transaction costs in housing purchases and sales. We then pay special attention to the model by Nakajima and Telyukova (2013a, 2017), which adds different features coming from the RSP literature and up to date represents the most state-of-the-art contribution when it comes to models of retirement saving with housing.

4.1 Yang (2009)

A relevant contribution to the modelling of retirement savings with housing, and which represents a good starting point for this section, is given by Yang (2009). Using US data from the SCF and the Consumer Expenditure Survey, she shows that non-housing consumption tends to be hump-shaped over the life-cycle, while housing consumption increases and then flattens during the retirement phase. A standard life-cycle model would predict that housing consumption should follow the same path as non-housing consumption. Therefore, to explain the facts observed in the data, Yang builds a life-cycle model that explicitly models housing and its features. In her model, owner-occupied housing has a dual role: it directly provides utility, and it can be used as collateral. Furthermore, households face labour income risk,

borrowing constraints, uncertain lifetime and transaction costs for trading houses. Yang follows the work by Fernández-Villaverde and Krueger (2002),⁵ who build a life-cycle model to explain the expenditure patterns for durable and non-durable goods. However, their model abstracts from housing transaction costs and cannot generate the slow decline of the housing stock in old age observed in the data. In addition, Yang's model is related to the work by Díaz and Luengo-Prado (2010), who build a model which, even though it does not have a life-cycle component, includes features that are in common with Yang (2009) when it comes to the modelling of the housing asset.

In Yang's model, the individual's within-period utility function is of the constant relative risk aversion class, and it is given by

$$U(c, h) = \frac{g(c, h)^{1-\sigma} - 1}{1 - \sigma}, \quad (1)$$

where c is non-housing consumption, h is housing consumption, and σ is the coefficient of relative risk aversion.⁶ The two kinds of consumption are aggregated as $g(c, h) = (\omega c^\theta + (1 - \omega)h^\theta)^{\frac{1}{\theta}}$, where ω captures the relative weight of housing versus non-housing consumption, and θ determines the degree of substitutability between c and h . Households take into account the probability of dying in every period, and the probability of receiving an earnings shock. In addition, they discount future streams of utility by a constant factor β . Intertemporal utility is maximized by choosing c , h , and whether to rent or to own the house used as a residence.

If a household chooses to own, utility is maximized subject to

$$c + a' + h' + \tau(h, h') = Y(i, y) + (1 + r)a + (1 - \delta^h)h + b, \quad (2)$$

where a is the net asset position, $\tau(\cdot)$ is a transaction cost incurred in the case of moving and depends on the value of the old (h) and of the new house (h'), $Y(\cdot)$ denotes labour earnings, which depend on age i and a stochastic productivity shock y , r is the interest rate, δ^h is the depreciation rate of housing and b are received bequests. A prime indicates the value of a variable in the next period. The specification of the transaction cost is

$$\tau(h, h') = \begin{cases} 0 & \text{if } h' \in [(1 - v_1)h, (1 + v_2)h] \\ \rho_1 h + \rho_2 h' & \text{otherwise,} \end{cases} \quad (3)$$

which implies that households can change their level of housing consumption without moving by undertaking housing renovation up to a fraction v_2 of the value of the house, or by allowing depreciation up to a fraction v_1 . If h' exceeds one of these two boundaries, Yang assumes the house has been sold, and the household must pay a transaction cost consisting of a fraction ρ_1 of the selling value and a fraction ρ_2 of the buying value. The house can be used as a collateral, and borrowing without a collateral is not allowed. Thus a home-owner's financial assets must satisfy

$$a \geq -(1 - \lambda)h, \quad (4)$$

where λ determines the fraction of the value of the house that can be borrowed against, which is equal to the down payment requirement a household must satisfy upon the purchase of a house. For a renter, the borrowing constraint is simply $a \geq 0$.

To capture factors other than age, income and wealth that affect households' renting/owning decision, Yang assumes households face renting shocks with a certain probability. A household who receives a renting shock is not allowed to own and can only rent. The shock is exogenous and independent of household characteristics. If a home-owner chooses to be a renter, or faces a renting shock, utility is maximized subject to

$$c + a' + p^h h' + \tau(h, h') = Y(i, y) + (1 + r)a + (1 - \delta^h)h + b, \quad (5)$$

where p^h is the rental rate on housing. In case the household is already a renter and stays that way, $(1 - \delta^h)h$ drops from Equation (5). Renters can change the quantity of their housing services without incurring a transaction cost, as long as they keep renting. Therefore, the transaction cost $\tau(\cdot)$ will only be relevant if the household transits from owning to renting, in which case $\rho_2 = 0$, or from renting to owning, in which case $\rho_1 = 0$.

Yang parametrizes the model mostly using estimates given by previous studies, and investigates the implications of the model for average home-ownership rates by age, and for average life-cycle (housing and non-housing) consumption and wealth profiles for both home-owners and renters. The model predicts that young agents rent while accumulating financial assets. As time progresses, more households have accumulated sufficient funds for down payments to become home-owners. Because of the presence of a borrowing constraint and the role of housing as a collateral, they build housing stock quickly. Home-owners build up their highest housing stock at age 65, which remains flat thereafter, only slightly declining very late in life. Regarding non-housing consumption, it increases early in life and through adulthood, and at some point around age 65 starts decreasing due to the increasing mortality risk. Since there is no insurance against such risk, households discount their future consumption at an increasing rate as they age, and thus the non-housing consumption profile is hump-shaped.

Yang's model is thus able to match the evolution of housing and non-housing consumption throughout the life-cycle. The key element of the model that makes a difference is the introduction of transaction costs for trading houses, which play an essential role in explaining the slow decline of housing consumption later in life. By setting transaction costs to zero, Yang shows that the model generates a much faster decline of housing stock later in life, and thus the profile resembles then the one of non-housing consumption. Yang's model represents a substantial improvement with respect to the standard life-cycle model, and is able to accommodate the most basic insights of the HER literature. However, it leaves out most of the aspects considered to be important by the RSP literature, which could compete with housing transaction costs in generating a flat profile for housing wealth towards the end of life. Out of the three explanations for the RSP surveyed in Section 2, the model only includes lifetime uncertainty, and thus leaves out uncertain medical expenditures and the bequest motive.

4.2 Nakajima and Telyukova (2013a, 2017)

Arguing that the RSP cannot be explained without emphasizing the role of the housing asset, NT provide what up to date is the most state-of-the-art contribution in the domain of models of retirement savings with housing. Using HRS data, NT (2013a) find that the post-retirement evolution of assets shows a very different picture for home-owners compared to renters; while the former do not withdraw their wealth during retirement, the latter do, which suggests that home-ownership interacts with factors that explain the RSP. To investigate these issues, NT (2013a) study HER in the context of a structural life-cycle model of retirement savings. They do so taking into account the main takeaways from the RSP and the HER literatures, and incorporating the elements introduced by Yang (2009).⁷ Furthermore, in a more recent contribution (NT, 2017), they extend their model by introducing reverse mortgages to gauge what is the potential demand for such a product. NT's work is actually based on the De Nardi *et al.* (2010), who consider a model for single retirees which includes lifetime uncertainty, bequests and uncertain medical expenditures. The addition by NT with respect to De Nardi *et al.* (2010) consists of extending the model to couples and analysing the housing asset separate from the rest of the portfolio.

In the NT model, only retired households are considered and the within-period utility function has the form

$$U(c, h, o) = s \frac{\left(\frac{1}{\mu_s} c^\omega (\eta_o h)^{1-\omega} \right)^{1-\sigma}}{1 - \sigma} \quad (6)$$

where c , h , ω and σ play the same role as in (1), while s is the number of adults in the household, the subscript o is the tenure status, with $o = 1$ indicating owner and $o = 0$ indicating renter, μ_s is the effective household size and η_o captures the extra utility from owning a house.⁸ As in De Nardi *et al.* (2010), when all members in a household have died, any remaining assets are transferred to the heir(s). The utility that the household derives from leaving a bequest takes the form

$$v(b) = \gamma \frac{(b + \zeta)^{1-\sigma}}{1-\sigma}, \quad (7)$$

where b is posthumous wealth, γ captures the strength of the bequest motive and ζ is a parameter determining the extent to which bequests are luxury goods. Notice that bequests follow an egoistic motive, since the utility derived from leaving a bequest does not depend on the utility of the recipient(s).

Regarding Equation (6), there are two relevant features worth mentioning. The first is that, similar to Yang (2009), utility is non-separable in consumption and housing, which allows for the marginal utility of consumption to depend on housing and vice versa. The second relevant feature is that NT differentiate between couples and singles in their utility function. To that end, they follow a unitary assumption, implying that if $s = 2$ both members in a couple have the same utility function, and consumption is split equally between the two. However, each member enjoys more than half of the consumption flow because of the returns to scale within couples captured by what NT call the *household size multiplier*, expressed as $s/\mu_s^{1-\sigma}$.⁹

As in Yang (2009), households discount future streams of utility by a constant factor β , and take into account the probability of dying at every period. In addition, they take into account the probability of entering a bad health state and incurring medical expenditures, for which there is no insurance.¹⁰ The health status of a household follows a first-order Markov process in which transition probabilities are dependent on the present health state and on the age of the household. The inclusion of the health status allows defining the probability of incurring OPMs. The probability that a given x is drawn depends on age and health status of the household. In addition, with a given probability at any period a two-person household can transit from $s = 2$ to $s = 1$, which captures the death of a spouse. One spouse can die first via a stochastic shock to s , or both spouses can die at the same time via the household-wide mortality shock. NT assume away divorces and remarriages due to their low frequency in HRS.

For a home-owner, the housing decision consists of two options: staying in the present residence or becoming a renter. For a renter, the only housing choice is the size of the rental property. Differently from Yang (2009), own-to-own and rent-to-own moves are assumed away by NT due to their low frequency in the HRS. A home-owner maximizes utility subject to

$$c + a' + x + \delta h = (1 + r)a + \psi_s y, \quad (8)$$

where a denotes again financial assets, x are medical expenditures, δ is a proportional maintenance cost, r is the interest rate and y is pension income, which is adjusted according to the number of adults in the household by the parameter ψ_s . Similarly to Yang (2009), the house can be used as a collateral and borrowing without a collateral is not allowed. Thus a home-owner's financial assets must satisfy

$$a \geq -(1 - \lambda_{i,y,s,m})h, \quad (9)$$

which is the same as (4), but now the fraction of the house that can be borrowed depends on age i , income y , household size s and health status m . In that way, NT capture the idea that the household's ability to borrow depends on its ability to service its debt. In every period, the household can decide to sell the house and become a renter, in which case a proportional transaction cost τ must be paid.

If the household is a renter, utility is then maximized subject to

$$c + a' + p^h h + x = (1 + r)a + \psi_s y, \quad (10)$$

$$c = \begin{cases} \max\{s\underline{c}, \tilde{c}\} & \text{if } a' = 0 \text{ and } h = h_1 \\ \tilde{c} & \text{otherwise,} \end{cases} \quad (11)$$

where p^h is again the rental rate, $\underline{c}$ is the publicly provided consumption floor, $\tilde{c}$ denotes consumption if the consumption floor is not enforced and h_1 is the smallest rental property available. The consumption floor is enforced if, after selling all its assets and moving to the smallest rental property available, the household cannot meet the minimum established consumption threshold.

NT estimate the model in two steps. First, they calibrate a few parameters using estimates available from previous studies or directly computing them using the HRS data, which are μ_2 , ψ_2 , δ , τ and r . In addition, in the first step they compute the health status and household structure transition probabilities, as well as the probability of incurring medical expenditures. In the second step, they use the method of simulated moments to estimate the rest of the parameters in the model, i.e. β , ω , σ , η_1 , γ , ζ , $\underline{c}$ and λ . The latter are estimated such as to provide the best match between the model and several moments in a sample of three HRS cohorts (those of age 65, 75 and 85 in 1996), which are followed over time between 1996 and 2006. The targets are home-ownership rate profiles, life-cycle profiles of median financial assets, median housing assets and median total assets, proportion of households in debt, median debt of debtors, and median net worth profiles for home-owners and renters separately.

Once the model is estimated, NT investigate the role of several model features on the saving behaviour of retirees. They do so by shutting down each mechanism one at a time and comparing the outcome with the benchmark model. The mechanisms they consider are the bequest motive, medical expenses, extra utility from home-ownership, collateral constraints, and the house price boom of the years 1996–2006. The results differ with the previous literature, and show that leading motivators for home-ownership and net worth levels in retirement are the utility benefits of home-ownership and the bequest motive. Upon shutting down the bequest motive, that is, setting $\gamma = 0$, NT observe considerably faster declines in home-ownership and net worth of home-owners compared to the benchmark. The net worth withdrawal rate of renters is also increased, however, less so than the one of home-owners. Similar results are found for home-owners when the utility benefits of home-ownership are shut off, i.e. $\eta_1 = \eta_0 = 1$.¹¹ In contrast, they find that borrowing constraints and OPMEs play a rather small role in explaining the evolution of housing and of net worth in general during retirement. They do find that house price growth during the sample period partially explains low wealth withdrawal rates. However, the results regarding the bequest motive and the utility benefits of home-ownership still hold after controlling for house price growth.

In a recent extension of their initial model, NT (2017) include the possibility for the household to take out a reverse mortgage. Using data from the US Department of Housing and Urban Development, they show that the average yearly fraction between 1997 and 2013 of home-owners above 65 years who have a reverse mortgage is around 1%. NT model reverse mortgages by allowing households to borrow with a constraint that only depends on age, and thus is much less strict than the one given by Equation (10). Upon the payment of an initial fee, households can get access to a line of credit which depends on the age of the household and the value of the house. In exchange, the house is transferred to the bank once the household dies or decides to move. Their model is able to mimic the low demand for reverse mortgages observed in the data. They find that eliminating the initial fees, triples the take-up of reverse mortgages. In addition, a very interesting result is that shutting down the bequest motive multiplies by 17 the amount of home-owners that take out a reverse mortgage. This result holds even when households are not pushed to liquidate housing due to a possible medical expense shock. This indicates that, absent a bequest motive, households are willing to liquidate housing equity for non-medical consumption.

In summary, NT find that the bequest motive and the utility benefits of home-ownership are the most relevant factors determining the low withdrawal rates of housing wealth during retirement. On the other hand, OPMEs do not seem to play a major role in explaining home-ownership late in life. These results differ importantly from those in De Nardi *et al.* (2010), who find an insignificant bequest motive and a larger role for medical expenditures. There are two main potential explanations for these differences.

First, De Nardi *et al.* (2010) do not consider housing as a separate element of the portfolio and thus they do not match the evolution of home-ownership and housing wealth when estimating their parameters. In the work of NT, matching these profiles clearly seems to emphasize the role of bequests and of the utility benefits of home-ownership. Secondly, De Nardi *et al.* (2010) employ data only on singles who, arguably, are less prone to have a bequest motive than couples. Couples are more likely to have children and they are also likely to be richer, both of which are facts that potentially lead to a stronger bequest motive.

5. Alternative Bequest Motives

The literature surveyed in Sections 3 and 4 puts through several reasons why housing wealth is generally not spent during retirement, namely, transaction costs, utility benefits of home-ownership, precautionary saving against unforeseen medical expenditures and LTC, and the bequest motive. Out of these reasons, the literature has paid attention, up to the present moment, specially to transaction costs to justify why housing should be modelled separately from the rest of the portfolio. In this paper, we want to pay special attention to one of the least considered reasons, that is, the bequest motive. To that end, we review additional literature that may help further understand the association between home-ownership and bequests that comes out of the model by NT. By doing this, we do not intend to propose formal extensions of the NT model. Instead, we want to propose new directions for future research, as well as connections between different streams of existing literature.

There are several reasons why households might prefer to leave a bequest in the form of a house rather than in a more liquid form. NT suggest that, since home-ownership provides utility benefits, households who want to accumulate assets in retirement due to a bequest motive prefer to do so in housing. Furthermore, they point at the fact that due to the transaction costs associated with liquidating housing equity, it is convenient for older home-owners to stick to housing when saving for a bequest rather than opting for more liquid alternatives.¹² Alternatively, it can be that, regardless of utility benefits and transaction costs, households choose to include housing in their portfolio already with the idea to use it as a bequest in the future, or that there are third factors that explain home-ownership and bequests simultaneously. In addition to these ideas, there are alternative ways of modelling bequests that provide further insights on the connection between home-ownership and bequests.

5.1 Altruistic Bequests

Following previous work such as Hurd (1989) and Kopczuk and Lupton (2007), NT model the bequest motive as an egoistic motive, which implies that bequests are generated purely by the desire of individuals to have positive net worth upon death. The egoistic motive is thus independent of the economic situation of the heir(s), unless one interprets the utility from bequests as utility of heir(s). As an alternative to this model, Laitner (2002) proposes a model in which the bequest function depends on the consumption possibilities of the heir(s). This idea originated from earlier work by Barro (1974) and Becker (1974), and, in its simplest form, it would consist of rewriting the within-period utility in the NT model as

$$U^P = u(c, h, o) + \alpha U^K(b), \quad (12)$$

where $U^P(\cdot)$ is the utility function of the parents and $U^K(\cdot)$ is the utility function of the heir(s). The first element in (12) is simply the same as in Equation (6), whereas the second element substitutes the bequest motive in the NT model by $\alpha U^K(b)$, where α indicates to what extent a household cares about leaving a bequest b to its heir(s). Receiving a bequest increases lifetime income of the recipient(s) and thus has a positive effect on her utility through increased consumption possibilities, i.e. $\partial U^K(b)/\partial b > 0$. However, the higher the pre-bequest lifetime income of the recipient(s), the lower is the marginal utility

of additional bequeathed wealth. Therefore, if the heir(s) have already high lifetime income, the amount bequeathed is likely to be comparatively small.

Employing a survey of US pension holders, Laitner and Juster (1996) find that willingness to leave a bequest is higher for households with the lowest assessments of their children's likely earnings. In addition, Laitner and Ohlsson (2001) find evidence of parental altruism in Sweden and the USA. However, this evidence contradicts with the work by Altonji *et al.* (1997) and James Poterba (2001), who find that in the USA parents do not modify inter-vivos transfers in response to changes in their children's lifetime income. In addition, Kopczuk and Lupton (2007), who employ panel data on singles from the AHEAD survey, make a case against the altruistic model by showing that there are households who save for a bequest without having children, and thus argue that children and bequests are independent of each other. However, we must note that altruism is not necessarily only towards children. There can be as well altruism towards other family members and/or towards non-family members.

Even though in general the evidence appears to be mixed, the altruistic model should not be dismissed since it has important implications for understanding the rationale behind the bequest motive. In addition, it has important implications as well for understanding how income and wealth inequality is transferred from one generation to the next. Furthermore, the altruistic model, in combination with other branches of the literature that we discuss below, may provide additional insights on the association between home-ownership and the bequest motive that stems from the NT model.

5.2 Strategic Bequests

A different approach to the bequest motive was introduced by the early work of Bernheim *et al.* (1985), who suggest that bequests are generated in a context of intergenerational exchange. In this context, parents are still altruistic in that they care about the utility of their descendants. However, at the same time, they also care about services provided to them by their children. In consequence, they try to strategically influence the descendants' actions in their favour by using the bequest as an incentive. In the strategic model, it makes sense to separate housing from the other elements of the household portfolio, since it is an asset that parents can easily use to signal a reward for their children's services. In that way, the strategic model provides additional insights on the association between home-ownership and the RSP that go beyond the ones suggested by NT.

In a very stylized way, strategic bequests could be introduced in the NT model by rewriting the within-period utility function of the altruistic version of the model as

$$U^P = u(c, h, o, \kappa) + \alpha U^K(b, \kappa), \quad (13)$$

where κ denotes the services provided by the children to their parents, which increase parental utility, that is, $\partial u(\cdot)/\partial \tau > 0$, but affect the utility of the children negatively, that is, $\partial U^K(b, \kappa)/\partial \kappa < 0$. In Bernheim *et al.*'s model, the household commits herself to a bequest rule. The latter specifies the fraction of the bequest given to each recipient for each amount of services provided, and establishes that a descendant will be disinherited in favour of other recipient(s) if she does not contribute with a minimum amount of services. For the rule to be convincing, parents must be credibly committed to retain enough wealth as a bequest. This can be done by holding wealth in an illiquid form such as housing equity. If transactions costs are high and financial products to liquidate housing are hardly available, holding a house can be a way for older adults to signal a future bequest to the heirs.

The empirical literature on the strategic model generally follows an approach that consists of regressing the number of visits by the heir(s) to the parents on parental wealth. The main challenge is to take into account the endogeneity of parental wealth, since, if strategic behaviour applies, parents will increase their wealth holdings in response to increased attention. Furthermore, there may be unobserved factors affecting both parental wealth and the number of contacts. The literature generally tackles this issue by

instrumenting for wealth. Bernheim *et al.* (1985) instrument wealth with lifetime earnings and, based on US data, find evidence supporting the altruistic model. Perozek (1998) instruments with an index that maps occupations into a socioeconomic ranking and controls for additional individual and family characteristics. Using a different US data set, she claims that the results by Bernheim *et al.* are not entirely robust. On the other hand, Angelini (2007) uses the educational level and the number of rooms in the parental house as instruments. Using data on several European countries she finds empirical support for the strategic model. The effect appears to be the strongest when using illiquid forms of wealth, such as housing, as explanatory variable. This finding suggests that housing is used as a strategic bequest. It brings thus an additional meaning to the association between home-ownership and bequests observed by NT.

The above-mentioned literature uses parental wealth as a proxy for bequests. In a more recent contribution, instead of using a proxy, Groneck (2017) uses information on the actual inheritance given to each child as well as on hours of help with activities of daily living provided by each child. The information on inheritances comes from the HRS exit interviews, which are conducted after the respondent's death with a close relative or a friend. With this information at hand, Groneck regresses inheritances on informal services provided and, using gender of the child as an instrument for children's help, finds that children who provide help have a higher probability of receiving positive bequests. In addition, he finds that increasing the amount of care with respect to one's siblings increases the share received of the total bequest transferred within the family. Interestingly, Groneck identifies the presence of a written will as an important determinant of the correlation between caregiving and bequests. He interprets the will as a contract between parents and children that is necessary for the exchange motive to work.

6. Housing as a Commitment Device

An additional branch of the literature that may shed additional light on HER and how it may relate to the bequest motive is the literature on temptation and self-control. In two seminal contributions to this literature, Gul and Pesendorfer (2001, 2004) develop a model in which an agent chooses between different sets of alternatives for consumption, some of which contain a tempting good. The latter is a good that the agent may crave for, however, consuming it represents a suboptimal choice. If the agent chooses the set of alternatives that contains the tempting good, she will either consume it or exert self-control in order not to do so, which comes at a utility cost. A different option consists of choosing a set of alternatives that excludes the temptation good and thus commits the agent to not choosing it. This option saves the cost of self-control.

The model by Gul and Pesendorfer has been applied to several fields within economics. There is a recently emerging literature (*e.g.* Angelini *et al.*, 2013; Ghent, 2015; and Kovacs, 2016) that applies it to the study of housing demand over the life-cycle. This literature points out the role of housing as a commitment device. The idea is that if immediate consumption is a temptation good, households will suboptimally choose to consume too much in the present and will not save enough for retirement. In this context, households can commit themselves to save by investing their wealth in housing.¹³ In the NT framework, this feature can be potentially incorporated by rewriting the utility function as

$$U = u(c, h, o) - \rho(v(c^*, h, 0) - u(c, h, o)), \quad (14)$$

where for simplicity we have excluded the bequest motive. The second element in (14) is the temptation term, which is weighted by ρ , and where $v(\cdot)$ is the level of utility attained when all wealth is liquidated, the household is a renter ($o = 0$) and consumption is set to its maximum immediate level, c^* . If the household chooses this utility level, the temptation term cancels out. Otherwise, the temptation term is assumed to be positive, *i.e.* $u(\cdot) < v(\cdot)$ if $c < c^*$, and it can be seen as the utility cost of self-control since it provides the utility difference between the tempting alternative and the actual choice.

To increase lifetime utility, a household should save for the future, but at the same time reduce the cost of self-control. This is possible by investing in illiquid assets, which will reduce the wealth disposable for immediate consumption and, in turn, will reduce the cost of self-control. Housing can play this role, since its liquidation usually implies high transaction costs and housing equity lines are not always readily available. If, in the presence of immediate consumption as a tempting alternative, one wants to make sure that a bequest is left for the following generation, housing can act as a commitment device. That is especially the case if one wants to strategically signal that a bequest will come. Therefore, the temptation motive has the potential to explain to some extent the slow downsizing in housing and, in turn, the association between home-ownership and bequests.

To test the temptation motive for housing, Angelini *et al.* (2013) use European life history data and regress the hazard rate of home-ownership, that is, the probability for a renter to transit to home-ownership, on the value of liquid and illiquid financial assets in the household portfolio. They find a considerable effect of holding illiquid financial assets, which is especially strong for individuals above 40 years of age. As the authors argue, the latter are the most expected to transit into home-ownership for commitment purposes, since earlier in life the purchase of a house is more likely related to family formation. On the other hand, Kovacs (2016) follows a different approach consisting of estimating a structural life-cycle model with temptation preferences. Her model predicts that the interaction between housing services in the utility function and temptation preferences induces a high demand for housing as a commitment device. Housing demand appears to be significantly higher at its peak over the life-cycle when housing plays a commitment role compared to when it does not.

7. The Netherlands as an Empirical Case Study

The main takeaways from the literature surveyed in this paper translate into questions that can be tackled empirically. In this section, we provide descriptive evidence for the Netherlands. The Netherlands provides an interesting case study since, according to Van Ooijen *et al.* (2015), there is substantial evidence of low withdrawal rates of net worth (specially of housing) during retirement. Furthermore, in the last decades the Netherlands has experienced an important increase in home-ownership,¹⁴ which appears to remain high as households enter retirement (see, for example, Van der Schors *et al.*, 2007; De Graaf and Rouwendal, 2012; Van Ooijen *et al.*, 2015). Even more interesting is the fact that in the Netherlands medical expenditure risk is less likely to play a role as LTC is publicly provided. This leaves other explanations such as transaction costs, and the bequest motive as more likely to apply in the Netherlands.

To conduct our case study, we rely on data from the DHS, which is an Internet-based panel survey run by CentERdata (a data collection institute based at Tilburg University) that provides data on economic, financial and psychological aspects of household behaviour.¹⁵ It collects data for around 2000 Dutch households every year between 1993 and 2016. We use the last 10 waves, which provide a recent and large enough sample for our purposes. Out of 4819 households interviewed between 2007 and 2016 (both included), we exclude 1263 from the sample due to missing data on wealth, which leaves us with 3556 households.¹⁶ Only about 15% of these households are observed for the full 10 waves and every household is observed on average for about four waves, implying that we have an unbalanced panel with a total of 14296 household-year observations. CentERdata deals with attrition by biannually refreshing the sample with new households to keep the panel representative of the Dutch population.

7.1 The Retirement-Savings Puzzle

Figure 1 shows the evolution of several portfolio components and home-ownership for three cohorts of Dutch households. These are 50–59, 60–69 and 70–79 years old in 2007, respectively. For all monetary

Figure 1. Wealth and Home Ownership among Older Adults by Cohort (2007–2016).

Notes: All panels show data on three cohorts. These are 50–59, 60–69 and 70–79 years old in 2007, respectively. All monetary values are given in thousands. For all panels except for (c), four different percentiles (p25, p50, p75 and p90) are displayed for each cohort.

Table 1. Housing Moves among Older Adults (2007–2016).

Total older households interviewed	1383	100%
Total moves at 60+	297	21.48%
Within-sample moves at 60+	100	7.23%
Rent-to-own	8	
Own-to-rent	16	
Own-to-own	34	
Downsize	22	
Upsize	12	
Rent-to-rent	42	

Notes: Older households are defined as households with a household head who is 60 or older. Total moves at 60+ refer to the total number of households who report to have moved while being 60 or older. Within-sample moves at 60+, refer to the total number of households who report to have moved while being 60 or older and during the years in which they were interviewed. The survey does not capture nursing home entries.

variables, Figure 1 shows the evolution of percentiles 25, 50, 75 and 90 for each cohort. Panels (a) and (b) show that net worth and net financial assets do not significantly decrease over time neither between nor within cohorts. Even though the upper percentiles of the distribution show more volatility, we cannot distinguish a pattern indicating that households aim at depleting their wealth before death. Panel (c) shows that home-ownership does not significantly decrease within cohorts and over time. However, we do observe differences between cohorts. Panels (d) and (f) show that households do not generally decumulate neither gross nor net housing wealth. There does seem to be a decreasing pattern in net housing wealth for the 75th and 50th percentiles among the oldest cohort. However, all values do not decrease below 200 thousand Euros for those percentiles. Panel (e) shows an inter- and intra-cohort decrease of mortgage debt over time, which suggests that, while households do not decumulate their housing wealth, they reduce their mortgage debt over time.

The findings discussed in the literature review generally agree with the evidence in Figure 1, which shows low wealth withdrawal rates and cohort effects in home-ownership. This evidence suggests that the RSP is present in the Netherlands and that housing might play an important role in understanding it. An important caveat to take into account here is that the low withdrawal rates shown in Figure 1 might be the result of survival bias, that is, the fact wealthier individuals live longer and thus tend to stay in the sample longer. However, in Figure 1 we partially overcome this issue by splitting the sample into wealth percentiles since the upper percentiles are likely to have lower mortality rates at a given age. Furthermore, Figure A1 in the appendix shows that if we restrict the sample to households who are observed for the full 10 years the bottom line of the results does not change. Note that households who are observed for the full 10 years represent only about 15% of the total, thus the sample in Figure A1 becomes rather small especially for the older cohorts.

Table 1 takes the analysis a step further by showing that, according to DHS data, most Dutch older households do not move. Among the 3556 households interviewed between 2007 and 2016, 1383 had a household head that was at least 60 years old when interviewed. Out of these 1383 households, 297 (21.48%) reported to have moved at some point in time while the household head was already at least 60. The average age of the household head when these households moved is 67.40, while the median is 66. Out of these 297 households, 100 (7.23% of the 1383 older households interviewed) moved during the period in which they were interviewed, which implies that we are able to know what type of move it was. Table 1 shows that of these 100 moves, most (42%) were rent-to-rent moves, while only a little more than one-third (38%) were clear downsizing moves, that is, either own-to-rent or own-to-own with a downsizing of the housing asset.

Table 2. Willingness-to-Use Equity Contained in the Main Residence (2007–2016).

	Certainly yes	Probably yes	Probably not	Definitely not	Do not know	N of obs.
Age < 60	1.91%	3.08%	31.10%	60.89%	3.01%	5422
60 ≤ Age < 75	1.61%	3.75%	31.34%	61.43%	1.87%	3429
Age ≥ 75	2.19%	3.25%	25.81%	65.84%	2.92%	1087

Notes: Households are asked: ‘Are you planning on using the surplus value of your property in the next 2 years (by taking out an extra mortgage, by increasing your mortgage amount or by moving)?’. Older households are defined as households with a household head who is 60 or older.

In addition, Table 2 shows that Dutch home-owners are generally not planning to liquidate housing equity contained in the main residence, which could be done by either moving, taking out an extra mortgage or increasing the amount of the present mortgage. About two-thirds of all home-owners in all three age categories displayed in Table 2 (*i.e.* less than 60 years, more or equal to 60 and less than 75 years and equal or more than 75 years) respond that they are definitely not planning to use their housing equity, while almost the whole other one-third replies that they are probably not going to do it. The results in Table 2 are in accordance with the findings by Suari-Andreu (2015), who, using the same DHS data set employed in this study, reports that Dutch households of all ages do not compensate house price increases (declines) by decreasing (increasing) their stock of savings. This type of behaviour suggests that Dutch households do not plan to tap housing wealth to finance regular consumption, which further indicates that housing plays an important role in explaining the RSP.

7.2 Home-Ownership and the Bequest Motive

The association between home-ownership and the bequest motive pointed out by NT has potentially relevant implications for the understanding of the RSP. Bringing our analysis a little further, Table 3 shows how in our DHS sample home-ownership is clearly associated with the bequest motive, which we measure using a stated preference approach. Households are asked both about the importance to save for leaving a house and/or other illiquid assets and about the importance to save to leave a bequest in the form of money. In both cases, the degree of importance is ranked on a scale which goes from one (very unimportant) to seven (very important). In addition, households are asked what is the chance that they leave a bequest, on a scale from 0 to 100. In all cases, home-owners seem more inclined than renters to leave a bequest, which, as Table 3 shows, holds when considering both the mean and median of the responses’ distribution. Furthermore, the relationship between home-ownership and the bequest motive becomes more clear the older the age category we consider.

The results of the work by NT, as well as the evidence for the Netherlands shown in Table 3, indicate the presence of an association between home-ownership and the bequest motive. However, relying only on this evidence one cannot exactly say in which way does the causality run: either from home-ownership to the bequest motive or vice versa. On the one hand, it can be that home-owners do not initially save due to a bequest motive. However, due to issues such as high transaction costs and the utility benefits of home-ownership, they remain attached to their house until the last stages of life and then rationalize it as an asset to be bequeathed. Conversely, it can be that, regardless of transaction costs and utility benefits, households with a strong bequest motive decide to become home-owners already with the initial intention to leave their house as a bequest. Furthermore, it can be that there is a third variable, for instance lifetime income, that explains both home-ownership and bequests simultaneously.

To briefly check for the role of lifetime income as a confounding factor, Table 4 provides, next to the bivariate correlation between home-ownership and the different measures of the bequest motive, the

Table 3. Importance of the Bequest Motive by Housing Tenure (2007–2016).

		Home-owners			Renters		
		Mean	Median	No. of obs.	Mean	Median	No. of obs.
Importance of saving for a bequest (house or other assets)	Age < 60	2.84	2	5498	2.17	1	2211
	60 ≤ Age < 75	3.12	3	3519	2.06	1	1319
	Age ≥ 75	3.51	4	1157	2.31	1	557
Importance of saving for a bequest (money)	Age < 60	2.95	2	5500	2.45	1	2210
	60 ≤ Age < 75	3.15	3	3525	2.31	1	1320
	Age ≥ 75	3.76	4	1159	2.85	2	558
Chance of leaving a bequest	Age < 60	79.03	99	5475	54.23	50	2202
	60 ≤ Age < 75	81.25	100	3526	38.80	20	1307
	Age ≥ 75	82.86	100	1154	38.60	20	553

Notes: Importance of saving for a bequest is measured on a scale from one (very unimportant) to seven (very important). In the first row, households rank the importance of saving ‘to leave a house and/or other illiquid assets to your children (or other relatives)’. In the second row, they rank the importance of saving ‘to leave money to your children (or other relatives)’. Chance of leaving a bequest is measured on a scale from zero (no chance) to a hundred (absolute certainty).

corresponding partial correlations keeping fixed the time-average of household income, which we use as a proxy for lifetime income. The latter are the correlations that would be observed if average income did not vary across households. The last column provides the *p*-values associated to the partial correlations.¹⁷ A comparison of the first and second columns illustrates that keeping average income constant slightly decreases the correlation between home-ownership and the bequest motive. However, the correlation coefficients remain positive and, as the last column in Table 4 shows, all partial correlations are highly significant. These results suggest that income is not the explanation, or at least not the only explanation, for the associations observed in Table 3. Once again, we observe that the intensity of the correlation grows the higher the age category we consider. Note that for the older categories, average household income is a better proxy for lifetime income, since, compared to labour income, pension income is considered to be a better proxy for lifetime income.¹⁸

In addition, we have run several panel data regressions of the different measures of the bequest motive on home-ownership controlling for demographic variables (age, gender, presence and number of children in the household, presence of a partner, subjective survival probabilities, and health status), economic variables (university education, retirement status, income and net worth) and psychological variables (risk aversion and happiness). Tables 5 and 6 show the results of the regression analysis, while Tables A1 and A2 in the appendix give variable definitions and summary statistics, respectively. Table 5 shows that, when using pooled OLS with cluster-robust standard errors, home-ownership has a positive and statistically significant (always at the 1% level) relation with all measures of the bequest motive. The impact is always higher when restricting the sample to households with a household head above 60 years of age.

The data do not show many ownership transitions, especially when considering older households (see Table 1). Which implies that our main explanatory variable displays very low time variation. Therefore, it is not appropriate to include household fixed effects in our panel regressions. If we did so, almost all of the variation in the home-ownership variable would be simply captured by the household fixed effect, and thus the home-ownership effect could not be estimated. Nevertheless, in Table 6 we apply the method by Mundlak (1978) and report the results of the same regressions as in Table 5, but including the household specific time averages for those control variables that display enough within-household variation.¹⁹ That

Table 4. Correlation between Home Ownership and Bequests (2007–2016).

		Correlation	Partial correlation	<i>p</i> -Value
Importance of saving for a bequest (house or other assets)	Age < 60	0.180	0.127	0.000
	60 ≤ Age < 75	0.284	0.256	0.000
	Age ≥ 75	0.300	0.261	0.000
Importance of saving for a bequest (money)	Age < 60	0.130	0.086	0.000
	60 ≤ Age < 75	0.221	0.185	0.000
	Age ≥ 75	0.221	0.191	0.000
Chance of leaving a bequest	Age < 60	0.335	0.269	0.000
	60 ≤ Age < 75	0.513	0.470	0.000
	Age ≥ 75	0.531	0.495	0.000

Notes: Importance of saving for a bequest is measured on a scale from one (very unimportant) to seven (very important). In the first row, households rank the importance of saving ‘to leave a house and/or other illiquid assets to your children (or other relatives)’. In the second row, they rank the importance of saving ‘to leave money to your children (or other relatives)’. Chance of leaving a bequest is measured on a scale from 0 (no chance) to a 100 (absolute certainty). The first column provides bivariate correlations. The second column provides partial correlations, which keep the influence of average household income constant. The third column provides the significance of the partial correlations. Partial correlations are obtained by fitting regressions of each of the measures of the bequest motive on home-ownership and average household income. The coefficient is then computed as $t/\sqrt{t^2 + n - k}$, where t is the t -statistic associated with the estimate of the home-ownership effect, n is the number of observations and k is the number of explanatory variables in the regression. The p -values are given by $2Pr(t_{n-k} > |t|)$, where t_{n-k} follows a Student’s t distribution with $n - k$ degrees of freedom.

is the case for all variables except for *owner*, *gender* and *university*.²⁰ For the rest of the variables, the coefficients displayed in Table 6 rely only on within household variation. In this case, we see that the coefficients on the ownership variable are sensibly smaller. However, they still reflect a strong and highly significant correlation between home-ownership and the measures of the bequest motive that we employ, which still stands even after controlling for a host of potentially relevant demographic, economic and psychological variables.²¹

The results of the work by NT, as well as the evidence for the Netherlands in Tables 3–6 show that there is a significant association between housing and preference towards leaving a bequest, which suggests that housing usually represents an important share of all bequeathed wealth. Even though we cannot make definitive assertions about causality or about a structural relationship between home-ownership and bequests, it is clear that, in any case, the reduced-form analysis suggests that home-ownership is an element to take into account when studying bequests. This insight has relevant implications for understanding the RSP, especially in the Netherlands, where due to public coverage of LTC expenses, precautionary saving is unlikely to play a role, which opens the door to consider bequests as an important factor.

7.3 Alternative Bequest Motives

In Section 5.1, we have seen that, in a model with altruistic bequests, the size of the bequest is determined by the gain it implies for the recipient(s). Corroborating this implication, albeit in a very superficial and preliminary way, Table 7 shows that, among Dutch older households, those who have children give higher importance to saving for a bequest. This difference is the most clear when only home-owners are considered. Considering only altruism towards children, that is, leaving out altruism towards other (non-)family members, this descriptive result suggests that the altruistic model is likely to apply in the

Table 5. Results: Pooled OLS (2007–2016).

	(1) Illiquid	(2) Illiquid (60+)	(3) Liquid	(4) Liquid (60+)	(5) Chance	(6) Chance (60+)
Owner	0.460*** (0.075)	0.757*** (0.116)	0.257*** (0.083)	0.466*** (0.130)	27.490*** (1.721)	34.94*** (2.564)
Children	1.266*** (0.148)	−0.129 (0.431)	1.252*** (0.161)	−0.331 (0.462)	2.629 (2.388)	0.933 (5.954)
N. of children	−0.017 (0.066)	0.648** (0.260)	−0.019 (0.072)	0.794*** (0.275)	−1.602 (1.138)	−1.560 (3.846)
N. of child. out	0.239*** (0.032)	0.203*** (0.035)	0.218*** (0.032)	0.188*** (0.034)	0.354 (0.428)	0.443 (0.459)
Partner	0.021 (0.080)	−0.059 (0.132)	−0.048 (0.085)	−0.103 (0.143)	−5.128*** (1.455)	−6.743*** (2.346)
Gender	0.102 (0.077)	0.154 (0.142)	−0.010 (0.085)	−0.020 (0.157)	2.731 (1.502)	4.458 (2.723)
Age	−0.096*** (0.016)	0.163 (0.131)	−0.120*** (0.017)	0.169 (0.151)	−1.436*** (0.255)	−2.962 (2.076)
Age sq.	0.001*** (0.000)	0.000 (0.000)	0.001*** (0.000)	−0.001 (0.001)	0.009*** (0.002)	0.020 (0.014)
University	−0.288*** (0.089)	−0.527 (0.149)	−0.245** (0.095)	−0.482*** (0.157)	10.261*** (1.258)	8.048*** (1.979)
Survival prob.		−0.014 (0.021)		−0.001 (0.023)		0.005 (0.340)
Risk aversion	0.021 (0.014)	0.030 (0.020)	0.038** (0.015)	0.0458** (0.021)	2.542*** (0.262)	2.603*** (0.345)
Happiness	0.001 (0.046)	−0.032 (0.072)	0.018 (0.050)	−0.022 (0.080)	−1.698* (0.869)	−3.160** (1.251)
Health	0.017 (0.044)	0.045 (0.067)	0.033 (0.047)	0.048 (0.071)	−2.834*** (0.734)	−2.668*** (1.023)
Retired	0.371*** (0.103)	0.098 (0.122)	0.272** (0.111)	0.047 (0.130)	8.376*** (1.631)	7.625*** (1.753)
Income	0.000 (0.001)	0.001 (0.001)	0.002* (0.001)	0.003* (0.002)	0.055*** (0.019)	0.066** (0.030)
Net worth	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.015*** (0.002)	0.011*** (0.003)
Constant	3.723*** (0.427)	−5.227 (5.022)	4.399*** (0.459)	−5.649 (5.323)	94.726*** (6.993)	143.449* (74.189)
R^2	0.155	0.125	0.134	0.112	0.263	0.327
Observations	10,432	5183	10,442	5192	10,458	5195
Households	2630	1183	2631	1184	2635	1184

Note: Standard errors, clustered by household, are reported in parentheses. All regressions include year dummies. Columns 2, 4 and 6 are based on a subsample including only household heads above 60 years of age. The variable *survival prob.* is only available for household heads above 60 years of age. *** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level. For variable definitions, refer to Table A1.

Table 6. Results: Pooled OLS with Mundlak Terms (2007–2016).

	(1) Illiquid	(2) Illiquid (60+)	(3) Liquid	(4) Liquid (60+)	(5) Chance	(6) Chance (60+)
Owner	0.411*** (0.078)	0.663*** (0.121)	0.203** (0.086)	0.374*** (0.133)	26.034*** (1.717)	33.160*** (2.564)
Children	0.282** (0.156)	−0.123 (0.432)	0.427*** (0.159)	−0.322 (0.463)	−2.479 (2.406)	1.373 (5.784)
N. of children	0.154* (0.083)	0.656** (0.259)	0.087 (0.078)	0.801*** (0.274)	1.323 (1.376)	−1.444 (3.618)
N. of child. out	0.052** (0.024)	0.205*** (0.035)	0.025 (0.022)	0.189*** (0.034)	0.527 (0.461)	0.423 (0.451)
Partner	−0.062 (0.136)	−0.146 (0.163)	0.000 (0.141)	−0.119 (0.164)	−2.955 (1.928)	−7.941*** (2.915)
Gender	0.116 (0.077)	0.169 (0.144)	0.000 (0.085)	−0.023 (0.160)	2.905* (1.512)	4.446 (2.734)
Age	−0.136*** (0.033)	−0.148 (0.113)	−0.157*** (0.031)	−0.199* (0.102)	−1.352** (0.578)	−3.747* (2.186)
Age sq.	0.001** (0.000)	0.000 (0.000)	0.000*** (0.000)	0.001* (0.000)	0.004 (0.004)	0.020 (0.015)
University	−0.301*** (0.090)	−0.569*** (0.153)	−0.267*** (0.096)	−0.529*** (0.159)	9.202*** (1.286)	6.836*** (2.002)
Survival prob.		0.021 (0.017)		0.010 (0.015)		−0.064 (0.291)
Risk aversion	0.002 (0.011)	−0.009 (0.015)	0.024** (0.011)	0.024* (0.014)	0.545** (0.213)	0.396 (0.260)
Happiness	−0.064* (0.037)	−0.0560 (0.054)	−0.002 (0.034)	0.022* (0.054)	−1.960*** (0.648)	−1.010 (1.000)
Health	0.025 (0.040)	0.077 (0.052)	0.066 (0.041)	0.042 (0.049)	−0.111 (0.652)	−1.015 (0.950)
Retired	0.145* (0.081)	0.104 (0.123)	0.048 (0.071)	0.051 (0.131)	1.936 (1.630)	7.671 (1.715)
Income	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	−0.004 (0.016)	−0.031 (0.023)
Net worth	−0.001 (0.000)	0.000 (0.001)	0.000 (0.000)	0.000 (0.000)	−0.001 (0.001)	−0.001 (0.001)
Constant	3.442*** (0.467)	−10.934 (6.741)	4.192*** (0.504)	−12.204* (7.26)	88.000 (7.760)	89.894 (96.836)
R ²	0.170	0.134	0.148	0.123	0.278	0.342
Observations	10,432	5183	10,442	5192	10,458	5195
Households	2630	1183	2631	1184	2635	1184

Notes: Standard errors, clustered by household, are reported in parentheses. All regressions include year dummies. Columns 2, 4 and 6 are based on a subsample including only household heads above 60 years of age. The variable *survival prob.* is only available for household heads above 60 years of age. Regressions include household-specific time averages (i.e. the Mundlak terms) for variables *children*, *n. of children*, *n. of child. out*, *partner*, *age*, *age sq.*, *risk aversion*, *happiness*, *health*, *retired*, *income* and *net worth*. For regressions based on the 60+ sample (i.e. columns 2, 4 and 6), the averages of *children*, *n. of children*, *n. of child out* and *retired* are not included, while the average of *survival prob.* is included. *** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level. For variable definitions, refer to Table A1.

Table 7. Importance of the Bequest Motive by Presence of Children (2007–2016).

Home-Owners		With children			No Children		
		Mean	Median	N. of obs.	Mean	Median	N. of obs.
Importance of saving for a bequest (house or other assets)	Age < 60	3.40	3	3616	1.61	1	1745
	60 ≤ Age < 75	3.42	3	2971	1.28	1	519
	Age ≥ 75	3.75	4	1026	1.52	1	123
Importance of saving for a bequest (money)	Age < 60	3.47	3	3617	1.80	1	1746
	60 ≤ Age < 75	3.44	3	2975	1.43	1	520
	Age ≥ 75	3.93	4	1028	2.28	1	123
Chance of leaving a bequest	Age < 60	79.10	99	3684	78.88	95	1791
	60 ≤ Age < 75	81.54	100	3003	79.51	100	523
	Age ≥ 75	83.30	100	1031	79.08	100	123

Renters		With children			No Children		
		Mean	Median	N. of obs.	Mean	Median	N. of obs.
Importance of saving for a bequest (house or other assets)	Age < 60	2.96	3	868	1.62	1	1277
	60 ≤ Age < 75	2.27	2	1019	1.27	1	278
	Age ≥ 75	2.49	2	468	1.28	1	82
Importance of saving for a bequest (money)	Age < 60	3.29	3	868	1.86	1	1277
	60 ≤ Age < 75	2.58	2	1020	1.30	1	278
	Age ≥ 75	3.10	3	469	1.52	1	82
Chance of leaving a bequest	Age < 60	44.90	50	893	60.48	70	1309
	60 ≤ Age < 75	35.72	15	1027	49.93	50	280
	Age ≥ 75	37.99	20	470	42.03	25	83

Notes: Importance of saving for a bequest is measured on a scale from one (very unimportant) to seven (very important). In the first row (of both the home-owners and the renters respective panels), households rank the importance of saving 'to leave a house and/or other illiquid assets to your children (or other relatives)'. In the second row, they rank the importance of saving 'to leave money to your children (or other relatives)'. Chance of leaving a bequest is measured on a scale from zero (no chance) to a 100 (absolute certainty).

Dutch case. However, regarding the chances of leaving a bequest, having children does not seem to play such an important role.²² In fact, among renters, those with children report a lower chance of leaving a bequest compared to those without children, and, among home-owners, there does not seem to be a clear difference between households with and without children. Nevertheless, note that the importance to save for a bequest is not the same as the chance to actually leave a bequest. Someone might consider very important to save for a bequest but not actually have the chance to do so.

Conditional on having children, Table 8 shows whether DHS respondents identify themselves with the altruistic or the strategic bequest motive. In case they do not identify with any of the two, they can also say whether they still have not made plans about leaving a bequest, or whether their plan is to leave no bequest. The first row in Table 8 shows that the strategic motive is apparently not very popular among Dutch households. Home-owners who are above 75 years of age appear to be the most prone to use bequests strategically. However, only 4.48% of them report a strategic bequest motive.²³ The

Table 8. Presence of Strategic and Altruistic Bequests Motives (2007–2016).

	Age < 60		60 ≤ Age < 75		Age ≥ 75	
	Home-owners	Renters	Home-owners	Renters	Home-owners	Renters
(1) Strategic bequest	2.94%	1.31%	3.79%	0.62%	4.48%	2.55%
(2) Altruistic bequest	16.61%	12.62%	25.67%	4.68%	36.90%	10.04%
(3) Not planned yet	71.04%	56.12%	62.50%	51.98%	52.11%	51.93%
(4) No bequest	1.83%	4.88%	1.50%	7.24%	0.98%	5.86%
(5) None of the above	7.58%	25.08%	6.55%	35.48%	5.53%	29.61%
N. of obs.	3684	893	3003	1027	1031	470

Notes: Conditional on having children, respondents are asked which statement is closest to their opinion: (1) Leaving a bequest if children provide services; (2) Leaving a bequest regardless of services provided; (3) No explicit plans about leaving a bequest; (4) No intention to leave a bequest; (5) None of the above. Older households are defined as households with a household head who is 60 or older.

second row shows that households of all ages, and specially home-owners, are more prone to report an altruistic bequest motive rather than a strategic one. In addition, the third and fourth row show that many households have not yet made any plans regarding bequests, while very few of them plan to leave no bequest.

However, there are several caveats to keep in mind when looking at Table 8. First, households may be inclined towards reporting altruistic bequests to avoid disclosing any kind of egocentricity; and, secondly, those willing to leave a bequest regardless of the services provided, might be willing to increase it if services are actually provided. These are arguments suggesting that strategic bequests might be more important than reflected in Table 8. In any case, Table 8 shows that both strategic and altruistic bequest motives are present, and that they are more popular among home-owners than among renters. Note that there is a considerable share of renters that identify themselves with the fifth option, that is, none of the above. Since rows one to four seem to cover all possible options, we interpret the fifth row as an option for those who are unsure or do not know with which of the other options they identify.

7.4 Housing as a Commitment Device

In Section 6, we have briefly outlined how the literature has attempted to check empirically for the use of housing as a commitment device. This is actually a very challenging endeavour, and thus a promising venue for research in the future. In one of the very few existing examples, Angelini *et al.* (2013) look at the probability of renters to become home-owners when they are above 40 years of age, since at earlier ages the purchase of a house is more likely to be linked to family formation. Table 9 shows that about 45% of the rent-to-own transitions registered in the DHS data set correspond to households with a household head that is 40 years of age or more. Even though these moves could be linked to events like marriage, divorce or increase in family size, Angelini *et al.* (2013) point out that rent-to-own transitions that take place above 40 are more likely to be for commitment purposes than those that take place below that age. In addition, the lower panel of Table 9 shows that remaining mortgage debt is still relatively high for households at older ages, which suggests that a reasonable share of households are likely to have become home-owners (or have increased the size of their property) late in life.

Even though Table 9 indicates that commitment demand for housing is a possibility that could be relevant in the Netherlands, a note of caution has to be made here since the evidence is very descriptive and a more in-depth study is needed to elucidate the true relevance of the use of housing as a commitment

Table 9. Rent-to-Own Moves and Remaining Mortgage Debt (RMD) (2007–2016).

		Below 40	40–50	50–60	60–70	70+	Total
Rent-to-own moves	Number	82	46	10	6	6	150
	%	54.66%	30.66%	6.66%	4.00%	4.00%	100%
RMD	% with RMD	37.61%	46.41%	41.31%	35.30%	27.57%	37.40%
	Average	74.94	87.84	62.03	45.25	29.19	59.21

Notes: Average RMD is provided in thousands. The last column of the RMD panel provides the % of households with RMD and the average RMD when all ages are pooled together. Renters are included when computing statistics regarding RMD.

device.²⁴ For example, the fact that even older home-owners still hold mortgage debt could be explained as well by the tax deduction of mortgage interest rates, and/or by the popularity of interest-only mortgages in the Netherlands. Therefore, any future study should take into account this factor as well. The literature on this topic is still very incipient, which implies that, albeit difficult, the identification of the commitment demand for housing is a very fruitful challenge. In any case, the evidence reported here does not rule out the fact that, combined with the previous descriptive evidence on the relationship between home-ownership and bequests, the commitment demand for housing potentially adds to the understanding of the RSP in the Netherlands.

8. Conclusion

The full understanding of the underlying causes behind the RSP is crucial for the assessment of the adequacy of retirement savings in a context of pension system reforms. To that end, we complement the RSP literature by reviewing the literature on HER. The HER literature indicates that retirees are generally reluctant to withdraw their housing equity, which has clear implications for the understanding of the RSP. This insight is picked up by Nakajima and Telyukova (2013a, 2017), who develop a model of retirement savings with housing. One of their main conclusions is that there is an association between home-ownership and bequests, suggesting that housing as a bequeathable asset plays an important role in explaining the RSP. Further literature on altruistic and strategic bequests, as well as on housing as a commitment device, provide additional insights to understand the connection between bequests, home-ownership, and the RSP.

The descriptive evidence that we draw from the DHS shows that a vast majority of Dutch home-owners do not sell their house to finance retirement, and that it is likely that home-ownership among retirees will increase in the near future due to cohort effects. More interestingly, the evidence shows that, controlling for a host of economic (including permanent income), demographic and psychological variables there is a strong correlation between home-ownership and the importance given to leave a bequest, as well as between home-ownership and the self-perceived chance that a bequest will be left. Even though the evidence does not allow us to take a stand on the direction in which causality runs, i.e. either from the bequest motive to home-ownership or vice versa, it does seem to be the case that home-owners have a tendency to use their home as a bequest. On the one hand, it can be that due to high transaction costs and the utility benefits of home-ownership, home-owners remain attached to their home and then rationalize it as an asset to be bequeathed. Conversely, it can be that, regardless of transaction costs and utility benefits, households with a strong bequest motive become home-owners in the first place with the original intention to leave the house as a bequest. Regardless of how the correlation is interpreted, it is clear that any future study on bequests has to consider the relevance of housing. Leaving housing out of the picture

may seriously underestimate the bequest motive for those who view their housing equity as the main element to be bequeathed.

Regarding the policy domain, policy-makers as well as academics are paying attention nowadays to housing equity as a source of funds to finance general consumption and LTC during retirement. However, the reluctance of households to withdraw housing equity in old age suggests that this can be a rather unfruitful venue. Nevertheless, when a retired household suffers a precipitating event (*e.g.* widowhood, divorce, nursing home entry, etc.) the literature clearly points out that this triggers a demand for liquidating housing wealth. In these cases, governments should facilitate housing equity withdrawal. This could be done by easing housing transactions (*e.g.* by reducing associated taxes or by directly assisting in the sell and/or purchase of a house) or by promoting the use of financial products such as reverse mortgages.

In regard to the current unpopularity of reverse mortgages, an interesting way to market them is by stressing that, besides helping provide liquidity for general consumption and LTC expenses, they can as well be regarded as a way to optimize the timing of a bequest. Given the recent increases in life expectancy, individuals nowadays are likely to receive bequests at an increasingly advanced stage of the life-cycle, which might not be the preferred option. For example, an optimal period in life to receive a bequest can typically be around ages between 30 and 40, when family building and house purchase are most likely to take place nowadays. However, due to the rise in longevity, individuals are increasingly likely to receive a bequest at ages between 50 and 60, when the need for financial help is likely to be smaller. A reverse mortgage can potentially offer a solution to this problem, since it would allow parents to transfer housing equity to the heir(s) (either through a lump sum or through a stream of inter-vivos transfers) at any time they prefer without having to move out of their residence. Taking into account this aspect may help kick start the market for reverse mortgages, which would help households, both with and without a bequest motive, to optimize the use of their housing equity.

In this paper, we have provided a glimpse of a vast field of literature. However, the RSP literature is still a fertile ground for new contributions. Structural models in the line of De Nardi *et al.* (2010) and Nakajima and Telyukova (2013a), as well as reduced-form type of analysis, can bring on a better understanding of the connection between home-ownership, bequests, and the RSP. In addition, the literature on strategic bequests as well as the literature on temptation and commitment provide potentially fruitful lines of research for the further understanding of the stylized facts laid out in this paper.

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Notes

1. Banks *et al.* (1998) use the same terminology to refer to the consumption drop that individuals seem to experience upon entering retirement but this is not what we are studying in this review.
2. Rodriguez-Palenzuela and Déés (2016) report using the Household Finance and Consumption Survey (HFCS) that as of 2011 main residences accounted for 40% to 70% of total household assets among the Euro Area countries.
3. Venti and Wise (2004) do find a very slight decrease in the housing equity among the oldest households (75+) that do not experience any precipitating event. However, they attribute it to depreciation of the housing asset, which can actually be considered as a form of housing equity withdrawal.

4. A striking fact about this survey is that only 9% of respondents declare to know what a reverse mortgage is.
5. This working paper was later published as Fernández-Villaverde and Krueger (2011).
6. This is a slight simplification of Yang's model as we assume that the service flow from housing is equal to the value of the housing stock. In her model, they are allowed to differ.
7. Their model is also introduced in Nakajima and Telyukova (2013b), where, in addition to exposing the model, they also conduct a European-level cross-country empirical comparison of the RSP and the evolution of HER.
8. NT set $\eta_0 = 1$, while η_1 is estimated to be larger than one.
9. NT assume that $\mu_1 = 1$ and $\mu_2 \in \{1, 2\}$, which implies that the household size multiplier for a single is $1/\mu_1^{1-\sigma} = 1$; while for a couple it is $2/\mu_2^{1-\sigma}$, which is equal to 2 if $\mu_2 = 1$ and it is equal to 2^σ if $\mu_2 = 2$.
10. Davidoff (2010) employs US data to investigate the role of home equity as a substitute for long-term insurance. He claims that households are reluctant to withdraw housing wealth in old age because they view it as an insurance against medical expenditures derived from LTC needs.
11. The utility benefits of home-ownership capture factors such as attachment to one's house and neighbourhood and the ability to adapt the house to one's tastes. Furthermore, they capture financial benefits of ownership that are not explicit in the model, for example, tax exemption of imputed rents, mortgage interest payment deduction, and insurance against rental rate fluctuation.
12. This idea is in line with the conclusions by Blundell *et al.* (2016), who argue that the utility value of housing, its illiquidity, and the mix of risk and returns it provides are likely to be important factors in explaining the trajectory of wealth in retirement.
13. This idea was already present in the work by Laibson (1997) in a context of preferences with hyperbolic discounting.
14. The Netherlands experienced during the 1990s and early 2000s the largest increase in home-ownership among OECD countries (Andrews and Caldera-Sanchez, 2011).
15. Households without a computer and/or access to Internet are provided with a basic computer and Internet connection to complete the survey. High-income households are slightly overrepresented. Therefore, for all results presented in this paper we employ sample weights provided by CentERdata, which take into account unequal selection probabilities.
16. Households with missing wealth data do not appear to be significantly different from the rest in terms of age, household structure, income and employment status. Therefore, we assume that missing wealth data do not imply a selection problem for our study.
17. Partial correlations do not make an assumption about the direction of causality: the outcome would be the same if in the regressions home-ownership was used as dependent variable and the bequest motive as explanatory variable. For more information on partial correlation, see Greene (2012).
18. Using Dutch data, Knoef *et al.* (2013) find that pension income represents a major share of the income of retirees, that the variance of income shocks is smaller for retirees than for working people, and that income shocks are more persistent for retirees. For all these reasons, they argue that pension income is a specially good proxy for lifetime income.
19. Mundlak (1978) shows that including time averages of all variables yields the same result as including a household-specific fixed effect. Since we include the time averages only for some variables, i.e. those that display enough variation over time, the method we apply in Table 6 can be seen as a hybrid between pooled OLS and fixed effects.
20. Table A2 in the appendix shows that the within standard deviation of these three variables is very low. The average of the children variables (i.e. *n. of children* and *n. of child. out*) is as well not included in the regressions using the 60+ sample.

21. The results that we obtain do not change when we employ ordered probit to estimate our regression models. The results of the ordered probit analysis are available on request.
22. This is something that can be clearly seen as well in Tables 5 and 6. There we see how, in both tables, the presence of children has a significant impact on the importance of saving for a bequest, but not on the chance of actually leaving a bequest.
23. Note that the higher share of home-owners above 75 reporting a strategic bequest motive compared to the rest might be simply due to the fact that older households are more likely to have plans about the use of their net worth. In any case, for all ages the share of respondents reporting a strategic bequest motive is always rather low.
24. To bring the analysis a step further, we have checked whether answers to the DHS question ‘Do you find it easy or difficult to control your expenditures?’ correlate with housing tenure. We find that the correlation coefficient is very close to zero. However, the reliability of the answers to such a question is not entirely clear.

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Appendix

Table A1. Variable Definitions

Variable	Definition
Illiquid	Importance given to save for a bequest in the form of a house and/or other illiquid assets. Takes values from 1 (very unimportant) to 7 (very important).
Liquid	Importance given to save for a bequest in the form of cash. Takes values from 1 (very unimportant) to 7 (very important).
Chance	Chance of leaving a bequest. Takes values from 0 (no chance) to 100 (absolute certainty).
Owner	Dummy indicating home-ownership.
Children	Dummy indicating whether the household head has any children.
N. of children	Number of children living in the household.
N. of child. out	Number of children living outside of the household.
Partner	Dummy indicating the presence of a partner.
Gender	Dummy indicating whether the household head is a man.

(Continued)

Table A1. *Continued*

Variable	Definition
Age	Age of the household head.
Age sq.	Age of the household head squared.
University	Dummy indicating whether the household head has university studies.
Survival prob.	Self-reported probability to survive for the next 11-15 years. This variable is only available for household heads above 60 years of age.
Risk aversion	Index variable indicating how much household heads agree with having safe investments with guaranteed returns. Takes values from 1 (totally disagree) to 7 (totally agree).
Happiness	Self-reported level of happiness. Takes values from 1 (very happy) to 5 (very unhappy).
Health	Self-reported health level. Takes values from 1 (excellent) to 5 (poor).
Retired	Dummy indicating whether a household head is retired.
Income	Total household income in thousands of Euros.
Net worth	Total household assets minus total household liabilities in thousands of Euros.

Table A2. Summary Statistics

Variable	Mean	Median	Between std. dev.	Within std. dev.	Min.	Max.
Illiquid	2.783	2	1.711	0.958	1	7
Liquid	2.852	2	1.750	0.914	1	7
Chance	69.370	90	31.689	17.989	0	100
Owner	0.579	1	0.442	0.082	0	1
Children	0.714	1	0.434	0.180	0	1
N. of children	0.526	0	1.00	0.269	0	6
N. of child. out	1.141	0	1.312	0.494	0	12
Partner	0.659	1	0.452	0.122	0	1
Gender	0.753	1	0.428	0.020	0	1
Age	56.469	58	15.403	2.21	18	94
University	0.149	0	0.368	0.045	0	1
Survival prob.	5.999	6	2.157	1.184	0	10
Risk aversion	4.996	5	1.498	1.152	1	7
Happiness	2.014	2	0.571	0.346	1	5
Health	2.194	2	0.643	0.348	1	5
Retired	0.397	0	0.451	0.149	0	1
Income	32.067	27.637	18.567	27.832	0.349	2197.460
Net worth	161.060	93.138	190.270	63.917	-1491.380	999.855

Notes: All summary statistics are computed based on the estimation sample in the first column of Table 5. Except for the variable *survival prob.*, in that case the summary statistics are based on the estimation sample in the second column of Table 5.

Figure A1. Wealth and Home Ownership among Older Adults by Cohort (2007–2016).

Notes: All panels show data on three cohorts. These are 50–59, 60–69 and 70–79 years old in 2007, respectively. All monetary values are given in thousands. For all panels except for (c) four different percentiles (p25, p50, p75 and p90) are displayed for each cohort. All panels in this figure are based on households that are present in all years of the sample period ranging from 2007 until 2016. These represent about 15% of the households used in Figure 1 in the main text.